

I2C-RL412IN405BM, I2C-RL412IN405CM, I2C-RL424IN405BM, I2C-RL424IN405CM**4-Relay with 4-Opto-coupler Controlled via I2C bus****1 Features**

- I2C bus controller chips: PCA9554B and PCA9554C
- I2C bus speed: 400kHz (Fast mode)
- Selectable I2C bus pull-up resistors
- Address by 3 jumpers for use of up to 8 addresses
- 4-relays and 4-opto-coupler Inputs
- Relay coil voltage: 12VDC and 24VDC
- Relay contact rating: 10A @120VAC/24VDC, NO/NC: 10A/6A @250VAC
- Operating voltage: 3.0V to 5.5V
- Inverse polarity protection circuits
- Prevent relays turning-on during power-up
- Mountable on DIN-Rail PCB holder
- PCB dimensions: 87.50 x 72.00 mm

This is an expansion relay board controlled via an I2C bus, making it ideal as a 4-relay and 4-opto-coupler inputs expander. It is designed based on the PCA9554B and PCA9554C. Up to 8 of PCA9554B boards and 8 of PCA9554C boards can be connected on a single bus, allowing a maximum of 16 boards on the same I2C bus.

The board supports a 400 kHz I2C bus frequency and includes selectable pull-up resistors for the SDA and SCL lines. The board also provides an interrupt (INT) output signal that becomes active when an input port receives a signal. The board features four power relays with selectable coil voltage options-12VDC or 24VDC.

For protection, the board includes reverse polarity protection circuitry to prevent damage caused by incorrect power supply connections.

The PCA9554 is better than the PCF8574 because it supports an I2C bus speed of up to 400 kHz and allows each port to be configured as either an input or an output.

The board can be mounted on DIN-Rail PCB holder.

