

M4K Group (1)
Application Note
Clock Control and Operation Mode
(CG-M4K (1)-A)

Outlines

This application note is a reference material for developing products using the clock control and the operation mode (CG) functions of M4K Group (1).

The release of the low power mode is done by an external interrupt.

This document helps the user check operation of the product and develop its program.

Target sample program: CGRST_EXINT_M4K4A

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1. Preface

This sample program changes the operating mode according to the control of a push switch. LED's show the operation mode on the evaluation board.

The operation mode can be changed from the NORMAL mode to the Low power mode (IDLE/STOP1). It is triggered by a port input signal of the switch.

When the operation mode transits to the Low power mode, a corresponding LED turns on, which confirms the transition is successful.

The operation mode returns to the NORMAL mode when an external interrupt is detected during the Low power mode.

2. Reference Document

1. Datasheet
 TPM4K Group (1) datasheet Rev2.0 (Japanese edition)
2. Reference manual
 Clock Control and Operation Mode (CG-M4K(1)-A) Rev2.0 (Japanese edition)
 Input/Output Ports (PORT-M4K(1)) Rev2.0 (Japanese edition)
 Exception (EXCEPT-M4K(1)) Rev1.0 (Japanese edition)
3. Application note
 M4K Group (1) Application Note Startup (CMSIS System & Clock Configuration) Rev1.0
4. Other reference document
 TPM4KxA Group Peripheral Driver User Manual (Doxygen) V1.0.4.0

3. Function to Use

IP	Channel	Port	Function/Operation mode
Clock Control and Operation Mode	—	—	System clock control/Mode change
Input/Output Ports	—	PL0 (Input port)	Input
		PL1 (Input port)	
		PA1 (INT09)	External interrupt
	—	PL2 (Output port)	Output
		PL3 (Output port)	
		PJ4 (Output Port)	

4. Target Device

The target devices of this application note are as follows;

TMPM4K4FYAUG	TMPM4K4FWAUG	TMPM4K4FUAUG	TMPM4K4FSAUG
TMPM4K4FYAFG	TMPM4K4FWAFG	TMPM4K4FUAFG	TMPM4K4FSAFG
TMPM4K2FYADUG	TMPM4K2FWADUG	TMPM4K2FUADUG	TMPM4K2FSADUG
TMPM4K1FYAUG	TMPM4K1FWAUG	TMPM4K1FUAUG	TMPM4K1FSAUG
			TMPM4K0FSADUG

* This sample program operates on the evaluation board of TMPM4K4FYAUG.

If other function than the TMPM4K4 one is checked, it is necessary that CMSIS Core related files (the startup file and I/O header file) should be changed properly.

Additionally, the name of microcontroller which is set to the project should be changed.

The BSP related file is dedicated to the evaluation board (TMPM4K4FYAUG). If other function than the TMPM4K4 one is checked, the BSP related file should be changed properly.

5. Operation Confirmation Condition

Used microcontroller	TMPM4K4FYAUG
Used board	TMPM4K4 evaluation board (Product of ESP-kikaku Co. Ltd.)
Integrated development environment	IAR Embedded Workbench for ARM 8.22.2
Integrated development environment	Arm® Keil® MDK Version 5.24.2.0
Sample program	v1.0.0

6. Evaluation Board Operation

An external input pin and the SW1 should be connected on the evaluation board to generate an interrupt. They should be connected with a jumper wire and others.

NORMAL mode

The LED1 blinks.

IDLE mode

The operation mode transits to the IDLE mode by setting the PL0 to Low. The LED2 turns on.

STOP1 mode

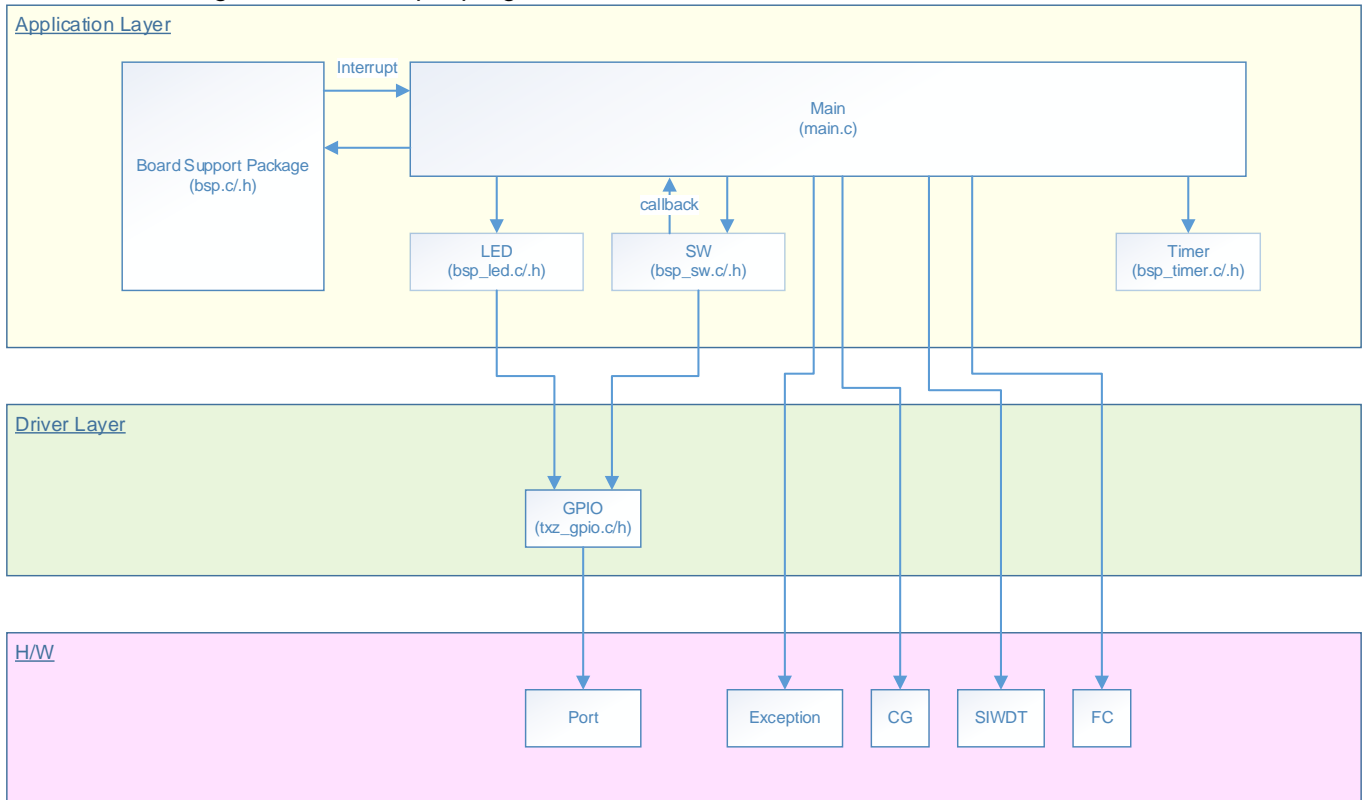
The operation mode transits to the STOP1 mode by setting the PL1 to Low. The LED3 turns on.

The operation mode returns to the NORMAL mode by setting the PA1 to Low.

7. Sample Program

7.1. Structure Diagram of Sample Program

The structure diagram of the sample program is shown below.



7.2. Startup Routine

The following initialization is done after power is supplied.

The initialization of each clock setting and the initialization of the watchdog timer setting are done.

7.3. Main Operation

The initialization of the BSP (Board Support Package) is done.

The reset flag is cleared.

The settings of the LED's and the switches are done as the setting of the variables.

After each initialization setting completes, the sample program executes the main operation.

The sample program sets the timer as the driver initialization.

The 1-ms timer setting, the LED setting, and the Push switch setting are done as the application initialization.

The mode switching is done by the Push switches.

S_SW1 switch; Transition to the IDLE mode

S_SW2 switch: Transition to the STOP1 mode

The operation mode of the sample program can be checked using the LED's.

In the NORMAL mode, the LED D1 blinks.

It repeats 1-second lighting and 1-second lights-out.

In the IDLE mode, the LED D2 lights.

In the STOP1 mode, the LED D3 lights.

When the operation mode transits to the Low power mode by the Push switch, the following operation is done.

When the INT09 interrupt is detected, the operation mode returns to the NORMAL mode.

The direct transition between the different Low power modes is not supported by this sample program.

