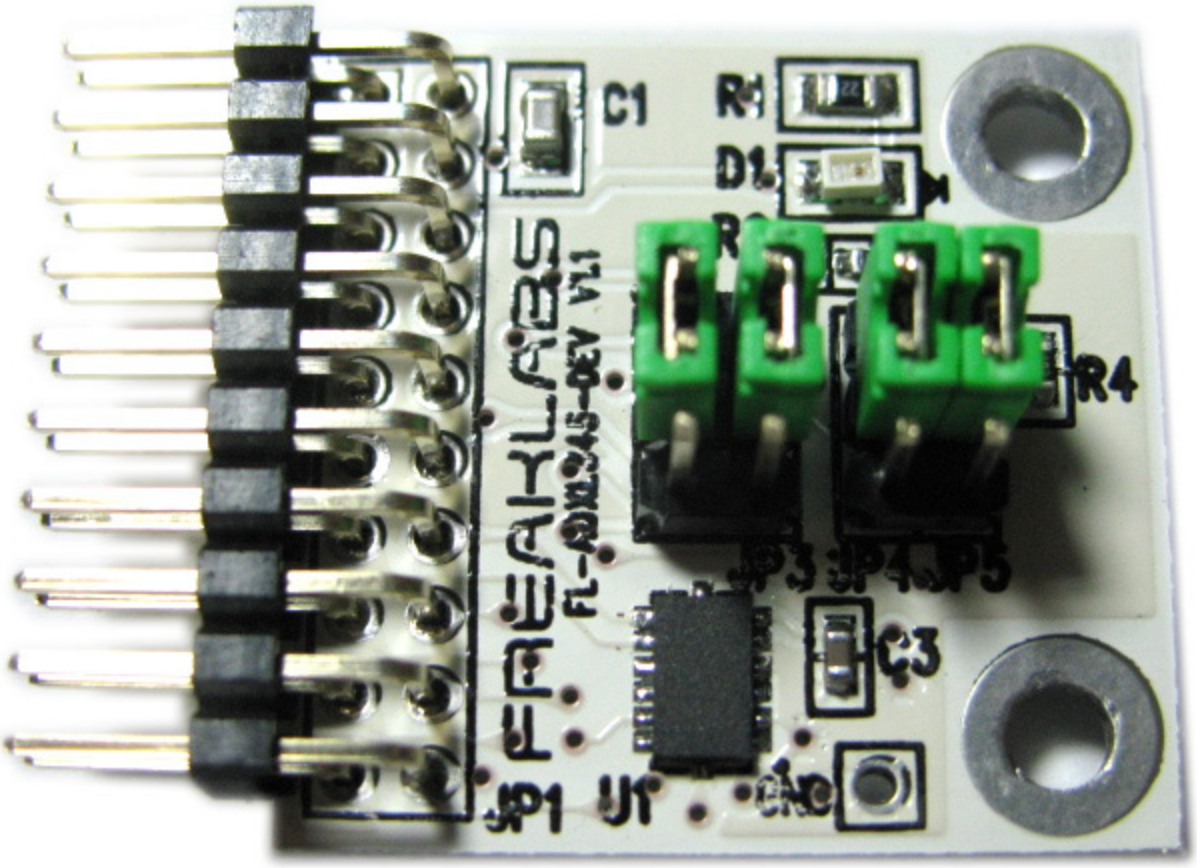
FREAKLABS

Rapid Prototyping Platform

FL-ADXL345-DEV v1.1

User Guide v1.1A



Document Revision History

Date	*Description*
2010-05-01	User Guide v1.1A Document creation

Specifications

The FreakLabs FL-ADXL345-DEV accelerometer board is a rapid prototyping sensor board designed to quickly evaluate and test applications that require an accelerometer. The board uses an ADXL345 3-axis accelerometer with a high sensitivity and +/-16g maximum measurement capability. The board also contains a FreakLabs universal serial peripheral connector so that it can be seamlessly integrated into any FreakLabs MCU development board.

