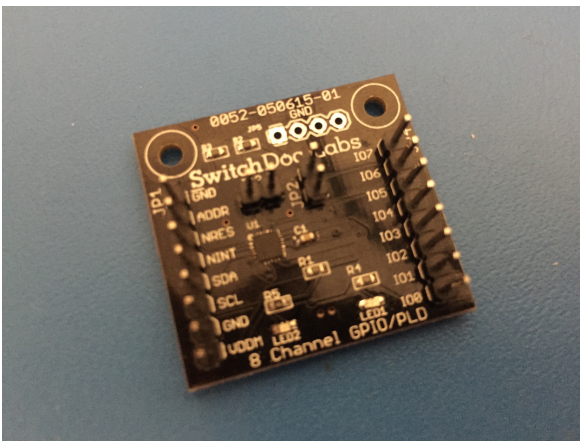


The **8 GPIO I2C Extender (8GPIO)** board is an easy to use 4 channel solid state relay board controlled by I2C. Each channel can switch up to 20V and 2.33A

#### Features and Benefits:

- Great for Robotics Projects
- I2C controlled
- 8 GPIO pins
- All pins can interrupt the computer
- Two bank power supply allows two banks of 4 GPIO pins to have 5V or 3.3V
- Can program GPIO pins to make up to 3 pin logic gates (PLD)
- Software drivers for Arduino and Raspberry Pi Include
- Low Cost
- Quantity Discounts Available
- Immediate Availability

## Introduction



This board is an inexpensive I2C controlled 8 pin GPIO Extender Board (8GPIO).

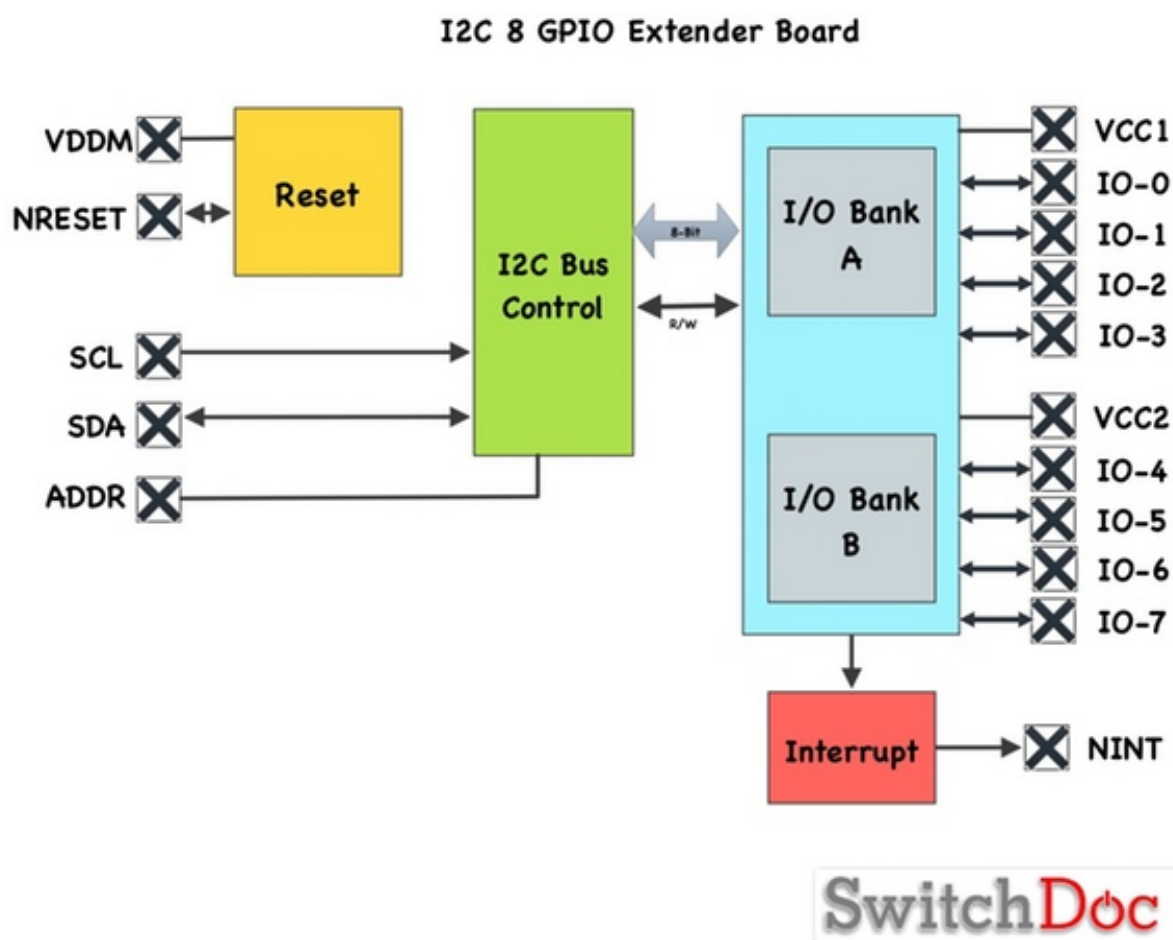
It allows you to add 8 pins of GPIO, with interrupts allowed on all pins, to any Arduino or Raspberry Pi design. It works with 5V and 3.3V and in fact you can have 4 pins at 5.0V while having 4 pins at 3.3V at the same time. It is based upon the Semtech SX1502 and it has some really excellent features include a PLD (Programmable Logic Device) mode.

