HP03 programming guide

1. Brief description

The HP03 is a low power device, include a piezo-resistive pressure senor and an ADC interface. It provide 16 bit da ta for pressure and t emperature re late volta ge 1 1 unique coefficients were stored on the chip, thus accurate pressure and temperature reading ca n be realized. IIC interface is used for communication with a microprocessor.

2. Read compensation coefficients and ADC value

1 Read compensation coefficients

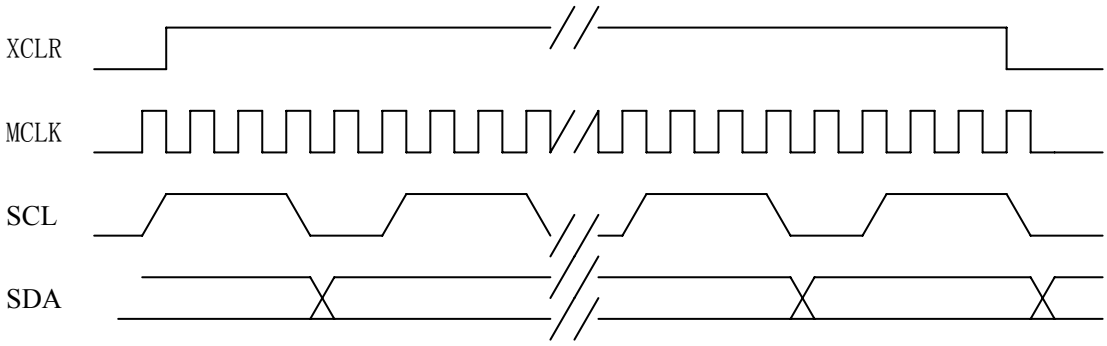
There are 11 compensation datum on the chip, the address of those coefficients are:

C 1 (MSB : LSB)	(0x10 : 0x11)
C2 (MSB : LSB)	(0x12 : 0x13)
C3 (MSB : LSB)	(0x14 : 0x15)
C4 (MSB : LSB)	(0x16 : 0x17)
C5 (MSB : LSB)	(0x18 : 0x19)
C 6 (MSB : LSB)	(0x1a : 0x1b)
C 7 (MSB : LSB)	(0x1c : 0x1d)
A (MSB : LSB)	(0x1e)
B (MSB : LSB)	(0x1f)
C (MSB : LSB)	(0x20)
D (MSB : LSB)	(0x21)

