M3H Group(1)
Application Note
Digital Noise Filter Circuit
(DNF-A)

Outlines

This application note is a reference material for developing products using the digital noise filter circuit (DNF) function of H3M Group(1).
This document helps the user check operation of the product and develop its program

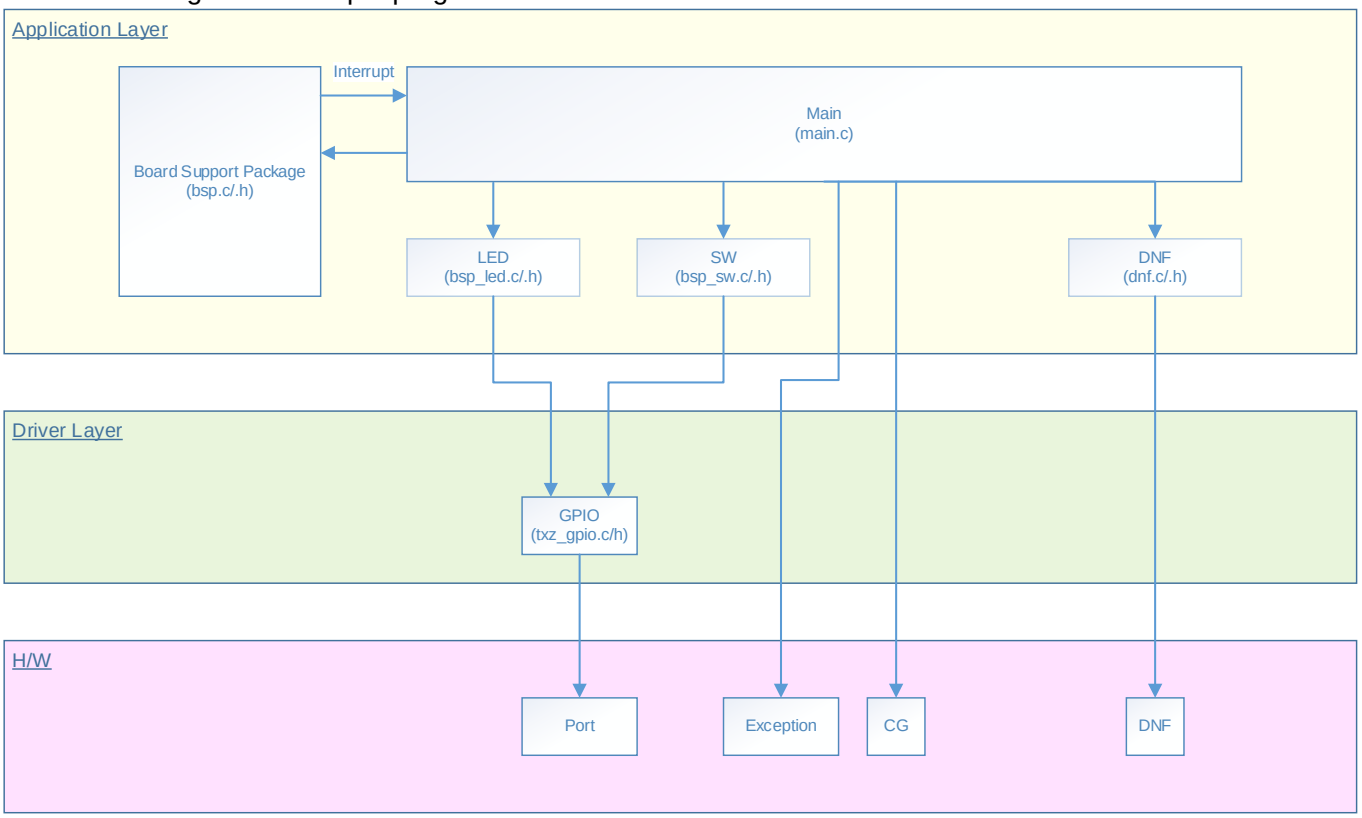
Target sample program: DNF_LED

Table of Contents

1. Preface

This sample program is used to check the operation of the digital noise filter circuit function.

