
How To: 3G Sensor

Revision History

Rev.	Date	Written by	Remarks
1.0	2010-03-09	Lars	Draft copy

Contents

Overview	2
Terminology	2
Hardware	3
Distinctive Features and Functions of Accelerometer (KXTF9-2042)	3
Software	5
Communication Method between Application and Accelerometer Device Driver	5
Execution of Application Program	5
Example of Application Source	7

Overview

This document describes the Application Programming Interface (API) of the 3-axis accelerometer (KXTF9-2042) of CAANOO.

Terminology

1. I2C – This is a serial computer type developed by Philips. It is a communication method that is adopted to connect low-speed peripheral devices such as a motherboard, embedded system, mobile phone, etc.
2. Accelerometer - A sensor that measures acceleration of a moving object or strength of impact.

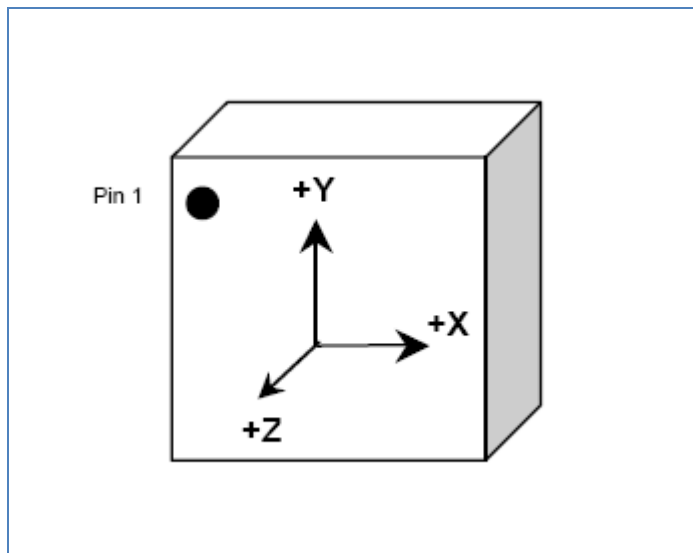
Hardware

This chapter describes distinctive features and functions of the accelerometer and the hardware connection of the CPU with the accelerometer in CAANOO. Additionally, this chapter describes basic hardware knowledge that is considered necessary when using a device driver in application programs.

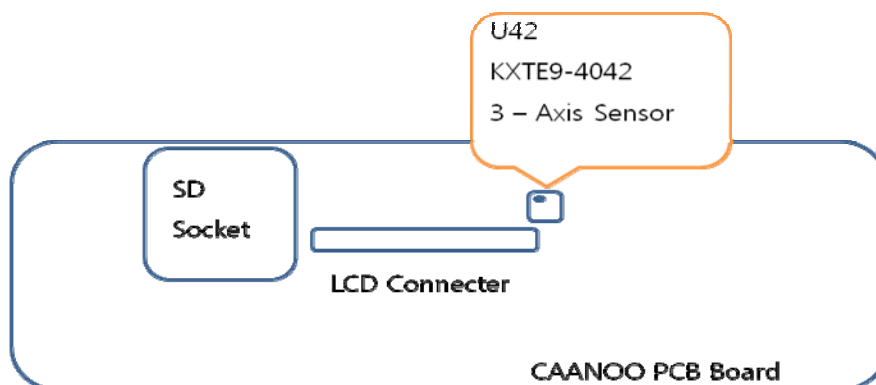
Distinctive Features and Functions of Accelerometer (KXTF9-2042)

Basic Functions

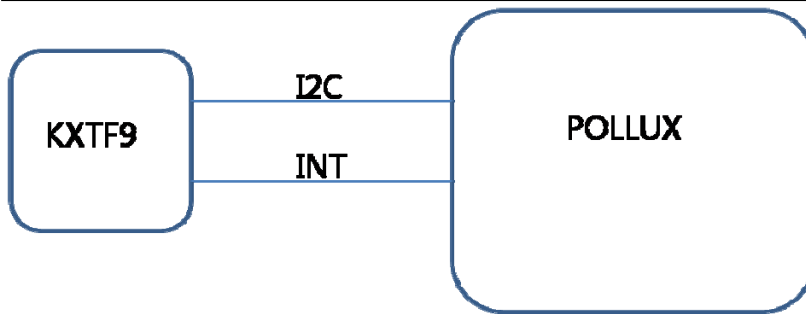
An accelerometer measures degree of acceleration in three axes (x, y, z). The direction of force of those three axes working towards the accelerometer is pictured as follows.



The position of the 3-axis sensor chip in CAANOO is shown as follows.



Connection with the MCU (Pollux) in CAANOO is shown as follows.



As shown above, the accelerometer and MCU share data with each other via I2C communication (MCU-Master). The accelerometer uses the INT pin connected to the MCU to inform the MCU that it has data to transmit and receive.