User can read them as same as read AT24c02 chip,

2 Read AD value of the pressure and temperature

Timing diagram



In order to get the AD value, must be follow the following timing

Read pressure

S	0xEE	**A**	0xFF	**A**	0XF0	**A**	P	D	S	0xEE	**A**	0xFD	**A**	S	0XEF	**A**	MSB	A	LSB	N	P

Read temperature

S	0xEE	**A**	0xFF	**A**	0XE8	**A**	P	D	S	0xEE	**A**	0xFD	**A**	S	0XEF	**A**	MSB	A	LSB	N	P

S: start bit

P: stop bit

A:acknowledge from slave

A: acknowledge from master

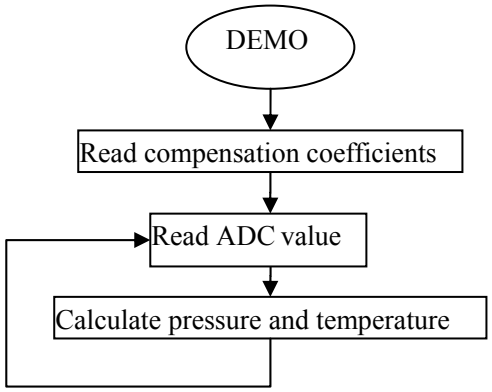
N: no acknowledge from master

D: delay for 40ms

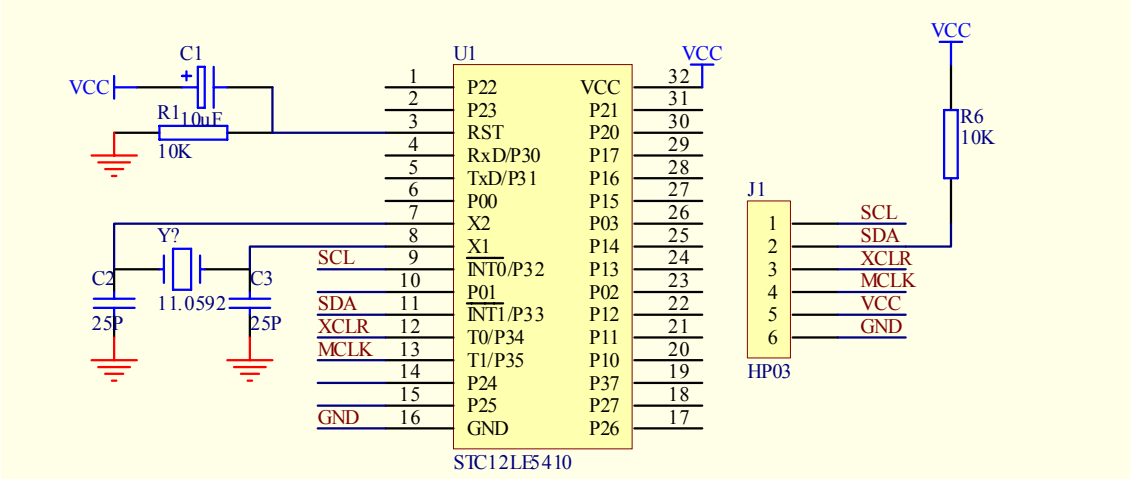
MSB: conversion result MSB

LSB: conversion result LSB.