Quick Specs

Sensor: ADXL345

Features: +/-16g 3-axis accelerometer, I2C/SPI interface, tap/double-tap detection, free-fall detection, FIFO, 2 mappable interrupts

Connectors: 1 USC Peripheral

Peripherals

The ADXL345 was chosen because of some very nice features. One of the main features is a digital interface using either I2C or SPI bus. Previous versions of the Analog Devices 3-axis accelerometer MEMS sensors had three separate analog outputs and required three ADC channels. The ADC channels are now integrated on-board the chip and the measurements for each axis can be directly read from the chosen bus.

Integrating the measurement circuitry on-board also allowed the ADXL345 to incorporate other interesting features such as two separate interrupt lines, tap and double-tap detection, activity/inactivity detection, free-fall detection, smart power management, and FIFO-buffered measurements.

There are two separate interrupt lines on the chip and the interrupt sources can be mapped to either of these interrupts. Each interrupt pin can also support multiple interrupt sources which allows a great deal of flexibility in how to manage the interrupts, especially for applications where the interrupt will signal a processor to wake.

The accelerometer can also be used to generate interrupts on tap and double-tap detection. The user just needs to specify the parameters that signal a tap or double tap. Tap detection can also be set specifically on each axes.

The device can also generate interrupts on activity or inactivity, as determined by thresholds set in the register. If an accelerometer measurement is above the activity threshold, an interrupt will be sent to the mapped interrupt pin. Or if a measurement is below the inactivity threshold for a specified amount of time, then an interrupt can also be generated and the device can also be set to go to sleep mode.

Free fall detection processes the values of all three axes and compares it to a free-fall threshold set in the device registers. If the threshold is exceeded, then a free-fall interrupt will be generated. This is potentially very useful for things like fall-detection in wireless health monitoring types of applications.

Finally, the device has a configurable FIFO to buffer measurements. If a high measurement time resolution is required, the FIFO can buffer the measurements to relieve the burden on the proces-

sor for reading out each measurement in real time. The FIFO can hold up to 32 measurements and a configurable watermark can be set which will trigger an interrupt when the watermark is exceeded. In a typical application that uses the FIFO buffering, the processor would wait for a watermark interrupt and then drain the FIFO of data, rather than constantly polling the device for each measurement. This is also very useful in a low power application where the processor will sleep as the measurements are taken and only wake to drain the FIFO, collect the data, and possibly transmit it to a central location for processing.

Jumpers/Options

There are four option jumpers that need to be configured on the board. These jumpers determine whether the device will use the I2C interface or SPI interface. The jumper mapping is as follows:

SPI/I2C Interface Select		
Jumper	***Position (1-2)***	***Position (2-3)***
JP2	SPI MOSI	I2C SDA
JP3	SPI SCLK	I2C SCL
JP4	SPI MISO	I2C ADDR SELECT
JP5	SPI SELECT_N	UNUSED/PULLUP

There are also two option resistors that need to be chosen in I2C mode to select the I2C device address. Only one resistor should be populated. The default is R3:

Resistor	***I2C Dev Addr***
R2	0x1D
R3	0x53

Connectors

The universal serial connector (USC) interface is standard for all of the FreakLabs development boards. The FL-ADXL345-DEV board contains a peripheral-side universal serial connector.

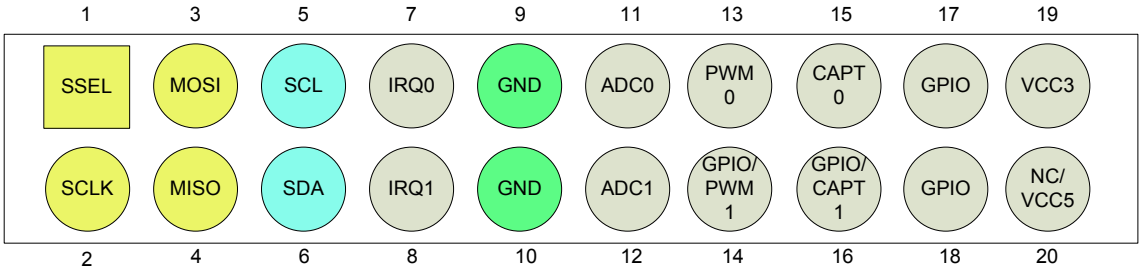
Universal Serial Connector Pinouts

The FL-ADXL345-DEV radio board supports the Universal Serial Connector (USC) v1.1. The connector supports an SPI bus, I2C bus, 2 interrupts, 2 analog inputs, 1 PWM output, 1 timer/capture input, 6 GPIOs, 3.3V supply, and optional 5V supply. All pins except power pins can also be used as GPIO if there is no need for the principal function. In the case of the radio board, only the SPI bus, 1 interrupt, and a few GPIO pins are used.

