NANO100通過I2C驅動ADXL345

NuMicro® 32 位系列微控制器範例代碼介紹

文件資訊

代碼簡述	本範例代碼使用 NANO100 的 I2C 接口驅動 ADXL345
BSP 版本	Nano100B_Series_BSP_CMSIS_v3.03.000
開發平台	NuTiny-EVB-Nano130-LQFP128 V1.0

The information described in this document is the exclusive intellectual property of Nuvoton Technology Corporation and shall not be reproduced without permission from Nuvoton.

Nuvoton is providing this document only for reference purposes of NuMicro microcontroller based system design. Nuvoton assumes no responsibility for errors or omissions.

All data and specifications are subject to change without notice.

For additional information or questions, please contact: Nuvoton Technology Corporation.

www.nuvoton.com

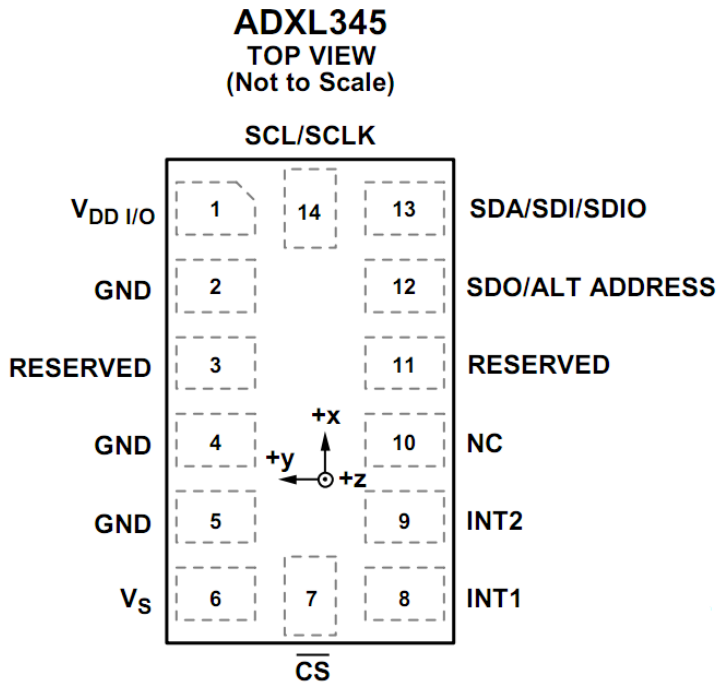
1 功能介紹

1.1 簡介

ADXL345是一款小而薄的超低功耗3軸加速度計，分辨率高（13位），測量範圍達±16g。數據輸出格式為16位二進制補碼格式，可通過SPI（3線或4線）或I2C接口訪問。

1.1.1 引腳配置

ADXL34的引腳圖如下：



引腳功能描述如下：

引腳編號	引腳名稱	描述
1	$V_{DD\ I/O}$	數字接口電源電壓
2	GND	地
3	RESERVED	保留，該引腳必須連接到V_S或保持斷開
4	GND	地
5	GND	地

6	V_S	電源電壓
7	CS	片選
8	INT1	中斷1輸出
9	INT2	中斷2輸出
10	NC	內部不連接
11	RESERVED	保留，該引腳必須接地或保持斷開
12	SDO/ALT ADDRESS	串行數據輸出（SPI 4線）/備用I2C地址選擇（I2C）
13	SDA/SDI/SDIO	串行數據（I2C）/串行數據輸入（SPI 4線）/串行數據輸入和輸出（SPI 3線）
14	SCL/SCLK	串行通信時鐘，SCL為I2C時鐘，SCLK為SPI時鐘

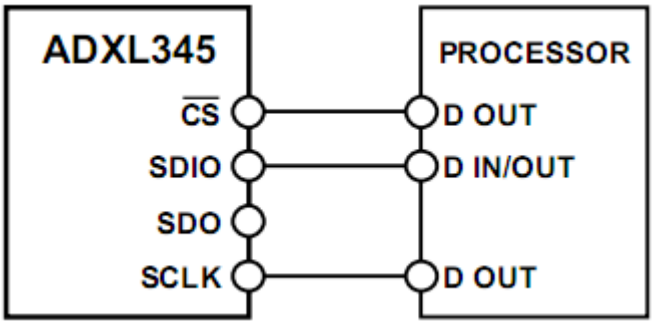
1.1.2 寄存器映射

地址	名稱	類型	複位值	描述
0x00	DEVID	R	11100101	器件ID
0x01~0x1C	Reserved			保留，不要操作
0x1D	THRESH_TAP	R/W	00000000	敲擊閾值
0x1E	OFSX	R/W	00000000	X軸偏移
0x1F	OFSY	R/W	00000000	Y軸偏移
0x20	OFSZ	R/W	00000000	Z軸偏移
0x21	DUR	R/W	00000000	敲擊持續時間
0x22	Latent	R/W	00000000	敲擊延遲
0x23	Window	R/W	00000000	敲擊窗口
0x24	THRESH_ACT	R/W	00000000	活動閾值
0x25	THRESH_INACT	R/W	00000000	靜止閾值
0x26	TIME_INACT	R/W	00000000	靜止時間