3. Demo flow diagram



4. Example for standard 8051 core microcontroller



```
/*********************************************************************
      copyright (c) 2007
Title:                 H P03 simple example based on 8051 C
Current version:       v1 .0
Function:              C  alculate pressure ,altitude and temperature
Processor              STC12LE5410AD(8051 core)
Clock:                 11.0592MHz Crystal
Author:                Merrick
Company:               Hope   microelectronic Co.,Ltd.
Contact:               +86 -0755-86106557
E-MAIL:                  hopefsk@hoperf.com
Date:                  2007-10-24



                    Connections

        STC12LE5410AD SIDE          HP03 SIDE
                P3.2---------------->SCL
                P3.3<--------------->SDA
                P3.4---------------->XCLR
                P3.5---------------->MCLK
*********************************************************************/



#include "reg52.h"
#include <math.h>

#define   MaxPress   1100   /  /1100Hpa
#define  D  ELAY10US 10



//*************************************************
//function declaration
//*************************************************
void IIC_ReadCalData(void);
void ReadTemperaturePreesureAD(void);
unsigned int IIC_ReadTempretureAD(void);
unsigned int IIC_ReadPressureAD(void);
void CalculatePressTemp(void);
void CalculateAltitude(void);
```

```
void IIC_ReadCalData(void);
unsigned char IIC_ReadByte(void);
void IIC_WriteByte( unsigned char);
void IIC_Start(void);
void IIC_Stop(void);
void IIC_ACK(void);
void IIC_NoAck(void);
void IIC_SDA_HIGH(void);
void IIC_SDA_LOW(void);
void IIC_SCL_HIGH(void);
void IIC_SCL_LOW(void);
void IIC_XCLR_LOW(void);
void IIC_XCLR_HIGH(void);
void SysDelay2ms(unsigned int);
void SysDelay(unsigned int);




//*************************************************
//symbol defined
//*************************************************

sbit SCL = P3^2;
sbit SDA = P3^3;
sbit XCLR = P3^4;
sbit MCLK = P3^5;


unsigned int C1 ;
unsigned int C2 ;
unsigned int C3 ;
unsigned int C4 ;
unsigned int C5 ;
unsigned int C6 ;
unsigned int C7 ;
unsigned char AA ;
unsigned char BB ;
unsigned char CC ;
unsigned char DD ;

unsigned int D1 ;
unsigned int D2 ;
```

```
long float DUT;
long float OFF;
long float SENS;
long float X;
long float  Pr  ess;
long float    Temp;
long    Altitude;


//***************************************************
//comparison table for pressure and altitude
//***************************************************

long    code Tab_BasicAltitude[80]={-6983,-6201,-5413,-4620,-3820,-3015,-2203,-1385,-560, 270,    //0.1m
                                    //  1  100    1090    1080    1070   1 060   1 050    1040    1030   1 020   10 10    //hpa
                                      1  108, 1953, 2805, 3664, 4224, 5403, 6284, 7172, 8068, 8972,
                                   //   1 000    990     980     9 70    9 60     950     940     9 30    92 0     910     //hpa
                                      9885, 10805,11734,12671,13617,14572,15537,16510,17494,18486,
                                   //   9 00     890     880     8 70    8 60     850     840     8 30    82 0     810     //hpa
                                      19489,20502,21526,22560,23605,24662,25730,26809,27901,29005,
                                   //   8 00     790     780     7 70    7 60     750     740     7 30    72 0     710     //hpa
                                      30121,31251,32394,33551,34721,35906,37106,38322,39553,40800,
                                   //   7 00     690     680     6 70    6 60     650     640     6 30    62 0     610     //hpa
                                      42060,43345,44644,45961,47296,48652,50027,51423,52841,54281,
                                   //   6 00     590     580     5 70    5 60     550     540     5 30    52 0     510     //hpa
                                      55744,57231,58742,60280,61844,63436,65056,66707,68390,70105,