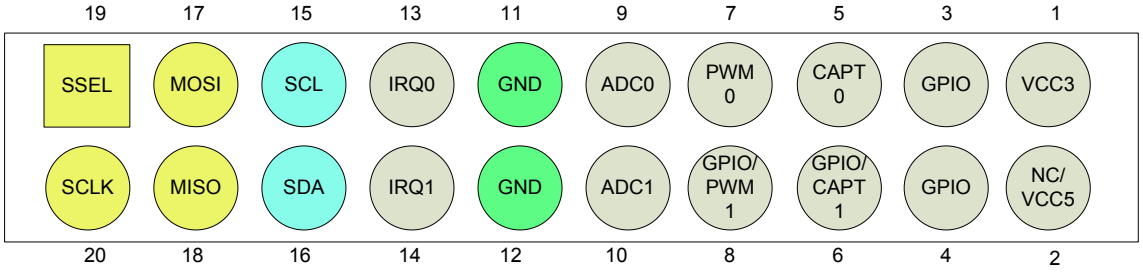
The connector consists of a host side which is a 20-pin, female, right-angle header and a peripheral side which is a 20-pin, male, right-angle header. The host side connector will always be on MCU boards and the peripheral connector will be found on peripheral boards that interface to the MCU boards.

The reason right angle connectors were chosen was so that the complete system can be level. This makes it easier to access individual signals and pins, as well as make modifications to the circuit. The following diagram shows the pinouts of the connectors:

Universal Serial Connector v1.1 – Host (MCU) side



Universal Serial Connector v1.1 – Peripheral side



The specific pinout of the universal serial peripheral connector of the FL-BRDBRD-DEV board can be found below:

USC Peripheral Connector (JP1)			
Pin	Description	Pin	Description
1	VCC3	2	NC
3	NC	4	NC
5	NC	6	NC
7	NC	8	NC
9	NC	10	NC
11	GND	12	GND
13	INT0	14	INT1
15	SCL	16	SDA
17	MOSI	18	MISO
19	SS_n (SPI Select)	20	SCLK

Disclaimer

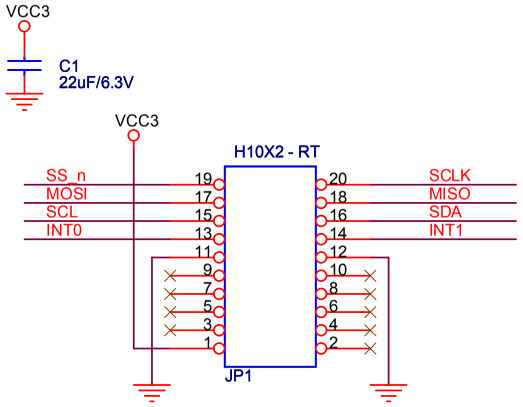
The FL-ADXL345-DEV board is NOT FCC approved. It is designed to comply with FCC Part 15 rules. However this board is not in a finished product form and is only intended for experimental and research/development purposes. If you wish to use this board in an actual product, you will need to attain certification with the appropriate local regulatory body for the complete system. Additionally, please use the wireless equipment in a responsible manner with regard for others and your surroundings.

Schematics

Schematics can be found on the following page:

JUMPERS NEED TO BE CONFIGURED FOR SPI OR
I2C OPERATION.