Structure diagram of Sample program



2. Reference Document

- Datasheet
  TMPM3H group (1) datasheet Rev2.0 (Japanese edition)
- Reference manual
  Digital noise filter circuit (DNF-A) Rev2.0 (Japanese edition)
- Other reference document
  TMPM3H Group Peripheral Driver User Manual (Doxygen)

3. Function to Use

IP	channel	port	Function / operation mode
Digital noise filter	–	–	Noise reduction
Input and Output ports	–	PN3 (INT10)	External interrupt
	–	PB7 (Output Port)	Output

4. Target Device

The target devices of application note are as follows.

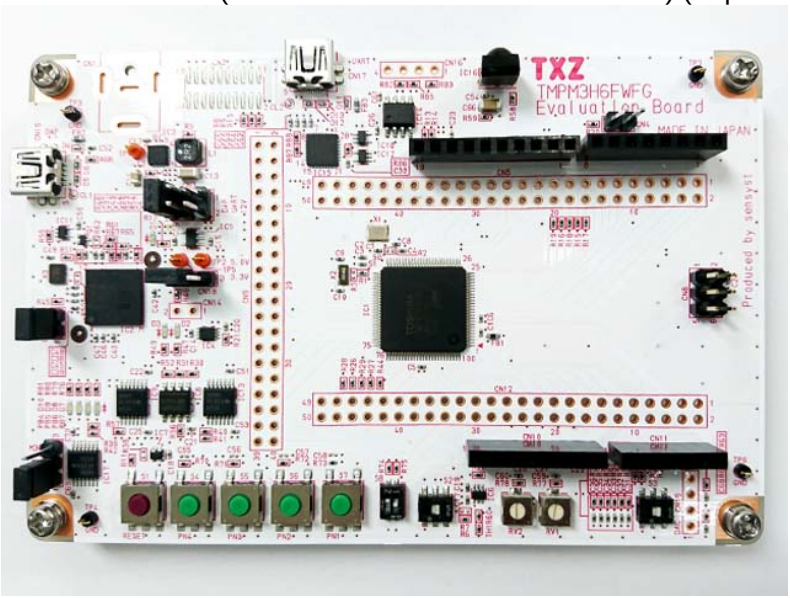
TMPM3H6FWFG	TMPM3H6FUFG	TMPM3H6FSFG
TMPM3H6FWDFG	TMPM3H6FUDFG	TMPM3H6FSDFG
TMPM3H5FWFG	TMPM3H5FUFG	TMPM3H5FSFG
TMPM3H5FWDFG	TMPM3H5FUDFG	TMPM3H5FSDFG
TMPM3H4FWUG	TMPM3H4FUUG	TMPM3H4FSUG
TMPM3H4FWFG	TMPM3H4FUFG	TMPM3H4FSFG
TMPM3H3FWUG	TMPM3H3FUUG	TMPM3H3FSUG
TMPM3H2FWDUG	TMPM3H2FUDUG	TMPM3H2FSDUG
TMPM3H2FWQG	TMPM3H2FUQG	TMPM3H2FSQG
TMPM3H1FWUG	TMPM3H1FUUG	TMPM3H1FSUG
TMPM3H1FPUG	TMPM3H0FSDUG	TMPM3H0FMDUG

* This sample program operates on the evaluation board of TMPM3H6FWFG.
If other function than the TMPM3H6 one is checked, it is necessary that CMSIS Core related files (C startup file and I/O header file) should be changed properly.
The BSP related file is dedicated to the evaluation board (TMPM3H6). If other function than the TMPM3H6 one is checked, the BSP related file should be changed properly.