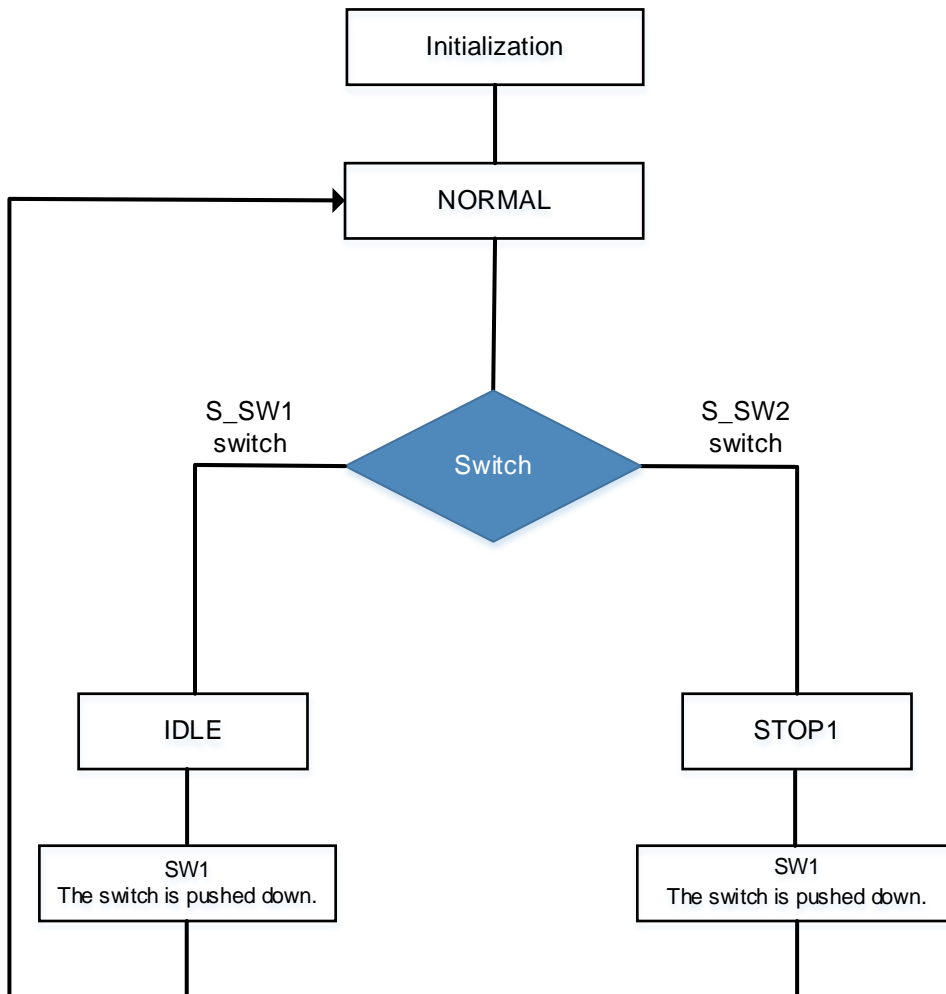
The transition to the Low power mode should be done via the NORMAL mode.

7.4. Operation Mode Switching

When either of the PORT pin (the switch S_SW1 or S_SW2) is set to GND in this sample program, the operation mode switches to a Low power mode.

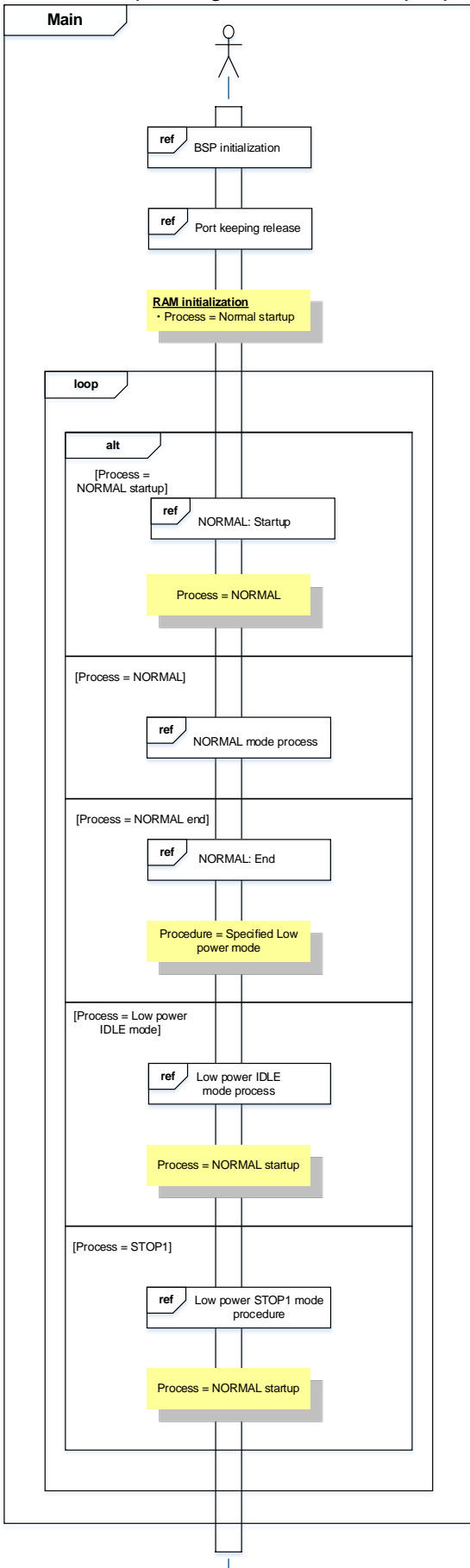
After power is supplied or the reset is done, the microcontroller enters the NORMAL state.

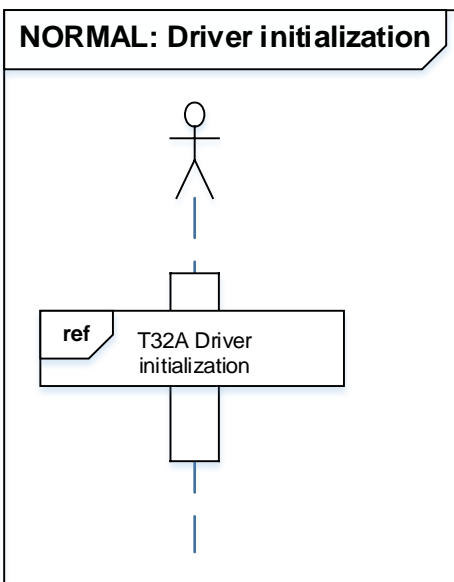
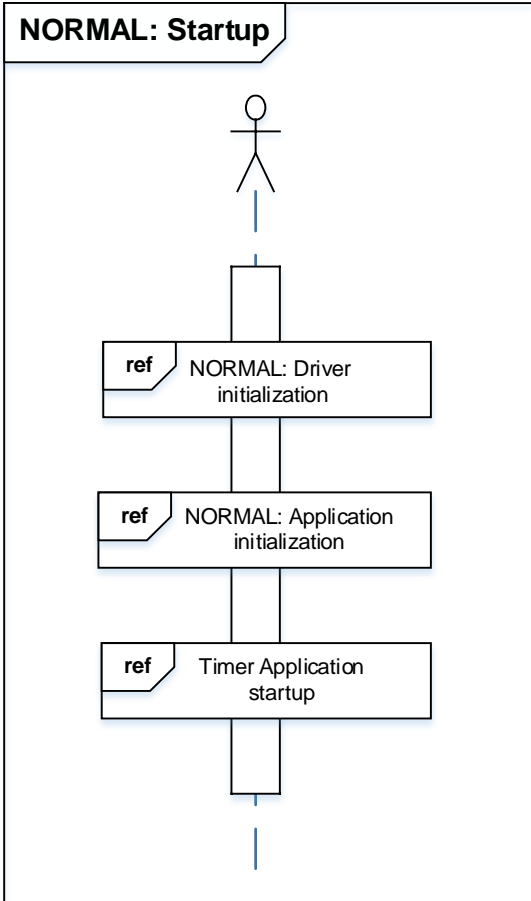
The operation mode returns to the NORMAL mode by an interrupt generated by the Push switch SW1 (INT09).

