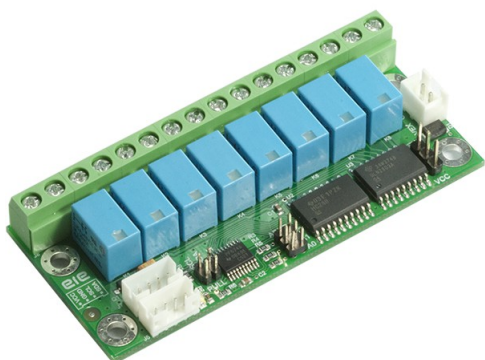# I2C-RL8XXS, I2C-RL8XXSA

I2C Bus 8-Relay Boards for small space

Features

- PCF8574 and PCF8574A I2C bus chips
- 100kHz I2C bus frequency
- Selectable I2C bus pulling-up resistors
- Address by 3 jumpers for use of up to 8 addresses
- Up to 16 boards on a single bus
- Compatible with most microcontrollers
- Support 2.5–5.5V microcontroller ports
- 8 relay outputs
- 5Vdc, 12Vdc and 24Vdc coil voltages
- Relay contact rating 0.5A/120Vac, 1A/30Vdc, 0.15A/48Vdc
- I2C operating voltage 2.5Vdc to 5.5Vdc
- On-board inverse polarity protection circuits
- Small PCB size 81.6x36.1mm

