Use NANO100 I2C to Control ADXL345

Example Code Introduction for 32-bit NuMicro®Family

Information

Application	This sample code is the driver of ADXL345 based on NANO100 series.
BSP Version	Nano100B_Series_BSP_CMSIS_v3.03.000
Hardware	NuTiny-EVB-Nano130-LQFP128 V1.0

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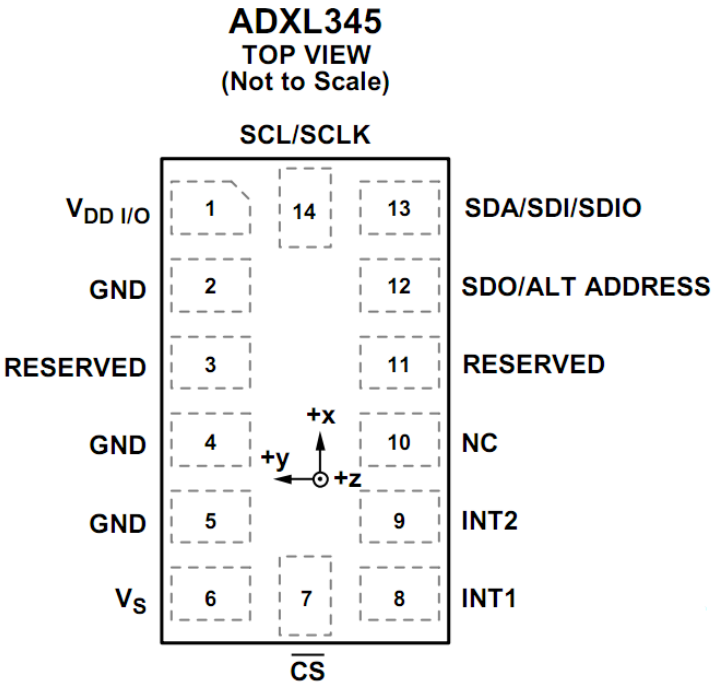
1 Function Description

1.1 Introduction

The ADXL345 is a small, thin, ultralow power, 3-axis accelerometer with high resolution (13-bit) measurement at up to ±16g. Digital output data is formatted as 16-bit two's complement and is accessible through either a SPI (3- or 4-wire) or I2C digital interface.

1.1.1 Pin Configuration

The pin configuration of ADXL345 is shown below.



Pin description is shown in the following table.

Pin No.	Pin Name	Description
1	$V_{DD\ I/O}$	Digital Interface Supply Voltage.
2	GND	This pin must be connected to ground.
3	RESERVED	Reserved. This pin must be connected to V_S or left open.
4	GND	This pin must be connected to ground.
5	GND	This pin must be connected to ground.
6	V_S	Supply Voltage.
7	CS	Chip Select.

8	INT1	Interrupt 1 Output.
9	INT2	Interrupt 2 Output.
10	NC	Not Internally Connected.
11	RESERVED	Reserved. This pin must be connected to ground or left open.
12	SDO/ALT ADDRESS	Serial Data Output (SPI 4-Wire)/Alternate I2C Address Select (I2C)
13	SDA/SDI/SDIO	Serial Data (I2C)/Serial Data Input (SPI 4-Wire)/Serial Data Input and Output (SPI 3-Wire).
14	SCL/SCLK	Serial Communications Clock. SCL is the clock for I2C, and SCLK is the clock for SPI.

