I2C-RL412B, I2C-RL412C, I2C-RL424B, I2C-RL424C
4-Relay with 4-I/O 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-input/output (I/O) ports
- Relay coil voltage: 12VDC and 24VDC
- Relay contact rating: 10A @120VAC/24VDC, NO/NC: 10A/6A @250VAC
- Operating voltage: 3.0V to 5.5V
- On-board inverse polarity protection circuits
- Prevent relays turning-on during power-up
- PCB dimensions: 87.50 x 55.00 mm

This is an expansion relay board controlled via an I2C bus, making it ideal as a 4-relay and 4-I/O 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 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.

2 Diagram

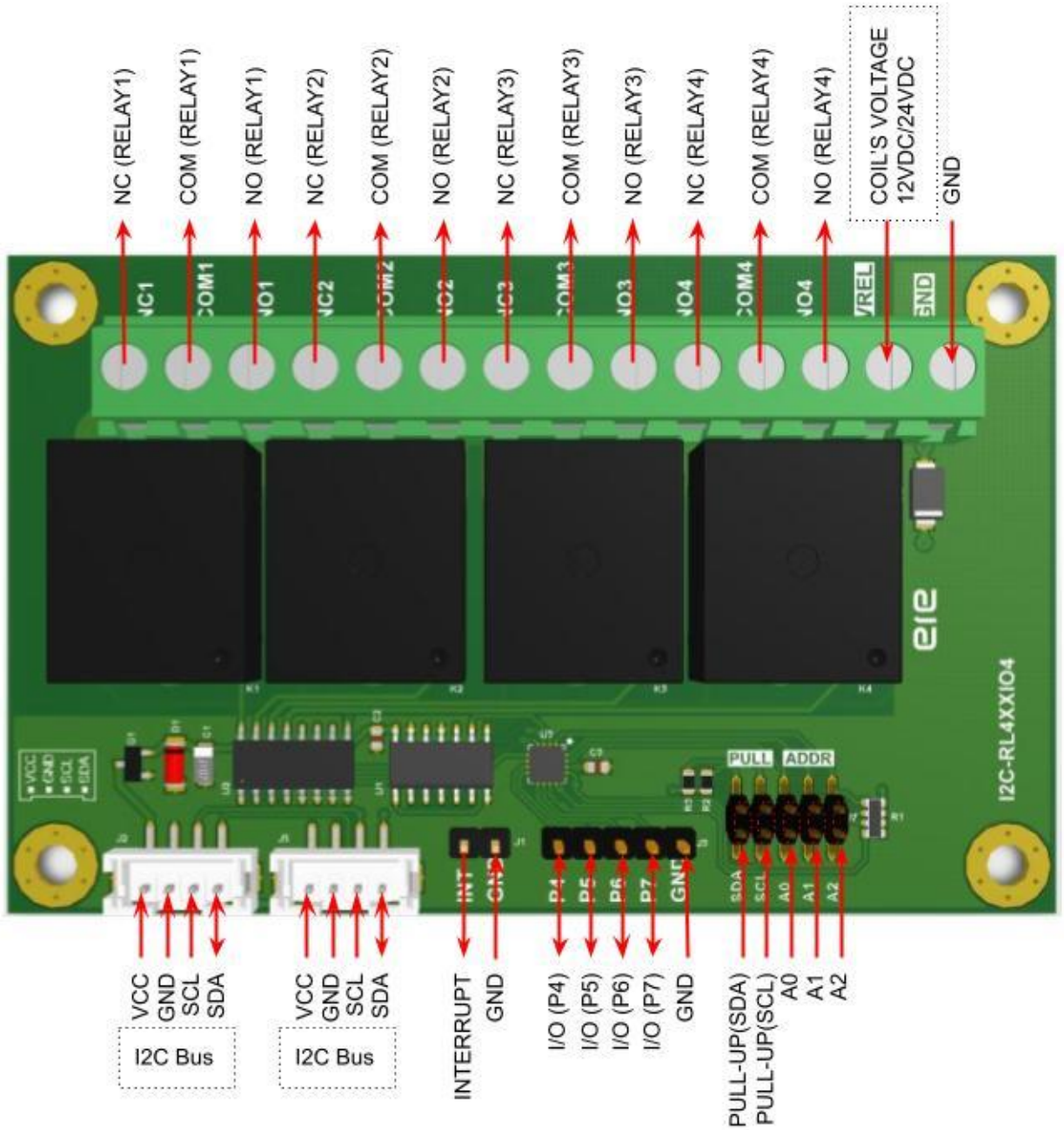

Figure 1: Board layout

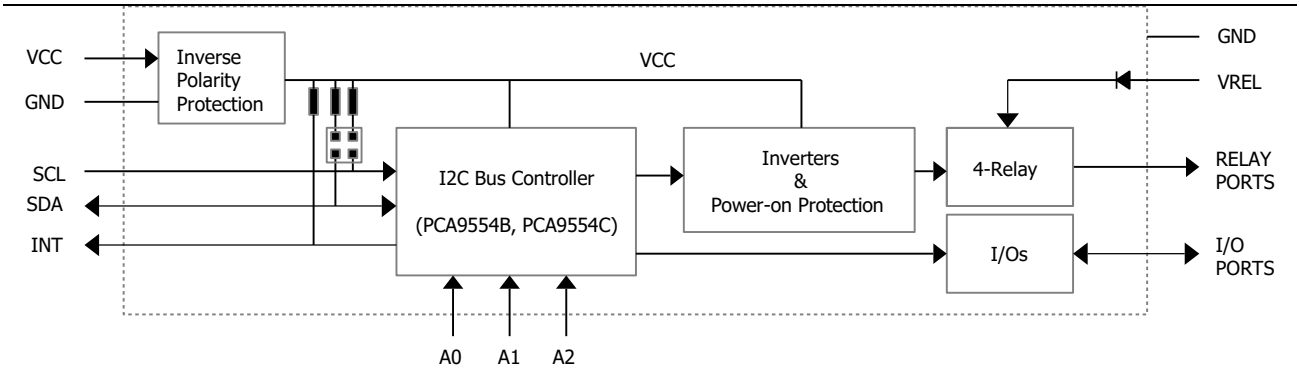