5. Operation confirmation condition

Used microcontroller TMPM3H6FWFG
Used board TMPM3H6FWFG Evaluation Board (Product of Sensyst)
Unified development environment IAR Embedded Workbench for ARM 8.11.2.13606
Unified development environment μVision MDK Version 5.24.2.0
Sample program V1100

Evaluation board (TMPM3H6FWFG Evaluation Board) (Top view)



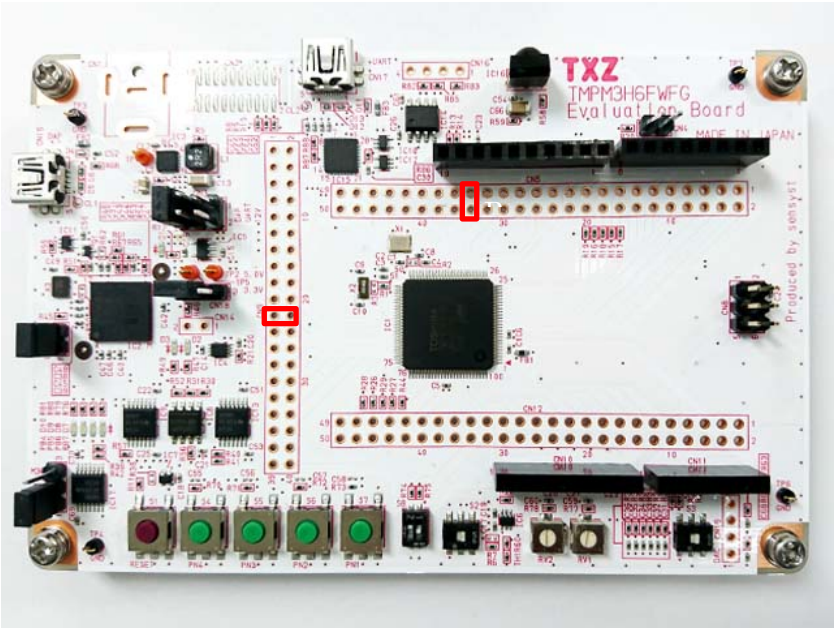
For purchasing the board, refer to the following homepage. (http://www.chip1stop.com/)

6. Evaluation Board Setting

The following pin connections should be done on the evaluation board.

CN5		
Use	Through-hole No.	Setting
LED (D7)	33-34	Connection

CN9		
Use	Through-hole No.	Setting
Push SW (S5)	21-22	Connection



7. Operation of Evaluation Board

When Push switch (S5) is pushed down, LED (D7) lights on and off alternately.
When the Push switch is pushed down, the external interrupt request is generated.
The interrupt request is detected through the DNF.
When the interrupt request is detected, the LED lighting and lights-off are controlled by Port B7.

8. Outline of Digital Noise Filter Circuit Function

The digital noise filter circuit consists of a clock control circuit, noise removal circuits and interrupt request selectors.

9. Sample Program

It repeats the turning on and off of the LED by the external interrupt signal passed through the digital noise filter.

9.1. Initialization

The following initialization is done after power is supplied.
The PORT setting is executed after the initialization of each clock setting and the clock setting.