JP2: (1-2) SPI MOSI (2-3) I2C SDA
JP3: (1-2) SPI SCLK (2-3) I2C SCL
JP4: (1-2) SPI MISO (2-3) I2C ADDR SEL
JP5: (1-2) SPI SEL (2-3) UNUSED (PULLUP)



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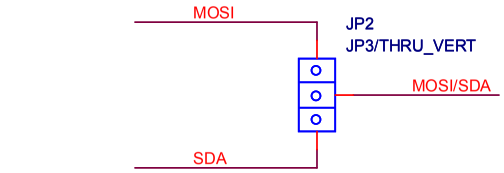

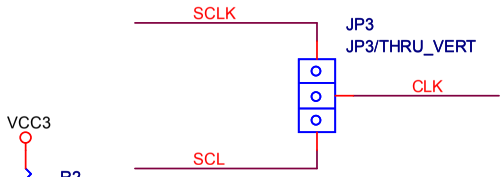

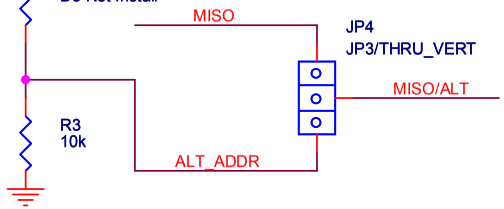

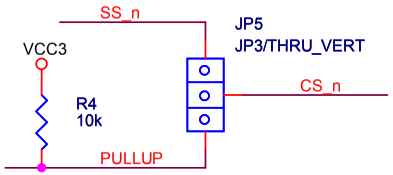

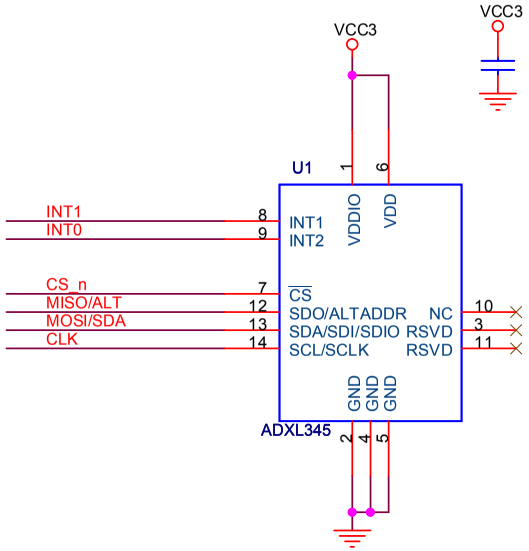

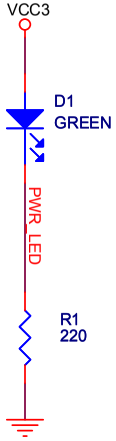

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A	Page Title:	SENSOR	v1.1
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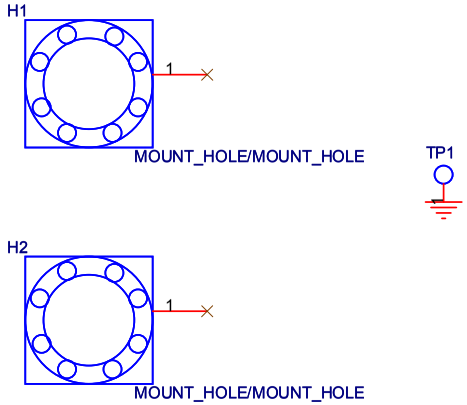

