DT0005
Design tip

Providing flexibility in sampling the accelerometer and gyroscope by using the DEN_G pin of the iNEMO inertial module

By Gang Xu

Main components	
LSM330DLC	iNEMO inertial module: 3D accelerometer and 3D gyroscope
LSM330D	iNEMO inertial module: 3D accelerometer and 3D gyroscope

Purpose and benefits

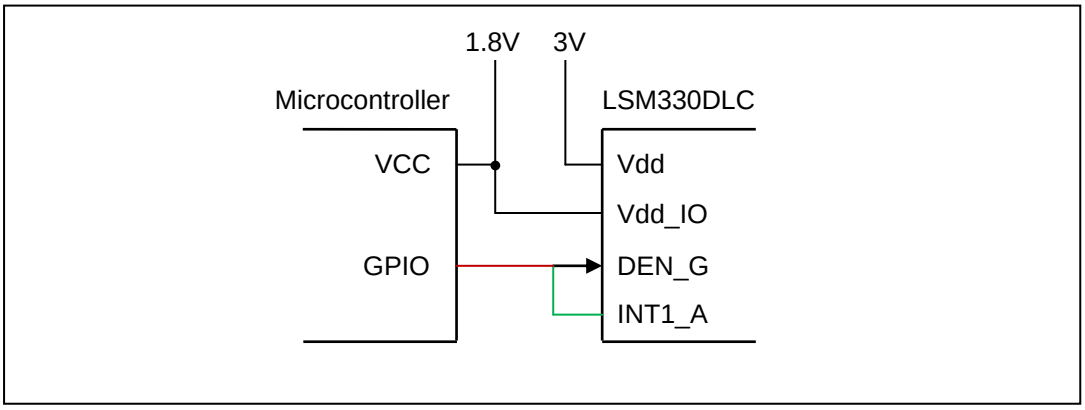
iNEMO inertial modules LSM330DLC/LSM330D consist of a 3-axis digital accelerometer and 3-axis digital gyroscope. There is a DEN_G input pin on the iNEMO inertial modules to control the gyroscope data samples. This note describes how to use the DEN_G pin to enable updating the gyroscope data aligned to the accelerometer data, a motion event or a microcontroller GPIO pin. Therefore, users are flexible to sample both accelerometer data and gyroscope data in their applications.

The eMotion motherboard STEVAL-MKI109V2 and the Unico Windows GUI software can be used to verify the DEN_G pin features together with the adapter boards of the LSM330DLC STEVAL-MKI122V1 / LSM330D STEVAL-MKI123V1.

Description

The LSM330DLC DEN_G can be tied to the microcontroller GPIO pin in red color or the accelerometer interrupt output pin in green color as shown in Figure 1.

Figure 1. Options to connect to DEN_G pin of the iNEMO module



The operating voltage range Vdd for LSM330DLC is from 2.4V to 3.6V while the digital interface voltage range Vdd_IO is from 1.71V to Vdd+0.1V. Figure 1 shows the connection between a microcontroller and LSM330DLC when the microcontroller VCC works at 1.8V only. If the microcontroller VCC works at 3V or 3.3V, then VCC, Vdd and Vdd_IO can be tied together.

The DEN_G pin-16 of the LSM330DLC is an input pin to trigger both gyroscope data registers and the FIFO. The use of this pin is related to EXTRen and LVLen bits in CTRL_REG2_G(21h) control register.

The relationship between DEN_G pin and EXTRen and LVLen bits is as shown in Table 1. The DEN_G pin can be configured to be level sensitive or trigger sensitive.

Table 1. Gyroscope data with respect to the status of the DEN_G pin

EXTRen	LVLen	DEN_G level	Results
0	0	x	Default. DEN_G level has no impact to gyroscope data registers and FIFO.
0	1	HIGH (= Vdd_IO)	Gyroscope X/Y/Z axis data from both data registers and FIFO will be odd signed integers, because the least bit in X/Y/Z axis low bytes is always “1”.
		LOW (= GND)	Gyroscope X/Y/Z axis data from both data registers and FIFO will be even signed integers, because the least bit in X/Y/Z axis low bytes is always “0”.
1	x	Rising edge	Gyroscope X/Y/Z axis data from both data registers and FIFO will be updated only once. Next rising edge will trigger another one time measurement.
		Falling edge	Gyroscope X/Y/Z axis data from both data registers and FIFO will not be updated.

Note: “x” means don’t care.

If the DEN_G feature is not used, it can be tied to Vdd_IO or GND for gyroscope normal operation.

If the DEN_G pin is connected to a MCU GPIO output pin, then the MCU can send rising edge pulses to control the LSM330DLC when the gyroscope measurement is started with the DEN_G pin trigger sensitive.

If the DEN_G pin is connected to the accelerometer interrupt output pin, then there are two options to control the gyroscope data. The first option is to configure the accelerometer interrupt to be data ready and DEN_G pin for trigger sensitive. Then the gyroscope will update its measurements according to the accelerometer data ready signal. The second option is to configure the accelerometer interrupt for wakeup detection and DEN_G pin for level sensitive. If there is no accelerometer interrupt, then the gyroscope data is always even. When the accelerometer detects a wakeup interrupt, the DEN_G pin goes high and the gyroscope data will always be odd. After reading the accelerometer status register, the DEN_G pin becomes low again. Then the gyroscope data is controlled by the motion event detected by the accelerometer.

Support material

Related design support material
Product / system Evaluation boards STEVAL-MKI109V2, eMotion motherboard based on STM32F103 STEVAL-MKI122V1, LSM330DLC adapter board for standard DIL24 socket STEVAL-MKI123V1, LSM330D adapter board for standard DIL24 socket
Documentation
Datasheets: LSM330DLC, iNEMO inertial module: 3D accelerometer and 3D gyroscope LSM330D, iNEMO inertial module: 3D accelerometer and 3D gyroscope
User manual: UM0979, STEVAL-MKI109V1 and STEVAL-MKI109V2 – eMotion motherboards for MEMS adapter boards UM1049, Unico GUI: software guide
Application notes: AN3308, LIS3DH: MEMS digital output motion sensor ultra-low-power high performance 3-axis “nano” accelerometer AN3393, L3G4200D: three axis digital output gyroscope
Schematics: STEVAL-MKI122V1 LSM330DLC adapter board schematics STEVAL-MKI123V1 LSM330D adapter board schematics

Revision history

Date	Version	Changes
24-Oct-2012	1	Initial release

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