NANO100通过I2C驱动ADXL345

NuMicro® 32 位系列微控制器范例代码介绍

文件信息

代码简述	本范例代码使用 NANO100 的 I2C 接口驱动 ADXL345
BSP 版本	Nano100B_Series_BSP_CMSIS_v3.03.000
开发平台	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

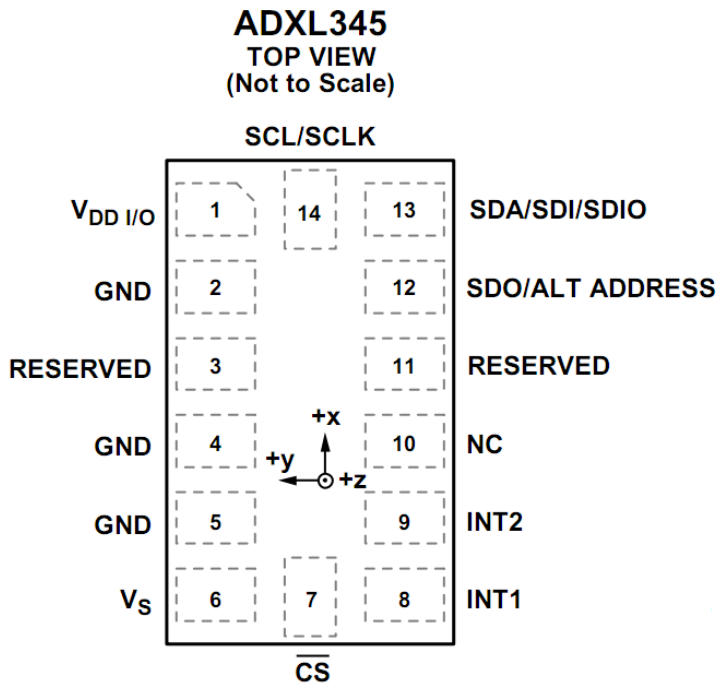
1 功能介绍

1.1 简介

ADXL345是一款小而薄的超低功耗3轴加速度计，分辨率高（13位），测量范围达±16g。数据输出格式为16位二进制补码格式，可通过SPI（3线或4线）或I2C接口访问。

1. 1. 1 引脚配置

ADXL345的引脚图如下：



引脚功能描述如下：

引脚编号	引脚名称	描述
1	$V_{DD\ I/O}$	数字接口电源电压
2	GND	地
3	RESERVED	保留，该引脚必须连接到VS或保持断开
4	GND	地
5	GND	地
6	V_S	电源电压
7	CS	片选
8	INT1	中断1输出

9	INT2	中断2输出
10	NC	内部不连接
11	RESERVED	保留，该引脚必须接地或保持断开
12	SDO/ALT ADDRESS	串行数据输出（SPI 4线）/备用I2C地址选择（I2C）
13	SDA/SDI/SDIO	串行数据（I2C）/串行数据输入（SPI 4线）/串行数据输入和输出（SPI 3线）
14	SCL/SCLK	串行通信时钟，SCL为I2C时钟，SCLK为SPI时钟

