CoreTilt

Issue: A (Preliminary)

Contents

Table of Figures

Introduction

CoreTilt is a SExI-compliant 3-axis digital accelerometer using based the ADXL345. It can measure forces due to acceleration up to ±16*g* in *x*, *y*, and *z* axes. CoreTilt provides a convenient hardware platform in a standard footprint to allow rapid prototyping. For ultimate ease, the CoreTilt module is supported in CoreBASIC which provides a simple software interface into the powerful sensing capabilities of this module.

Features

- SExI-compliant footprint
- 4mg/LSB resolution
- Support for I2C (default) and SPI interfaces
- Single and double tap detection
- Free fall detection
- Supported in CoreBASIC using the **`CORE-TILT`** driver
- *x*, *y*, and z axes correspond to both the CoreGyro and CoreMag SExI module axes for easy configuration

Integration

- Use CoreTilt together with CoreGyro as a 6DOF Inertial Measurement Unit (IMU)
- Use CoreTilt together with CoreGyro and CoreMag as a 9DOF Attitude and Heading Reference System (AHRS)
- Use CoreTilt and CoreMag together as a tilt-compensated compass
- Accelerometer, gyroscope, and optional magnetometer can be fused using the CoreBASIC **`AHRS`** driver to provide both 6DOF and 9DOF (with magnetometer) sensor-fusion output as Euler angles or quaternion for immediate use in your application

For higher integration, consider a CoreMPU which integrates compass, gyro, and magnetometer on a single standard-width SExI module.

Applications

- Robotics
- Camera stabilization
- Use as part of an AHRS or IMU for quadcopters, wheel-balanced robots, augmented reality…

Electrical

CoreTilt uses the SExI interface for rapid integration into a hardware platform. The communications pins (I2C/SPI) from the ADXL345 are taken to the appropriate SExI connector pins, as are the power rails.

The two interrupt pins (INT1 and INT2) from the ADXL345 are routed to DIO and AN on the SExI connectors (through solder bridges) . Table 1 details the pin configuration.

CoreTilt uses the 3V3 rail and not 5V.

Left Con J1	Description	Right Con J2	Description
SCK	SPI Clock. (NC by default)	Tx	NC
MOSI	Master Out Slave In. (NC by default)	5V0	NC
MISO	Master In Slave Out. (NC by default)	3V3	3.3V power supply rail
CS	Chip Select. (NC by default)	0V	Power return path
AN	INT2. (NC by default)	RX	NC
SDA	I2C serial Data Line	5V0	NC
SCL	I2C serial clock line	3V3	3.3V power supply rail
DIO	INT1. (NC by default)	0V	Power return path

Table 1. CoreTilt SExI Pin Information

Jumper Configuration

CoreTilt is shipped configured to use the I2C interface. Figure 1 shows the default settings for all the jumper settings

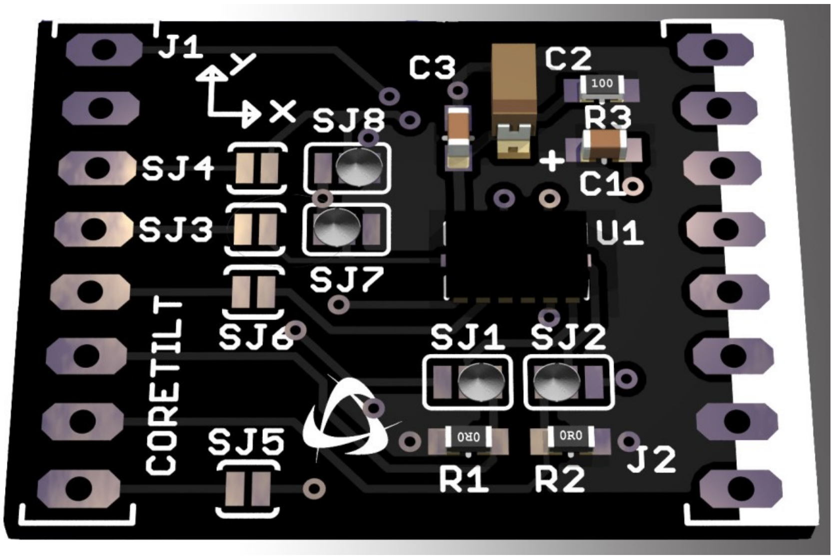

Figure 1. CoreTilt module. (I2C Config)