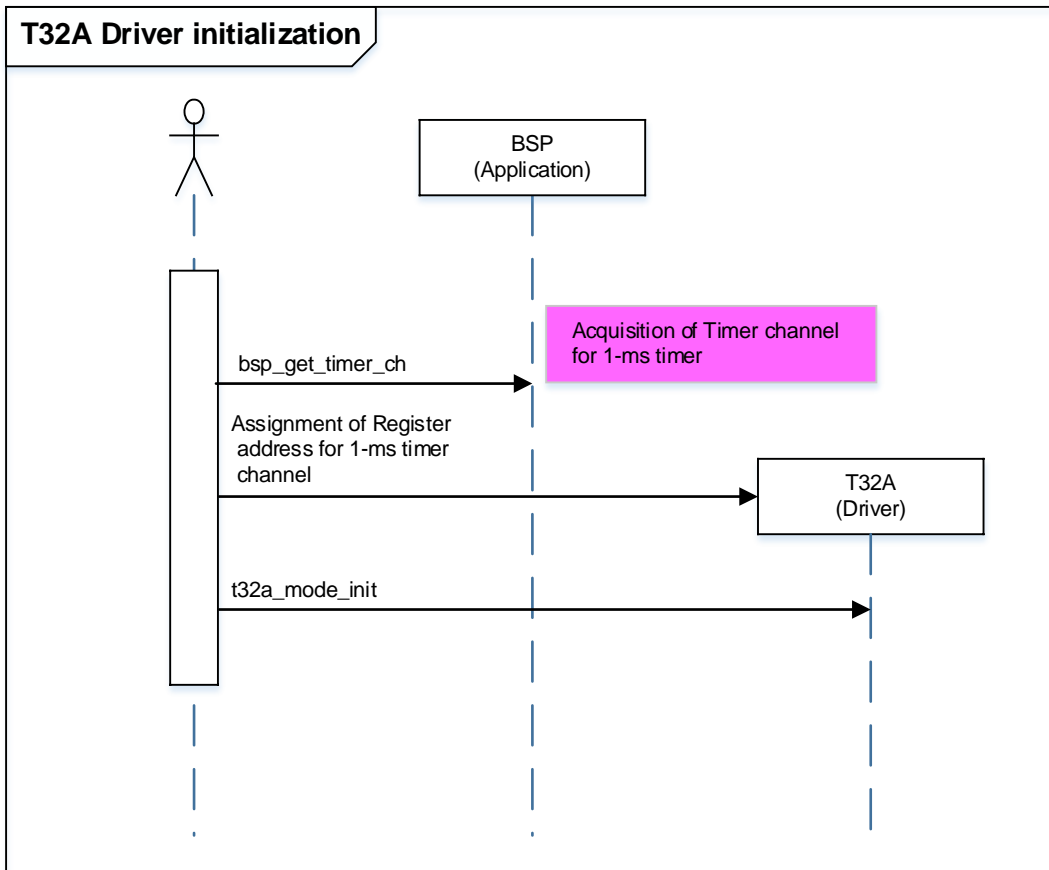


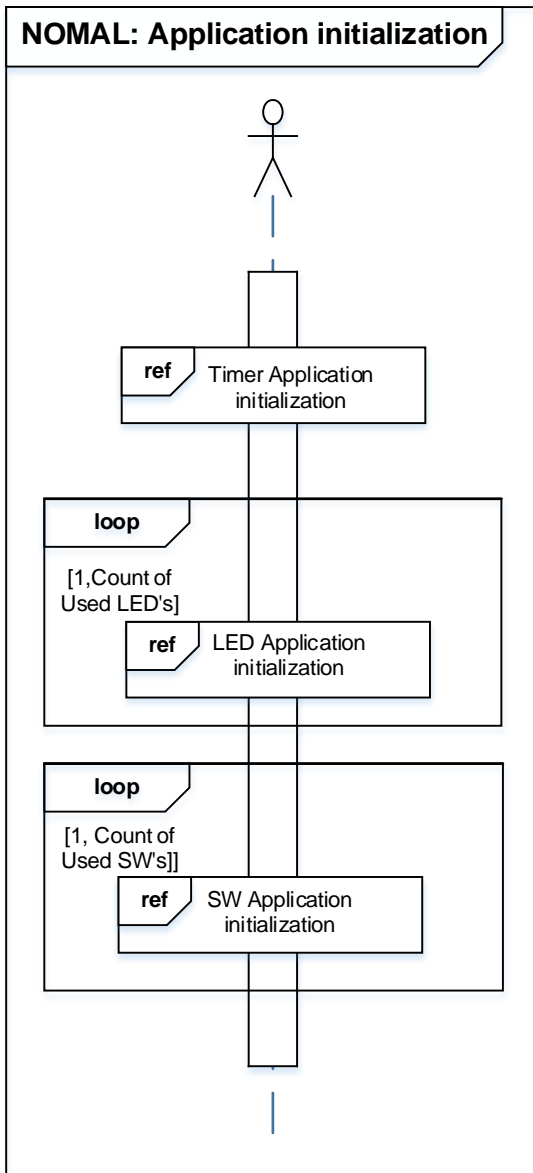
7.5. Operating Flow of Sample Program

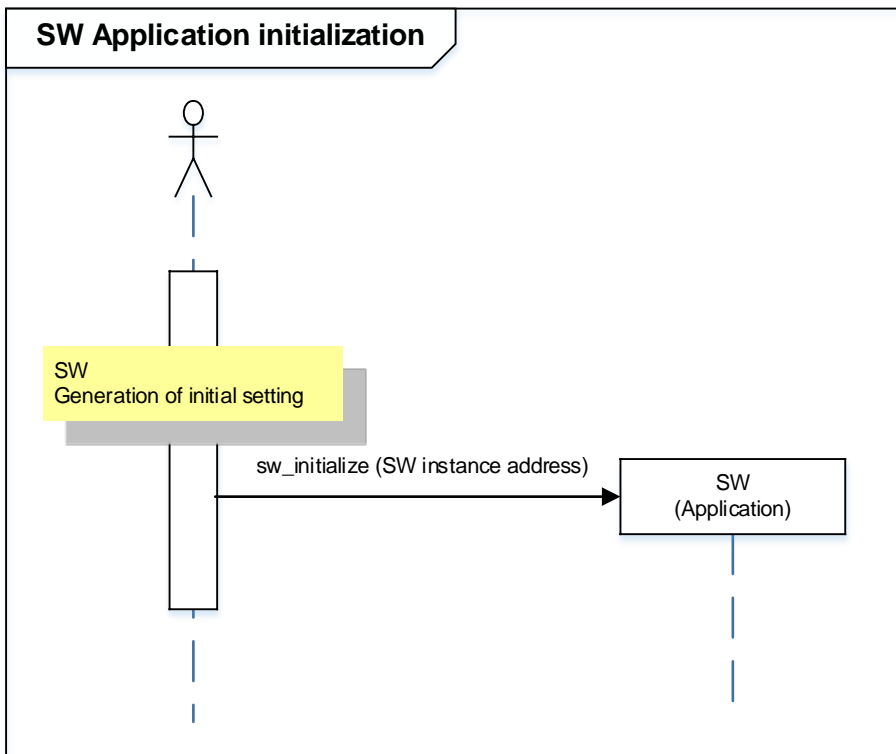
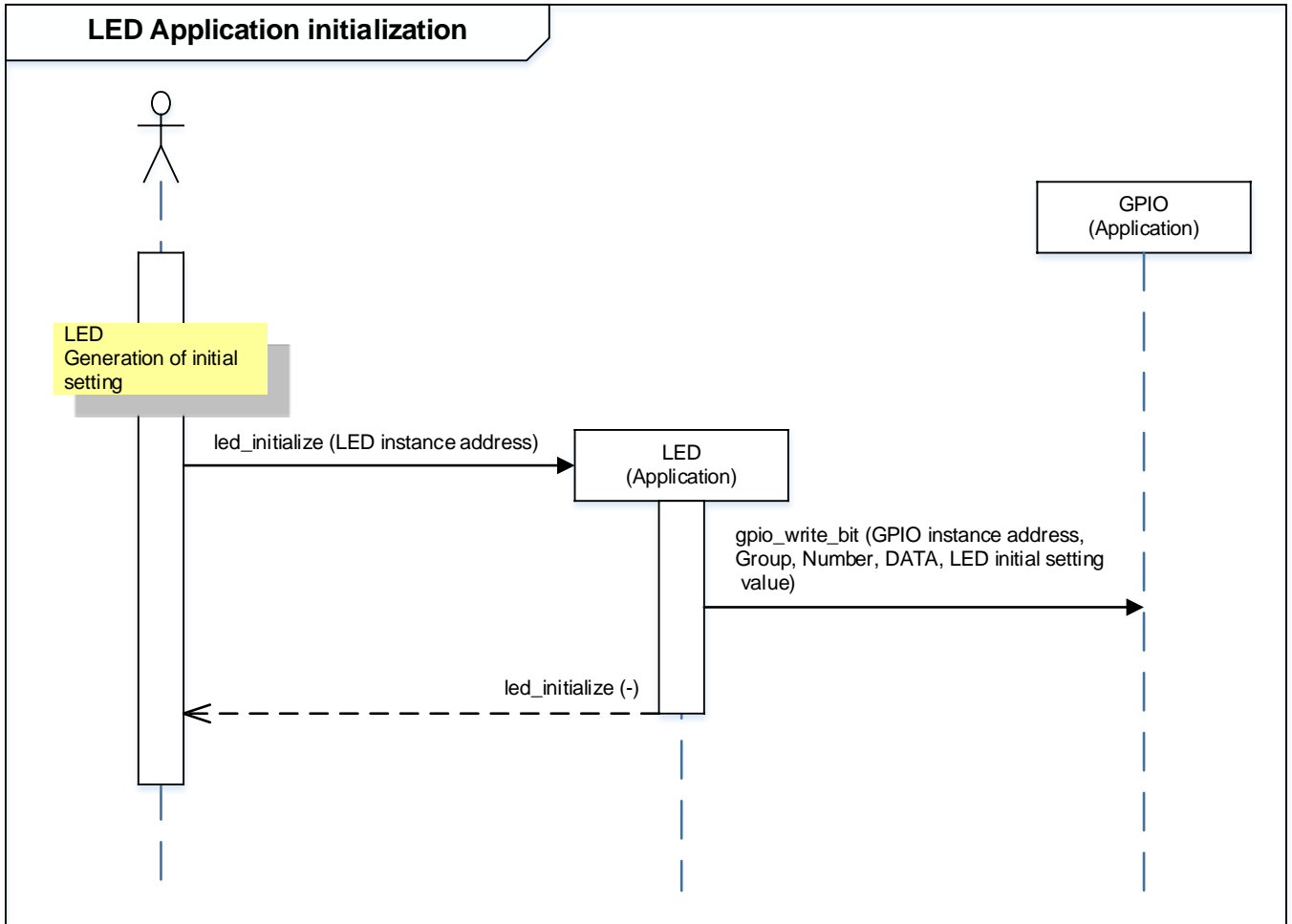
The basic operating flows of the sample program are shown in the following;