Introduction

This is remote relay board for I2C bus. Making it ideal as relay output expander for small space. It is based on PCF8574 and PCF8574A. Each of PCF8574 and PCF8574A boards can be connected on a single bus up to 8 boards. So a single bus can be connected up to 16 boards. The board supports 100kHz bus frequency and selectable bus pulling-up resistors for SDA and SCL signals. The board has eight small relays which are selected coil input voltage between bus voltage and external voltage. The board also has inverse polarity protection circuits to prevent damage of the board from a mistake of power supply connection. Double 4-pin bus connectors on the board make connection of bus easier than an old version. The LED will turn on when input voltage is applied into the board. Mounting holds are compatible with the old versions, EI2C-9AI and EI2C-9AIA.
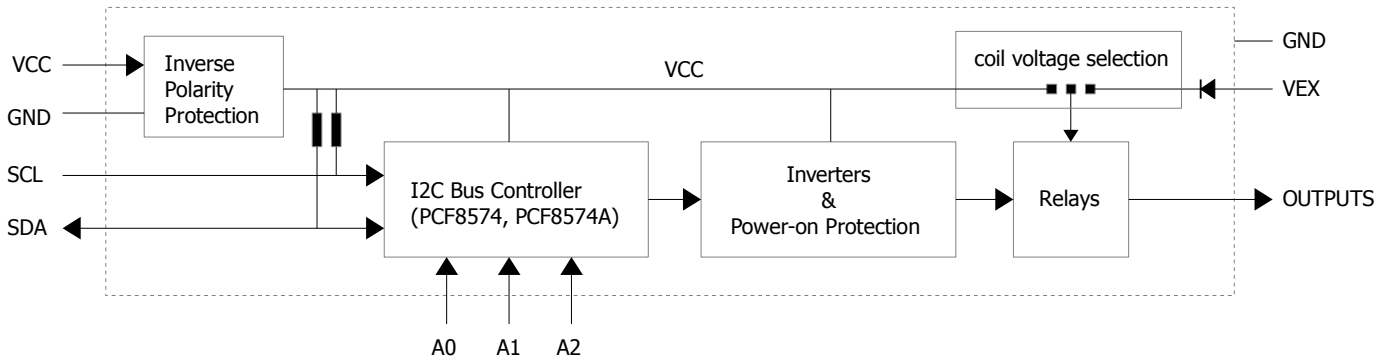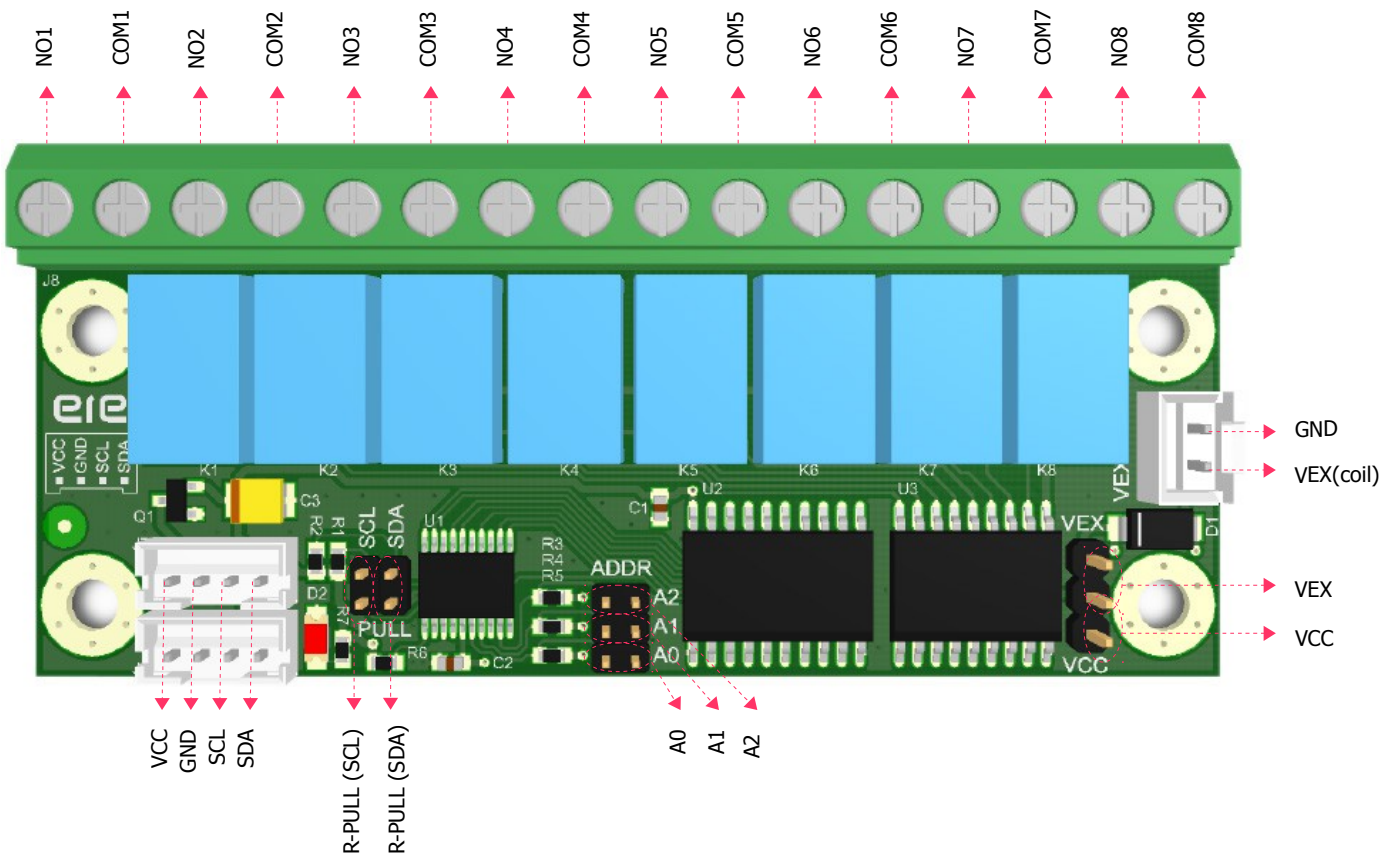
Diagram

Figure 1: Block diagram

Figure 2: Board diagram

Table 1: Pin Descriptions

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.
PULL (SDA)	A jumper for selecting 10K pull-up resistor of SDA.
PULL (SCL)	A jumper for selecting 10K pull-up resistor of SCL.
VEX-VCC (jumper)	A jumper for selecting input voltage for relays between VEX and VCC.
VEX-GND (power)	Power supply input voltage for coil of relay.
A0	A jumper for selecting address of A0.
A1	A jumper for selecting address of A1.
A2	A jumper for selecting address of A2.
NO1… NO8	Normal Open pins of relays1 to relay8.
COM1… COM8	Common pins of of relay1 to relay8.

I2C Bus Pull-Up Registers

The I2C bus needs resistors for pulling-up SCL and SDA lines. A board has two 10K ohm pulling-up resistors for this purpose. These resistors can be enabled by closing jumpers. These resistors have to be enabled if there is not any pulling-up resistor on the bus.