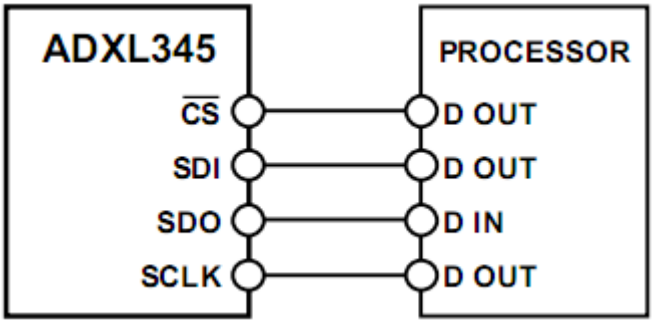
0x27	ACT_INACT_CTL	R/W	00000000	軸使能控制活動和靜止檢測
0x28	THRESH_FF	R/W	00000000	自由落體閾值
0x29	TIME_FF	R/W	00000000	自由落體時間
0x2A	TAP_AXES	R/W	00000000	單擊/雙擊軸控制
0x2B	ACT_TAP_STATUS	R	00000000	單擊/雙擊源
0x2C	BW_RATE	R/W	00001010	數據速率及功率模式控制
0x2D	POWER_CTL	R/W	00000000	省電特性控制
0x2E	INT_ENABLE	R/W	00000000	中斷使能控制
0x2F	INT_MAP	R/W	00000000	中斷映射控制
0x30	INT_SOURCE	R	00000010	中斷源
0x31	DATA_FORMAT	R/W	00000000	數據格式控制
0x32	DATAX0	R	00000000	X軸數據0
0x33	DATAX1	R	00000000	X軸數據1
0x34	DATAY0	R	00000000	Y軸數據0
0x35	DATAY1	R	00000000	Y軸數據1
0x36	DATAZ0	R	00000000	Z軸數據0
0x37	DATAZ1	R	00000000	Z軸數據1
0x38	FIFO_CTL	R/W	00000000	FIFO控制
0x39	FIFO_STATUS	R	00000000	FIFO狀態