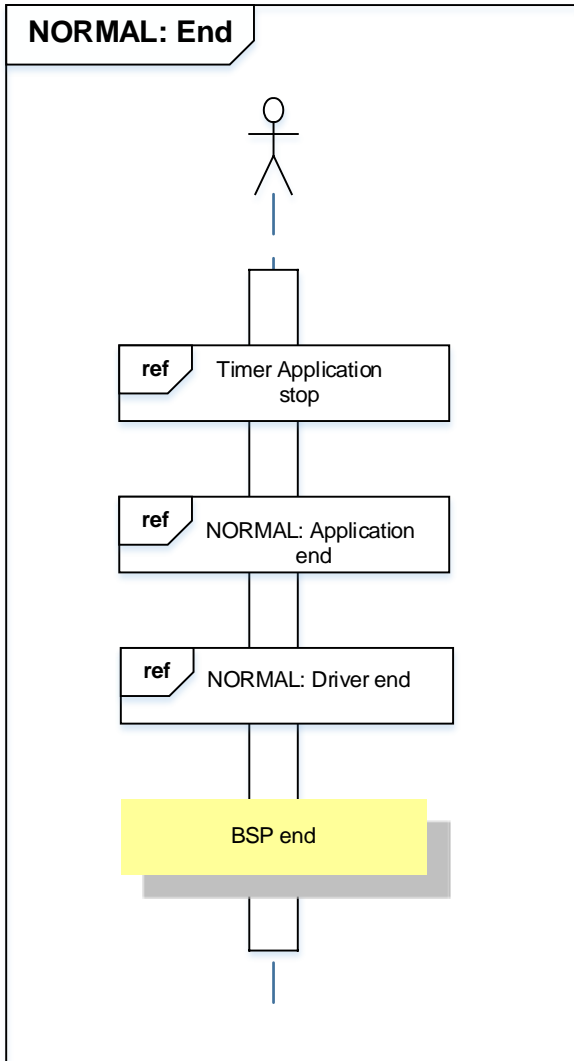


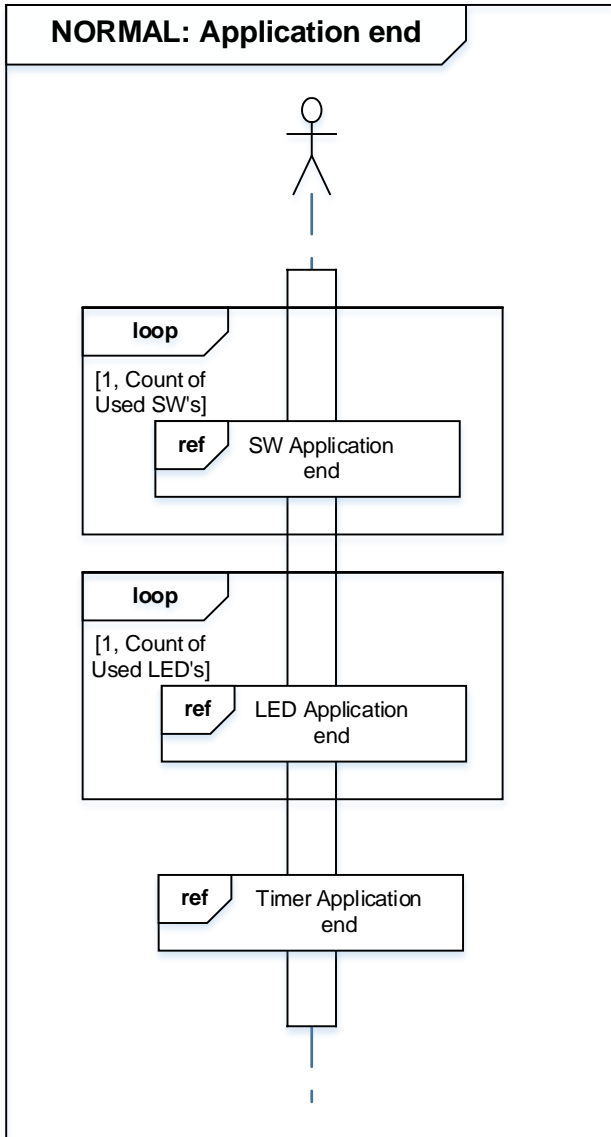


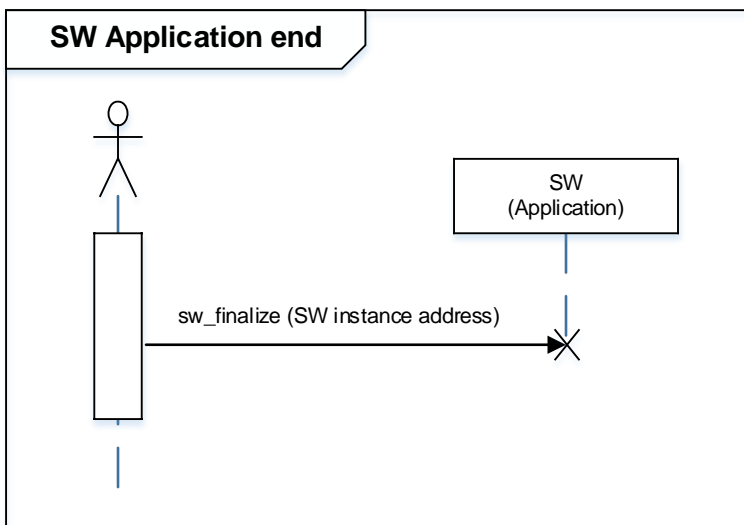
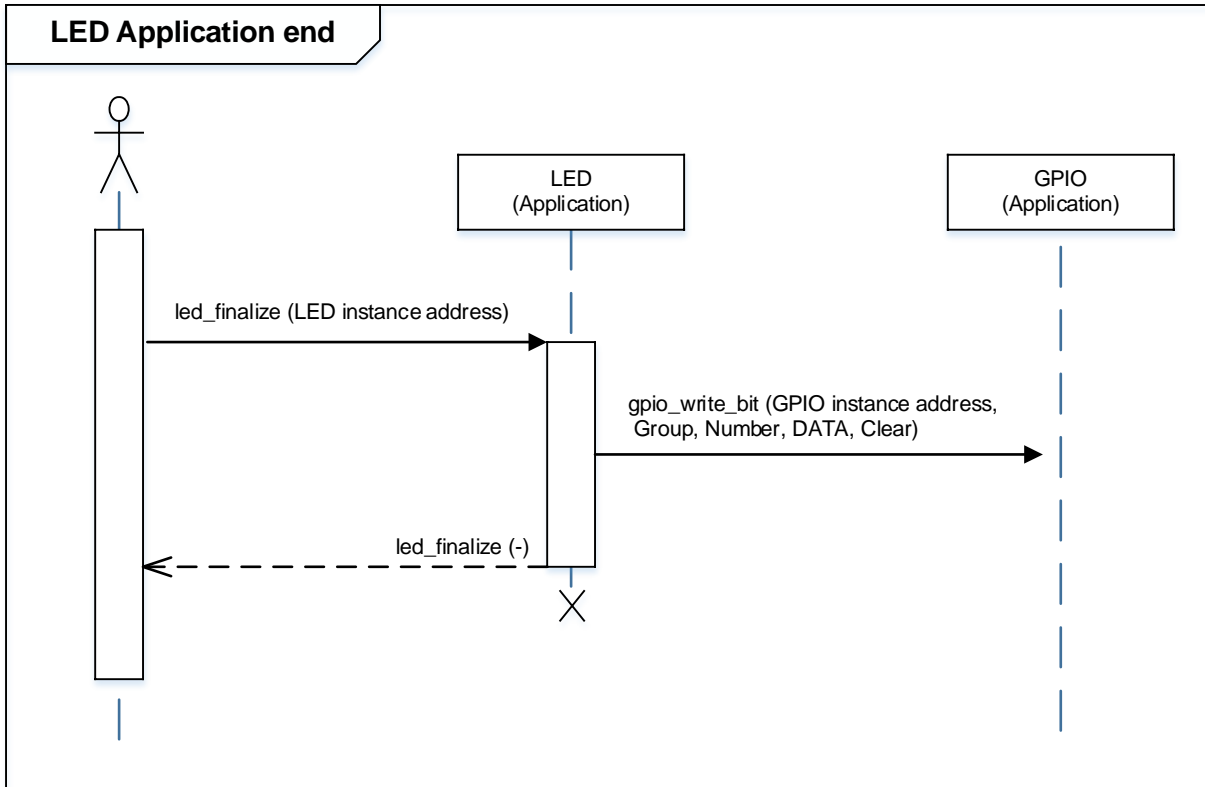