The bus usually needs only a pulling-up resistor while the boards connect together on a single bus. More pulling-up resistors make bus stronger. But the strong bus is needed for high frequency bus. The 10K ohm is suitable for 100KHz bus frequency.
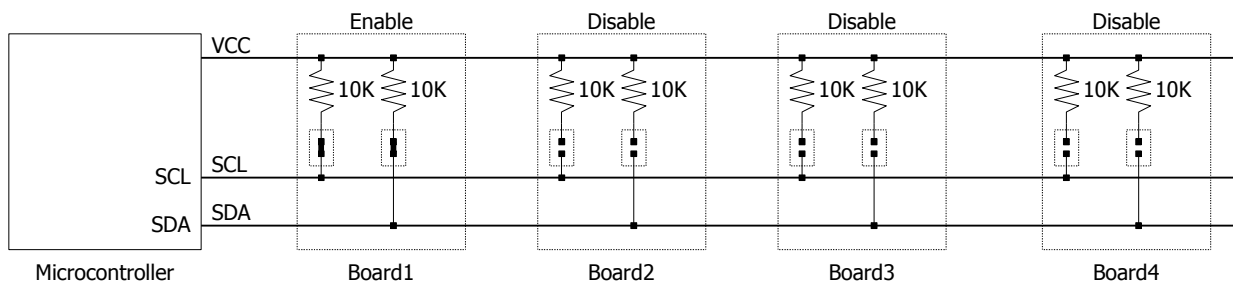

Figure 3: I2C bus pull-up resistors

VCC

VCC is operating voltage of the board.

Coil Voltage and VEX

The board needs an external voltage to be applied to VEX-GND connector and a jumper need to be selected to VEX when coil voltage and input voltage for VCC is not the same voltage. Example, the board connects to microcontroller. The VCC is 5V but the coil voltage is 12V.

The board doesn't need external power supply for coils when the coil voltage and input voltage for VCC is the same voltage. The jumper must be selected to VCC. Example, the board connects to microcontroller. The VCC and the relay coil voltage is the same 5V. In this case, the coils can draw current from the VCC.
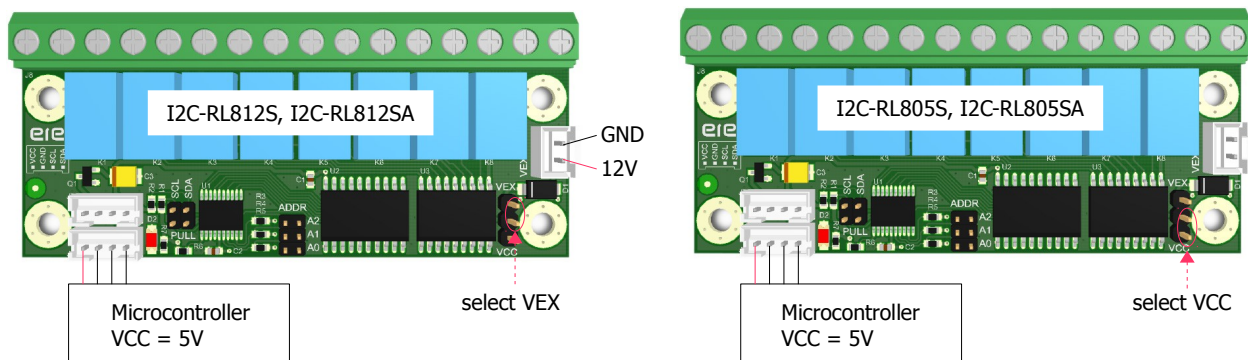

Figure 4: Coil voltage

The board has a schottky diode for VEX polarity protection. The diode drops about 0.5 volt. Soldering PCB pads on a bottom side of PCB to avoid voltage dropping. Or increasing input voltage of VEX about 0.5 volt is another idea to avoid voltage dropping without soldering.