1.1.3 應用電路

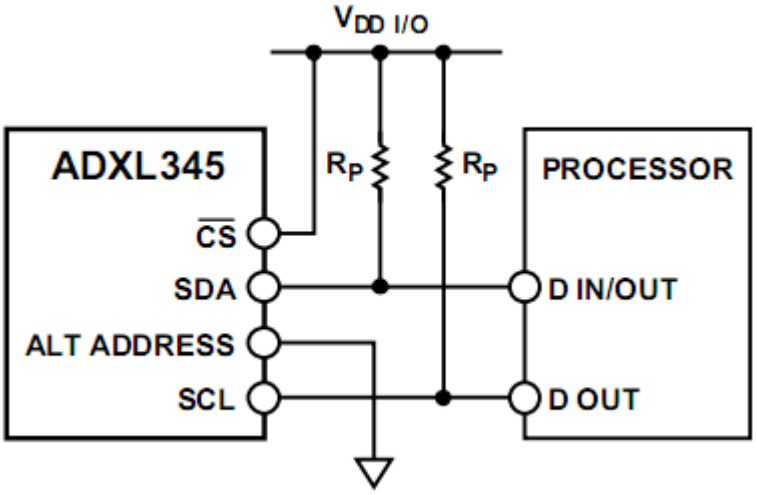
1.1.3.1 3線SPI連接示意圖



1.1.3.2 4線SPI連接示意圖



1.1.3.3 I2C連接示意圖



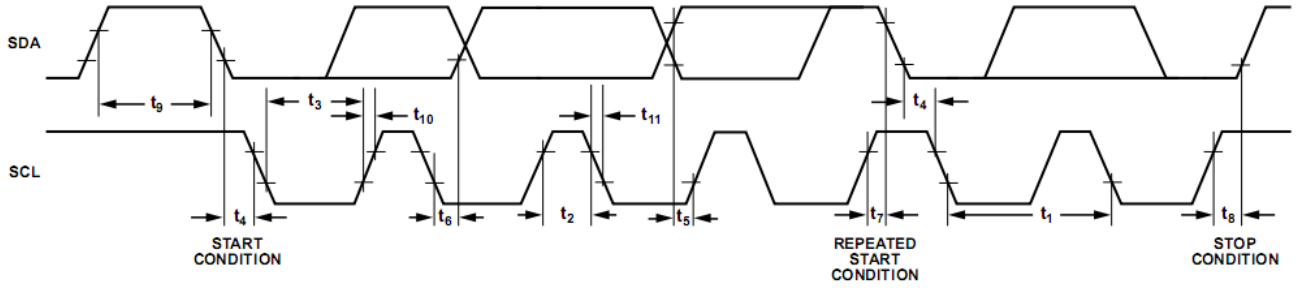
關於ADXL345的詳細信息，請參考ADXL345的數據手冊。

1.2 原理

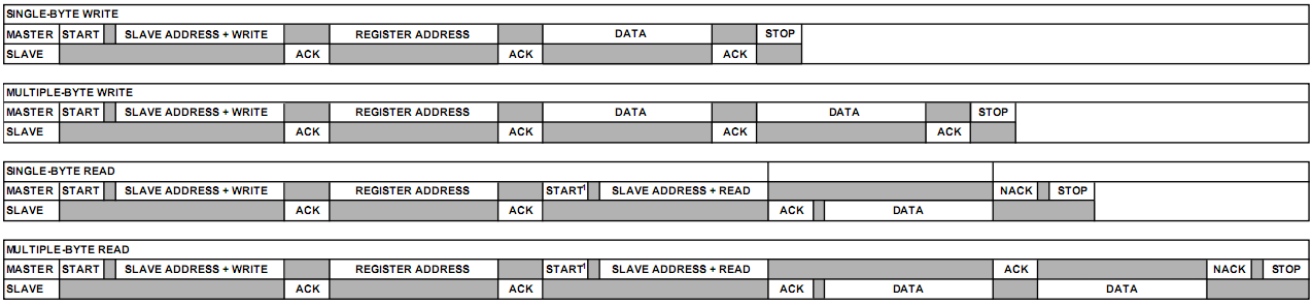
本範例代碼使用NANO100系列通過I2C接口實現對ADXL345的讀寫，獲取3軸加速度值。

注：輸出數據格式為16位二進制格式。

1.2.1 I2C 時序



1.2.2 I2C 讀寫（地址：0x53）



詳細信息，請參考ADXL345的數據手冊。

1.3 執行結果

執行結果，打印數據如下：

```
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 代碼介紹

初始化 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);
}
```

獲取 3 軸加速度值：

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

3 軟體與硬體環境

- **軟體環境**
  - BSP 版本
    - Nano100B_Series_BSP_CMSIS_v3.03.000
  - IDE 版本
    - Keil uVersion4.74
- **硬體環境**
  - 電路元件
    - NuTiny-EVB-Nano130-LQFP128 V1.0
    - ADXL345
  - 示意圖

NANO100 使用 I2C 接口對 ADXL345 進行初始化，獲取 3 軸加速度值。

NANO100		ADXL345
VDD	↔	VDD I/O
VDD	↔	VS
VDD	↔	CS
I2C0_SCL (PA.9)	↔	SCL
I2C0_SDA (PA8)	↔	SDA
GND	↔	SD0
GND	↔	GND

4 目錄資訊

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 如何執行範例程式

1. 根據目錄資訊章節進入 ExampleCode 路徑中的 KEIL 資料夾，雙擊 I2C_ADXL345.uvproj。
2. 進入編譯模式介面
   a. 編譯
   b. 下載代碼至記憶體
   c. 進入 / 離開除錯模式
3. 進入除錯模式介面
   a. 執行代碼

6 修訂紀錄

Date	Revision	Description
Dec.16, 2019	1.00	1. 初始發布.

Important Notice

Nuvoton Products are neither intended nor warranted for usage in systems or equipment, any malfunction or failure of which may cause loss of human life, bodily injury or severe property damage. Such applications are deemed, "Insecure Usage".

Insecure usage includes, but is not limited to: equipment for surgical implementation, atomic energy control instruments, airplane or spaceship instruments, the control or operation of dynamic, brake or safety systems designed for vehicular use, traffic signal instruments, all types of safety devices, and other applications intended to support or sustain life.

All Insecure Usage shall be made at customer's risk, and in the event that third parties lay claims to Nuvotonas a result of customer's Insecure Usage, customer shall indemnify the damages and liabilities thus incurred by Nuvoton.

Please note that all data and specifications are subject to change without notice.
All the trademarks of products and companies mentioned in this datasheet belong to their respective owners.