

Adjustable LED blinking speed using STM8 Nucleo-64 boards

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

Type	Part number
Evaluation boards	NUCLEO-8S208RB
	NUCLEO-8L152R8

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 2. LED LD1 configuration

User push button B1	LD1	Toggling period
At application start up (only)	Toggles	1 sec
1st press	Toggles	200 ms
2nd press	Toggles	100 ms
3rd press	Toggles	40 ms

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
 - $\text{TIM4_PSCR} = 7$
 - Counting frequency : $\text{Fck_cnt} = \text{F_master} / 2^{\text{PSCR}[2:0]} = 16 \text{ MHz} / 128 = 125 \text{ khz}$
 - $\text{TIM4_ARR} = 0x7C$ (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_PSC = 5
- Counting frequency : $F_{ck_cnt} = F_{master} / 2^{PSC[3:0]} = 8 \text{ MHz} / 32 = 250 \text{ khz}$
- TIM4_ARR = 0xF9 (249 cycles)

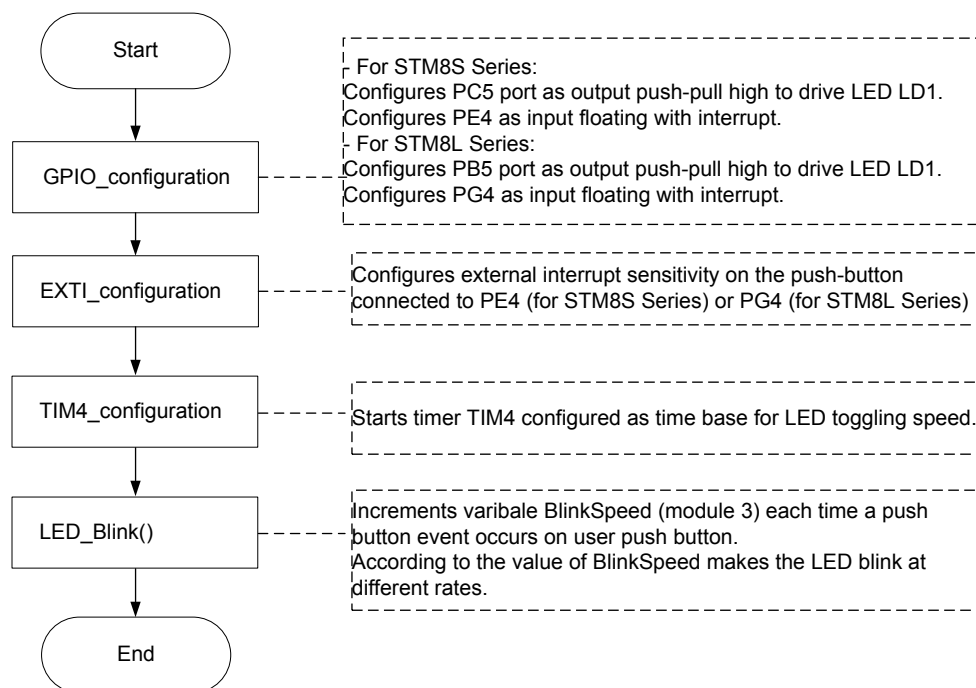
2.3 Application software flowcharts

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.

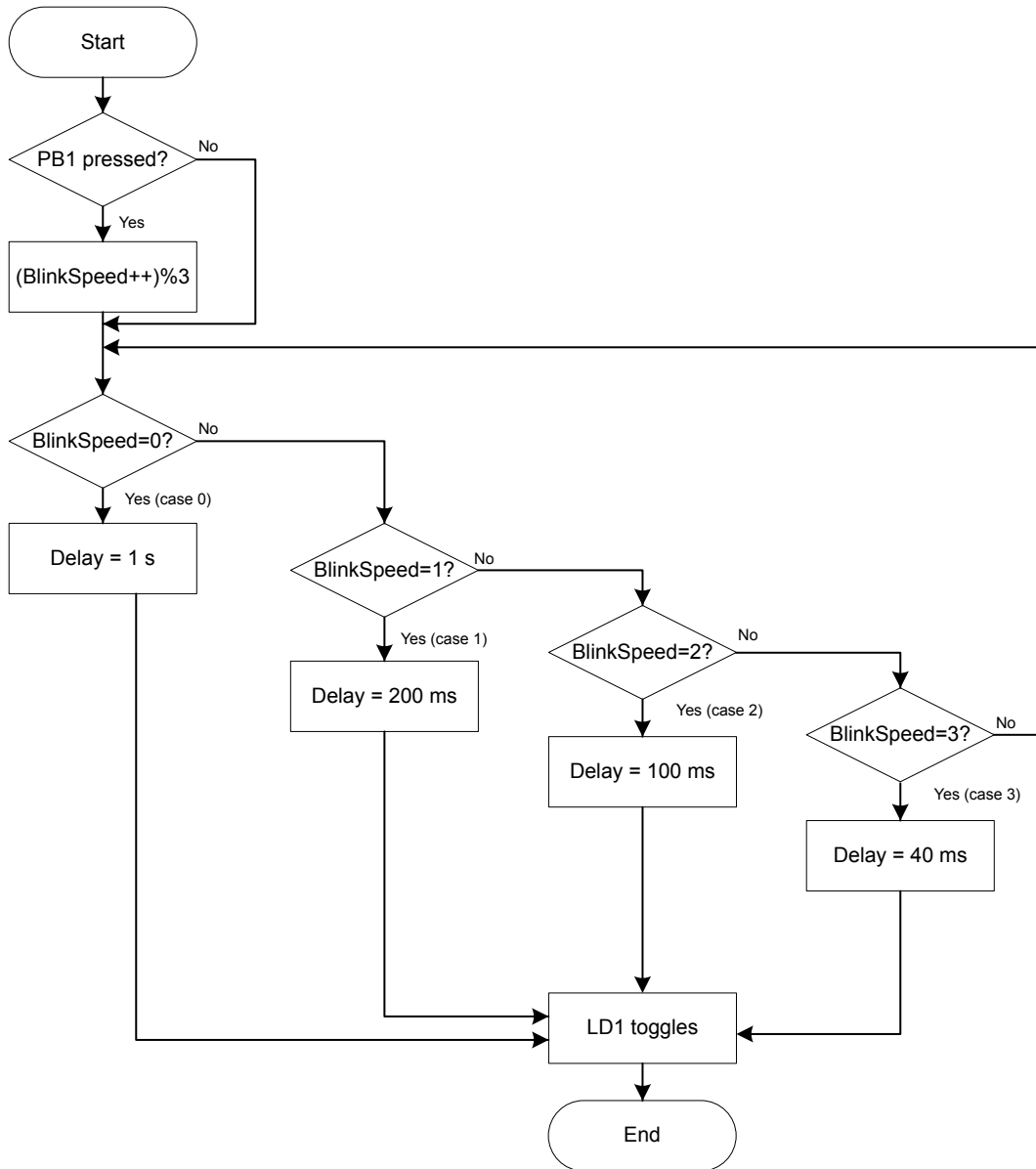
At application start-up, the state machine is in its default state, LD1 toggles every 1 s period, then BlinkSpeed is incremented at each push button detection. In state 1 and state 2 of the state machine, the programmed blinking frequency is changed.

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

Date	Version	Changes
27-Jun-2018	1	Initial release.

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

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