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## How To Use

The 8GPIO board is a eight-channel, flexible 8 pin GPIO extender controlled by an I2C bus. The 8GPIO board uses a SX1502 8 channel GPIO extender to provides 8 additional GPIOs.

To use the 8GPIO board, you connect up the I2C bus to an Arduino or Raspberry Pi.



The 8 GPIO pins are split into two banks, A and B. Each bank can be set to be 3.3V or 5.0V compatible.



Signal Name	8 GPIO I2C Extender Board	8 GPIO I2C Extender Board
VDD1	VDDM (JP3/1)	VDD1 (JP4/1)
VDD2	VDDM (JP3/2)	VDD1 (JP4/2)

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## Arduino Uno

Signal Name	Arduino Uno	8 GPIO I2C Extender Board
Power	5.0V (POWER/5V)	VDDM(JP1/1)
GND	GND (POWER/GND)	GND (JP1/2)
SCL	ADC5/SCL (ANALOG IN/A5)	SCL (JP1/3)
SDA	ADC4/SDA (ANALOG IN/A4)	SDA (JP1/4)

Signal Name	8 GPIO I2C Extender Board	8 GPIO I2C Extender Board
VDD1	VDDM (JP3/1)	VDD1 (JP4/1)
VDD2	VDDM (JP3/2)	VDD1 (JP4/2)

---

## Arduinio Mega 2560

Signal Name	Arduino Mega 2560	8 GPIO I2C Extender Board
Power	5.0V (POWER/5V)	VDDM (JP1/1)
GND	GND (POWER/GND)	GND (JP1/2)
SCL	SCL (COMMUNICATIONS 21)	SCL (JP1/3)
SDA	SDA (COMMUNICATIONS 20)	SDA (JP1/4)

Signal Name	8 GPIO I2C Extender Board	8 GPIO I2C Extender Board
VDD1	VDDM (JP3/1)	VDD1 (JP4/1)
VDD2	VDDM (JP3/2)	VDD1 (JP4/2)