2 Diagram

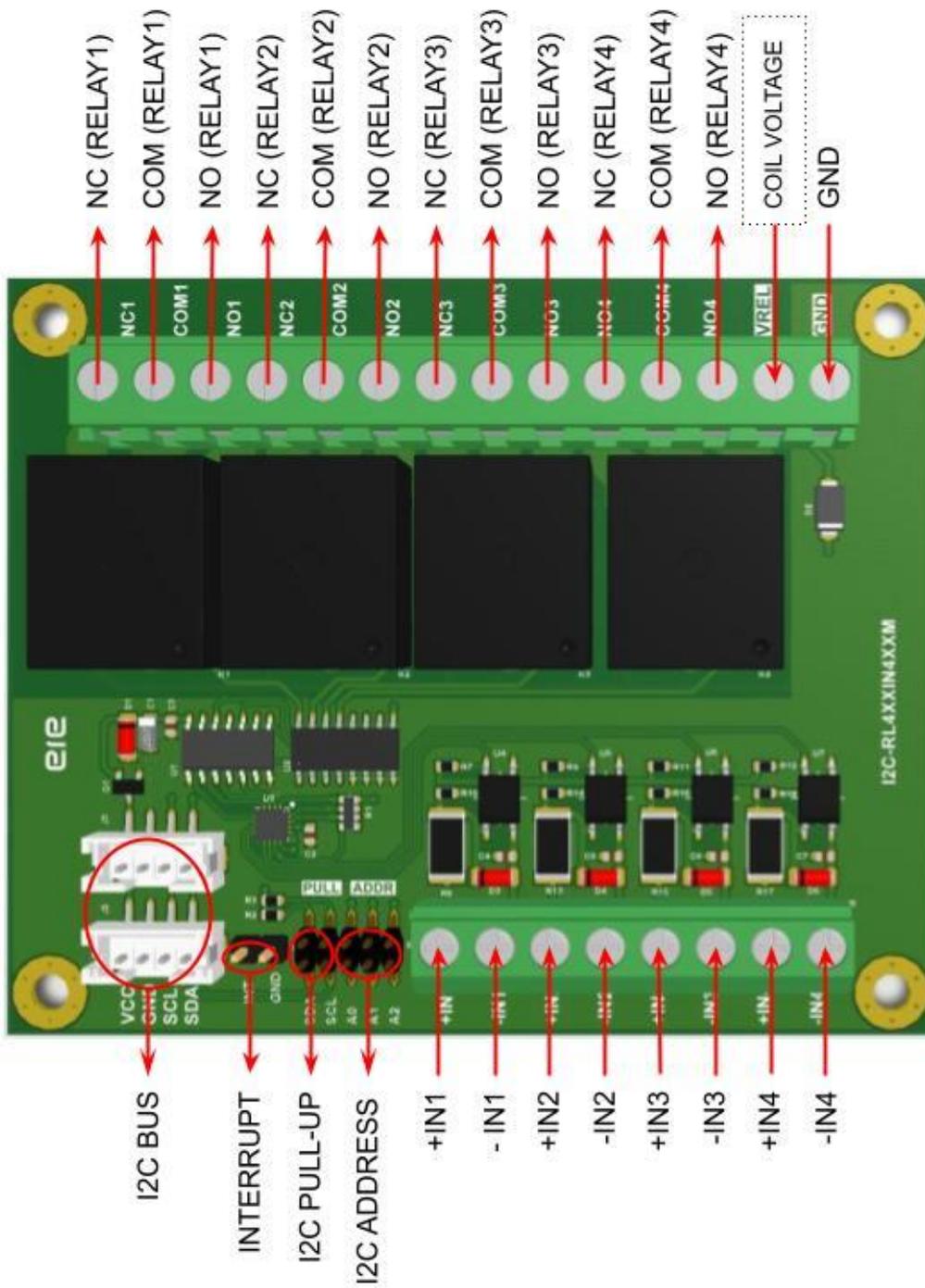


Figure 1: Board layout

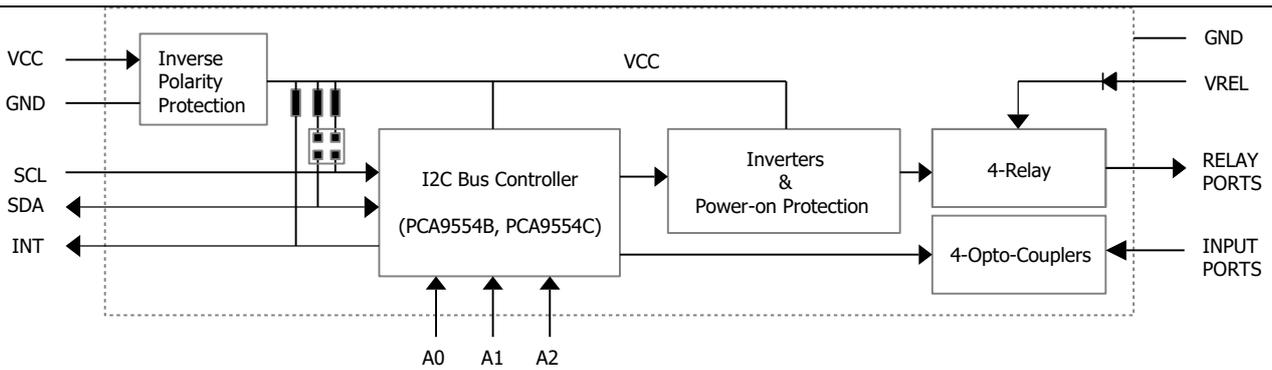


Figure 2: Block diagram

Symbols	Descriptions
VCC	Operating voltage (input power supply)
GND	Ground
SCL	I2C bus serial clock signal
SDA	I2C bus serial data signal
INT	Output interrupt signal
PULL-UP (SCL)	A jumper for selecting 10K pull-up resistor of SCL line
PULL-UP (SDA)	A jumper for selecting 10K pull-up resistor of SDA line
A0	A jumper for selecting the address of A0
A1	A jumper for selecting the address of A1
A2	A jumper for selecting the address of A2
IN1... IN4 (P4-P7)	Opto-coupler input ports
NO1... NO4	Normal-open contacts of relay1 to relay4
COM1... COM4	Common contacts of relay1 to relay4
NC1... NC4	Normal-closed contacts of relay1 to relay4
VREL	External power supply for coils of relays, 12VDC or 24VDC

Table 1: Pins descriptions

3 I2C bus pull-up resistors

Usually, the I2C bus requires pull-up resistors for the SCL and SDA lines. The board has two 10k pull-up resistors which can be enabled by closing the jumpers. These resistors should be enabled if there are no other pull-up resistors on the bus. Typically, only one pair of pull-up resistors is needed when multiple boards are connected on a single bus. Adding more pull-up resistors strengthens the bus, which is beneficial for high-frequency operation. A 10k resistor is suitable for a bus frequency of 100 kHz.

- An onboard pull-up resistor is disabled
- An onboard pull-up resistor is enabled

