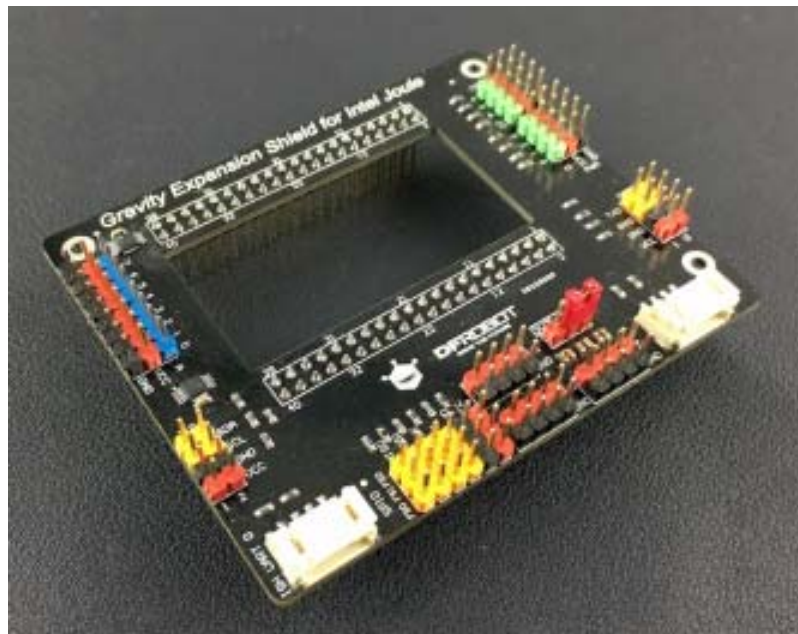# Gravity Expansion Shield for Intel Joule

# SKU: DFR0465



## Introduction

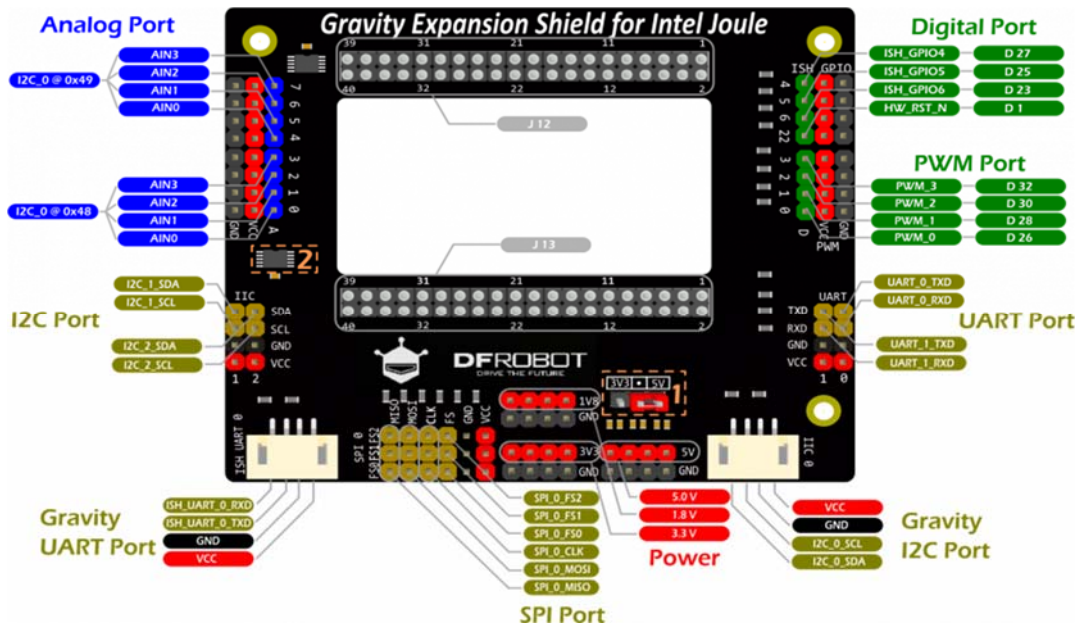Try to use Intel Joule with hundreds of sensors and modules. This will be a really good choice.

## Feature

- Deprecated shield board for Intel Joule
- Onboard ADC support
- Easy-to-use DFRobot Gravity connecter
- 3.3V and 5V multi-voltage support

# Specification

| | |
|---|---|
| Digital I/O: | 8 |
| PWM: | 4 |
| Analog I/O: | 8 (using onboard chip via I2C) |
| SPI: | 1 (with 3 chip select pins) |
| I2C: | 3 |
| UART: | 3 |
| Power Output: | 5V & 3.3V & 1.8V |
| Gravity I2C: | 1 |
| Gravity UART: | 1 |
| Module Voltage: | 5V or 3.3V |
| Size: | 86mm * 71mm * 22mm |
| Weight: | 30g |

# Board Overview

**Details about the board**

 Jumper cap for switching voltage

All the red pin named "VCC" on this board will affect.