Note that SJ3, SJ5, and SJ5 are intentionally left open circuit in the shipping configuration.

The I2C pull up resistors, R1 and R2, are **not** populated by default. If CoreTilt is used without SenseCore, R1/R2 should be fitted, or pull up resistors must be fitted elsewhere in the design.

To configure CoreTilt for SPI mode, the solder jumpers should be configured as shown in Figure 2 :

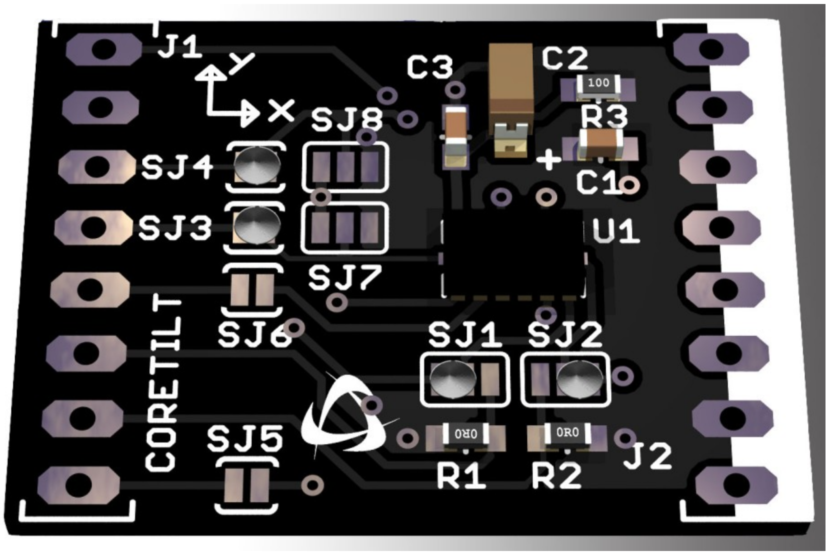

Figure 2. CoreTilt module. (SPI Config)

Further Information

Example programs written in C and CoreBASIC can be found at www.SolderCore.com. Here is an example program for the CorePressure sensor in CoreBASIC.

```
 10 ' Example program to demonstrate the CoreTile accelerometer
 20 '
 30 ' Written by Paul Curtis of Rowley Associates.
 40 '
 50 ' Do with this program what you like, just don't claim
 60 ' that you write it.
 70 '
 90 ' We emulate a spirit level, using the accelerometer to
100 ' measure tilt along the x axis.  The virtual bubble in the
110 ' tube moves along the display according to the tilt of the
120 ' device.
130 '
140 ' It also shows how to use restricted bitmapped graphics
150 ' on a character LCD display by utilizing the CHARACTER-GRAPHICS
160 ' driver.
170 '
180 INSTALL "MODKIT-MOTOPROTO-SHIELD" AS MOTO
190 INSTALL "CHARACTER-GRAPHICS" USING MOTO
200 '
210 ' We want to use the accelerometer.
220 INSTALL "CORE-TILT" AS LEVEL
230 '
240 ' We set a low accelerometer bandwidth to smooth its
250 ' response and, hence, the response of the bubble.
260 LEVEL.BANDWIDTH = 50
270 '
280 ' Clear the background.
290 MOTO.LINE(0) = ""
300 MOTO.LINE(1) = ""
310 '
320 ' Run the level for a bit...
330 FOR I = 1 TO 8000
340 '
350 ' Compute the new bubble position.  This crudely
360 ' converts the tilt linearly to a screen position.
370 ' The model is not really that brilliant, but
380 ' serves its purpose for this demonstration.
390 NEWX = 5 * INT(20 * LEVEL.X + 0.5) + 40
400 '
410 ' Remove the bubble from the old position and draw
420 ' it at the new position.
430 IF X <> NEWX THEN CALL SLIDE
440 '
450 ' Draw lines to delineate center.  The display is 80 pixels
460 ' wide, and I want a bubble 8 pixels across.
470 LINE 35, 0 TO 35, 15
480 LINE 45, 0 TO 45, 15
490 '
500 NEXT I
510 '
520 ' We're done.
530 END
540 '
550 ' Draw the bubble in the current color.
560 DEFPROC BUBBLE(X)
570 FILL X - 3, 5 TO X + 4, 11
580 ENDPROC
590 '
600 ' Move the bubble along the tube
610 DEFPROC SLIDE
620 COLOR 0 : CALL BUBBLE(X) : X = NEWX
630 COLOR 1 : CALL BUBBLE(X)
640 ENDPROC
```