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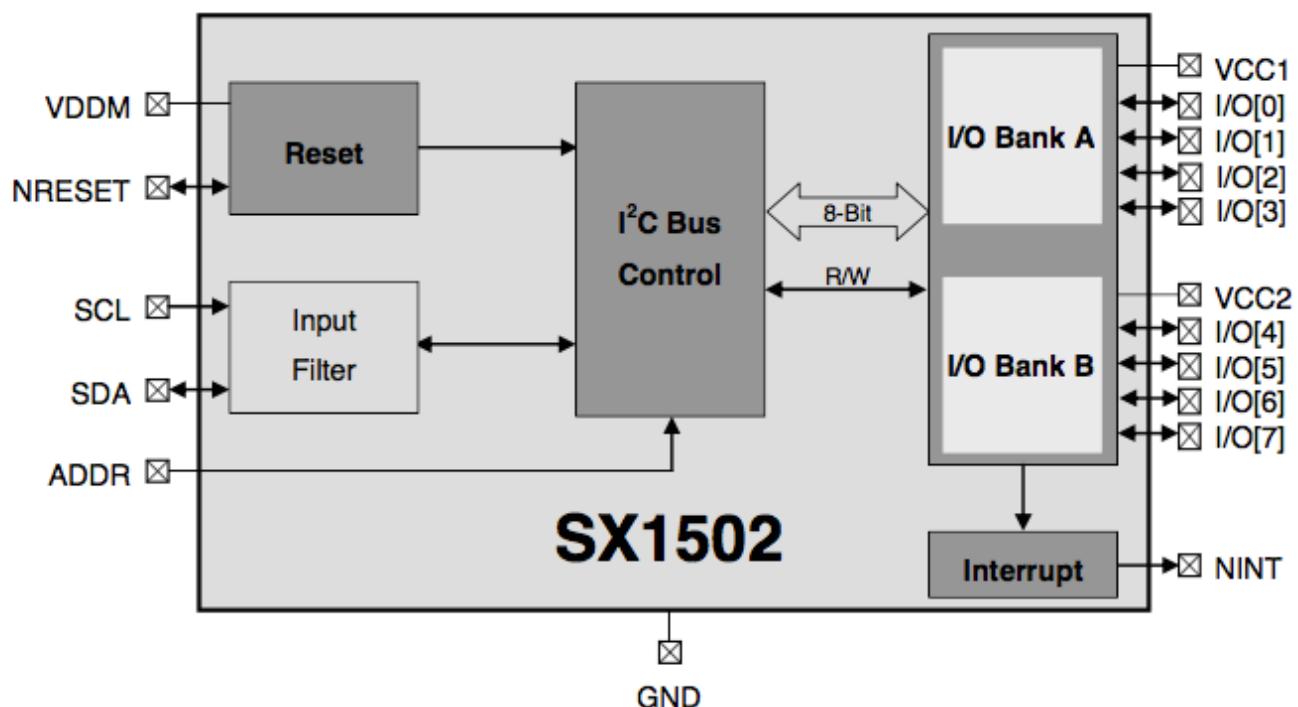
Note: As with most SwitchDoc Labs Breakout Boards, the 8 GPIO I2C Extender Board does not contain any Pullup resistors for the I2C Bus SCL/SDA. You must supply those somewhere on your bus (10K resistors generally work well). We do not put pull-ups on boards because if you put multiple devices on the same I2C bus you will end up having too many pull-ups.

## Theory of Operation

### SX1502 IC

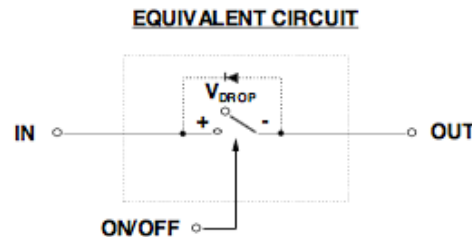
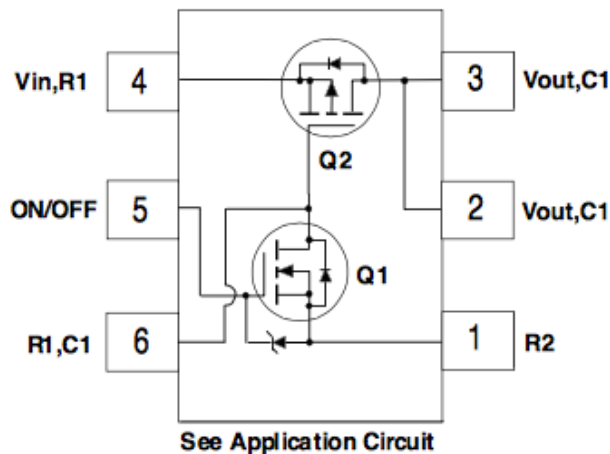
For more complete information, see the full SX1502 Specification at: <http://www.semtech.com/images/datasheet/sx150x.pdf>.