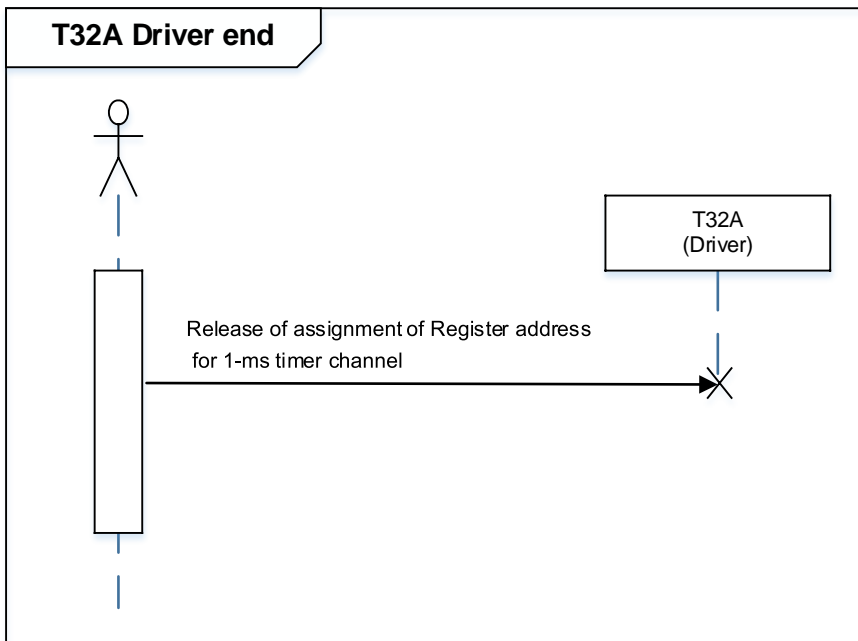
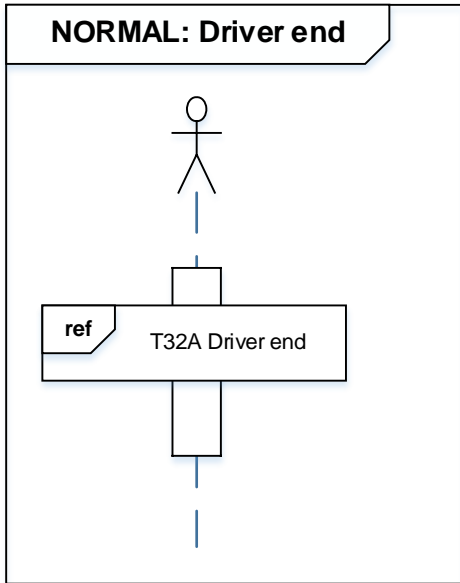


