HDSC 华大半导体 HUADA SEMICONDUCTOR

32-bit Microcontrollers

Data Calculation Unit DCU for HC 32 F 460 Series

Applicable objects

Series	Product Model
HC32F460	HC32F460JEUA HC32F460JETA HC32F460KEUA HC32F460KETA HC32F460PETB

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1 Abstract

This application note introduces the Data Computing Unit (DCU) module of HC32F460 series chip and triggers the operation of computing by hardware events.

2 DCU Introduction

A Data Computing Unit (DCU) is a module that simply processes data without the aid of a CPU. Each DCU

The unit has 3 data registers and is capable of adding, subtracting and comparing the size of 2 data, as well as a window comparison function.

3 DCU of HC32F460 Series

3.1 Introduction

The HC32F460 series MCUs are equipped with 4 DCU units, each of which can perform its own function independently.

3.2 Description

3.2.1 DCU Function

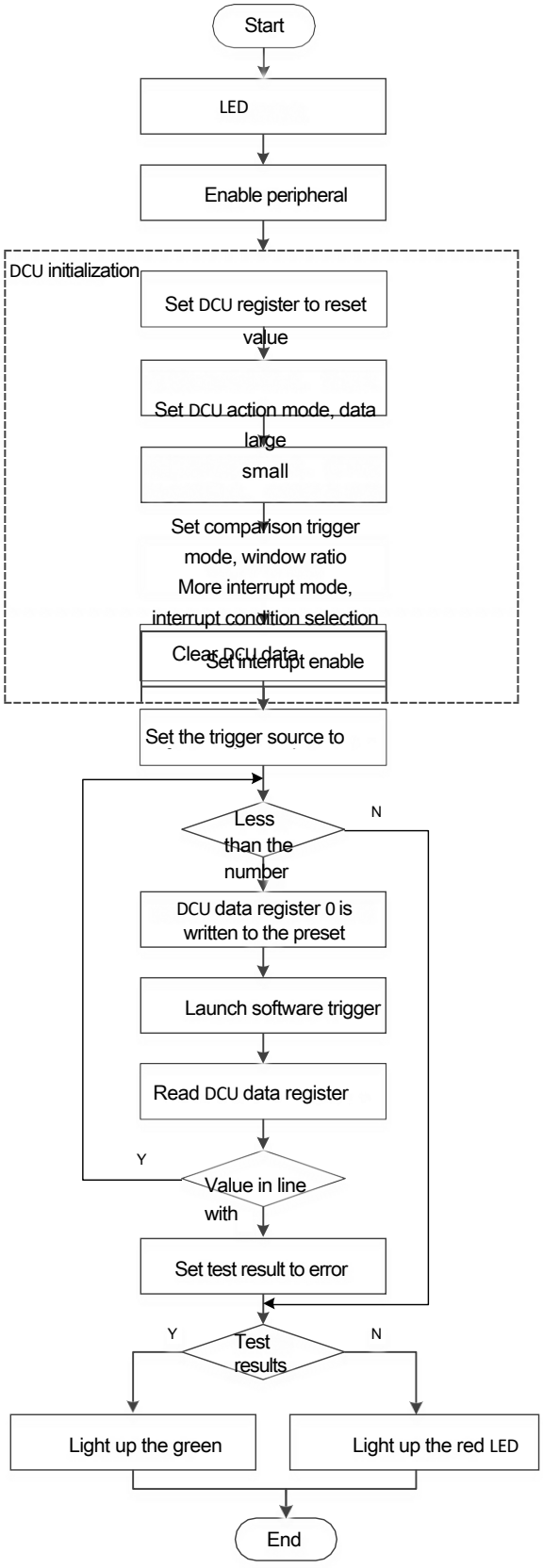
- 4 types of data processing are possible: addition of 2 data, subtraction, comparison and comparison of 3 data windows.
- The addition and subtraction operations are performed on the data in the DATA0 and DATA1 registers, and the results are stored in DATA0.
- Addition and subtraction can be computed either after writing the register or triggered by other peripheral circuit events.
- The result of addition and subtraction operations is automatically halved once, and the result of the halving operation and the result of the addition and subtraction operation are put into 2 data registers respectively for other modules.
- The comparison mode can be used to compare the 2 data points between the DATA0 and DATA1 registers, and between the DATA0 and DATA2 registers.
  The interrupt and flag bits can be generated when the data is greater than, less than, or equal to, respectively.
- The comparison mode can be used for window comparison, i.e., set DATA1 and DATA2 as the upper and lower limits of the window respectively, according to
  The comparison results of DATA0 and DATA1 and DATA0 and DATA2 determine whether DATA0 is inside or outside the window.
- The event signals are used to start the peripheral circuits when the DCU is selected as the trigger source by other peripheral circuits with hardware trigger start function.