Interfacing

When VCC is supplied into the board the LED turns on. The SCL and SDA pins must be connected to SCL and SDA pins of microcontroller respectively. Remember pulling-up resistors must be enabled when there is no external pulling-up resistor on the bus.
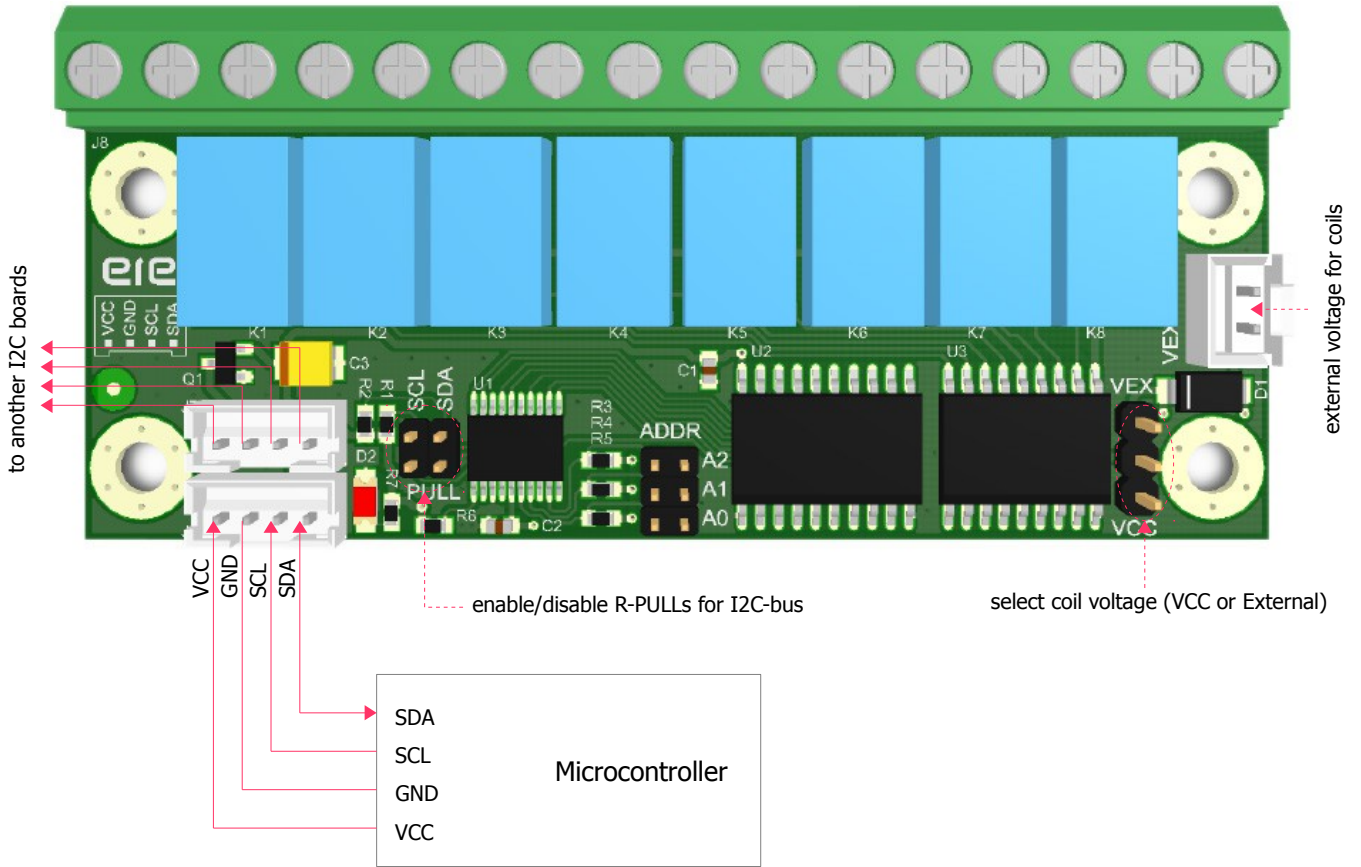

