



BH1710/BH1750 应用手册

Digital 16bit Ambient Light Sensor IC

BH1710FVC/BH1750FVI

应用手册



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1 参考设计图

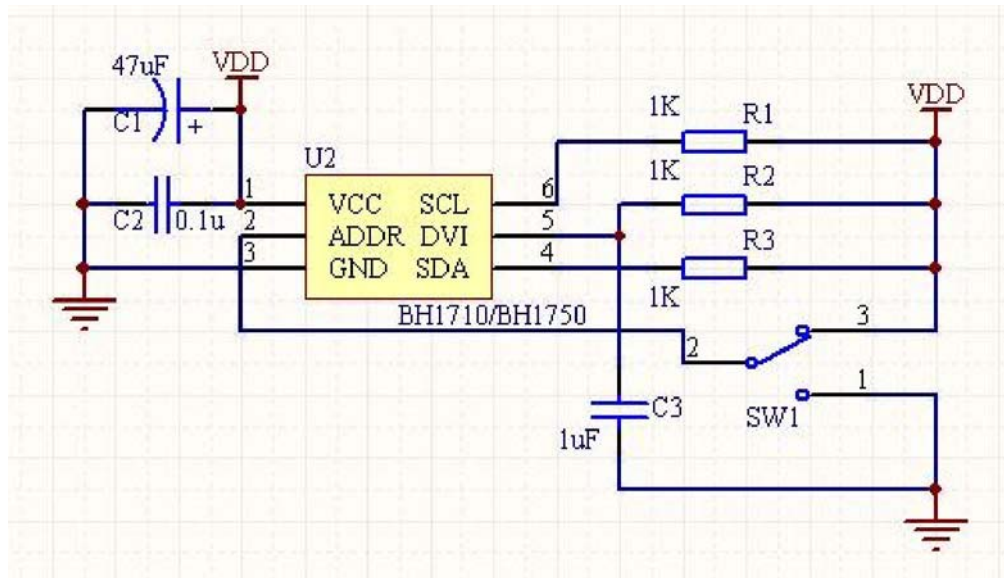
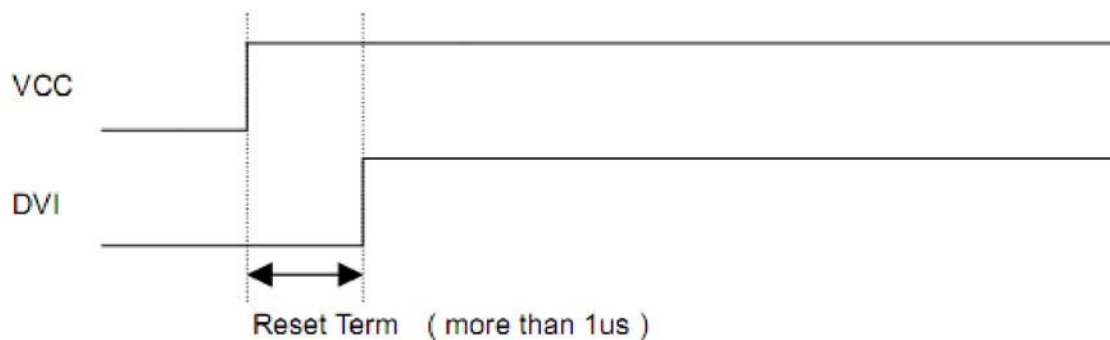