9.2. Sample program main operation

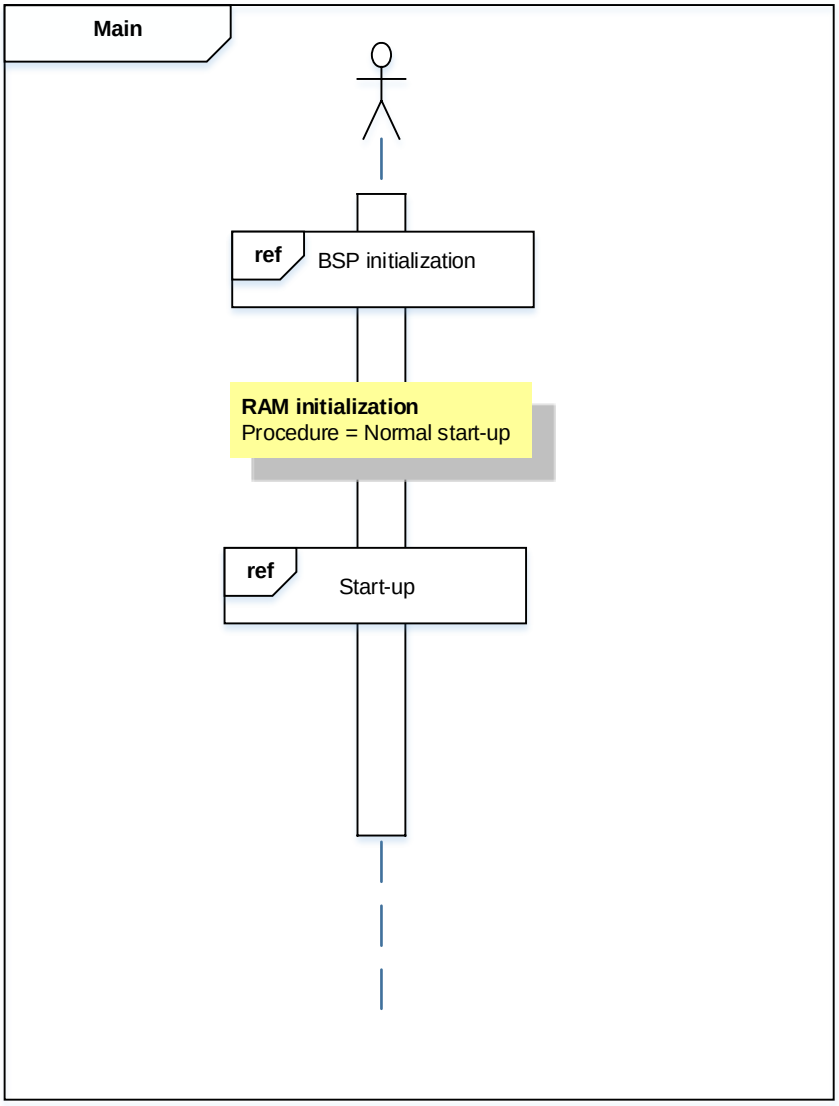
After the initialization, the “main” function executes. And the following initializations are done.

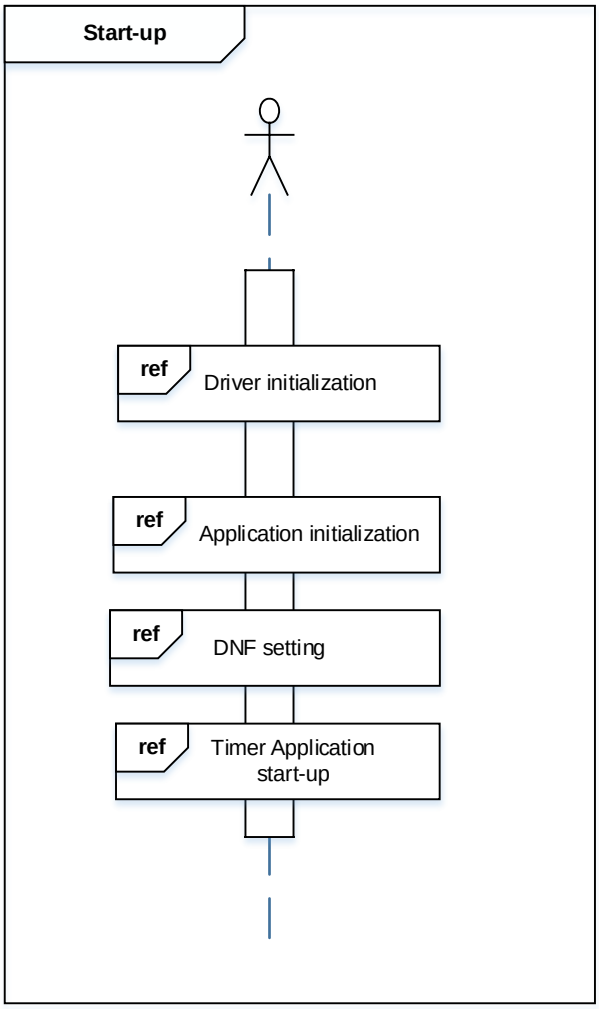
1. BSP (Board Support Package) initialization
2. Timer driver initialization
3. Application initialization
4. The timer starts to operate.
5. DNF setting