Jumper on 3V3 side: VCC = 3.3V
Jumper on 5V side: VCC = 5V

 ADC chip: ADS1115

Two ADS1115 carry 8 analog pins altogether and they are connected on I2C Bus 0.

I2C Address: 0x48 >> A0 ~ A3
I2C Address: 0x49 >> A4 ~ A7

Also see "Analog Read Demo" below.

**NOTE**: Other pins's function on Joule, you can check them here.

http://www.intel.com/content/www/us/en/support/boards-and-kits/000022494.html

## Get Started to blink a LED

In this section you will create your first project with Intel Joule -- Blink a LED.

### Tools needed

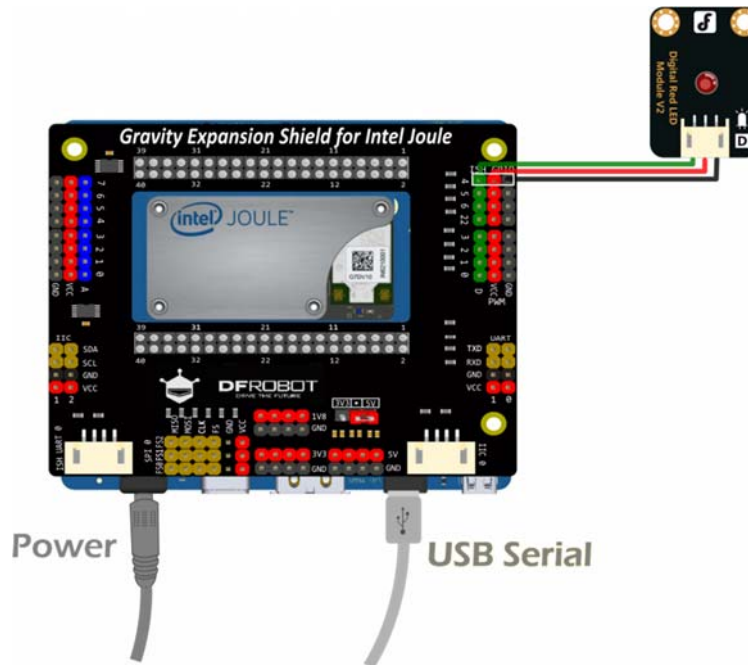| | |
|---|---|
| Intel Joule Developer Kit | x1 |
| Gravity Expansion Shield for Intel Joule | x1 |
| Gravity Sensor Kit for Intel Joule | x1 |
| Wall Adapter Power Supply 7.5VDC 1A | x1 |

### Intel Joule Setup

- Please follow the **<Intel® Joule Module User Guide>** for the setup steps. It is a deprecated and detailed guide by Intel. http://www.intel.com/content/www/us/en/support/boards-and-kits/000022494.html

## Hardware Connection



## Hardware

- Plug Gravity Expansion Shield onto Intel Joule board.
- Connect the power supply
- Connect usb serial port to your computer.
- Find the "Gravity:Digital RED LED Light Module" in the "Gravity Sensor kit for Intel Joule" and connect to GPIO pin 4 as the hardware connection showed above.

## Software

⚠ There is a known software issue in MRAA which prevents GPIO working properly. We reported it to Intel and they solved it quickly. However, it will not be released until fully tested.

Although It is a better idea to wait for the the fully tested version, if you are willing to have a try, you can get here and update the latest version.

https://software.intel.com/en-us/updating-libraries-for-joule

- Login your Joule via Putty or other serial tools.
- Create a Node JS example using vi.

```
vi blink.js
```

**NOTE**: Tip to get the right pin number:



For example: GPIO Pin 4 on board >> ISH_GPIO4 >> D 27, so the pin number in the code should be 27.