The 8GPIO board uses a Semtech SX1502 8 GPIO I2C IC to control the four solid state relays on the 8GPIO board.



The SX1502 is a complete ultra low voltage General Purpose parallel Input/Output (GPIO) expanders ideal for low power handheld battery powered equipment. It allows easy serial expansion of I/O through a standard I2C interface. GPIO devices can provide additional control and monitoring when the microcontroller or

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chipset has insufficient I/O ports, or in systems where serial communication and control from a remote location is advantageous.

These devices can also act as a level shifter to connect a microcontroller running at one voltage level to a component running at a different voltage level. The core is operating as low as 1.2V while the I/O banks can operate between 1.2V and 5.5V independent of the core voltage and each other.

Each GPIO is programmable via 8-bit configuration registers. Data registers, direction registers, pull-up/pull-down registers, interrupt mask registers and interrupt registers allow the system master to allow the system master to program and configure 8 GPIOs using a 2 wire standard 400kHz I C interface.

## PLD (Programmable Logic Device)

The SX1502 offers a unique fully programmable logic functions like a PLD to give more flexibility and reduce external logic gates used for standard applications. Pins IO4-IO7 are available for PLD use on the 8GPIO board.

Since the whole truth table is fully programmable, the SX1502 can implement combinatory functions ranging from the basic AND/OR gates to the most complicated ones with up to four 3-to-1 PLDs or two 3-to-2 PLDs which can also be externally cascaded if needed.

In all cases, any IO not configured for PLD functionality retains its GPIO functionality while I/Os used by the PLD have their direction automatically set accordingly.

Please note that while RegDir corresponding bits are ignored for PLD operation they may still be set to input to access unused PLD inputs as normal GPI (PLD truth table can define some inputs to have no effect on PLD output) and/or generate interrupt based on any of the PLD inputs or outputs bits.

For more information, check out the SX1502 specification from Semtech.

## Use in the 8GPIO Board

As you can see in the block diagram in the previous section, the 8GPIO solid state switches are available on header JP4 as standard GPIO pins. Each of the IO0 has an indicator LED to show that the GPIO Pin has been turned on. Each bank (IO0-3 and IO4-7) can be set to be 3.3V or 5.0V pins.

## Operating Values

			Min	Normal	Max	Unit
VDDM	Supply Voltage		1.2		5.5	V
VCC1/VCC2	IO Supply Voltage		1.2		5.5	V
IOH	GPIO Output High Source Current				8 at VCC1/ VCC2 > 2V 0.3 at VCC1/ VCC2 < 2V	mA
IOL	GPIO Output High Source Current				12 at VCC1/ VCC2 > 2V 6 at VCC1/ VCC2 < 2V	mA

## Pin Locations

Physical dimensions of board: 31 mm x 34 mm x 12mm(max).

