HDSC 华大半导体 HUADA SEMICONDUCTOR

32-bit microcontroller

RTC hardware compensation algorithm of HC32L110 series

Suitable

series	Product number
HC32L110	HC32L110C6UA HC32L110C6PA HC32L110C4UA HC32L110C4PA HC32L110B6PA HC32L110B4PA

content

1 Summary

This application note mainly introduces the RTC hardware compensation algorithm of HC32L110 series.

This application note mainly includes:

ÿ Introduction of hardware compensation principle

ÿ Introduction of compensation algorithm

ÿ Introduction to fitting crystal oscillator curve compensation

Notice:

- This application note is a supplementary material for the application of the HC32L110 series and cannot replace the user manual, specific functions and registers

  Please refer to the user manual for related matters such as operation.

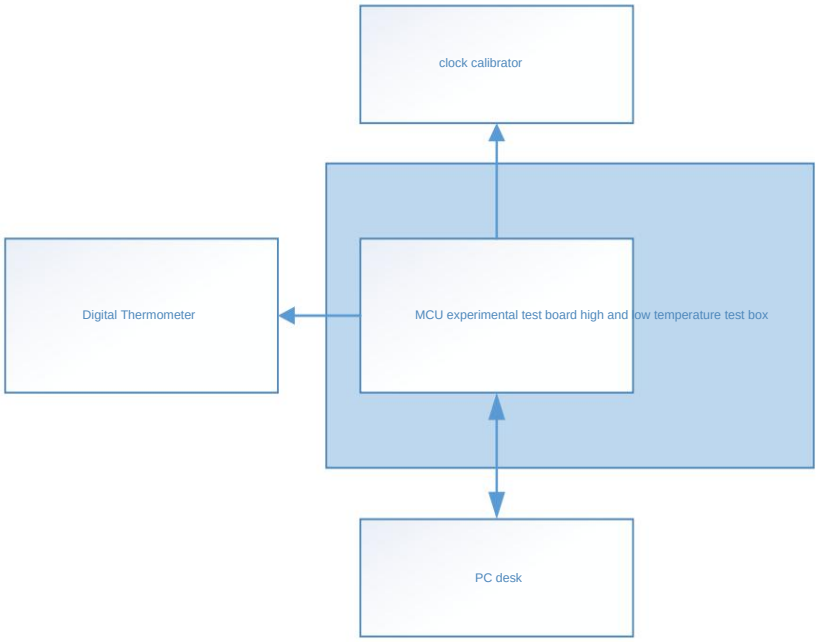
2 Function introduction

HC32L110 series RTC module hardware compensation algorithm, based on high-speed 24M clock compensation, can achieve the minimum compensation unit

The accuracy of 0.96ppm can meet the high-precision clock compensation requirements.

3 Introduction to the principle of hardware compensation

3.1 Hardware Platform



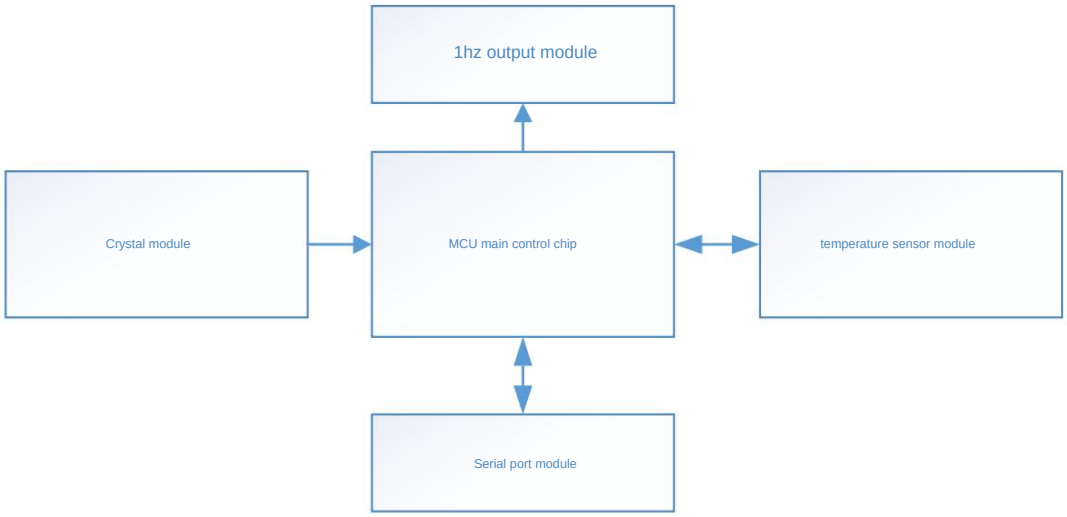
ÿ The experimental test board is put into the high and low temperature test box, and the test board is powered normally

ÿ Connect the clock calibrator to the 1hz output port of the test board to detect the clock error

ÿ Put the thermocouple wire of the digital thermometer into the position of the test board, and directly read the temperature value of the test point

ÿ The PC serial port is correctly connected to the test board UART, which is convenient for users to exchange data

MCU experimental test board hardware block diagram:



ÿ The crystal oscillator module provides the count clock source for the RTC clock module

ÿ 1hz output module provides test source for clock calibrator

ÿ The temperature sensor module measures the current temperature value in real time

ÿ The serial port module provides users with a data exchange carrier

Before the experiment, the size of the external 32k crystal oscillator matching capacitor should be adjusted according to the 1hz output accuracy to ensure that the error is calibrated at high and low temperature.

within the range.