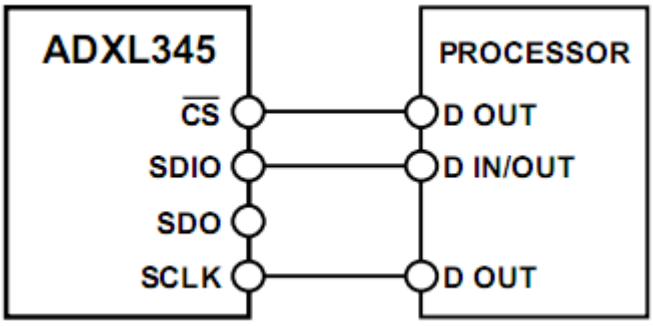
1.1.2 寄存器映射

地址	名称	类型	复位值	描述
0x00	DEVID	R	11100101	器件ID
0x01~0x1C	Reserved			保留，不要操作
0x1D	THRESH_TAP	R/W	00000000	敲击阈值
0x1E	OFSX	R/W	00000000	X轴偏移
0x1F	OFSY	R/W	00000000	Y轴偏移
0x20	OFSZ	R/W	00000000	Z轴偏移
0x21	DUR	R/W	00000000	敲击持续时间
0x22	Latent	R/W	00000000	敲击延迟
0x23	Window	R/W	00000000	敲击窗口
0x24	THRESH_ACT	R/W	00000000	活动阈值
0x25	THRESH_INACT	R/W	00000000	静止阈值
0x26	TIME_INACT	R/W	00000000	静止时间
0x27	ACT_INACT_CTL	R/W	00000000	轴使能控制活动和静止检测
0x28	THRESH_FF	R/W	00000000	自由落体阈值
0x29	TIME_FF	R/W	00000000	自由落体时间
0x2A	TAP_AXES	R/W	00000000	单击/双击轴控制
0x2B	ACT_TAP_STATUS	R	00000000	单击/双击源
0x2C	BW_RATE	R/W	00001010	数据速率及功率模式控制
0x2D	POWER_CTL	R/W	00000000	省电特性控制
0x2E	INT_ENABLE	R/W	00000000	中断使能控制
0x2F	INT_MAP	R/W	00000000	中断映射控制
0x30	INT_SOURCE	R	00000010	中断源

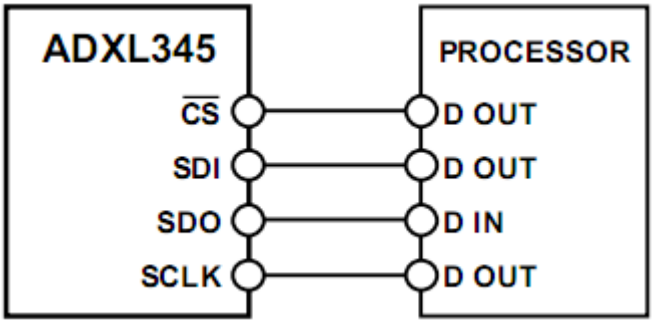
0x31	DATA_FORMAT	R/W	00000000	数据格式控制
0x32	DATAX0	R	00000000	X轴数据0
0x33	DATAX1	R	00000000	X轴数据1
0x34	DATAY0	R	00000000	Y轴数据0
0x35	DATAY1	R	00000000	Y轴数据1
0x36	DATAZ0	R	00000000	Z轴数据0
0x37	DATAZ1	R	00000000	Z轴数据1
0x38	FIFO_CTL	R/W	00000000	FIFO控制
0x39	FIFO_STATUS	R	00000000	FIFO状态