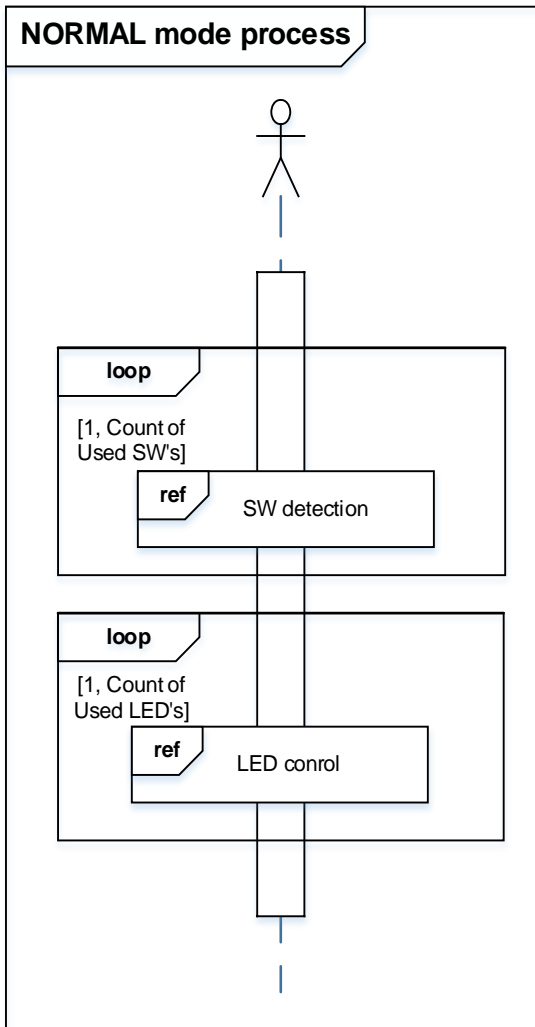


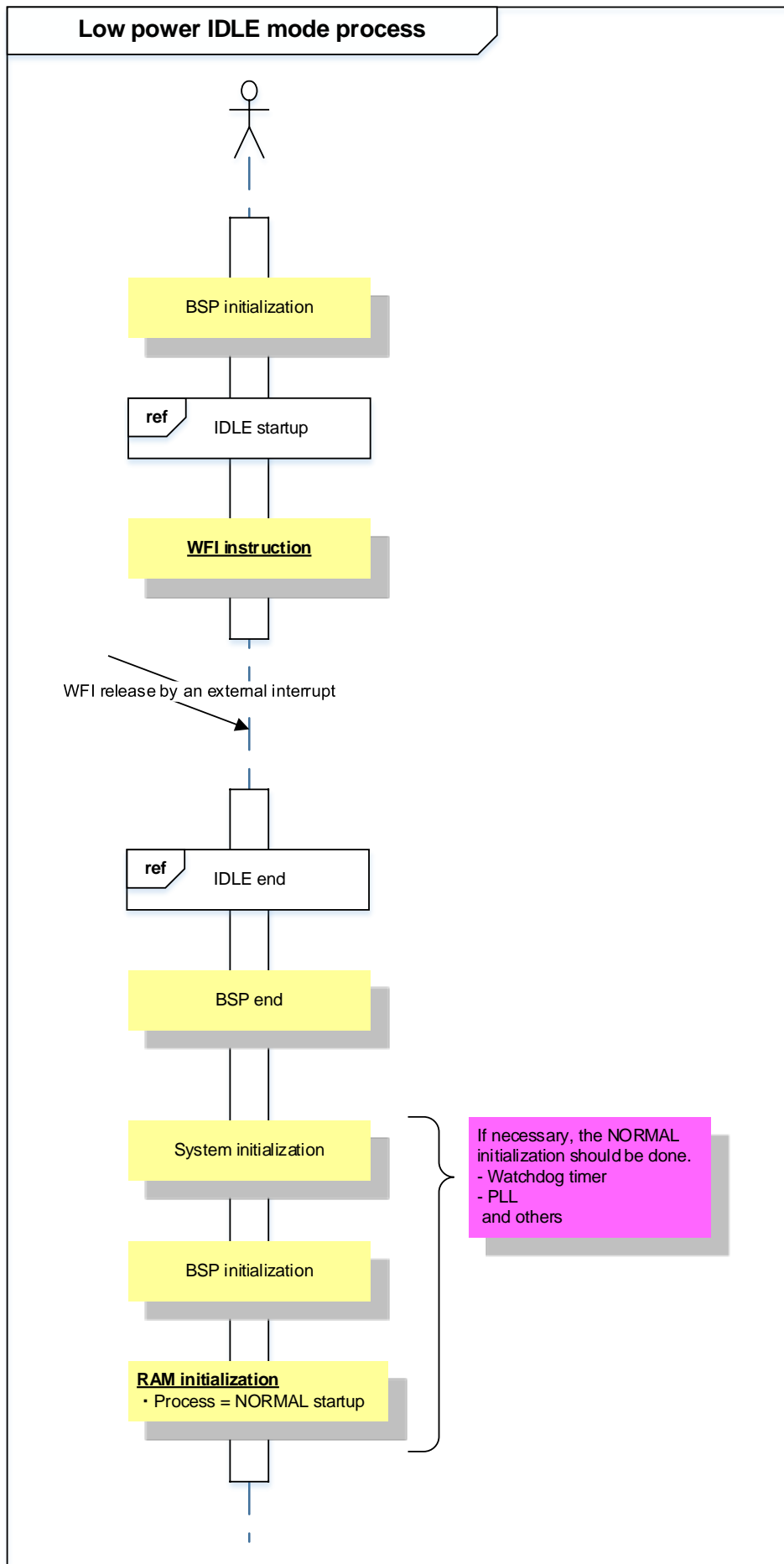


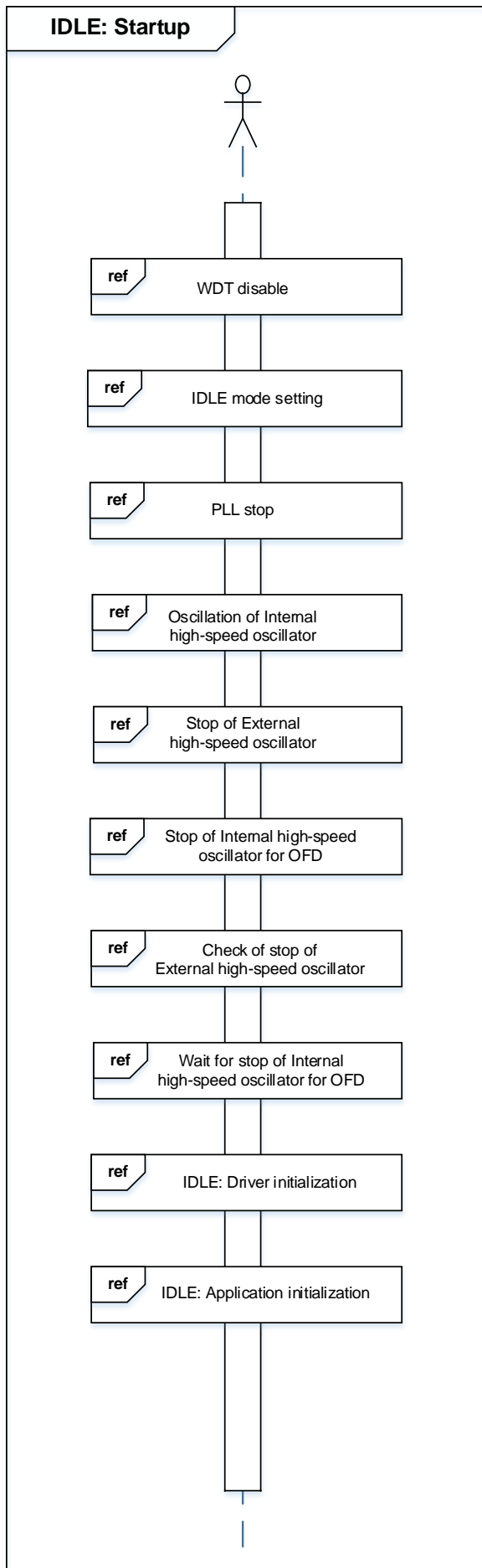


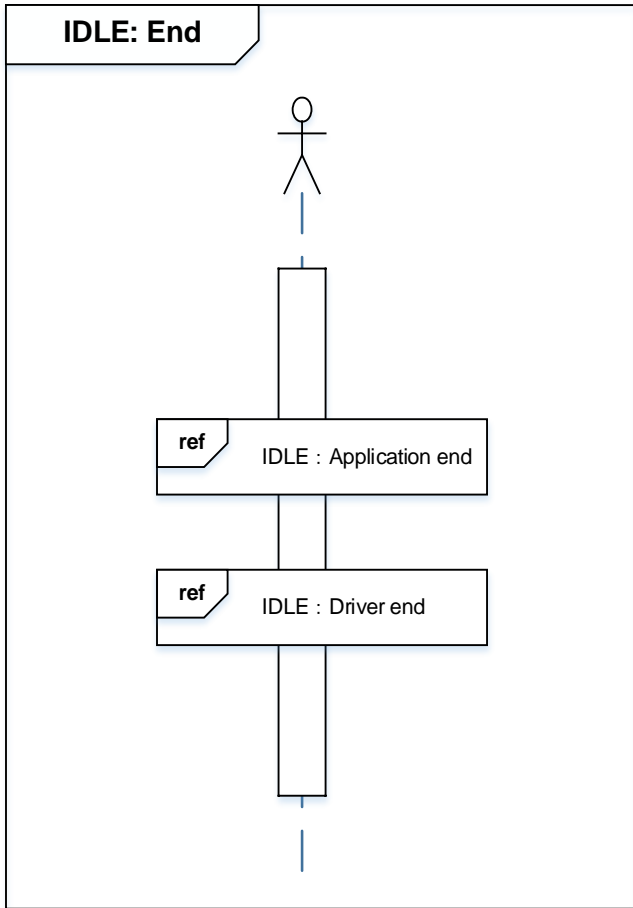




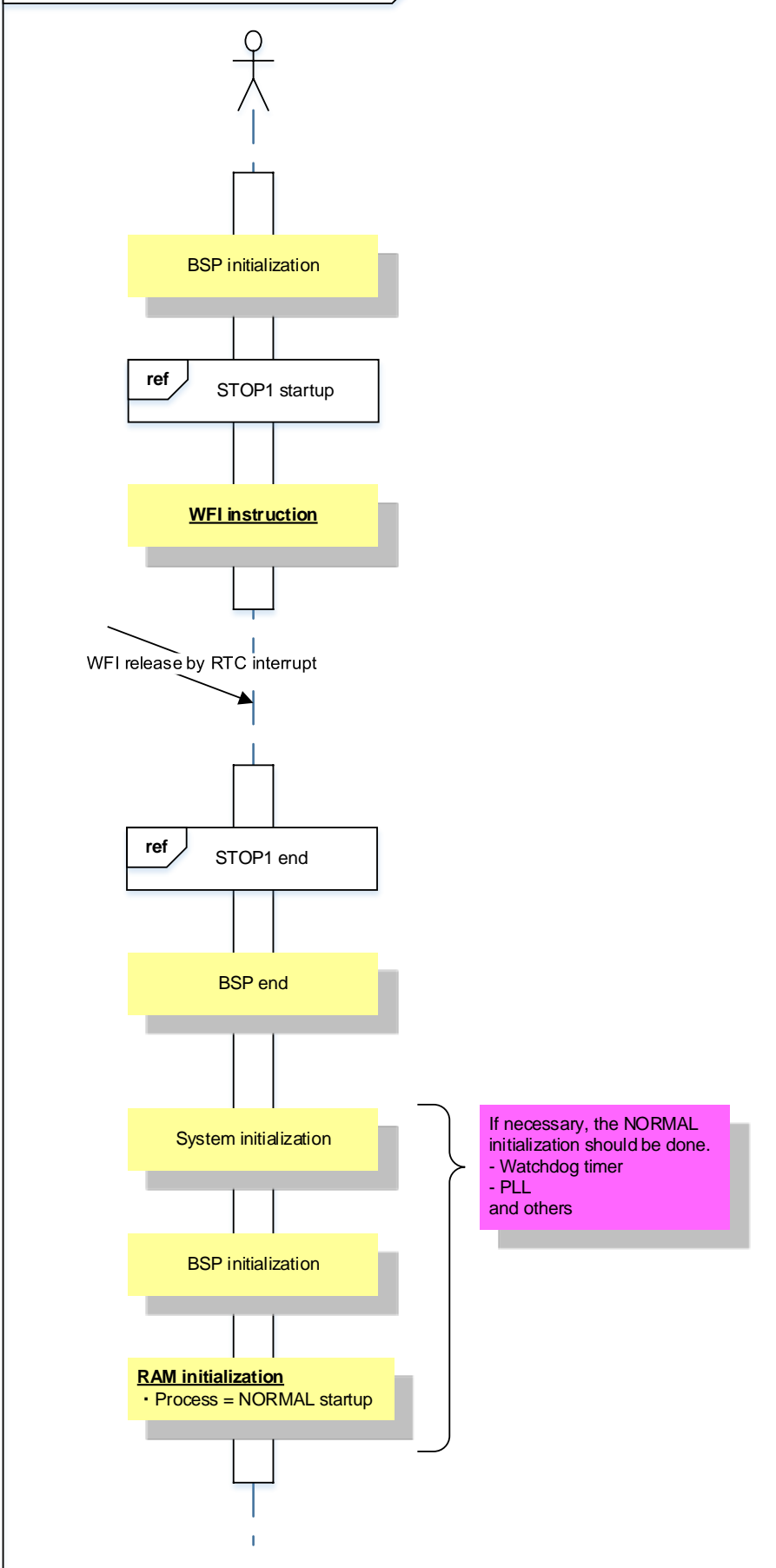


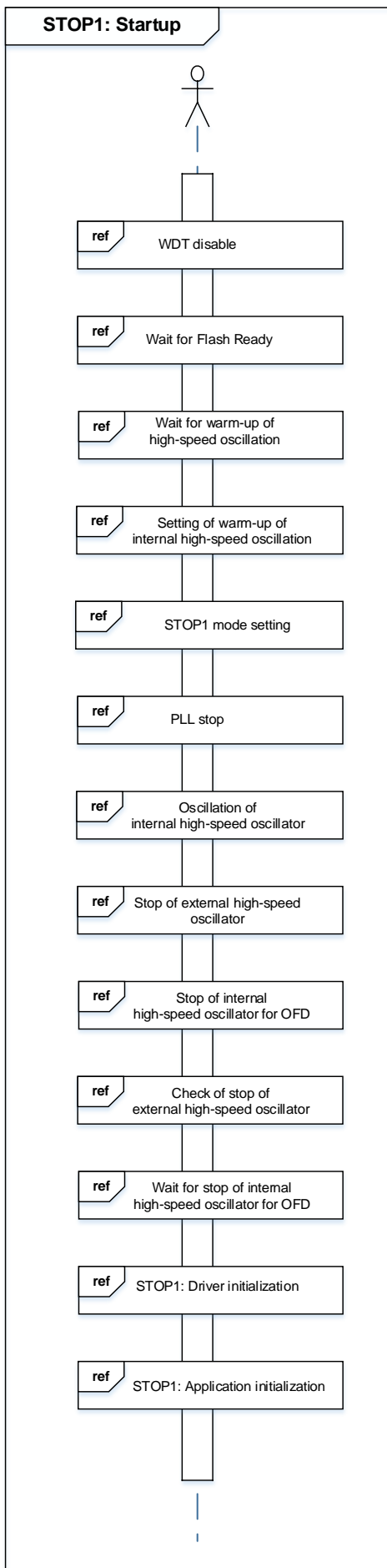


