Introduction

The NUCLEO-8S208RB (built around the STM8S208RBT6 device) and the NUCLEO-8L152R8 (built around the STM8L152R8T6 device) are boards that allow the evaluation of the main features of all the STM8S Series and STM8L Series microcontrollers.

This application note provides a short description of the demonstration firmware Discover which is preprogrammed in the Flash memory of the STM8S208RBT6 and STM8L152R8T6 microcontrollers.

This demonstration firmware makes use of the STM8S Series and STM8L Series basic 8-bit timer configured as a time-base generator to change the blinking speed of LED LD1 each time the user push button is pressed. Once the STM8 Nucleo-64 board is powered-up through a standard USB cable connected to the host PC, LED LD1 starts blinking slowly, meaning that the programming has been completed successfully.

Table 1. Applicable products

<table>
<thead>
<tr>
<th>Type</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation boards</td>
<td>NUCLEO-8S208RB</td>
</tr>
<tr>
<td></td>
<td>NUCLEO-8L152R8</td>
</tr>
</tbody>
</table>

Reference documents

- STM8 Nucleo-64 boards data brief (DB3591)
- STM8L152R8T6 Nucleo-64 board user manual (UM2351)
- STM8S208RBT6 Nucleo-64 board user manual (UM2364)
1  Application description

1.1  Hardware requirements
The following STM8 Nucleo-64 on-board resources are used:
•  LED, LD1
•  User push button, B1
No additional hardware is required to make this application software run on the STM8 Nucleo-64 boards.

1.2  Application schematics
Refers to below documents for implementation details:
•  STM8L152R8T6 Nucleo-64 board user manual (UM2351)
•  STM8S208RBT6 Nucleo-64 board user manual (UM2364)

1.3  Application principle
This application uses the 8-bit timer TIM4 as a time-base generator to control LED LD1 blinking speed. Each time the STM8S Series or STM8L Series value microcontroller detects an event on user push button B1, the delay (a multiple of the TIM4 time-base) between each toggle of the LED is adjusted to change the blinking frequency accordingly.
At application start-up, the blinking period is configured to 1 second and LD1 toggles at this rate (every second). This configuration allows to check visually that the STM8S Series or STM8L Series device's Flash memory was successfully programmed.
Each time a push button event is detected on the user push button B1, LD1 blinking frequency is increased according to the settings described in the table below.

<table>
<thead>
<tr>
<th>User push button B1</th>
<th>LD1</th>
<th>Toggling period</th>
</tr>
</thead>
<tbody>
<tr>
<td>At application start up (only)</td>
<td>Toggles</td>
<td>1 sec</td>
</tr>
<tr>
<td>1st press</td>
<td>Toggles</td>
<td>200 ms</td>
</tr>
<tr>
<td>2nd press</td>
<td>Toggles</td>
<td>100 ms</td>
</tr>
<tr>
<td>3rd press</td>
<td>Toggles</td>
<td>40 ms</td>
</tr>
</tbody>
</table>

Table 2. LED LD1 configuration
2 Software description

2.1 STM8S Series software description

This application software uses the STM8S Series standard firmware library to control general purpose functions and peripherals:

- **Clock (CLK)**
  The clock control enables and delivers the correct clock frequency to the CPU and to the peripherals.
  At power on, the master clock source is automatically selected as HSI clock with prescaler division factor = to 1.
  This setup is not changed by the application code: \( f_{\text{MASTER}} = 16 \text{ MHz} \).

- **GPIOs**
  The GPIOs drive the MCU I/Os to interface with external hardware.
  They configure port PC5 as output push-pull high to drive LED LD1. They configure PE4 as input floating with external interrupt to interface with the user push button B1.
  This interrupt is controlled by the interrupt controller.

- **EXTI**
  The external interrupt controlled is configured to control the external interrupt sensitivity on the push button connected to PC5.
  It is configured to trigger an interrupt each time a falling edge (and only a falling edge) is detected on PC5.