3.2.2 Register Introduction

English description (abbreviation)	Chinese Description
DCU Control Register (DCU_CTL)	DCU control register
DCU Flag Register (DCU_FLAG)	DCU flag register
DCU Data0 Register (DCU_DATA0)	DCU data register 0
DCU Data1 Register (DCU_DATA1)	DCU data register 1
DCU Data2 Register (DCU_DATA2)	DCU data register 2
DCU Flag Clear Register (DCU_FLAGCLR)	DCU flag reset register
DCU Interrupt Select Register (DCU_INTSEL)	DCU interrupt condition selection register
DCU Trigger Select Register (DCU_TRGSEL)	DCU Trigger Source Selection Register

3.2.3 Workflow Introduction

This section describes the workflow of the sample dcu_hw_trigger_add used in this AN.



4 Sample Code

4.1 Code Introduction

Users can write their own code to learn to verify the module according to the above workflow, or download the sample code of Device Driver Library (DDL) directly through the website of UW Semiconductors and use the sample of DCU to verify.

The following section briefly describes the configuration involved in the dcu_hw_trigger_add code of this sample AN DDL-based DCU module.

1) Initialization LED:

```
/* Initialize LED
*/ LedInit().
```

2) Enables the peripheral clock:

```
/* Enable peripheral clock */
PWC_Fcg0PeriphClockCmd(PWC_FCG0_PERIPH_PTDIS |
PWC_FCG0_PERIPH_DCU1, Enable).
```

3) Initialize DCU:

```
/* Initialize DCU */
MEM_ZERO_STRUCT(stcDcuInit);
stcDcuInit.u32IntSel = 0;
stcDcuInit.enIntWinMode = DcuIntInvalid;
stcDcuInit.enDataSize = DcuDataBit16;
stcDcuInit.enOperation = DcuHwTrigOpAdd;
DCU_Init(DCU_UNIT, &stcDcuInit).
DCU_WriteDataHalfWord(DCU_UNIT, DcuRegisterData0, 0x0000);
DCU_SetTriggerSrc(DCU_UNIT, EVT_TRIG_NUM).
```

4) Start DCU peripheral trigger operation:

```
for (i = 0; i < u8CalTimes; i++)
{
   DCU_WriteDataHalfWord(DCU_UNIT, DcuRegisterData1, m_au 16Data1Val[i]).

   /* Start soft trigger event */
   AOS_SW_Trigger().

   m_au16Data0Val[i] = DCU_ReadDataHalfWord(DCU_UNI T, DcuRegisterData0);
   m_au16Data2Val[i] = DCU_ReadDataHalfWo rd(DCU_UNIT, DcuRegisterData2 ).
```

```
/* Compare DCU regisger DATA0 && DATA2 value: DATA0 value == 2 * DATA2 value
*/
   if (m_au16Data0Val[i] ! = (2 * m_au16Data2Val[i]))
   {
      enTestResult = Error;
      break.
   }
   else
   {
   }
}
```

4.2 Code Run

Users can download the sample code of HC32F460 DDL through the website of UW Semiconductors.

(dcu_hw_trigger_add) and run the relevant code with the evaluation board (EV-HC32F460-LQFP100-050-V1.1) to learn to use the DCU module.