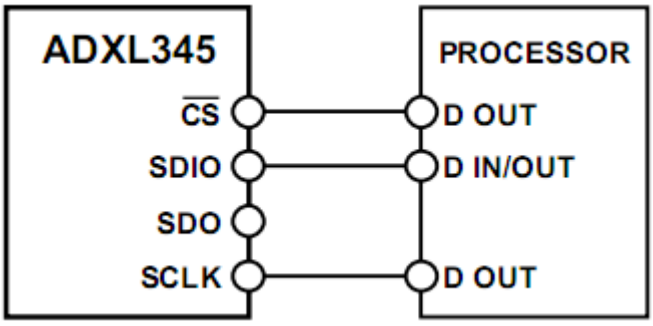
1.1.2 Register Map

Address	Name	Type	Reset Value	Description
0x00	DEVID	R	11100101	Device ID.
0x01~0x1C	Reserved			Reserved,do not access.
0x1D	THRESH_TAP	R/W	00000000	Tap threshold.
0x1E	OFSX	R/W	00000000	X-axis offset.
0x1F	OFSY	R/W	00000000	Y-axis offset.
0x20	OFSZ	R/W	00000000	Z-axis offset.
0x21	DUR	R/W	00000000	Tap duration.
0x22	Latent	R/W	00000000	Tap latency.
0x23	Window	R/W	00000000	Tap window.
0x24	THRESH_ACT	R/W	00000000	Activity threshold.
0x25	THRESH_INACT	R/W	00000000	Inactivity threshold.
0x26	TIME_INACT	R/W	00000000	Inactivity time.
0x27	ACT_INACT_CTL	R/W	00000000	Axis enable control for activity and inactivity detection.
0x28	THRESH_FF	R/W	00000000	Free-fall threshold.
0x29	TIME_FF	R/W	00000000	Free-fall time.
0x2A	TAP_AXES	R/W	00000000	Axis control for single tap/double tap.
0x2B	ACT_TAP_STATUS	R	00000000	Source of single tap/double tap.
0x2C	BW_RATE	R/W	00001010	Data rate and power mode control.
0x2D	POWER_CTL	R/W	00000000	Power-saving features control.

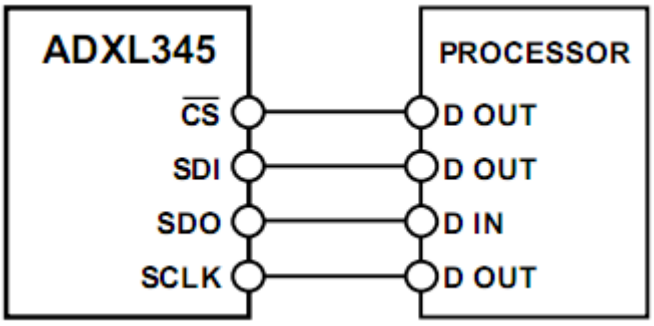
0x2E	INT_ENABLE	R/W	00000000	Interrupt enable control.
0x2F	INT_MAP	R/W	00000000	Interrupt mapping control.
0x30	INT_SOURCE	R	00000010	Source of interrupts.
0x31	DATA_FORMAT	R/W	00000000	Data format control.
0x32	DATAX0	R	00000000	X-Axis Data 0.
0x33	DATAX1	R	00000000	X-Axis Data 1.
0x34	DATAY0	R	00000000	Y-Axis Data 0.
0x35	DATAY1	R	00000000	Y-Axis Data 1.
0x36	DATAZ0	R	00000000	Z-Axis Data 0.
0x37	DATAZ1	R	00000000	Z-Axis Data 1.
0x38	FIFO_CTL	R/W	00000000	FIFO control.
0x39	FIFO_STATUS	R	00000000	FIFO status.

