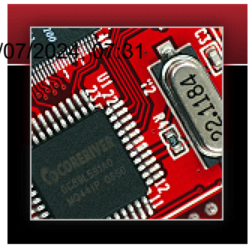
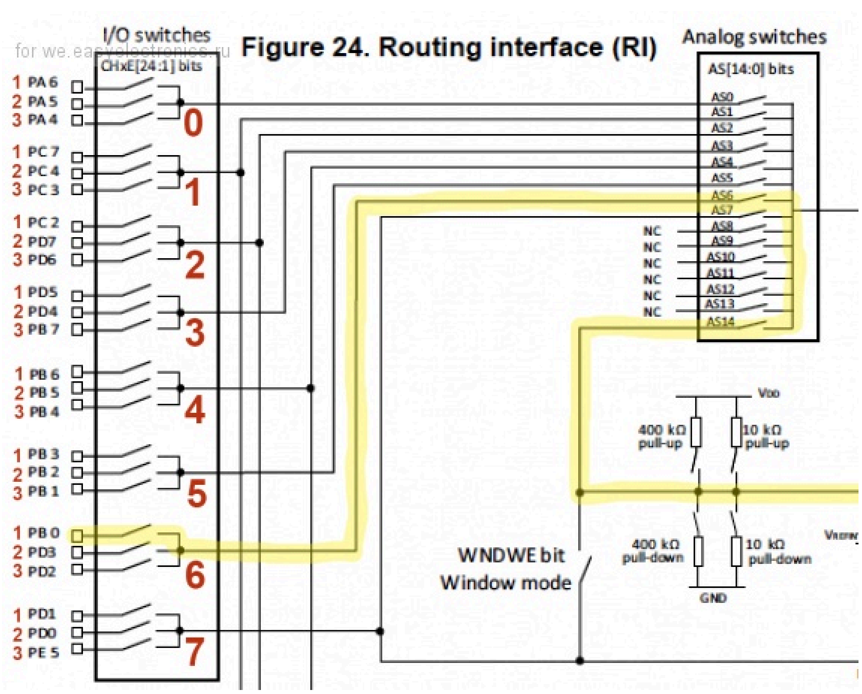


STM8L Comparators: Part 1 COMP1

STM8

Let's consider comparators in **STM8L** series microcontrollers using the example of **STM8L152C6T6** , which is installed on the STM8L-DISCOVERY board.

Our **STM8L152C6T6** belongs to the **medium** class . First, let's figure out how to connect the first comparator **COMP1** . To illustrate the connection of the comparator from RM0031, let's take a picture from the Routing interface (RI) section for **medium** :



We will feed the input signalto **the PBO** pin using a voltage divider.

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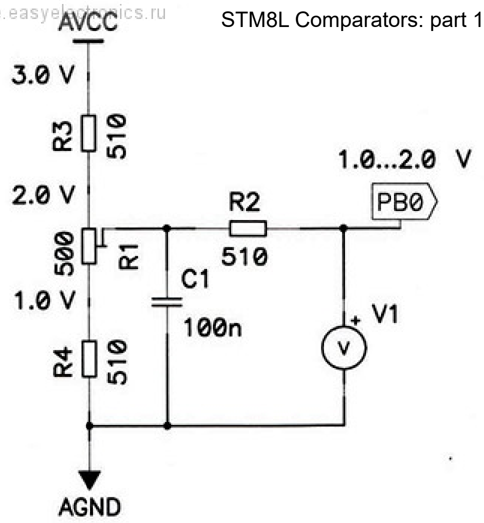
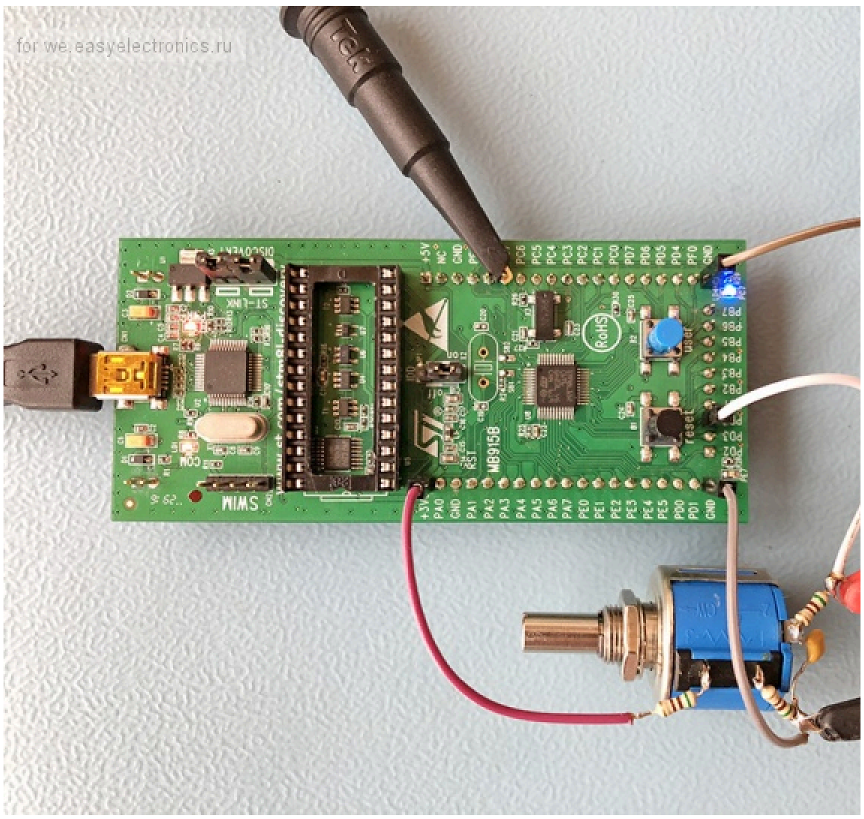