                                   //   5 00     490     480     4 70    4 60     450     440     4 30    42 0     410     //hpa
                                      71854,73639,75461,77323,79226,81172,83164,85204,87294,89438};
                                   //   4 00     390     380     3 70    3 60     350     340     3 30    32 0     310     //hpa
```

```
void main(void)
{
    Sy sDelay2ms(50);

    IIC_ReadCalData( );

  while(1)
        {
         R eadTemperaturePreesureAD(   );
         Ca lculatePressTemp( );
         Ca lculateAltitude(   );
         Sy sDelay2ms(300);
        }
}

//****************************************************
//function: calculate power for 2
//****************************************************
long int Get2_x(unsigned char i)
{
   long int uiData;
        uiData=2;
        i=i-1;
        while(i)
           {
              uiData <<= 1;
              i--;
            }
 retur n uiData;
}

//****************************************************
//function:calculate press and temperature
//input     :D1,D2,C1---C7,AA,BB,CC,D D;
//output    :Press, unit: 0.01hpa
//              temp, unit: 0.1℃
//****************************************************
void CalculatePressTemp(void)
{
 lo ng float MiddleData1;
 lo ng float MiddleData2;
 lo ng float MiddleData3;
 lo ng float MiddleData4;
```

```
//calculate the DUT value
if(D2<C5)
      {
        //D  UT = D2-C5-((D2-C5)/Get2_x(7))*((D2-C5)/Get2_x(7))*BB/Get2_x(CC);
          M  iddleData1 = (long)D2-C5;
          Mi  ddleData2 = MiddleData1*MiddleData1/16384;
          Mi  ddleData3 = MiddleData2*BB;
          M  iddleData4 = Get2_x(CC);
          Mi  ddleData4 = MiddleData3/MiddleData4;
          DUT   = MiddleData1 - MiddleData4;
        }
   else
      {
         //DUT = D2-C5-((D2-C5)/Get2_x(7))*((D2-C5)/Get2_x(7))*AA/Get2_x(C);
           MiddleData1 = D2-C5;
          Mi  ddleData2 = MiddleData1*MiddleData1/16384;
          Mi  ddleData3 = MiddleData2*AA;
          M  iddleData4 = Get2_x(CC);
          Mi  ddleData4 = MiddleData3/MiddleData4;
          DUT   = MiddleData1 - MiddleData4;
        }

 / /calculate the OFF value
/  /OFF = (C2+(C4-1024)*DUT/Get2_x(14))*4;
M  iddleData1 = (long)C4-1024;
M  iddleData2 = Get2_x(14);
M  iddleData3 = DUT*MiddleData1;
M  iddleData4 = MiddleData3/MiddleData2;
M  iddleData4 = (long)C2+MiddleData4;
OFF   = MiddleData4*4;

 / /calculate the SENS value
//SENS   = C1+C3*DUT/Get2_x(10);
M  iddleData1 = (long)C3*DUT;
M  iddleData2 = Get2_x(10);
M  iddleData3 = MiddleData1/MiddleData2;
SENS   = C1+MiddleData3;

 / /calculate the X value
/  /X = SENS*(D1-7168)/Get2_x(14)-OFF;
M  iddleData1 = Get2_x(14);
M  iddleData2 = (long)D1-7168;
M  iddleData3 = MiddleData2*SENS;
```

```
 M  iddleData4 = MiddleData3/MiddleData1;
 X   = MiddleData4-OFF;

  //calculate the Press value,have two decimal fraction
 /  /Press = X*100/Get2_x(5)+C7*10;
 M  iddleData1 = X*100;
 M  iddleData2 = Get2_x(5);
 M  iddleData3 = MiddleData1/MiddleData2;
 M  iddleData4 = C7*10;
 Press   = MiddleData3+MiddleData4;

 /  /calculate the Temperature value
 T  emp = 250+DUT*C6/Get2_x(16)-DUT/Get2_x(DD);

}

//****************************************************
//function:calculate altitude
//input     :Pre ss value
//output    :Altitude, unit: 0.1m
//****************************************************

void CalculateAltitude(void)
{
 c har ucCount;
 un signed int    uiBasicPress;
 un signed int    uiBiasTotal;
 un signed int   uiB iasPress;
 un signed int    uiBiasAltitude;

 f  or( ucCount=0;     ;  ucCount++ )
      {
        uiBasicPress = MaxPress-(ucCount*10);
       if(uiBasicPress   < (int)(Press/100))      break;
      }

  uiBiasTotal = Tab_BasicAltitude[ucCount] - Tab_BasicAltitude[ucCount-1];
  uiBiasPress = Press - (long)(uiBasicPress*100);
  uiBiasAltitude = (long)uiBiasTotal * uiBiasPress/1000;

  Altitude = Tab_BasicAltitude[ucCount] - uiBiasAltitude;

  ucCount = abs(Altitude % 10);        // four lose and five up
 if(Alt  itude < 0)
```

```
        {
          i f(ucCount > 4)