Figure 2: Block diagram

SYMBOL	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
I/Os (P4-P7)	Input and output 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. A 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.

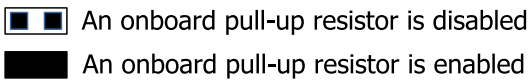

Figure 3: Jumpers for PULL-UP resistors

4 I2C bus address

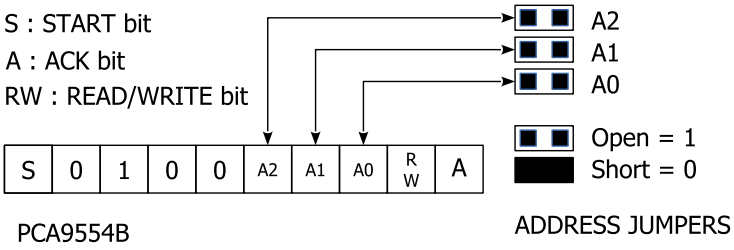

Figure 4: I2C-RL4XXB (PCA9554B) address

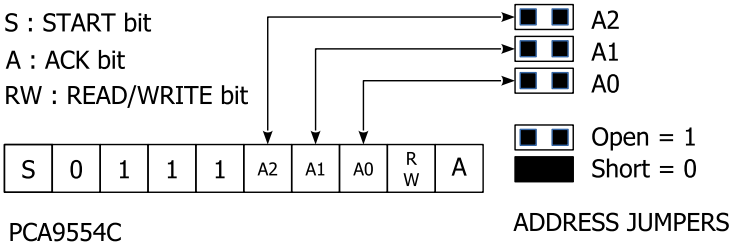

Figure 5: I2C-RL4XXC (PCA9554C) address

5 Data Frame

The data byte consists of 8 bits that control 4 relays and 4 input/output (I/O) 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 either input or output (I/O) 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.