Figure 3: Jumpers for pull-up resistors

4 I2C bus address

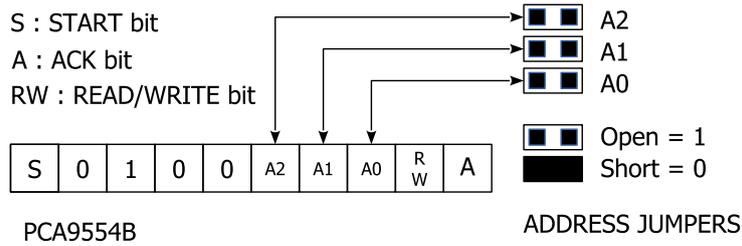


Figure 4: I2C-RL4xxIN4xxBM (PCA9554B) address

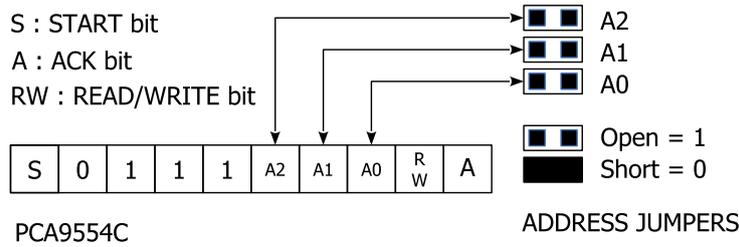


Figure 5: I2C-RL4xxIN4xxCM (PCA9554C) address

5 Data Frame

The data byte consists of 8 bits that control 4 relays and 4 input ports. BIT0 to BIT3 must be configured as output ports. The BIT0 controls relay1, and BIT3 controls relay4. While BIT4 to BIT7 can be configured as input ports.

A bit value of '1' turns the relay off, and a bit value of '0' turns the relay on. The logic is inverted because inverters are placed between the I2C controller and the relay drivers to prevent all relays from turning on during power-up.

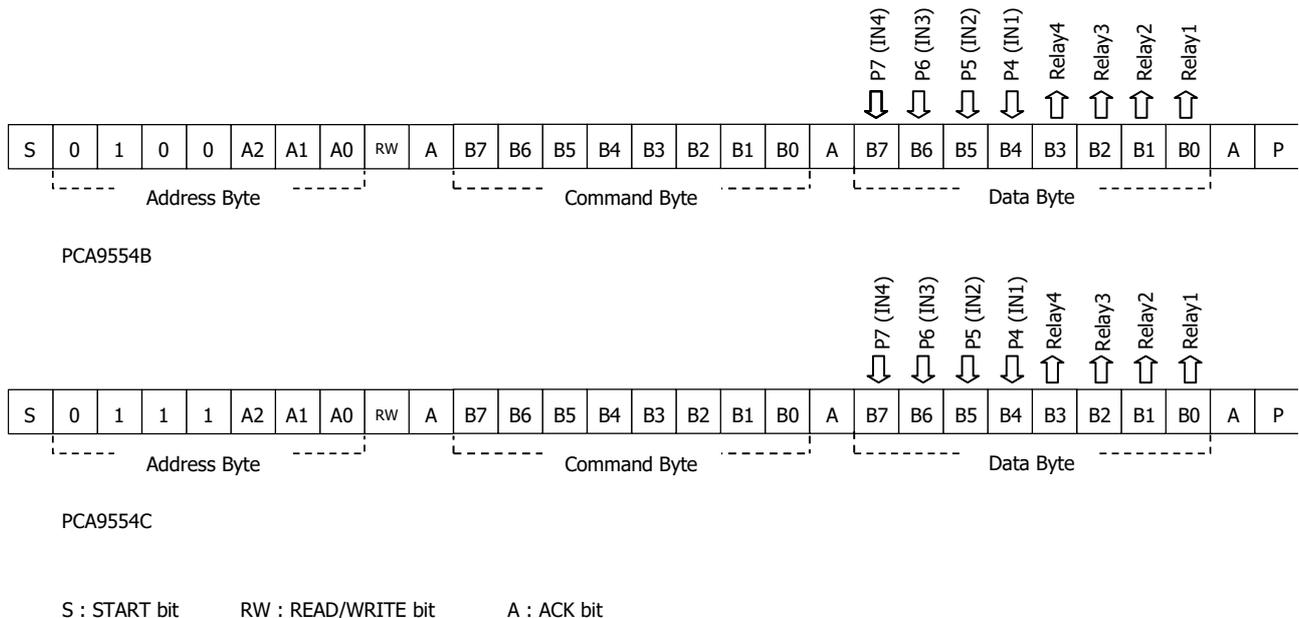


Figure 6: Data frame

6 Specifications

Parameters	Values
Operating voltage (VCC)	3.0VDC – 5.5VDC
Bus frequency	400kHz
On board I2C bus pull-up resistance	SDA: 10K SCL : 10K <i>These resistors can be enabled and disabled using jumpers.</i>
On board INT pull-up resistance	10K
I2C bus chips	PCA9554B: I2C-RL4xxINxxBM, I2C-RL4xxINxxBM PCA9554C: I2C-RL4xxINxxCM, I2C-RL4xxINxxCM <i>The only difference between PCA9554B and PCA9554C is their I2C bus address.</i>
I2C bus connectors	4-pin 2.00mm pin pitch
Opto-coupler inputs	
Total inputs	4 opto-coupler input ports
Input voltage	Logic "1": 5-30VDC Logic "0": Less than 5VDC
Logic "ON" current/voltage	3.5mA @5.0 VDC 10.8mA @12.0 VDC 22.8mA @24.0 VDC 29mA @30.0 VDC
Logic "OFF" current/voltage	1mA @2.0 VDC
Input impedance	1K ohm
Optical isolated input voltage	3700 VDC
Relay	
Total relays	4 relays
Relay coil's voltages (VREL)	12VDC: I2C-RL412INxxBM, I2C-RL412INxxCM 24VDC: I2C-RL424INxxBM, I2C-RL424INxxCM
Relay contact rating	10A @120VAC 10A @24VDC NO: 10A @250VAC, NC: 6A @250VAC <i>Please refer to the relay datasheet for the precise relay contact rating and specifications.</i>