1.1.3 Application Circuit

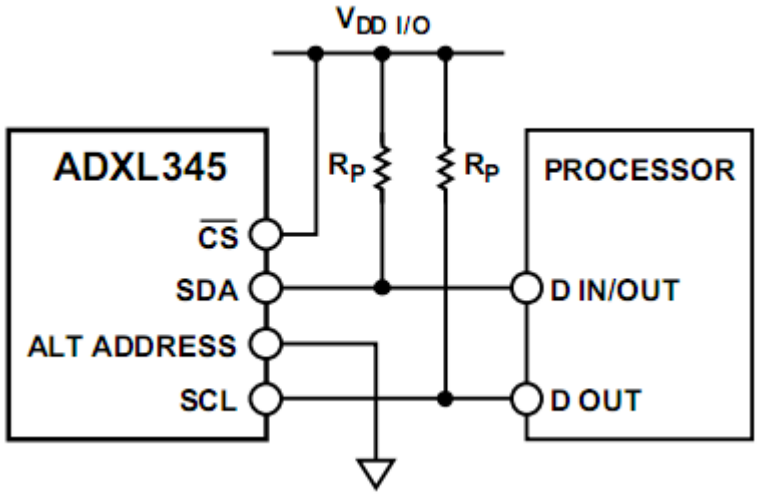
1.1.3.1 3-Wire SPI Connection Diagram



1.1.3.2 4-Wire SPI Connection Diagram



1.1.3.3 I2C Connection Diagram



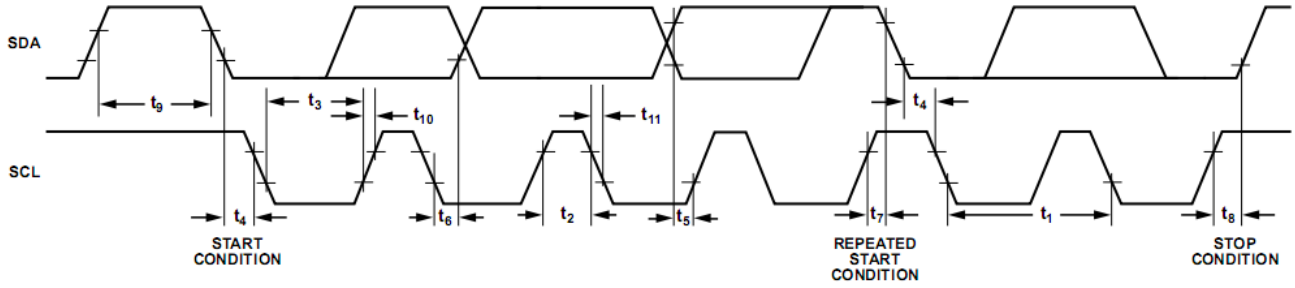
For more information about ADXL345, please refer to the datasheet of ADXL345.

1.2 Principle

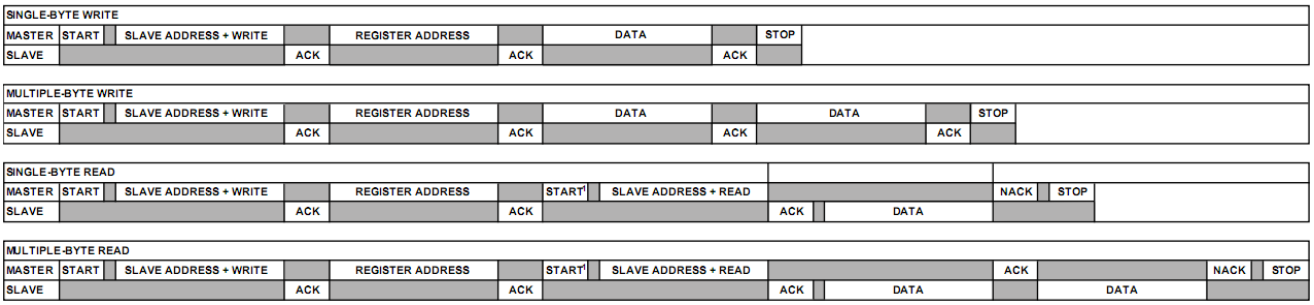
This sample code is the driver of ADXL345 based on NANO100 series. NANO100 series controls ADXL345 and reads 3-axis accelerometer data by I2C interface.

Note: Digital output data is formatted as 16-bit two's complement.

1.2.1 I2C Timing



1.2.2 I2C Read/Write(Address 0x53)



For more information, please refer to the datasheet of ADXL345.

1.3 Demo Result

```
Core Clock = 42000000 Hz

+------------------------------------------------------+
|   Nano100 Series I2C Sample Code with ADXL345        |
+------------------------------------------------------+
Data:  X: 65499  Y: 196  Z: 65196
Data:  X: 52  Y: 140  Z: 65267
Data:  X: 65532  Y: 114  Z: 65201
Data:  X: 105  Y: 21  Z: 65253
Data:  X: 345  Y: 130  Z: 65223
Data:  X: 318  Y: 71  Z: 65167
Data:  X: 306  Y: 1  Z: 65124
Data:  X: 317  Y: 65532  Z: 65119
Data:  X: 316  Y: 65521  Z: 65110
Data:  X: 315  Y: 65520  Z: 65104
Data:  X: 314  Y: 65517  Z: 65099
Data:  X: 312  Y: 65514  Z: 65093
Data:  X: 311  Y: 65513  Z: 65094
Data:  X: 310  Y: 65512  Z: 65092
```