图 1、BH1710/BH1750 参考原理图

- l C1、C2 为电源滤波电容
- l R1、R3 为 I2C 上拉电阻
- l ADDR 是 I2C 通讯时设备地址的选择

ADDR	说明	写操作	读操作
高	$ADDR > 0.7VCC$	0xB8	0xB9
低	$ADDR < 0.3VCC$	0x46	0x47

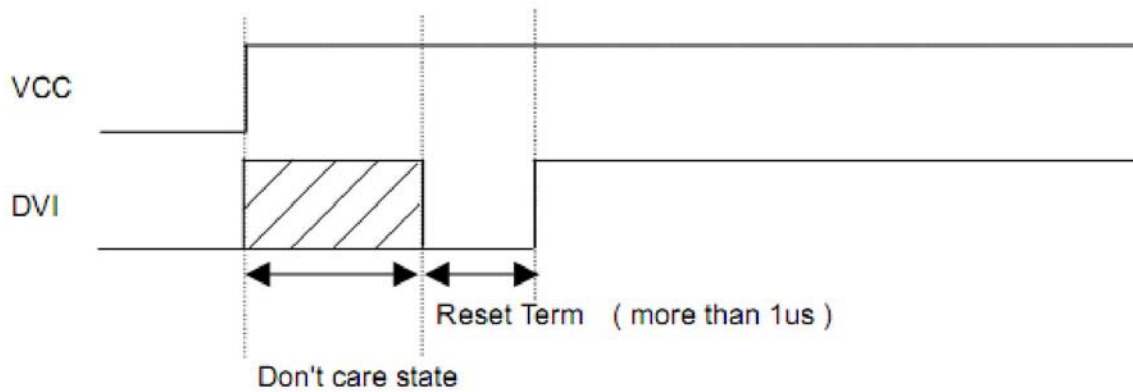
- l DVI 是 I2C 总线的参考电压端口,也是整个芯片的非同步 reset 端口,当芯片上电的瞬间,需要将该端口保持低电位,1us 过后拉高 DVI,如下图所示:



- 如果 DVI 上电不能满足上述要求,亦可在之后保证一个超过 1us 的低电平,如下图所示:



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请注意在这种情况下为了防止 ADDR 初始状态不稳定造成的过电流，请不要将 ADDR 直接与 VCC 或是 GND 相连，而在他们之间加一个 100kOhm 的电阻。

可参考上面的原理图连接 DVI，即可满足延迟要求。我们的 Spec 上还提供了另外 4 种 DVI 连接方法（参见 Spec 第 8、9 页），所达到的效果相同，建议根据不同情况酌情选择。



2 解析度（Resolution）设置

解析度即对环境光亮的测量精度，若解析度设置为 4，则 BH1710/BH1750 不能分辨环境光亮度在相差 4 个 Lux 值（例如 450 和 453）时所存在的亮度差异，也就是从芯片寄存器中所读取的值与真实值之间差异的最大值为 4。

BH1710 和 BH1750 各提供了 3 中解析度设置，具体情况参见下面表格：

	BH1710FVC			BH1750FVI		
	解析度	测量时间	寄存器设置	解析度	测量时间	寄存器设置
H-resolution Mode	1	120ms	0001_0000	1	120ms	0001_0000
H-resolution Mode 2	不支持			0.5	120ms	0001_0001
M-resolution Mode	4	16ms	0001_0011	不支持		
L-resolution Mode	32	2.9ms	0001_0110	4	16ms	0001_0011

关于 BH1750 H-resolution Mode 2：

与 BH1710 相比，BH1750 新增了另一种高精度模式，使得测量精度又提高了一倍。在设置了 H-resolution Mode 2 后，所测得的光亮度值为设置前的 2 倍，所以在实际应用前务必请先将测量值除以 2。



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3 透光率设置：

当 Light sensor 在机构设计时没有完全裸露在外面或是上面盖有不完全透明的遮挡物时,可进行透光率设置,使 Light sensor 测得的光亮度值不受其位置或上面遮挡物的影响。