Please check the Board Overview for other pins.
https://www.dfrobot.com/wiki/index.php/Gravity_Expansion_Shield_for_Intel_Joule_SKU:_DFR0465#Board_Overview

```javascript
var m = require('mraa'); //require mraa

console.log('MRAA Version: ' + m.getVersion()); //write the mraa version to the console


var myLed = new m.Gpio(27); //Corresponding to ISH_GPIO4

myLed.dir(m.DIR_OUT); //set the gpio direction to output

var ledState = true; //Boolean to hold the state of Led


function periodicActivity()
{
  myLed.write(ledState?1:0); //if ledState is true then write a '1' (high) otherwise write a '0' (low)
    ledState = !ledState; //invert the ledState
    setTimeout(periodicActivity,1000); //call the indicated function after 1 second (1000 milliseconds)
}


periodicActivity(); //call the periodicActivity function
```
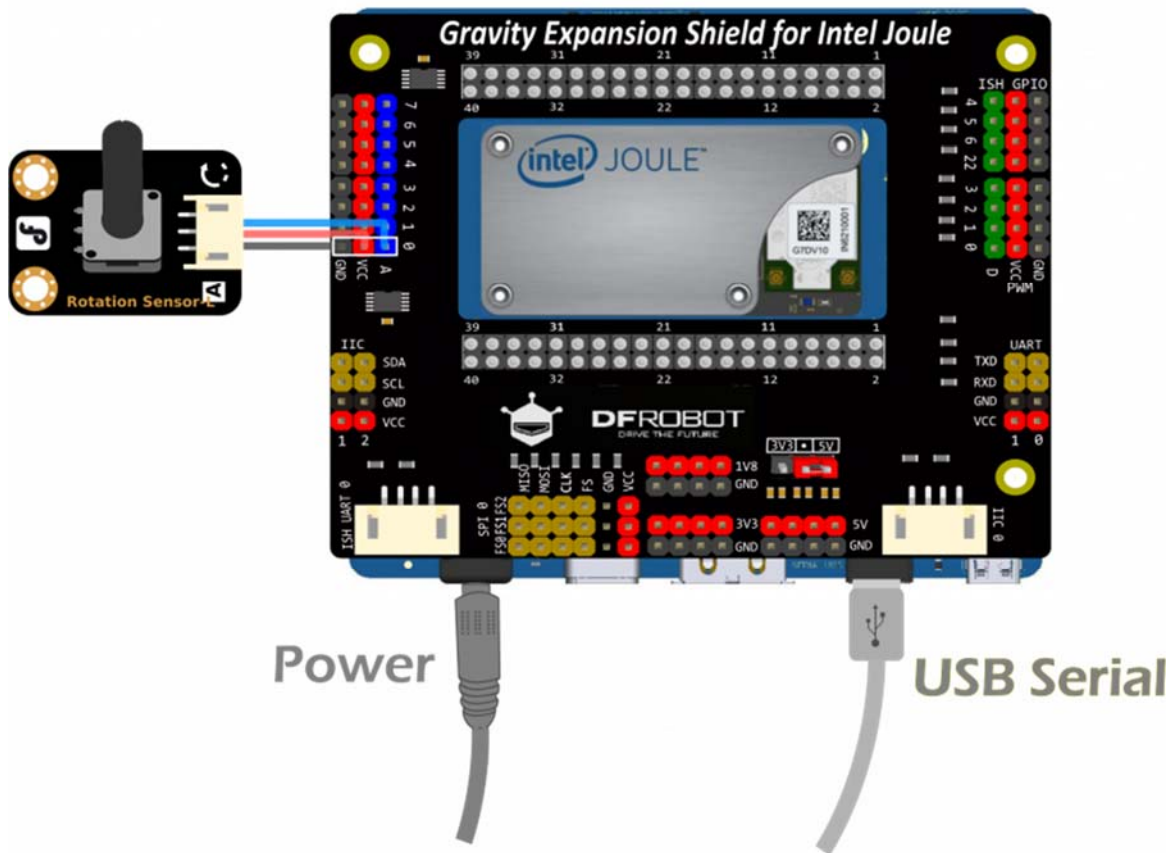
- Run the node sample in the bash.

```
node blink.js
```

- The LED starts to blink.
- <Ctrl>+<C> to stop running the demo.
- You have done the first project on Intel Joule. Well Done!

---

## Analog Read Demo

In this section, you will know how to use the onboard ADS1115. For this demo, we assume that you have successfully finished the blink demo above.

# Hardware Connection



## Hardware

Find the "Gravity:Analog Rotation Potentiometer Sensor V1 For Arduino" module in the "Gravity Sensor kit for Intel Joule" and connect to Analog pin 0 as the hardware connection showed above.