Table 2: Specifications

7 Product Comparison

Board Models	I2C-RL412IN405BM	I2C-RL412IN405CM	I2C-RL424IN405BM	I2C-RL424IN405CM
Control chip	PCA9554B	PCA9554C	PCA9554B	PCA9554C
Relay coil voltage	12VDC	12VDC	24VDC	24VDC
I2C bus Address	0x20-0x27	0x38-0x3F	0x20-0x27	0x38-0x3F

Table 3 Product comparison

8 Dimensions

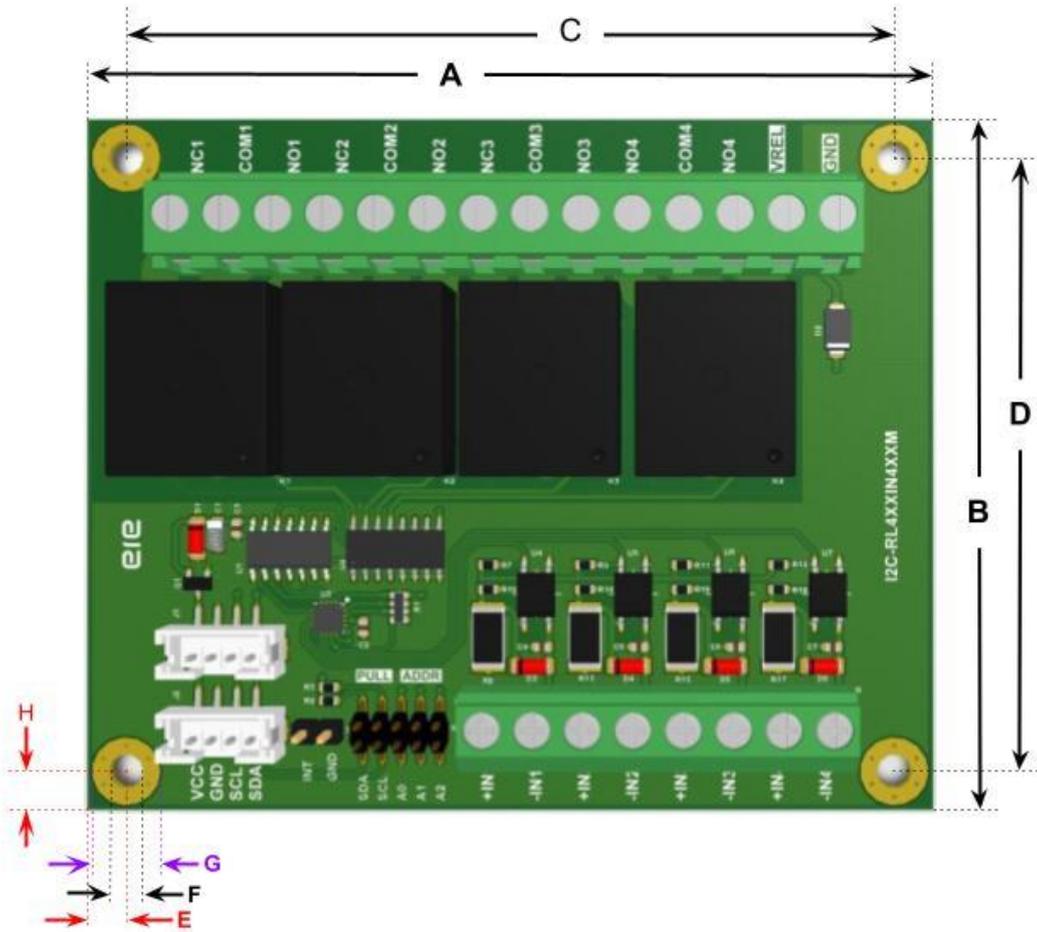


Figure 7: Dimensions

	Inch	mm
A	3.4448	87.50
B	2.8346	72.00
C	3.1299	79.50
D	2.5196	64.00
E	0.1574	4.00
F	0.1417	3.60
G	0.2834	7.20
H	0.1574	4.00

Table 4: Dimensions



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