             Altitu   de -= 10-ucCount;
            else
               Altitude += ucCount;
        }

    else
        {
          i f(ucCount > 4)
             Altitu   de += 10-ucCount;
            else
               Altitude -= ucCount;
        }
}

//==================================================

void IIC_ReadCalData(void)
{
    unsigned char ucValue;

    IIC_Start();
 IIC_W    riteByte(0xa0);
 IIC_W    riteByte(16);
 IIC_S    tart();
 IIC_W    riteByte(0xa1);
    ucValue = IIC_ReadByte();
 IIC_ACK();
    C1=ucValue;
    ucValue = IIC_ReadByte();
 IIC_ACK();
    C1 <<= 8;
    C1 |= ucValue;

    ucValue = IIC_ReadByte();
 IIC_ACK();
    C2=ucValue;
    ucValue = IIC_ReadByte();
 IIC_ACK();
    C2 <<= 8;
    C2 |= ucValue;

    ucValue = IIC_ReadByte();
```

```
IIC_ACK();
    C3=ucValue;
    ucValue = IIC_ReadByte();
IIC_ACK();
    C3 <<= 8;
    C3 |= ucValue;

    ucValue = IIC_ReadByte();
IIC_ACK();
    C4=ucValue;
    ucValue = IIC_ReadByte();
IIC_ACK();
    C4 <<= 8;
    C4 |= ucValue;

    ucValue = IIC_ReadByte();
IIC_ACK();
    C5=ucValue;
    ucValue = IIC_ReadByte();
IIC_ACK();
    C5 <<= 8;
    C5 |= ucValue;

    ucValue = IIC_ReadByte();
IIC_ACK();
    C6=ucValue;
    ucValue = IIC_ReadByte();
IIC_ACK();
    C6 <<= 8;
    C6 |= ucValue;

    ucValue = IIC_ReadByte();
IIC_ACK();
    C7=ucValue;
    ucValue = IIC_ReadByte();
IIC_ACK();
    C7 <<= 8;
    C7 |= ucValue;

    ucValue = IIC_ReadByte();
IIC_ACK();
    AA=ucValue;
    ucValue = IIC_ReadByte();
IIC_ACK();
```

```
      BB= ucValue;

      ucValue = IIC_ReadByte();
 IIC_ACK();
     C  C=ucValue;
      ucValue = IIC_ReadByte();
 IIC_NoAck();
 IIC_S      top();
      DD= ucValue;
}
//==================================================
void MCLKOn(void)
{
    T MOD = 0x12;
     TH0 = 0xf8;
    TL0  = 0xf8;
    ET0  = 1;
     EA = 1;
    PT0  = 1;
     TR0 = 1;

}
//==================================================
void MCLKOff(void)
{
     TR0 = 0;
    ET0  = 0;
}



//==================================================

void ReadTemperaturePreesureAD(void)
{
          lo ng uiSumADValue;
          uiS umADValue = 0;
          IIC_XCLR_HIGH();
          MCLKOn();
          SysDelay2m s(1);

          D 1 = IIC_ReadPressureAD();
           uiSumADValue += D1;
          D1  = IIC_ReadPressureAD();
```

```
            uiSumADValue += D1;
            D1  = IIC_ReadPressureAD();
            uiSumADValue += D1;
            D1  = IIC_ReadPressureAD();
            uiSumADValue += D1;
            D1 = uiSumADValue >> 2;

            D2  = IIC_ReadTempretureAD();

           SDA=0;
           SCL=0;

            MCLKOff();
           IIC_XCLR_LO W();

}

//=================================================
void vect_Timer0(void) interrupt 1 using 1    //porduct 32k Hz signal
{
   MCLK = ~MCLK;
}
//=================================================

unsigned int IIC_ReadTempretureAD(void)
{
    un signed char ucData;
        unsigned int wADT;


     IIC_S  tart();
     IIC_W  riteByte(0xEE);
        IIC_W  riteByte(0xff);
        IIC_W  riteByte(0xE8);
        IIC_S  top();
        SysDelay2m  s(20);

        IIC_S  tart();
        IIC_W  riteByte(0xEE);
        IIC_W  riteByte(0xFD);
        IIC_S  tart();
        IIC_W  riteByte(0xEF);

         ucData = IIC_ReadByte();
```

```
        IIC_ACK();
//      UartSe  nd(CCC);
        wADT   = ucData;
        wADT   <<= 8;

         ucData = IIC_ReadByte();
        IIC_NoAck();
        IIC_S  top();
        wADT   |= ucData;
//      UartSen  d(DD);


        re  turn wADT;

}
//================================================

 u nsigned int IIC_ReadPressureAD(void)
{
      unsigned char ucData;
      unsigned int wADp;


    IIC_S  tart();
    IIC_W  riteByte(0xEE);
       IIC_W  riteByte(0xff);
       IIC_W  riteByte(0xF0);
       IIC_S  top();
       SysDelay2m  s(20);

       IIC_S  tart();
       IIC_W  riteByte(0xEE);
       IIC_W  riteByte(0xFD);
       IIC_S  tart();
       IIC_W  riteByte(0xEF);

         ucData = IIC_ReadByte();
       IIC_ACK();