## Software
Run the following code to get the analog result.

```javascript
var mraa = require('mraa');
var version = mraa.getVersion();


if (version >= 'v0.6.1') {

    console.log('mraa version (' + version + ') ok');

}
else {

    console.log('mraa version(' + version + ') is old - this code may not wor
k')

}


var ads1115 = new mraa.I2c(0);


//A0~A3
ads1115.address(0x48)


//A4~A7
// ads1115.address(0x49)


setInterval(function(){
//A0 if i2c address is 0x48
//A4 if i2c address is 0x49
    ads1115.writeWordReg(1, 0x83C1);


//A1 if i2c address is 0x48
//A5 if i2c address is 0x49
//    ads1115.writeWordReg(1, 0x83D1);


//A2 if i2c address is 0x48
//A6 if i2c address is 0x49
//    ads1115.writeWordReg(1, 0x83E1);
```

```
//A3 if i2c address is 0x48

//A7 if i2c address is 0x49

//    ads1115.writeWordReg(1, 0x83F1);


    var raw = ads1115.readWordReg(0);

    var analogValue = ((raw&0xff00)>>8)+((raw&0x00ff)<<8);


    console.log(analogValue);
}, 200);
```

---

## Digital Read Demo

This Demo read the digital onboard GPIO pin 4 . we assume that you have successfully finished the demos above.

## Software

```
var m = require('mraa'); //require mraa

console.log('MRAA Version: ' + m.getVersion()); //write the mraa version to t
he console


var myDigitalPin = new m.Gpio(27); //setup digital read on onboard pin 4


myDigitalPin.dir(m.DIR_IN); //set the gpio direction to input

periodicActivity(); //call the periodicActivity function


function periodicActivity() //
{
  var myDigitalValue =  myDigitalPin.read(); //read the digital value of the
pin

  console.log('Gpio is ' + myDigitalValue); //write the read value out to the
console

  setTimeout(periodicActivity,1000); //call the indicated function after 1 se
cond (1000 milliseconds)
}
```

## PWM Demo

This Demo set the PWM value onboard PWM pin 3 . we assume that you have successfully finished the demos above.

### Software

```
var mraa = require('mraa');

var pin = new mraa.Pwm(32);

pin.enable(true);

pin.write(0.8)
```

## Servo Demo

This Demo control the Servo through PWM pin 0 . we assume that you have successfully finished the demos above.

### Software

```
var Servo_pin = 26;//Initialize PWM on Digital Pin #26 (D26) and enable the p
wm pin

var PWM_period_us = 20000;

var Min_Duty_Cycle = 0.029;

var Max_Duty_Cycle = 0.087;


var mraa = require("mraa"); //require mraa

console.log('MRAA Version: ' + mraa.getVersion()); //get the MRAA version

var pwm = new mraa.Pwm(Servo_pin);

pwm.enable(false);

pwm.period_us(PWM_period_us);

pwm.enable(true);


var servoState = true; //Boolean to hold the state of Led


function periodicActivity()
```

```
{
  moveServo(servoState?80:100); //move the servo to 80 or 100 degree

  servoState = !servoState;

  setTimeout(periodicActivity,1000);

}


periodicActivity(); //call the periodicActivity function


function moveServo(degree) {

    var processedValue = MapRange(degree,0,180,Min_Duty_Cycle,Max_Duty_Cycle)
;

    pwm.write(processedValue); //Write duty cycle value.

}


function MapRange (in_vaule, in_min, in_max, out_min, out_max) {

    var output = (in_vaule - in_min) * (out_max - out_min) / (in_max - in_min
) + out_min;

    if (output >= out_max) {

        output = out_max;

    } else {

        if (output <= out_min) {

            output = out_min;

        }

    }

    return output

}
```

## More Demos

The above demo is only the most fundamental one. You can check the joule github page for more demos

Or you can take a look at the examples of mraa.   https://github.com/intel-iot-devkit/mraa/tree/master/examples

# More

- ## Hardware
- Intel® Joule Expansion Board Pin Connector  http://www.intel.com/content/www/us/en/support/boards-and-kits/000022494.html
- Home page of Intel Joule  https://software.intel.com/en-us/iot/hardware/joule
- Expansion Board for Intel Joule Schematic  http://www.intel.com/content/dam/support/us/en/documents/joule-products/intel-joule-expansion-board-schematic.pdf
- Gravity Expansion Shield for Intel Joule Schematic
  https://raw.githubusercontent.com/DFRobot/WikiResource/master/DFR0465/Gravity%20Expansion%20Shield%20for%20Joule%20V1.0_原理图.PDF
- ADS1115 datasheet  http://www.ti.com/lit/ds/symlink/ads1113.pdf
- ## Software
- Intel® Joule Module User Guide  https://software.intel.com/en-us/intel-joule-getting-started
- libmraa - Low Level Skeleton Library  https://github.com/intel-iot-devkit/mraa
- Intel® Joule™ Module Code Samples  https://github.com/intel-iot-devkit/joule-code-samples
- Flashing the development platform with the latest version of Reference Linux* OS for IoT
  https://software.intel.com/en-us/flashing-ostro-on-joule
- Flashing the BIOS  https://software.intel.com/en-us/flashing-the-bios-on-joule