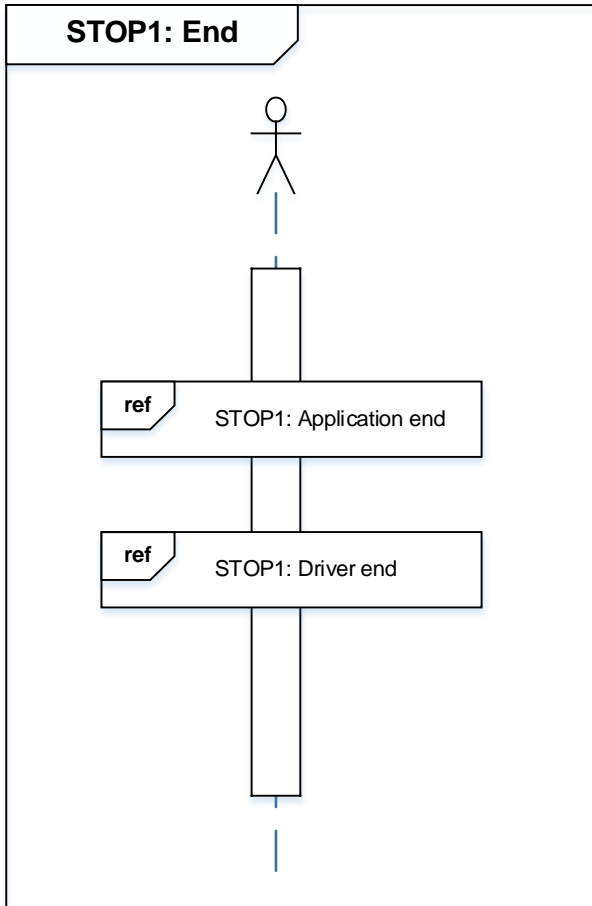


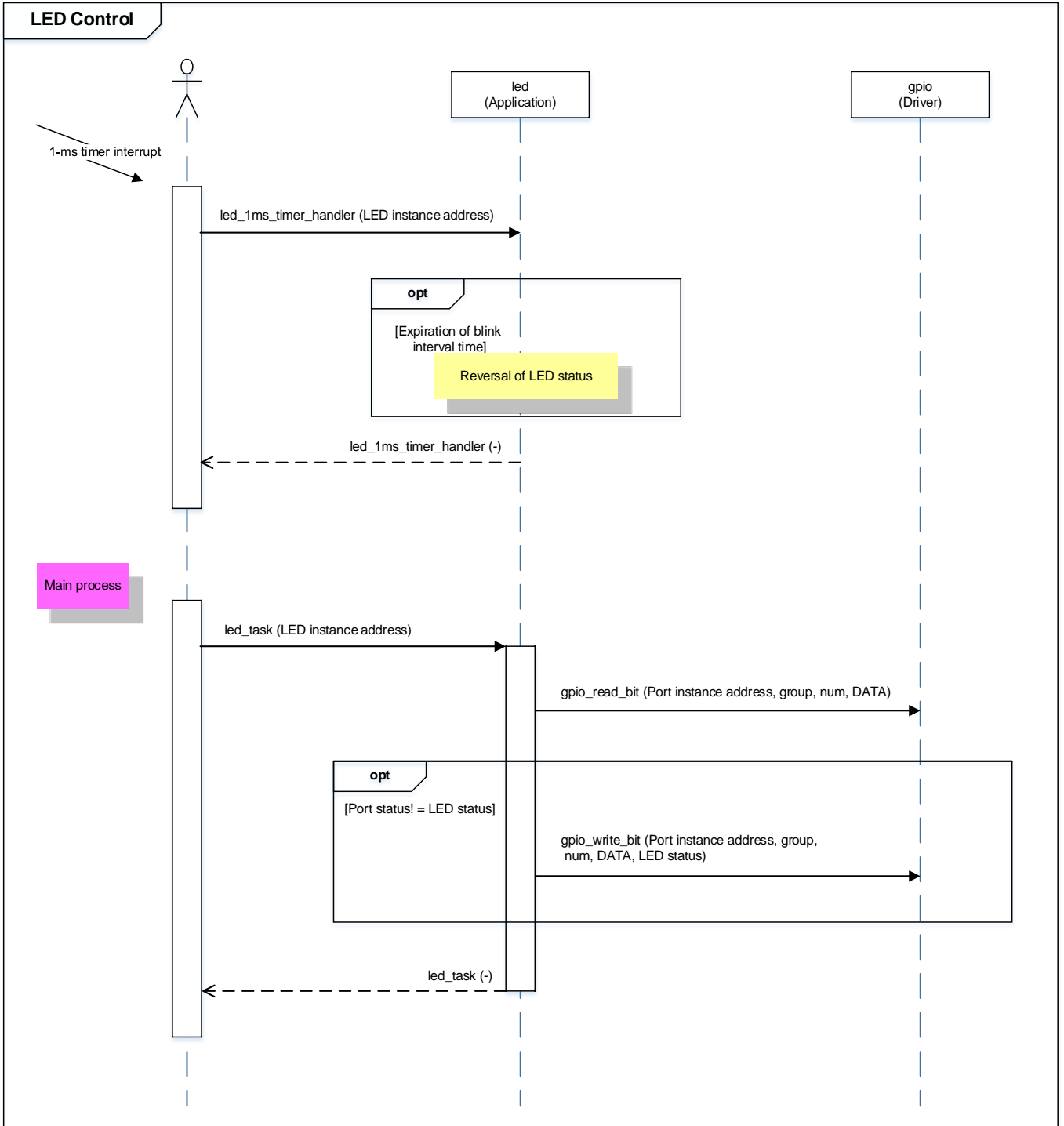


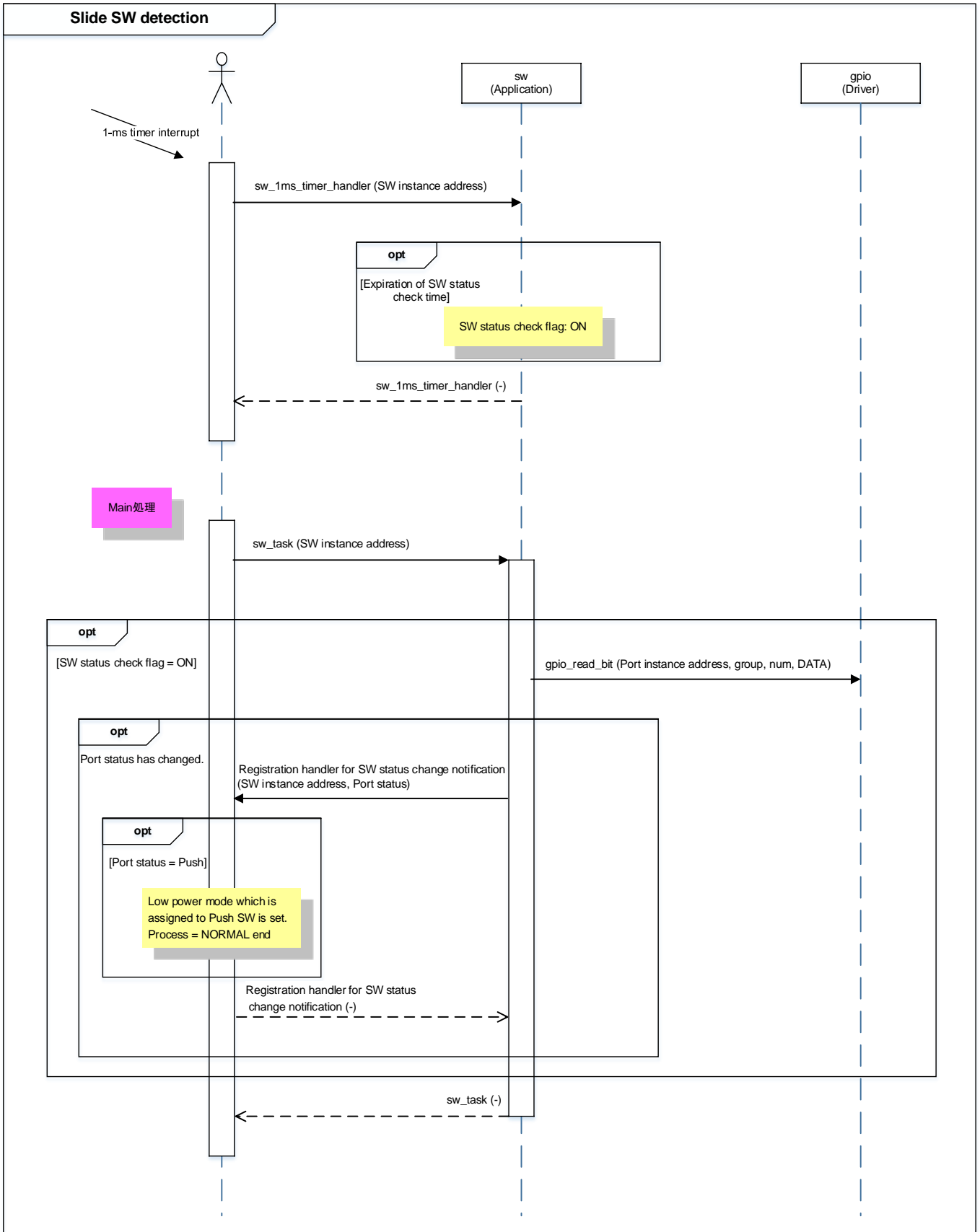
Low power STOP1 mode process

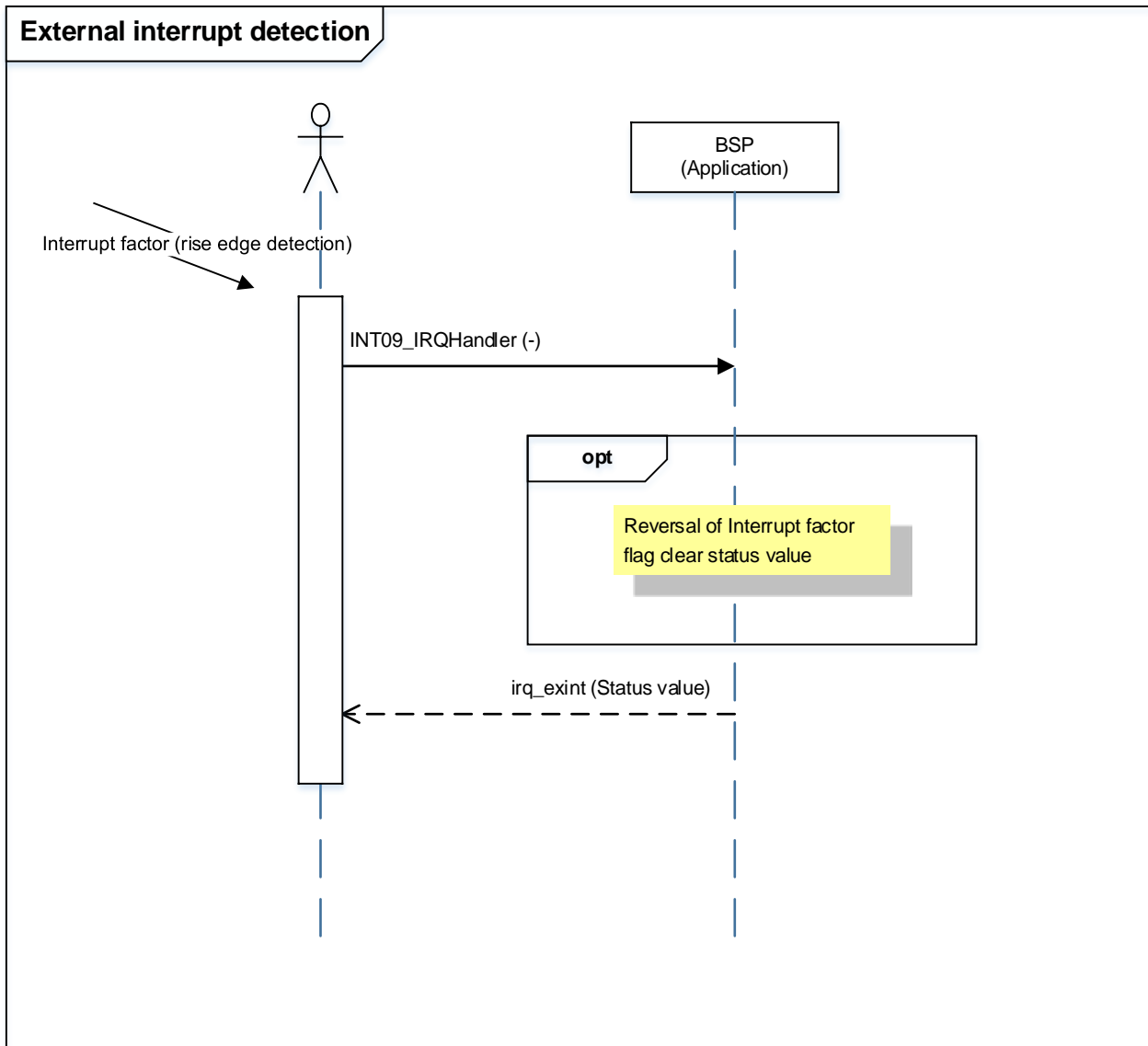












8. Points to Remember on Handling of Sample Programs

When using the sample program with other than “Operation Confirmation Condition” please check the operation sufficiently.

9. Revision History

Revision	Date	Description
1.0	2019-10-08	First release

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