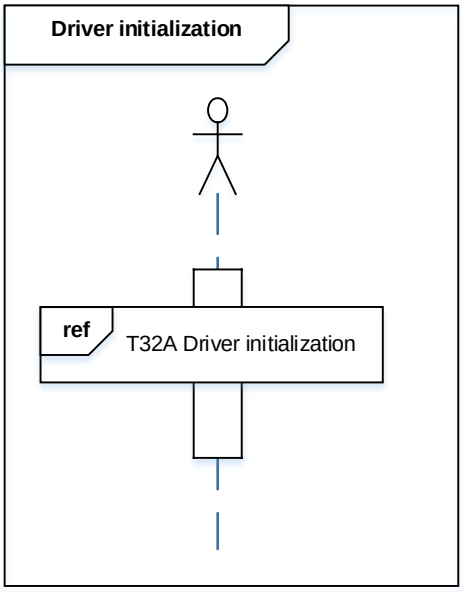
The lighting and lights-off of the LED are controlled by Push SW (S5).

9.3. Operating Flow of Sample Program

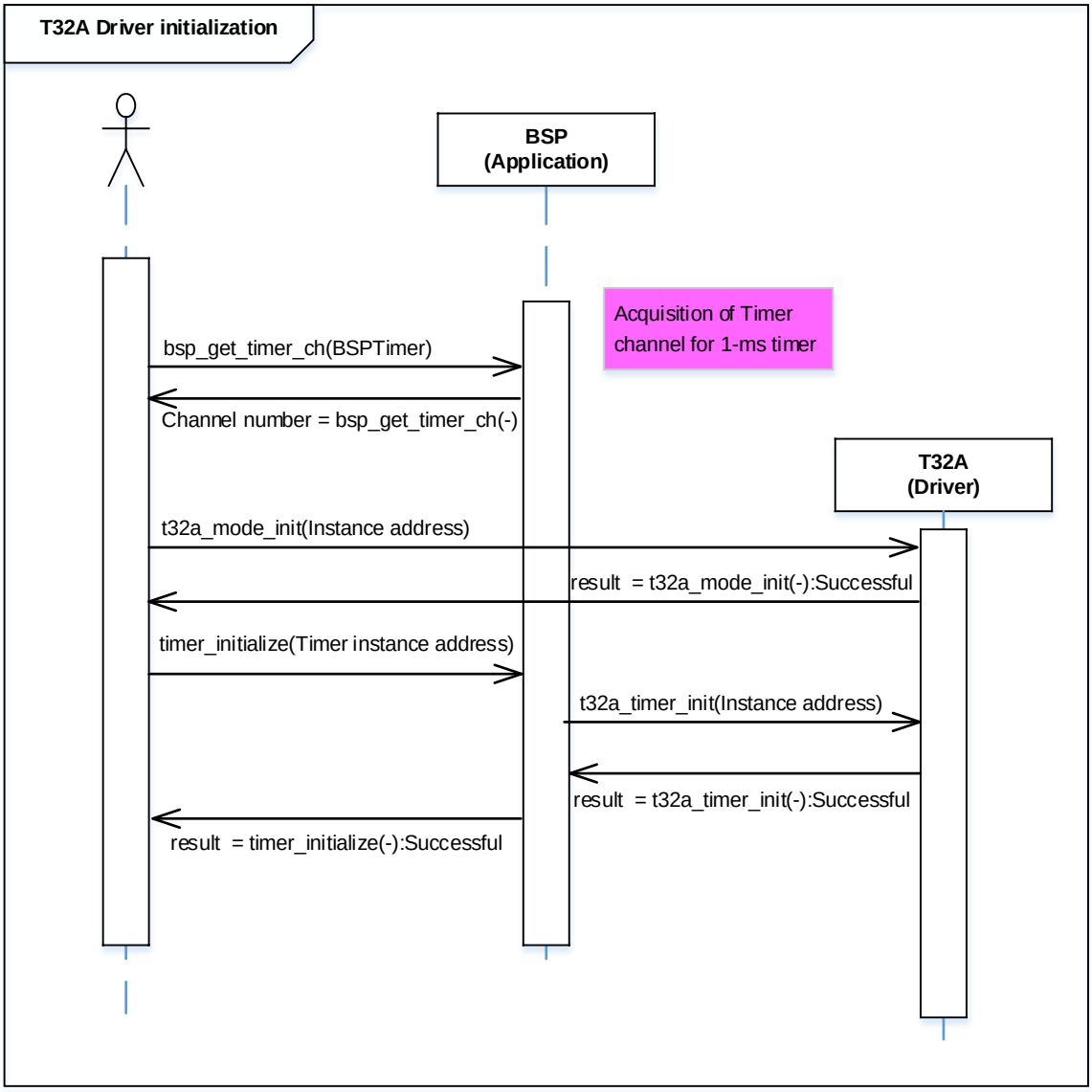
The operating flows of the sample program are shown as follows.