此时,从 BH1710/1750 内部寄存器读取的光亮度值为: $\text{读取值} = \text{实际值} \times \text{透光率}$

例如,若将透光率设为 80%,从寄存器中读取的值为 240,则实际未设置透光率时的值应为 $240 / 80\% = 300$ 。

设置透光率还可以改变光亮度的测量精度,例如,若将透光率设为 50%,则其测量精度实际上也会相应提高一倍,对于较低亮度环境下的测量将更为准确有效。

透光率设置方法：

若想把透光率设为 X,则在寄存器 Change Measurement time 中写入的值应为：

X 乘以 100%透光率的基准值。

透光率的基准值请参考下表红色部分

		BH1710FVC				BH1750FVI			
		最小值		最大值		最小值		最大值	
透光率范围		153.00%		29%		222.50%		27.20%	
		00110_00100b		11111_11110b		0001_1111b		1111_1110	
一组参考透光率		10 进制值	2 进制值	寄存器高 8 位值	寄存器低 8 位值	10 进制值	2 进制值	寄存器高 8 位值	寄存器低 8 位值
	100%基准值	300	01001_01100	0x49	0x6c	69	010_00101	0x42	0x65
	50%	600	10010_11000	0x52	0x78	138	100_01010	0x44	0x6a
	80%	375	01011_10111	0x4b	0x77	86	010_10110	0x42	0x76
	120%	250	00111_11010	0x47	0x7a	58	001_11010	0x41	0x7a
	150%	200	00110_01000	0x46	0x68	46	001_01110	0x41	0x7e
	200%	/				35	001_00011	0x41	0x73

在实际设计时,请尽量保证芯片上方的透光孔形状规则并且达到一定面积,使得芯片感光部分能够均匀、对称地接受光照。若在机构设计中遇到问题,可以向我们提出进行模拟光照的实验要求,我们会通过专用的光学仪器进行光照分析,并给出设计建议。



4 光亮度值计算方法

计算公式为：实际值 = 测量值 / (1.2 * 透光率 * 高精度模式 2 调整值)

例1、 BH1710 测量值为 450Lux，透光率设为 125%，采用 H-resolution Mode，则实际光亮度值等于： $450 / (1.2 * 125\% * 1) = 300 \text{ Lux}$

例2、 BH1750 的测量值为 20Lux，透光率设为 50%，采用 H-resolution Mode2，则实际光亮度值等于： $30 / (1.2 * 50\% * 0.5) = 100 \text{ Lux}$



5 参考软件代码

5.1 初始化

BH1710

```
void BH1710Init(void)
{
    REGWRITE(DEV_ADD, CMD_PWN_ON);           //Power On
    REGWRITE(DEV_ADD, CMD_RESET);             //Software Reset
    REGWRITE(DEV_ADD, 0x49);
    REGWRITE(DEV_ADD, 0x6C);                   //设置透光率为 100%
    REGWRITE(DEV_ADD, CMD_HRES);               //设置为高精度模式
}
DEV_ADD = 0xb8 / 0x46
```

BH1750

```
void BH1750Init(void)
{
    REGWRITE(DEV_ADD, CMD_PWN_ON);           //Power On
    REGWRITE(DEV_ADD, CMD_RESET);             //Software Reset
    REGWRITE(DEV_ADD, 0x42);
    REGWRITE(DEV_ADD, 0x65);                   //设置透光率为 100%
    REGWRITE(DEV_ADD, CMD_HRES);               //设置为高精度模式
}
DEV_ADD = 0xb8 / 0x46
```

BH1721

```
void BH1721Init(void)
{
    REGWRITE(DEV_ADD, CMD_PWN_ON);           //Power On
    REGWRITE(DEV_ADD, 0x42);
    REGWRITE(DEV_ADD, 0x65);                   //设置透光率为 100%
    REGWRITE(DEV_ADD, CMD_HRES);               //设置为高精度模式
}
DEV_ADD = 0xb8 / 0x46
```

5.2 光亮度值读取

REGREAD(DEV_ADD, &highbyte, &lowbyte); (REGREAD 函数即 IIC_read 函数，定义



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如下)

```
void IIC_read(unsigned char DeviceID, unsigned char* HighByte, unsigned char* LowByte)
{
    IICStart();
    IICSendbyte(DeviceID | 0x01);
    if (!IICGetAck())
    {
        //return;
    }
    (*HighByte) = IICGetbyte();
    IICSendAck();
    (*LowByte) = IICGetbyte();
    IICStop();
    //DelayUs(1);
}
```