### I/O Key:

I - Digital Input  
O - Digital Output  
A - Analog



## Pin Functions

### JP1 - Computer Side Pins

Input / Output Control Lines for 8 GPIO I2C Extender Board

NAME	PIN	I/O	DESCRIPTION
VDDM	JP1 / 1	A	Power for the 8 GPIO I2C Extender Board. Use 3.3V with Raspberry Pi and 5.0V with Arduino
GND	JP1 / 2	A	GND
SCL	JP1 / 3	I	Serial bus clock line; open-drain input.
SDA	JP1 / 4	I/O	Serial bus data line; open-drain input/output.
NINT	JP1 / 5	O	Outgoing Interrupt Line; 0 = Interrupt; open-drain output
NRES	JP1 / 6	I	Reset SX1502; open-drain input
ADDR	JP1 / 7	I	8GPIOB I2C Address Select - 0x21 if tied to VDDM, 0x20 if tied to GND. Default 0x21
GND	JP1 / 8	A	GND

### JP2 - Auxiliary VDDM Pins

Auxiliary VDDM pins

NAME	PIN	I/O	DESCRIPTION
VDDM	JP3 / 1	A	Tied to VDDM input on JP2 (JP2/1)
VDDM	JP3 / 2	A	Supply for SX1502 IO pins 4-7 (connected to load switches). Often tied to VDDM, but can be tied to 3.3V or 5.0V to provide level translation.



## JP3 - Bank A/B Power Supplies

VCC1/VCC2 Power Supplies

NAME	PIN	I/O	DESCRIPTION
VCC1	JP3 / 1	A	Supply for SX1502 IO pins 0-3. Often tied to VDDM, but can be tied to 3.3V or 5.0V to provide level translation.
VCC2	JP3 / 2	A	Supply for SX1502 IO pins 4-7. Often tied to VDDM, but can be tied to 3.3V or 5.0V to provide level translation.

## JP4 - GPIO Pins

GPIO Pins

NAME	PIN	I/O	DESCRIPTION
IO0	JP4 / 1	D	GPIO Pin 0
IO1	JP4 / 2	D	GPIO Pin 1
IO2	JP4 / 3	D	GPIO Pin 2
IO3	JP4 / 4	D	GPIO Pin 3
IO4	JP4 / 5	D	GPIO Pin 4
IO5	JP4 / 6	D	GPIO Pin 5
IO6	JP4 / 7	D	GPIO Pin 6
IO7	JP4 / 8	D	GPIO Pin 7

## JP5 - Auxiliary GND Pins

Auxiliary GND pins

NAME	PIN	I/O	DESCRIPTION
GND	JP4 / 1	A	GND
GND	JP4 / 2	A	GND
GND	JP4 / 3	A	GND
GND	JP4 / 4	A	GND

## Software for Arduino and Raspberry Pi

SwitchDoc Labs developed this pure Python Raspberry Pi library for this 8 GPIO I2C Extender Board as well as developing the Arduino C++ driver.

The software is located on the SwitchDoc Labs github under [https://github.com/switchdoclabs/SDL\\_Pi\\_SX1502](https://github.com/switchdoclabs/SDL_Pi_SX1502).

Arduino drivers are also located on github under [https://github.com/switchdoclabs/SDL\\_Arduino\\_SX1502](https://github.com/switchdoclabs/SDL_Arduino_SX1502)

The first test on the Raspberry Pi should always be “i2cdetect -y 1” which should show you the 8GPIOB at the default address of 0x21.

A similar test can be run on the Arduino (I2CTest - <http://playground.arduino.cc/Main/I2cScanner>).

Running the test results from the 8 GPIO I2C Extender board are below on the Raspberry Pi:

Test SDL\_Pi\_SX1502 Version 1.0 - SwitchDoc Labs

Sample uses 0x21 I2C Address  
Blinks IO0 once every second  
Program Started at:2015-08-04 03:45:27

```

-----
-----
+++++++
('GPIO Value =', 1)
-----
-----
-----
+++++++
('GPIO Value =', 1)
-----
-----
-----
+++++++
('GPIO Value =', 1)
-----
-----

```

Next, here are the results of the 8GPIOB test on the Arduino. This test blinks the IO0 LED:

```
-----
SDL_Arduino_SX1502_Test
Version 1.1
-----
```

```
+++++
GPIO Value =1
-----
-----
-----
```

```
+++++
GPIO Value =1
-----
-----
-----
+++++
```