Appendix A: SolderCore Expansion Interface

The SolderCore range of sensors use a standard interface called SExI (Sensor Expansion Interface). This standard allows a single development hardware platform to be used to evaluate a range of sensors.

Referring to Figure 3, a SExI device is comprised of two sections. Each section has common power pins consisting of 3.3V, 5V and 0V. If a sensor uses only SPI, only the top four rows of pins are required. For I2C based sensors, only the bottom four pins are required, in both instances the sensor foot print can be halved.

The SExI footprint provides for sensors that use simple UART connections. The Tx and RX pins are located on the right hand side of the module.

The DIO line can be used as a digital input of output line. Many sensors use interrupt lines, to inform the external electronics/processor that an even has occurred. In most instances the interrupt line is taken to DIO.

AN can be either a Digital IO or an Analog output pin. Sensors that output readings as an analog signal use this pin. The SenseCore shield routes this pin to the ADC pins to the SolderCore / Arduino headers.

The right hand connector is marked with a thick white bar to easily identify it.

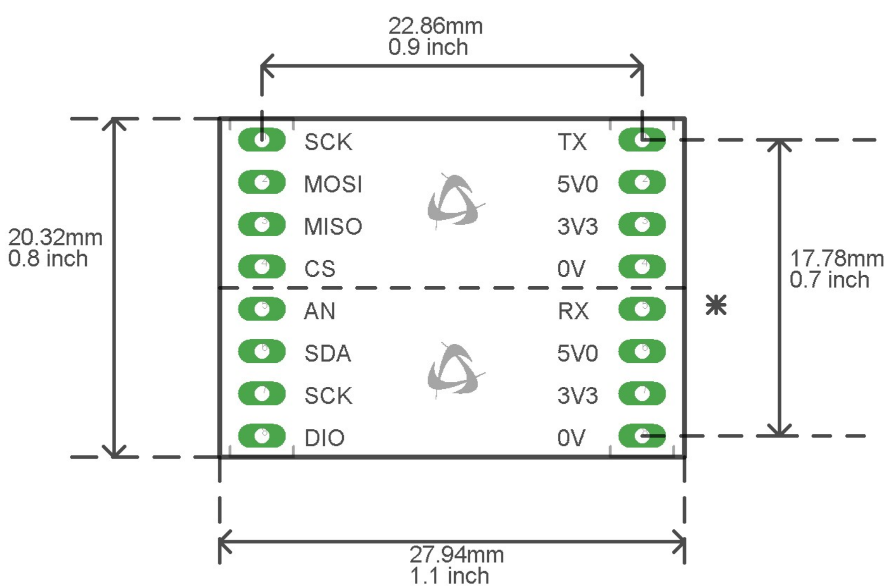

Figure 3. SExI device foot print.