The photo shows a multi-turn potentiometer, but you can get by with a regular one. An additional resistor **R2** is installed to avoid accidentally burning out **the PB0** input if it is suddenly programmed to output. Carefully remove the LCD indicator and put it aside. The **COMP1**



comparator has one fixed threshold level, V_ref = 1.202...1.242 Volts. This voltage is fed to the inverting input of the comparator. The exact V_ref value of a specific stone is measured at the factory at VDD = 3 V ±10 mV. This value can be read at address 0x00 4910 and used in your program to improve the accuracy of measurements. In IAR, you can read it like this:

```
//#include "iostm8l151c6.h"
#include <stdint.h>    // работа с uintx_t переменными
#include <stdio.h>    // работа с терминалом I/O

uint16_t D_ref_FACTORY;
```

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```
void main( void )
{
   D_ref_FACTORY = *((uint8_t*)0x4910); // читаем значение по адресу 0x4
   D_ref_FACTORY += 0x600;  // в старшем байте всегда 0x6, в младшем у м
   printf("D_ref_FACTORY = %d\n",D_ref_FACTORY); // опорное, замеренное

   //  3000mV           4095 единиц
   //  1,221V  D_ref_FACTORY единиц

   // получаем опорное в mV для конкретного камня
   D_ref_FACTORY = (uint32_t)D_ref_FACTORY * 3000 / 4095;
   printf("mV = %d\n",D_ref_FACTORY);

   while(1);
}
```

The header "iostm8l151c6.h" is not used in this example, we access it directly by the address in memory. The example file **READ_Vref.zip** is in the attachment. Now we know that our stone will compare the input voltage with the value V_ref = 1.221 Volts.

Note: In the same way, at the address 0x00 4911 you can read the calibration value of the built-in temperature sensor TS_Factory_CONV_V90, measured at the factory at 90 degrees Celsius. The most significant byte there will always be 0x3.

Now let's turn on COMP1 and see how it works.
We connect the voltage divider to the PBO input:

```
PB_DDR_bit.DDR0 = 0; // настраиваем PB0 на вход
PB_CR1_bit.C10 = 0;  // подтягивающий резистор - отключен
```

To monitor the operation of the comparator, we will use the blue LED located on the DISCOVERY board.

```
PC_DDR_bit.DDR7 = 1; //настраиваем C7 на выход ГОЛУБОЙ
PC_CR1_bit.C17 = 1; //переключаем его в режим push-pull
```

We enable clocking of the comparators and connect Vrefint to the inverting input of COMP1:

```
CLK_PCKENR2_bit.PCKEN25 = 1;
COMP_CSR3_bit.VREFEN = 1;
```

Close the switch AS14
Close the switch AS6
Connect PB0 to the non-inverting input COMP1