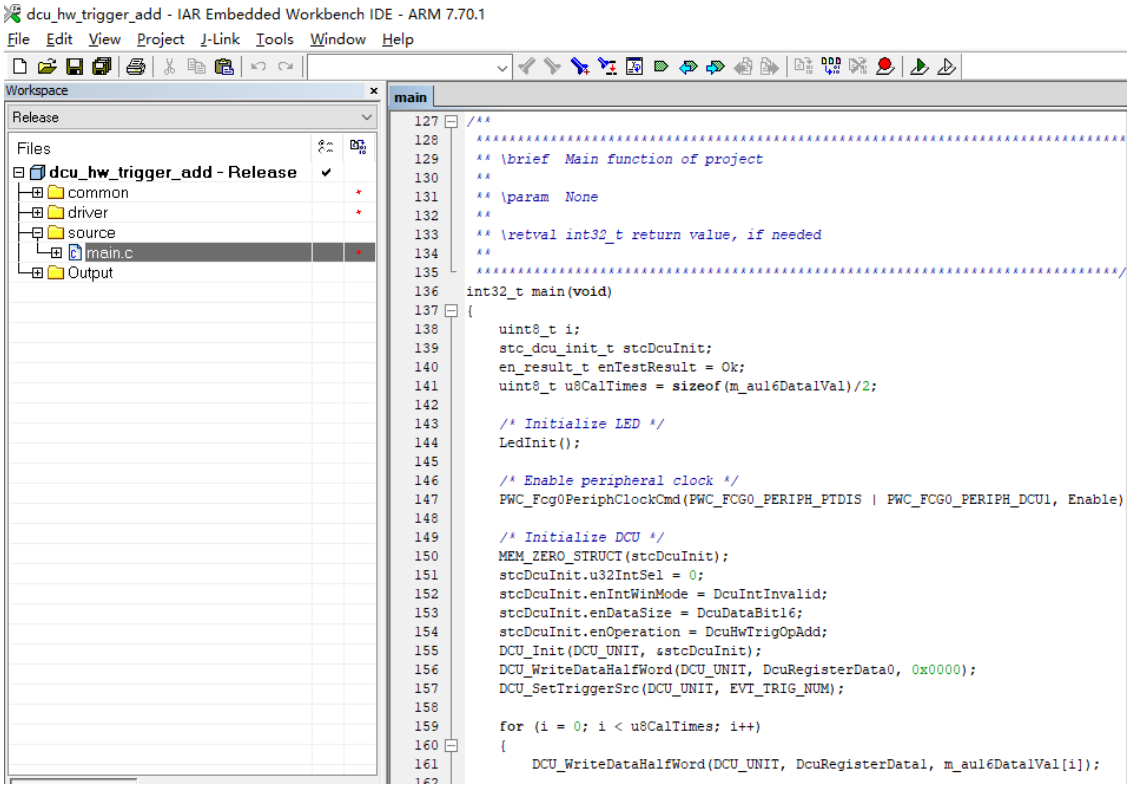
The following section describes how to run the DCU sample code on the evaluation board and observe the results:

— Verify that the correct IAR EWARM v7.7 tool is installed (please download the appropriate installation package from the official IAR website and refer to the user manual for installation).

— Download the HC32F460 DDL code from the UW Semiconductors website.

— Download and run the project file in dcu\dcu_hw_trigger_add\ at

1) Open the dcu_hw_trigger_add\ project and open the 'main.c' view as follows:



2) Click  to recompile the entire project.

3) Click  Download the code to the evaluation board and run it at full speed.

4) The green LED lights up.

5 Summary

The above section briefly introduces the DCU of HC32F460 series, explains the registers and part of the operation flow of DCU module, and demonstrates how to use the DCU sample code, so that users can configure and use the DCU module according to their needs in the actual development.

6 Version Information & Contact

Date	Versions	Modify records
2019/3/15	Rev1.0	Initial Release

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

Email: mcu@hdsc.com.cn

Website: http://www.hdsc.com.cn/mcu.htm

Address: 39, Lane 572, Bibo Road, Zhangjiang Hi-Tech Park, Shanghai, 201203, P.R. China