2 Code Description

Initialize ADXL345.

```
void ADXL345_Init(void)
{
    I2C0_Init();

    I2C0_Write(XL345_ALT_ADDR, XL345_DATA_FORMAT, XL345_RANGE_2G);
    I2C0_Write(XL345_ALT_ADDR, XL345_BW_RATE, XL345_BW_100);
    I2C0_Write(XL345_ALT_ADDR, XL345_POWER_CTL, XL345_MEASURE);
    I2C0_Write(XL345_ALT_ADDR, XL345_INT_ENABLE, XL345_INACTIVITY);
    I2C0_Write(XL345_ALT_ADDR, XL345_OFSX, 0x27);
    I2C0_Write(XL345_ALT_ADDR, XL345_OFSY, 0x29);
    I2C0_Write(XL345_ALT_ADDR, XL345_OFSZ, 0x81);
}
```

Read 3-axis accelerometer data.

```
void ADXL345_ReadData(uint8_t au8Data[6])
{
    I2C0_Read(XL345_ALT_ADDR, XL345_DATAX0, 6, au8Data);
}
```

3 Software and Hardware Environment

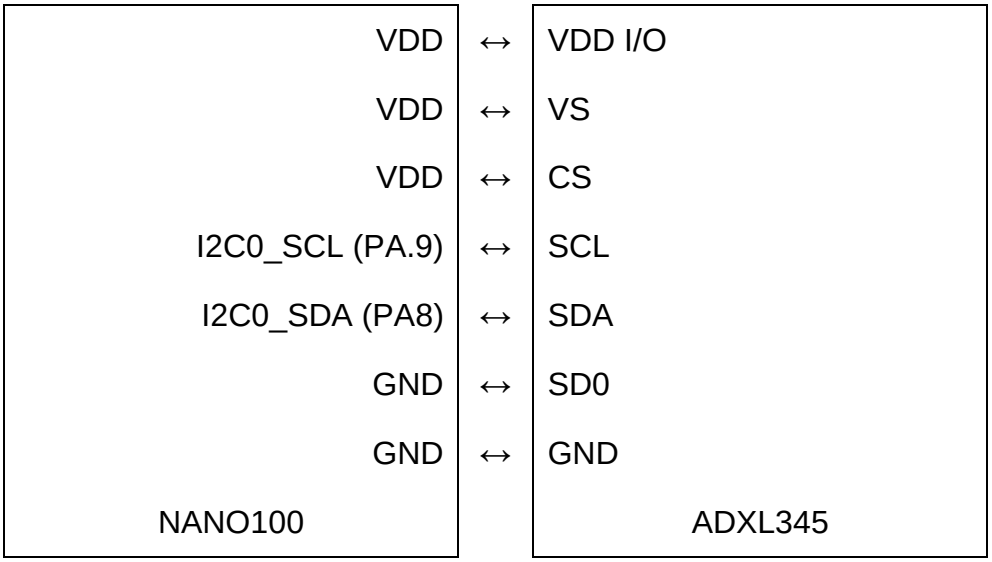
Software Environment

- BSP version
  - Nano100B_Series_BSP_CMSIS_v3.03.000
- IDE version
  - Keil uVersion4.74

Hardware Environment

- Circuit components
  - NuTiny-EVB-Nano130-LQFP128 V1.0
  - ADXL345
- Diagram

NANO100 series controls ADXL345 by I2C interface, and reads 3-axis accelerometer data.



4 Directory Information

- EC_NANO100_I2C_ADXL345_V1.00
  - Library — Sample code header and source files
    - CMSIS — Cortex®Microcontroller Software Interface Standard (CMSIS) V4.5.0 definitions by ARM® Corp.
    - Device — CMSIS compliant device header file
    - StdDriver — All peripheral driver header and source files
  - SampleCode
    - ExampleCode — Source file of example code

5 How to Execute Example Code

1. Browsing into sample code folder by Directory Information(section 4) and double click I2C_ADXL345.uvproj.
2. Enter Keil compile mode
   a. Build
   b. Download
   c. Start/Stop debug session
3. Enter debug mode
   a. Run

6 Revision History

Date	Revision	Description
Dec.16, 2019	1.00	1. Initially issued.

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