5.3 光亮度值计算

```
unsigned long BH1710Cal(unsigned char highbyte, unsigned char lowbyte)
{
    unsigned long data = 0, result = 0, temp = 0;
    unsigned char bitCont = 0, i = 0;
    data = (highbyte<<8) | lowbyte;
    for (bitCont=0; bitCont<16; bitCont++)
    {
        temp = (data << bitCont) & 0X8000;
        if (temp)
        {
            i = 15-bitCont;
            result = result + pow(2,i);
        }
    }
    result = result*10/12; //测量准确度调整
    return result;
}
```

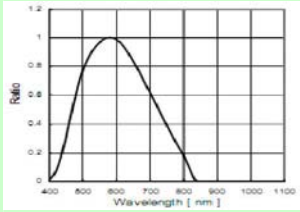
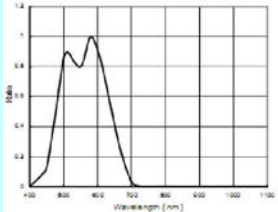
几点说明：

- 1、除了 Power On 和 Software reset 外，其它初始化语句的顺序可以颠倒。
- 2、由于我们的高精度模式单次测量时间为 120ms，在初始化完成后，请等待一定的时间（推荐 200us 以上），再对芯片的寄存器进行光亮度的读操作。如果没有达到相应的时间，可能会发生读出的亮度值为 0 的情况。



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6 BH1710FVC 与 BH1750FVI 其他差别

	BH1710FVC	BH1750FVI
最大待机电流	0.2uA	1.0uA
测量准确度	37.50% ($< 830\text{nm}$)	20% Small ($< 710\text{nm}$)
受红外光波的影响		
透光率设置	010_MT(9,8,7,6,5) 010_MT(4,3,2,1,0)	01000_MT(7,6,5) 011_MT(4,3,2,1,0)

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附 如何设定透光率（eg BH1710 BH1750）

若设置 BH1710 透光率为 100%，按照 Spec 应选择 01001_01100，将此数值填入到对应的 Measurement time 指令中，得到 01001001、01101100；即 0x49、0x6C。此数值与本文第三节透光率设置中，BH1710 100% 透光率（红色部分）相对应。

Supported Mtrege value is seeing below.

	Min.	Typ.	Max
Supported value (hex)	00110_00100 (transmission rate 153%)	01001_01100 (transmission rate 100%)	11111_11110 (transmission rate 29.4%)

For example BH1710FVC is possible to detect min. 0.35 lx when Mtrege value is "11111_11110" at H-Resolution mode.

BH1710 透光率配置实例

One time L-Resolution mode	0010_0110	Measurement time is typically 2.9ms. It is automatically set to Power Down mode after measurement.
Change Measurement time (High bit)	010_MT[9,8,7,6,5]	Change measurement time. ※ Please refer "adjust measurement result for influence of optical window."
Change Measurement time (Low bit)	011_MT[4,3,2,1,0]	Change measurement time. ※ Please refer "adjust measurement result for influence of optical window."

若设置 BH1750 透光率为 100%，按照下图，则输出指令为 01000010、01100101，即 0x42、0x65，此数值与本文第三节透光率设置中，BH1750 100%透光率（红色部分）相对应。

Supported Mtrege value is seeing below.

	Min.	Typ.	Max
Supported value (hex)	0010_1101	0100_0101	1111_1110

For example BH1750FVI is possible to detect min. 0.35 lx when Mtrege value is "1111_1110" at H-Resolution mode.

BH1750 透光率配置实例

		It is automatically set to Power Down mode after measurement.
Change Measurement time (High bit)	01000_MT[7,6,5]	Change measurement time. ※ Please refer "adjust measurement result for influence of optical window."
Change Measurement time (Low bit)	011_MT[4,3,2,1,0]	Change measurement time. ※ Please refer "adjust measurement result for influence of optical window."

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