Figure 5: Bus interfacing

The boards can be connected together up to 16 boards on a single bus. Each of PCF8574 and PCF8574A boards can be connected up to eight boards.
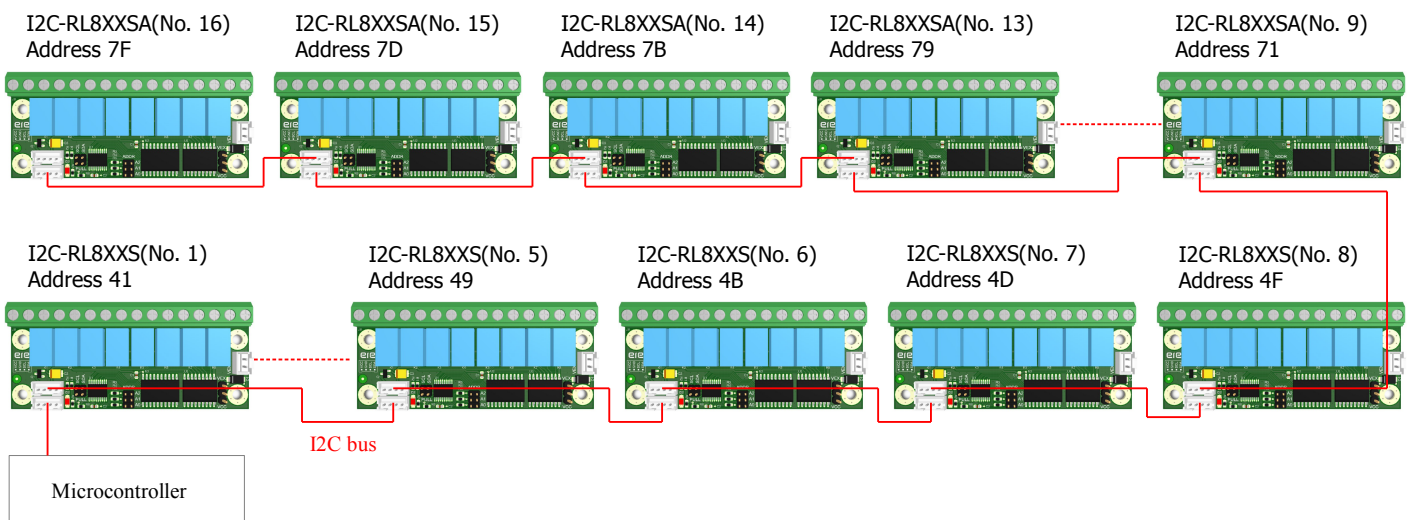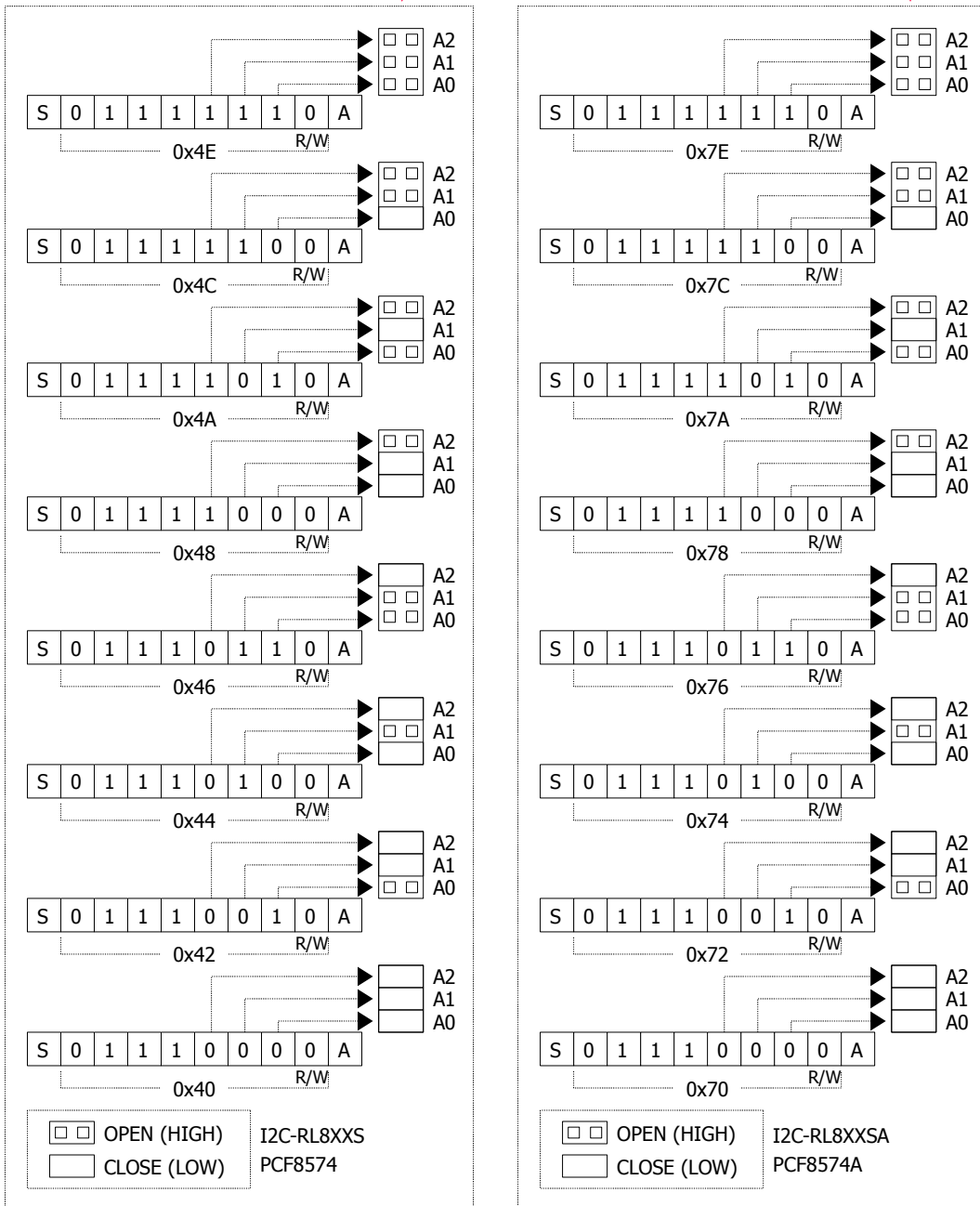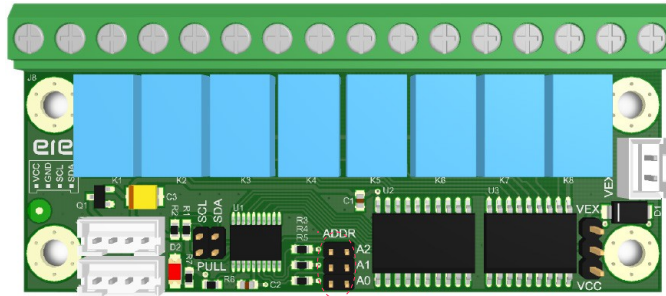