```
RI_ASCR2_bit.AS14 = 1;
RI_ASCR1_bit.AS6 = 1;
RI_IOSR1_bit.CH19E = 1;
```

The input pins are divided into 8 groups. Each group has 3 pins. PB0 is pin **1** in a group, meaning RI_IOSR **1** ; group #6 means 6 bits, called **CH19E** . So you can select any of the 24 available pins. You can use the ADC and COMP1 comparator at the same time, only if they are connected to the same line (highlighted in yellow).

Turn on the Schmitt trigger.

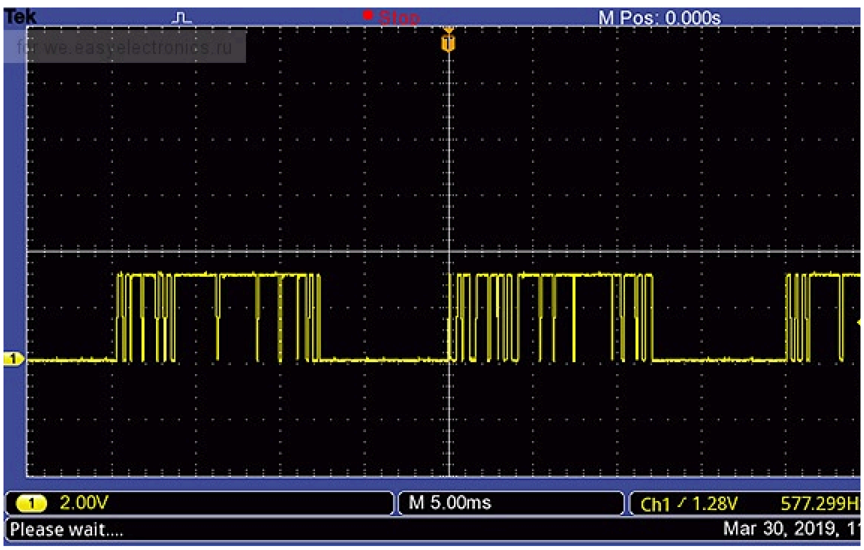
Turn on the edge detector (turn it on even if you don't need interrupts!)


```
COMP_CSR1_bit.STE = 1;
COMP_CSR1_bit.CMP1 = 3; // 0-COMP1 выключен; 1-по спаду; 2-по фронту; 3-
```

In the loop we will display the comparator output:

```
while (1)
{
  PC_ODR_bit.ODR7 = COMP_CSR1_bit.CMP1OUT; //компаратор в “1” - светодио
}
```

The COMP_1.zip example file is attached. In addition to the LED, I connected an oscilloscope to the C7 output. While the input voltage is below the threshold, the comparator output is "0" and the LED does not light. When it is higher, the comparator output is "1" and the LED lights. If the input voltage is equal to the threshold, the comparator is in an unstable state and this can be seen on the oscilloscope. A confident "0" (1.220 V) differs from a confident "1" (1.222 V) by 2mV.



Let's make an example that will use COMP1 interrupts.
Let's add an interrupt handler:

```
#pragma vector = COMP_EF1_vector   // прерывания по срабатыванию COMP1
__interrupt void COMP_EF1(void)
{
  PC_ODR_bit.ODR7 = COMP_CSR1_bit.CMP1OUT; //голубой светодиод отображае
  COMP_CSR1_bit.EF1 = 0;   // обнуляем бит выхода из прерывания
}
```

Now the blue LED displays the comparator output already inside the interrupt. Inside the handler, it is necessary to manually zero the interrupt exit bit **EF1** . Interrupts not only from COMP1, but also from COMP2 and from the ADC arrive at this vector **(20)**

. The edge detector is configured by the CMP1 bit in the COMP_CSR1 register.
COMP_CSR1_bit.CMP1 = 0; // COMP1 is disabled
COMP_CSR1_bit.CMP1 = 1; // generates an interrupt on falling edge
COMP_CSR1_bit.CMP1 = 2; // generates an interrupt on rising edge

COMP_CSR1_bit.CMP1 = 3; // generates an interrupt on falling edge and falling edge

In **main,** we enable COMP1 interrupts and globally enable interrupts.

```
COMP_CSR1_bit.IE1 = 1;
asm("rim");
```

While the input voltage is below the threshold, the comparator output is "0" and the LED does not light. When it is higher, the comparator output is "1" and the LED lights. The example file **COMP_1_INTERRUPTS.zip** is attached. In the next section, we will look at COMP2 and the joint operation of comparators in windowed mode.

STM8L, comparator , COMP1, STM8L-Discovery

+6 01 April 2019, 00:09 **CreLis** 3

Files in the topic: READ_Vref.zip , COMP_1.zip , COMP_1_INTERRUPTS.zip

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