- **TIM4**
  TIM4 is a basic 8-bit timer used as a 1 ms time base. This time base is used by the application to control LD1 blinking speed.
  TIM4 is configured by the application as follows:
  - Up-counting mode
  - TIM4_PSCR = 7
  - Counting frequency : \( F_{\text{ck_cnt}} = F_{\text{master}} / 2^\text{PSCR}[2:0] = 16 \text{ MHz}/128 = 125 \text{ kHz} \)
  - TIM4_ARR = 0x7C (124 cycles)

2.2 STM8L Series software description

This application software uses the STM8L Series standard firmware library to control general purpose functions and peripherals:

- **Clock (CLK)**
  The clock control enables and delivers the correct clock frequency to the CPU and to the peripherals.
  At power on, the master clock source is automatically switched to HSE_bypass with prescaler division factor = to 1.
  This setup is not changed by the application code: \( f_{\text{MASTER}} = 8 \text{ MHz} \).

- **GPIOs**
  The GPIOs drive the MCU I/Os to interface with external hardware.
  They configure port PB5 as output push-pull high to drive LED LD1. They configure PG4 as input floating with external interrupt to interface with the user push button B1.
  This interrupt is controlled by the interrupt controller.

- **EXTI**
  The external interrupt controlled is configured to control the external interrupt sensitivity on the push button connected to PB5.
  It is configured to trigger an interrupt each time a falling edge (and only a falling edge) is detected on PB5.

- **TIM4**
TIM4 is a basic 8-bit timer used as a 1 ms time base. This time base is used by the application to control LD1 blinking speed.
TIM4 is configured by the application as follows:
- Up-counting mode
- TIM4_PSCR = 5
- Counting frequency: \( F_{\text{ck\_cnt}} = F_{\text{master}} \times 2^{-\text{PSCR}[3:0]} = \frac{8 \text{ MHz}}{32} = 250 \text{ kHz} \)
- TIM4_ARR = 0xF9 (249 cycles)

2.3 Application software flowcharts

This section gives an overview of the application software main loop as well as of the function that controls LD1 blinking speed.

2.3.1 Main loop flowchart

The figure below shows the flowchart of the application software main loop.

**Figure 1. Main loop flowchart**

2.3.2 LED_Blink() flowchart

The figure below shows the detailed flowchart of the LED_Blink() function part of the main routine. The LED_Blink() function implements the algorithm that controls the LED blinking speed depending on the state selected by the push button.

At application start-up, the state machine is in its default state, LD1 toggles every 1 s period, then BlinkSpeed is incremented at each push button detection. In state 1 and state 2 of the state machine, the programmed blinking frequency is changed.

LED LD1 blinking frequency is defined using the 8-bit timer TIM4 configured as a time-base generator to assert an update interrupt every 1 ms.

The toggling period depends on the value of PeriodNumber. This variable defines the number of times the timer interrupt is to be asserted (reach overflow) before toggling the LED LD1.
As a result, LED blinking frequency can only be a multiple of 1 ms (see table on Section 1.3 Application principle).

**Figure 2. LED_Blink() flowchart**
Revision history

Table 3. Document revision history

<table>
<thead>
<tr>
<th>Date</th>
<th>Version</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>27-Jun-2018</td>
<td>1</td>
<td>Initial release.</td>
</tr>
</tbody>
</table>
Contents

1  Application description ............................................................ 2
   1.1  Hardware requirements ......................................................... 2
   1.2  Application schematics .......................................................... 2
   1.3  Application principle ............................................................ 2

2  Software description............................................................... 3
   2.1  STM8S Series software description ............................................... 3
   2.2  STM8L Series software description ............................................... 3
   2.3  Application software flowcharts ................................................... 4
       2.3.1  Main loop flowchart ....................................................... 4
       2.3.2  LED_Blink() flowchart ..................................................... 4

Revision history ........................................................................ 6
List of tables

Table 1. Applicable products ................................................................. 1
Table 2. LED LD1 configuration ............................................................ 2
Table 3. Document revision history ....................................................... 6
List of figures

Figure 1. Main loop flowchart ................................................................. 4
Figure 2. LED_Blink() flowchart ............................................................... 5
IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2018 STMicroelectronics – All rights reserved