Figure 6: boards on a single bus

Figure 7: Addressing

Address

The board is addressed by 3 jumpers to make 8 different addresses.

Data Frame

When microcontroller sends data to the board. The first byte is an address byte and the second byte is data byte. Bit0 of the second byte controls relay1. Bit value '1' means relay 'off' and bit value '0' means relay 'on' because there are inverters between controller ports and relay drivers.
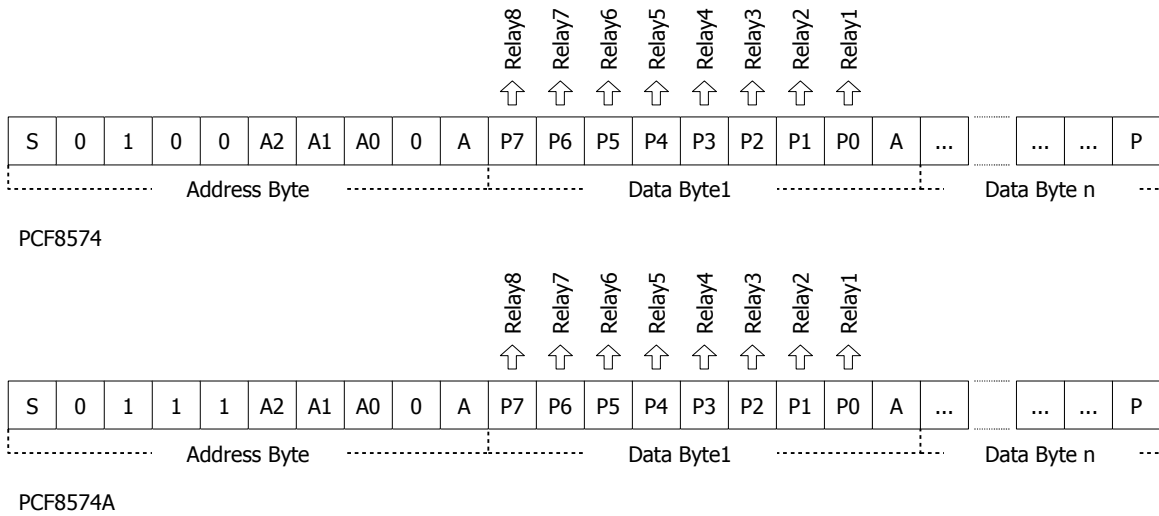
										Relay8	Relay7	Relay6	Relay5	Relay4	Relay3	Relay2	Relay1					
										⇑	⇑	⇑	⇑	⇑	⇑	⇑	⇑					
S	0	1	0	0	A2	A1	A0	0	A	P7	P6	P5	P4	P3	P2	P1	P0	A	...	...	...	P