4 Introduction to Compensation Algorithm

Based on its own 32.768khz RTC, the compensation unit per second is 1/32768=30.5ppm, which cannot meet the high precision requirements. Calculate

After being enlarged by 32 times, 30.5/32=0.96ppm can be achieved, so the compensation register introduces the setting of 5 decimal places. for

In order to improve the compensation accuracy, it is necessary to increase the compensation clock source.

If the compensation clock source is 24M, then 23 24M clocks clk represent 1hz clock cycles, so that the compensation can be

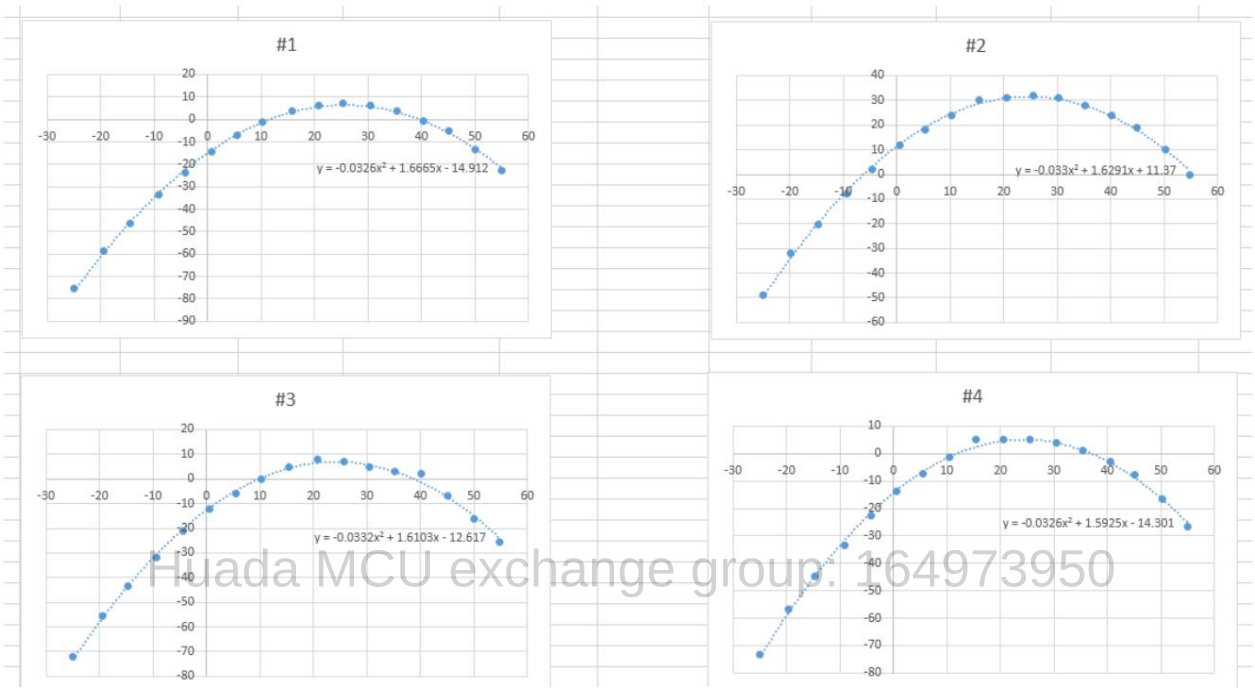
In order to achieve the function of accurate calibration per HZ.

5 Introduction to fitting crystal oscillator curve compensation

5.1 High and low temperature fitting crystal oscillator temperature drift curve

Under the high and low temperature experiment, the corresponding 1hz error ppm at different temperatures was recorded, and the parabola simulation was carried out according to the experimental data points.

combine. After fitting, the 1hz temperature drift curve parameters of each MCU parameter can be obtained.



5.2 Principle of automatic compensation

After fitting the parabolic parameters, write the parabolic parameters into the program, and calculate the ppm at this time according to the parabolic parameters and real-time temperature

value, and then calculate the compensation value according to the compensation formula, and write it into the compensation register to realize the automatic compensation function of the 1hz program.

$$\text{Compensation target value} = \frac{\text{actual frequency - target frequency}}{\text{target frequency}} * 106$$

$$\text{Compensation Register CR[8:0]} = \left(\frac{\text{Compensation target value [PPM]}*215}{106}\right) \text{take 2 's complement} + 0001.00000B$$

6 Reference samples and drivers

Through the above introduction and in conjunction with the HC32L110 series user manual, we calculate the RTC hardware compensation of the above series of MCUs.

The application and operation methods of the method have been further mastered.

Huada Semiconductor (HDC) officially provides the application sample and driver library of this module at the same time. Users can open the sample by opening the

The project is further intuitively familiar with the application of the module and the driver library, and can also directly refer to the sample and use in the actual development

Driver library to quickly implement the operation of this module.

ÿ Example reference: ~/HC32L110_DDL/example/rtc

ÿ Driver library reference: ~/HC32L110_DDL/driver/…/rtc

7 Summary

The above chapters briefly introduced the RTC hardware compensation algorithm of the HC32L110 series, and explained the operation steps of this compensation function in detail.

step. In the actual application development process, if the user needs to have a deeper understanding of the usage and operation of this module,

The corresponding user manual shall prevail. The samples and driver libraries mentioned in this chapter can be used as user's further experiments and learning.

It can also be directly applied in actual development.

8 Additional information

Technical support information: www.hdsc.com.cn

9 Version Information & Contact

date	Version revision record	
2018/5/31	Rev1.0 initial release	

If you have any comments or suggestions in the process of purchasing and using, please feel free to contact us.

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