       wADp   = ucData ;
       wADp   <<=8;
//     UartSen  d(AA);

         ucData = IIC_ReadByte();
       IIC_NoAck();
```

```
        IIC_S  top();
        wADp   |= ucData;
//      UartSend(BB);


    re  turn wADp;
 }



//================================================

unsigned char IIC_ReadByte(void)
{
      unsigned char ucValue;
      unsigned char ucIndex;

    IIC_  SDA_HIGH();
 SysDelay(DELA      Y10US);
      for ( ucIndex = 0; ucIndex < 8; ucIndex++ )
 {
 uc            Value <<= 1;

          II  C_SCL_LOW();
 SysDelay(DELA            Y10US);

 IIC            _SCL_HIGH();
 SysDelay(DELA            Y10US);

       if(SDA      )
              ucValue |= 1;

            SysDelay(DELAY10US);
          IIC_SCL_LOW();
 SysDelay(DELA            Y10US);

 }

      return ucValue;
}
//================================================

void IIC_WriteByte( unsigned char ucData )
{
```

```
    unsigned char i;
        for( i = 0; i < 8; i++ )
        {
IIC             _SCL_LOW();
SysDelay(DELA           Y10US);

if((uc          Data & 0x80) == 0x80)
            {
IIC_            SDA_HIGH();
SysDelay(DELA           Y10US);
            }
            else
            {
IIC_SD          A_LOW();
SysDelay(DELA           Y10US);
            }


            IIC_SCL_HIGH();
            SysDelay(DELAY10US);
ucData              <<= 1;
            IIC_SCL_LOW();
        }

IIC_  SDA_HIGH();
SysDelay(DELA  Y10US);
IIC_SCL_LOW();
SysDelay(DELA  Y10US);
IIC_SCL_HIGH  ();
SysDelay(DELA  Y10US);
IIC_SCL_LOW();
SysDelay(DELA  Y10US);


}
//==================================================

void IIC_Start(void)
{

    IIC_SDA_HIGH();
SysDelay(DELA    Y10US);

IIC_S    CL_HIGH();
```

```
    SysDelay(DELA  Y10US);

      IIC_SDA_LOW();
 SysDelay(DELA      Y10US);

 IIC_S      CL_LOW();
 SysDelay(DELA      Y10US);

}
//=================================================

void IIC_Stop(void)
{
      IIC_SCL_LOW();
  SysDelay(DELA  Y10US);

  II  C_SDA_LOW();
  SysDelay(DELA  Y10US);

  II  C_SCL_HIGH();
  SysDelay(DELA  Y10US);

  II  C_SDA_HIGH();
  SysDelay(DELA  Y10US);
}
//=================================================

void IIC_ACK(void)
{
   IIC_SDA_LOW();
  SysDelay(DELA  Y10US);

   IIC_SCL_HIGH ();
  SysDelay(DELA  Y10US);

   IIC_SCL_LOW();
  SysDelay(DELA  Y10US);

}
//=================================================


void IIC_NoAck(void)
{
```

```
 IIC_ SDA_HIGH();
 SysDelay(DELA_Y10US);

 IIC_SCL_HIGH();
 SysDelay(DELA_Y10US);

 IIC_SCL_LOW();
 SysDelay(DELA_Y10US);

}



//=================================================

void IIC_SDA_HIGH(void)
{
      SDA=1;
}

//=================================================

void IIC_SDA_LOW(void)
{
      SDA=0;
}

//=================================================

void IIC_SCL_HIGH(void)
{
      SCL=1;
}

//=================================================

void IIC_SCL_LOW(void)
{
      SCL=0;
}

//=================================================
```

```
void IIC_XCLR_LOW(void)
{
    XCLR=0;
}

//================================================

void IIC_XCLR_HIGH(void)
{
    XCLR=1;
}
//================================================

void SysDelay2ms( unsigned int t)
{
    unsigned int i;
 while(t--)
          {//for (i = 0; i < 1250; i++);
           for (i = 0; i < 1500; i++);
          }
}


//================================================

void SysDelay(unsigned int t)
{
    while(t--);
}
```

Notice：

1. Supply voltage ： 2.7V---3.3V
2. MCLK frequency ： 30K---35K。The up edge and down edge should be steep, the edge more steeper the power more lower.
3. Don’t be static electricity destroy ,don’t operation with power.
4. With constant temperature to solder.
5. After solder, wait for some time ,let temperature tranquilization. For the best wait for 24 hours.

HOPE MICROELECTRONICS CO.,LTD
4/F, Block B3, East Industrial Area,
Huaqiaocheng, Shenzhen, Guangdong,
China
Tel: 86-755-86096602
Fax: 86-755-86096587
Email: sales@hoperf.com
Website: http://www.hoperf.com
http://www.hoperf.cn
http://hoperf.en.alibaba.com