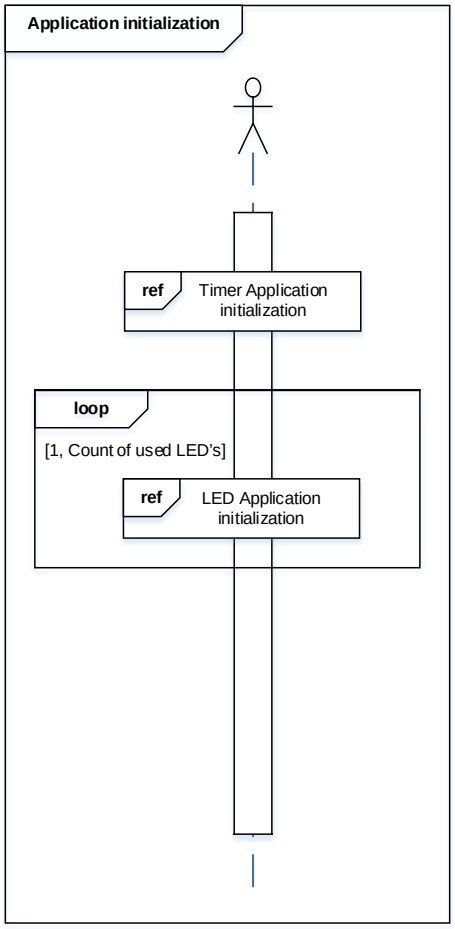


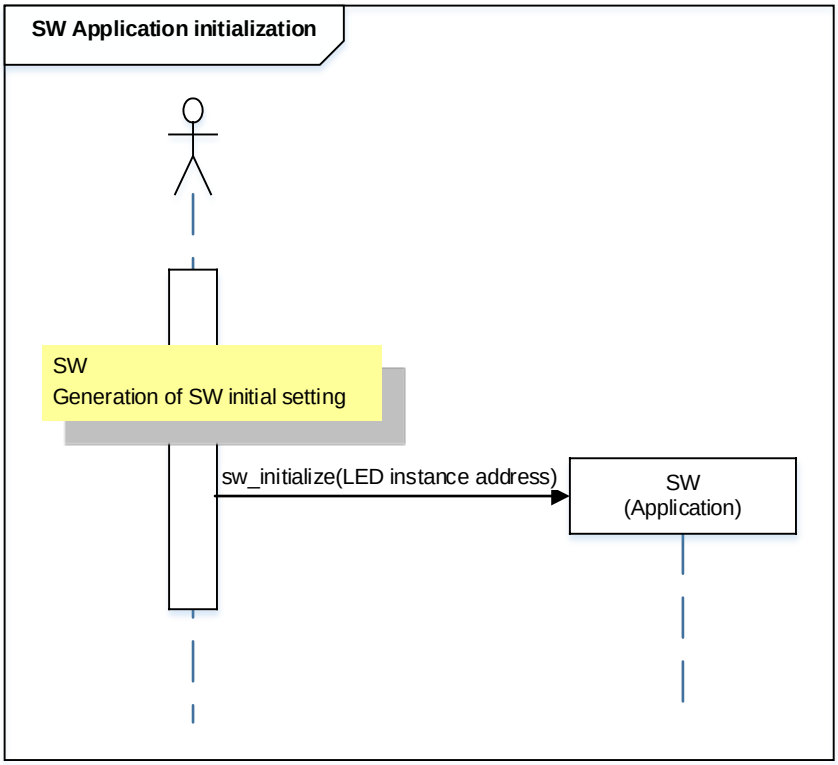

Start-up
ref
Driver initialization
ref
Application initialization
ref
DNF setting
ref
Timer Application start-up