Expansion Feature based on Built-in Algorithms

Monitor the acceleration towards KXTF9 regularly to use various expansion features offered by the KXTF9 chip. The major expansion features are as follows:

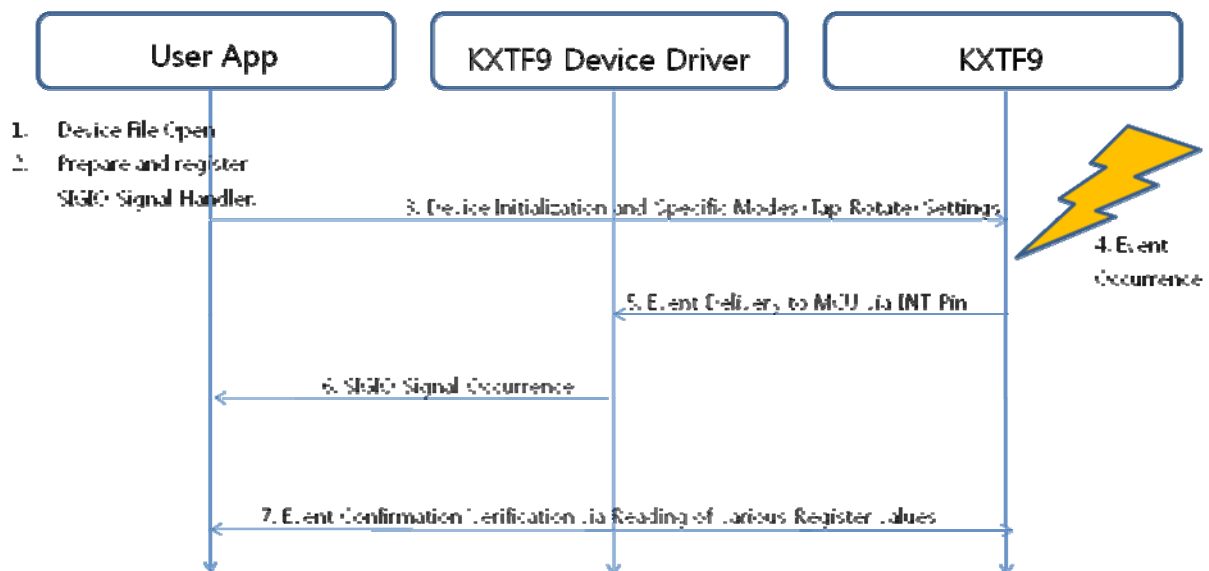
1. TAP Detection: Detects slight tapping on the accelerometer or a board/terminal installed with the accelerometer.
2. Screen Rotation: Detects a change in direction of the accelerometer to the ground.
3. Motion Detection: Detects a motion in the accelerometer (moving direction).

Software

This chapter describes how to control and utilize the accelerometer with examples of application.

Communication Method between Application and Accelerometer Device Driver

A user application communicates with the accelerometer using the I2C bus interface provided by Linux. The role of the accelerometer device driver is to detect any interruptions by the interrupt pin linked to the accelerometer and to deliver the signal named SIGIO to the user application.



The above displays the workings of the user application program, device driver, and the 3-axis accelerometer.

Execution of Application Program

Execution Environment

Store the application program file (te9_tf9_hybrid_driver) in the SD card. Insert the SD card into CAANOO for execution.

```
+-----[ Accelerometer Test ]-----+
| Kionix Driver Version   : 091130_1.0.0
|
| 1:ACCEL Init
| 2:ACCEL deinit
| 3:ACCEL Reset
| 4:Display/Dump Register Value
| 5:Read XYZ Count/g (LPF)
| 6:Read XYZ Count/g (HPF) - Not available, sorry~! ^^
| 7:Algorithm : Motion Detection
| 8:Algorithm : Screen Rotation
| 9:Algorithm : Directional-Tap
|
| ----- LARS added below functions -----
| 10:Integrated Test(Rotation, Tap, XYZ)
| 11:Directional Tap
| 12:Screen Rotation
| 13:Motion Detection
| 14:Shake Detection(Use Motion Detection)
| 15:Previous menu
+-----+
Select the number to test :
```

Execution of an application program causes the output result as above. Refer to the following table for the description on respective menus.

Items	Description
ACCEL Init	3G Sensor Initialization
ACCEL deinit	3G Sensor Interrupt Disable, and Enter Sleep-mode
ACCEL Reset	3G Sensor reset
Display/Dump Reg. Value	3G Sensor display all register value
Read X,T,Z Count/g (LPF)	Prints the acceleration value that is applicable to the x, y, and z axis.

Read X,T,Z Count/g (HPF)	
Algorithm: Motion Detection	Detects motions in the accelerometer.
Algorithm: Screen Rotation	Detects rotation in the accelerometer.
Algorithm: Directional-Tap	Detects slight tapping in the accelerometer.
Integrated Test	Integrated test (Detects tapping on the x axis + detects rotation + prints the 3-axis value.)
Directional Tap	Detects slight tapping. (Preset)
Screen Rotation	Detects rotation in the accelerometer. (Preset)
Motion Detection	Detects motion in the accelerometer. (Preset)
Shake Detection	Shake Detection via Motion Detection

※ Before using the menu no. 5 to 9, "1. ACCEL Init" must be executed first. Only then the respective functions start working as expected. The next step is to set the registers of the accelerometer needed for each function. For more information on each procedure, refer to the accelerometer manual.

※ Menu no. 10 to 14 use the menu no. 5 to 9 to set the accelerometer according to the preset value without asking for the user's input. If each value needs tuning to use this menu, refer to menu no. 5 to 9 to adjust the preset values and apply them to menu no. 5 to 9. In addition, menu no. 10 to 14 do not require execution of ACCEL Init before use as they perform the process of ACCEL Init internally for use.

Example of Application Source

This section describes the main parts of the application source provided as an example. Refer to the table below for the list and description of the application source file.

Filename	Description
Makefile	Builds applications by making files
i2c_dev.h	Linux I2C Interface Header File

te9_tf9_regs.h	Defines the KXTF9 internal register
te9_tf9_hybrid_driver.c, (.h)	Driver API that can control KXTF9 by using the Linux I2C Bus Interface
te9_tf9_main.c, (.h)	Example source for application programs where the accelerometer API is utilized