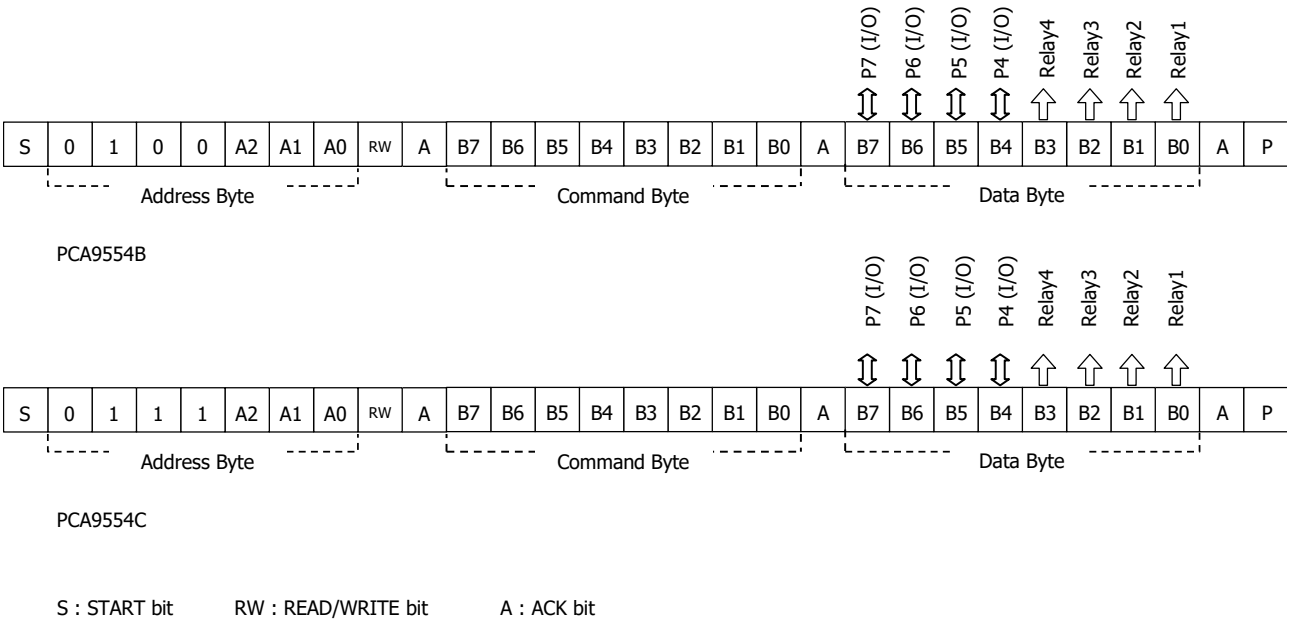

Figure 6: Data frame

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 *These resistors can be enabled and disabled using jumpers.*
On board INT pull-up resistance	10K
Relay coil's voltages (VREL)	12VDC: I2C-RL412B, I2C-RL412C 24VDC: I2C-RL424B, I2C-RL424C
I2C bus chips	PCA9554B: I2C-RL412B, I2C-RL424B PCA9554C: I2C-RL412C, I2C-RL424C *The only difference between PCA9554B and PCA9554C is their I2C bus address.*
Total relays	4 relays
Total I/O ports	4 I/Os
Relay contact rating	10A @120VAC 10A @24VDC NO: 10A @250VAC, NC: 6A @250VAC *Please refer to the relay datasheet for the precise relay contact rating and specifications.*
Maximum Voltage on I/Os	VCC
HIGH-level output current on I/Os	10mA
LOW-level output current on I/Os	25mA
I2C bus connectors	4-pin 2.00mm pin pitch