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A	FL-ADXL345-DEV	v1.1
	Page Title: MISC	
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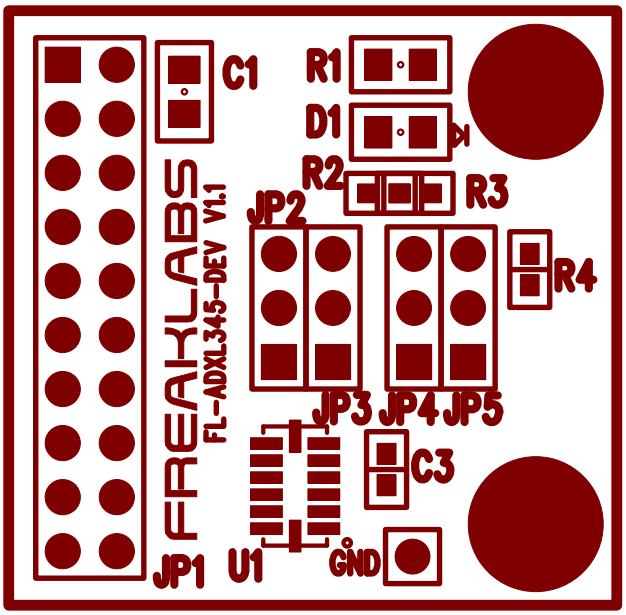
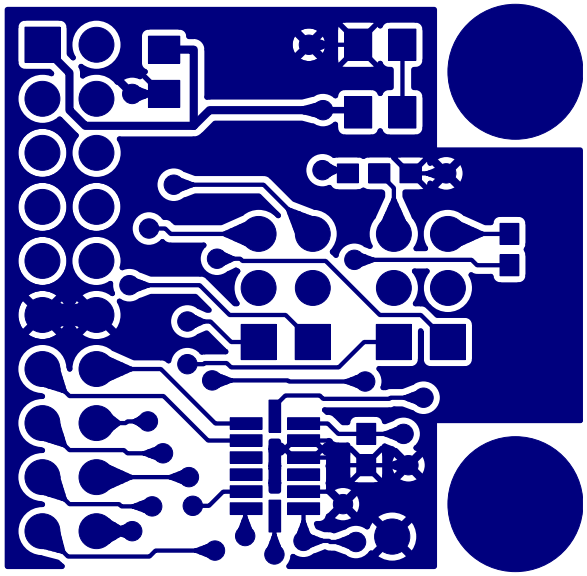
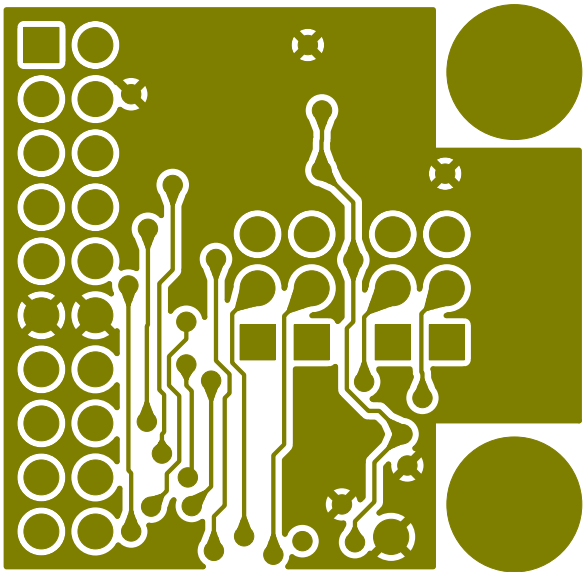
PCB Layout

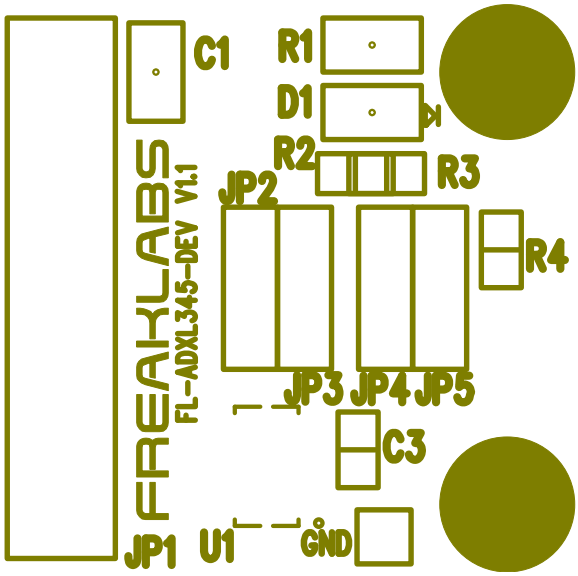
PCB layout file order:

1. *Assembly drawing*
2. *Top Layer*
3. *Bottom Layer*
4. *Silkscreen*









Bill of Materials

Quantity	Reference	Manufacturer	Part Number	Description
1	C1	Various		10uF/10V, 0805, MLCC
1	C3	Various		0.1uF/50V, 0603
1	D1	Various		Green LED, 0805
1	JP1	Various		10x2 Right angle header, male, 0.100”
1	R1	Various		220 ohms, 0805
1	R2	Various		10k, 0603, Do Not Install
2	R3,R4	Various		10k, 0603
1	U1	Analog Devices	ADXL345BCCZ	+/-16g, 3-axis accelerometer