Address Byte ·········· Data Byte1 ·········· Data Byte n

PCF8574

										Relay8	Relay7	Relay6	Relay5	Relay4	Relay3	Relay2	Relay1					
										⇑	⇑	⇑	⇑	⇑	⇑	⇑	⇑					
S	0	1	1	1	A2	A1	A0	0	A	P7	P6	P5	P4	P3	P2	P1	P0	A	...	...	...	P

Address Byte ·········· Data Byte1 ·········· Data Byte n

PCF8574A

Figure 8: Data frame

Table 2: Absolute maximum ratings

Max. bus frequency	100Khz
I2C Chips	PCF8574 and PCF8574A (*1)
I2C operating voltage (VCC)	2.5-5.5Vdc
Max. boards on a single bus	8(16) boards
Output relays	8 relays
Relay contact rating	0.5A/120Vac
	1A/30Vdc
	0.15A/48Vdc
Coil voltage	5Vdc, 12Vdc, 24Vdc
On board pull-up resistors	10Kohm (*3)
I2C connector pins x pitch	4-pin x 2.00mm
VEX connector	2-pin x 2.50mm

(*1) PCF8574 for I2C-RL8XXS, PCF8574A for I2C-RL8XXSA.
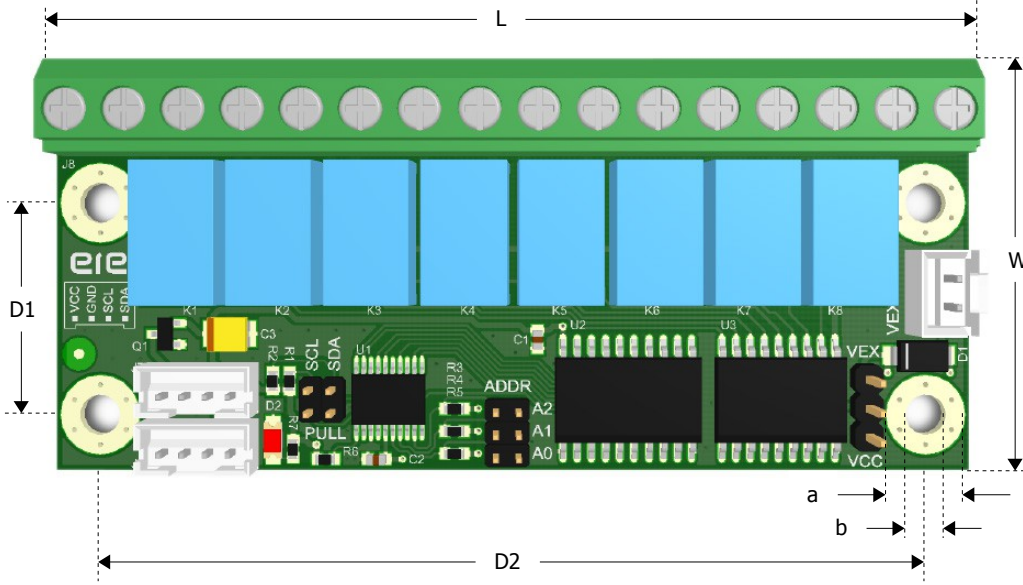
(*2) more than 30Vdc, need external resistors.

(*3) Selectable by jumpers.

Board Comparisons

Table 3: Board comparisons

	I2C-RL805S	I2C-RL812S	I2C-RL824S	I2C-RL805SA	I2C-RL812SA	I2C-RL824SA
I2C Chip	PCF8574			PCF8574A		
Coil Voltage	5Vdc	12Vdc	24Vdc	5Vdc	12Vdc	24Vdc

Dimensions

Figure 9: Board dimension

unit	inch	mm
L	3.212	81.60
W	1.421	36.10
D1	0.745	18.92
D2	2.905	73.80
a	0.279	7.10
b	0.141	3.60