1.1.3 应用电路

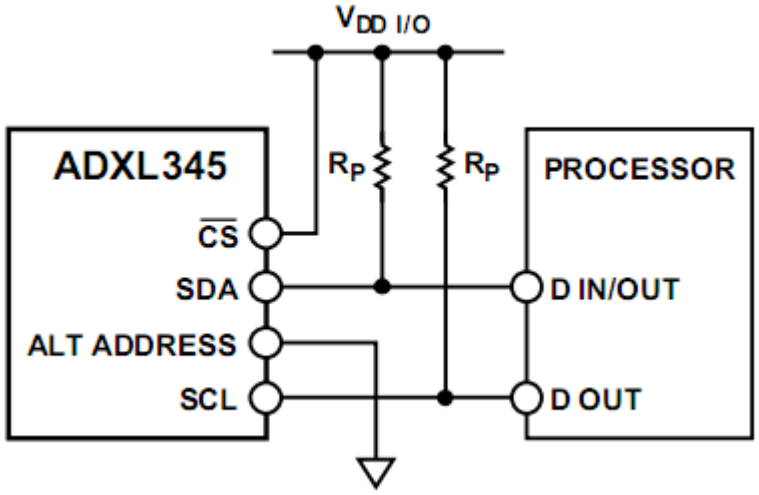
1.1.3.1 3线SPI连接示意图



1.1.3.2 4线SPI连接示意图



1.1.3.3 I2C连接示意图



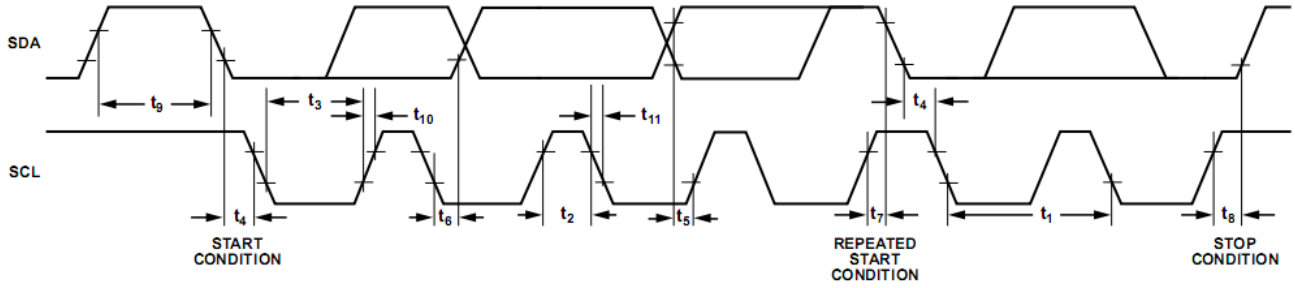
关于ADXL345的详细信息，请参考ADXL345的数据手册。

1.2 原理

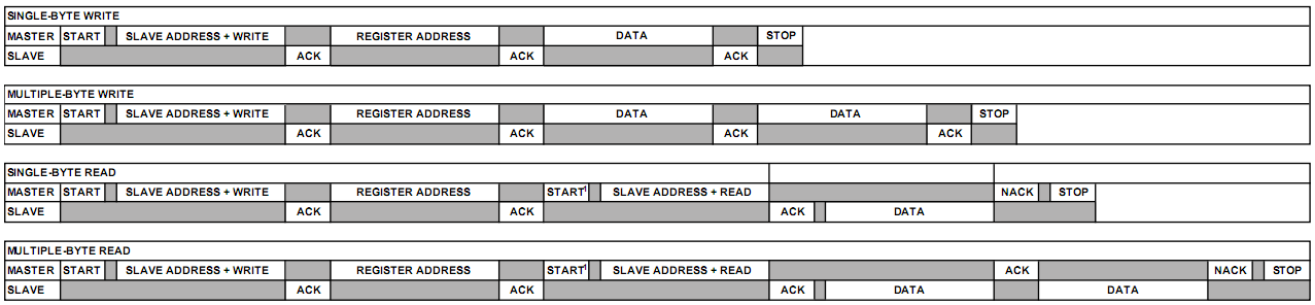
本范例代码使用NANO100系列通过I2C接口实现对ADXL345的读写，获取3轴加速度值。

注：输出数据格式为16位二进制补码格式。

1.2.1 I2C 时序



1.2.2 I2C 读写（地址：0x53）



详细信息，请参考ADXL345的数据手册。

1.3 执行结果

执行结果，以打印数据如下：

```
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 代码介绍

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);
}
```

读取 3 轴加速度值：

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

3 软件与硬件环境

- 软件环境
  - BSP 版本
    - Nano100B_Series_BSP_CMSIS_v3.03.000
  - IDE 版本
    - Keil uVersion4.74
- 硬件环境
  - 电路组件
    - NuTiny-EVB-Nano130-LQFP128 V1.0
    - ADXL345
  - 示意图

NANO100 使用 I2C 接口对 ADXL345 进行初始化，获取 3 轴加速度值。

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

4 目录信息

- 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 如何执行范例程序

1. 根据目录信息章节进入 ExampleCode 路径中的 KEIL 文件夹，双击 I2C_ADXL345.uvproj。
2. 进入编译模式接口
   a. 编译
   b. 下载代码至内存
   c. 进入 / 离开除错模式
3. 进入除错模式接口
   a. 执行代码

6 修订纪录

Date	Revision	Description
Dec.16, 2019	1.00	1. 初始发布.

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.