Table 2: Specifications

7 Dimensions

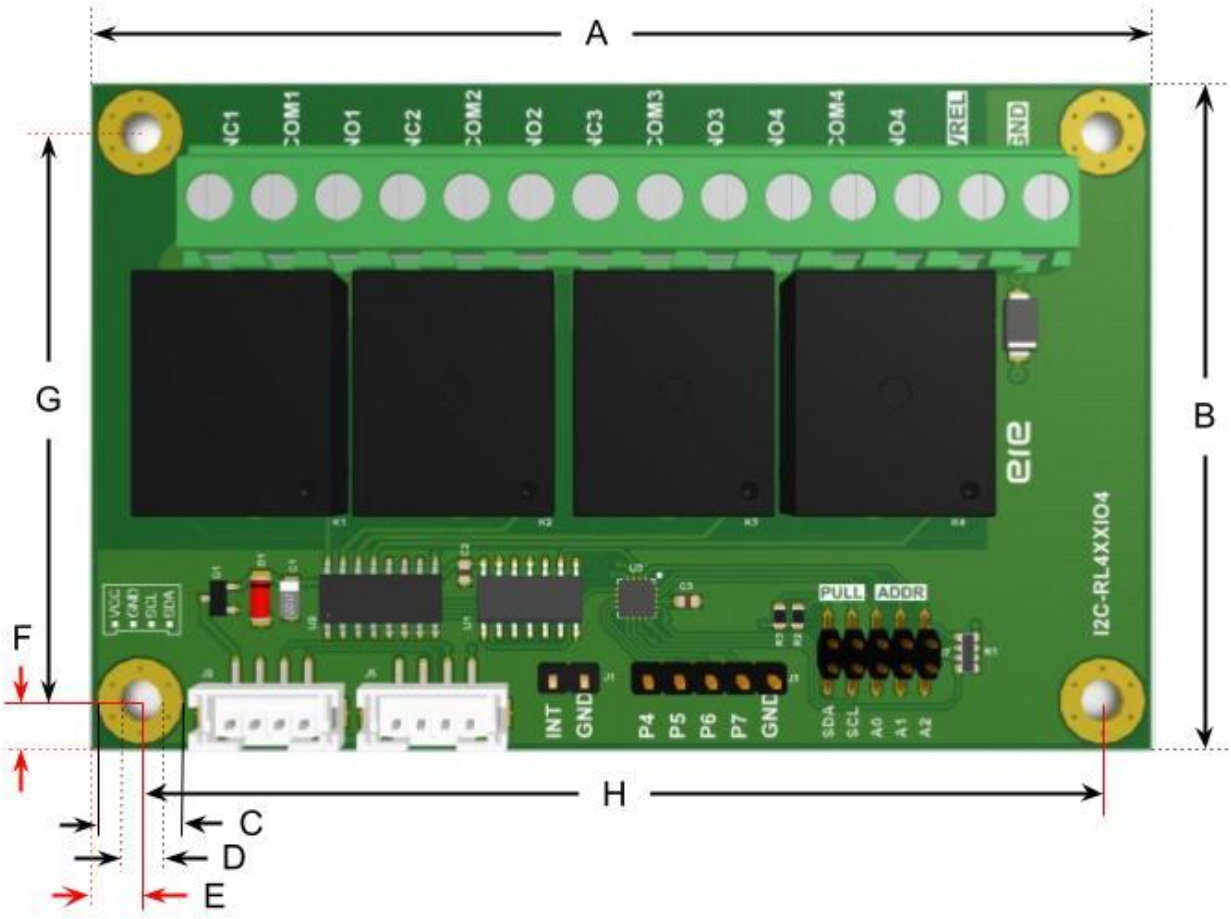

Figure 7: Dimensions

	Inch	mm
A	3.4448	87.50
B	2.1653	55.00
C	0.2795	7.10
D	0.1417	3.60
E	0.1574	4.00
F	0.1574	4.00
G	1.8503	47.00
H	3.1299	79.50

Table 3: Dimensions

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Declaration

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