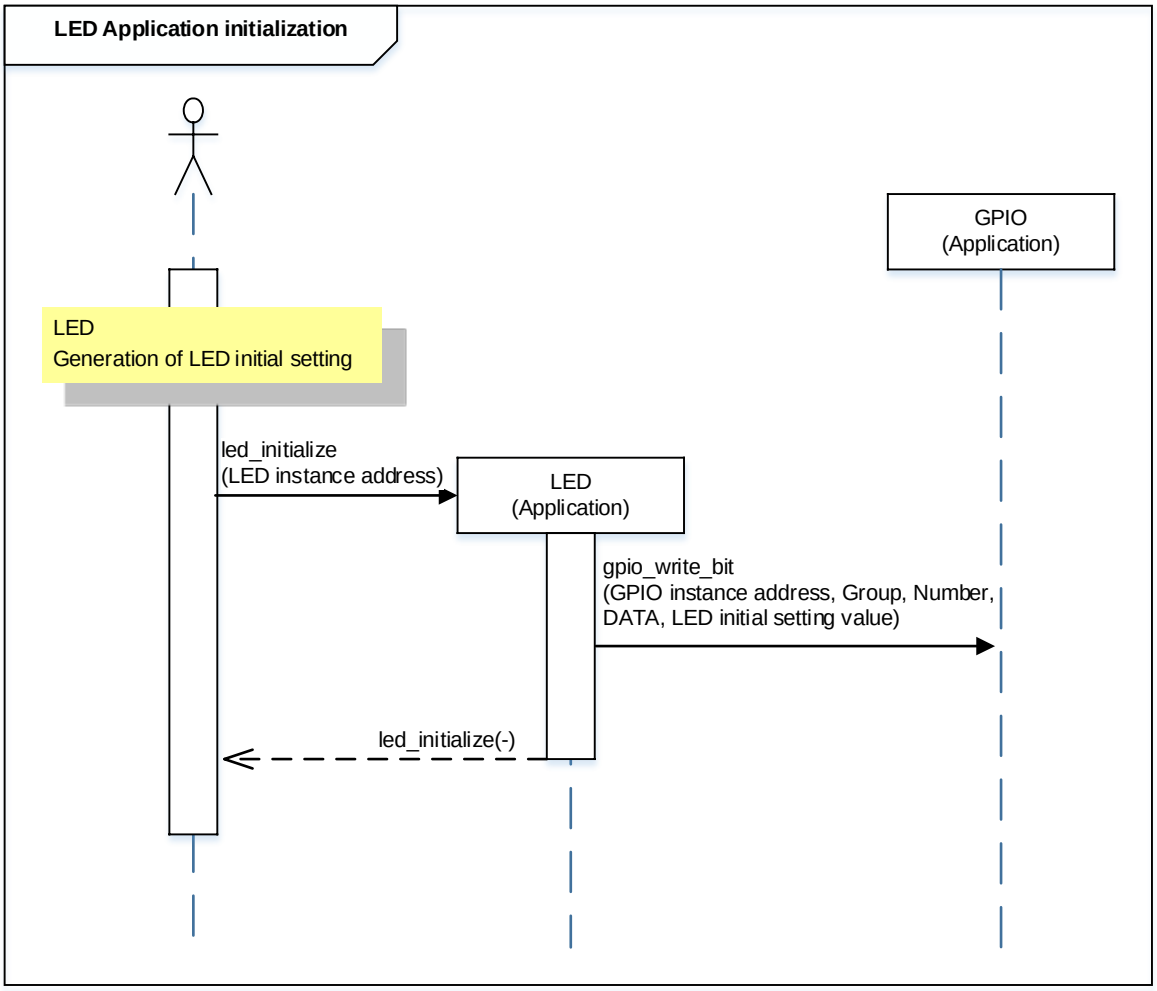

Driver initialization
ref
T32A Driver initialization

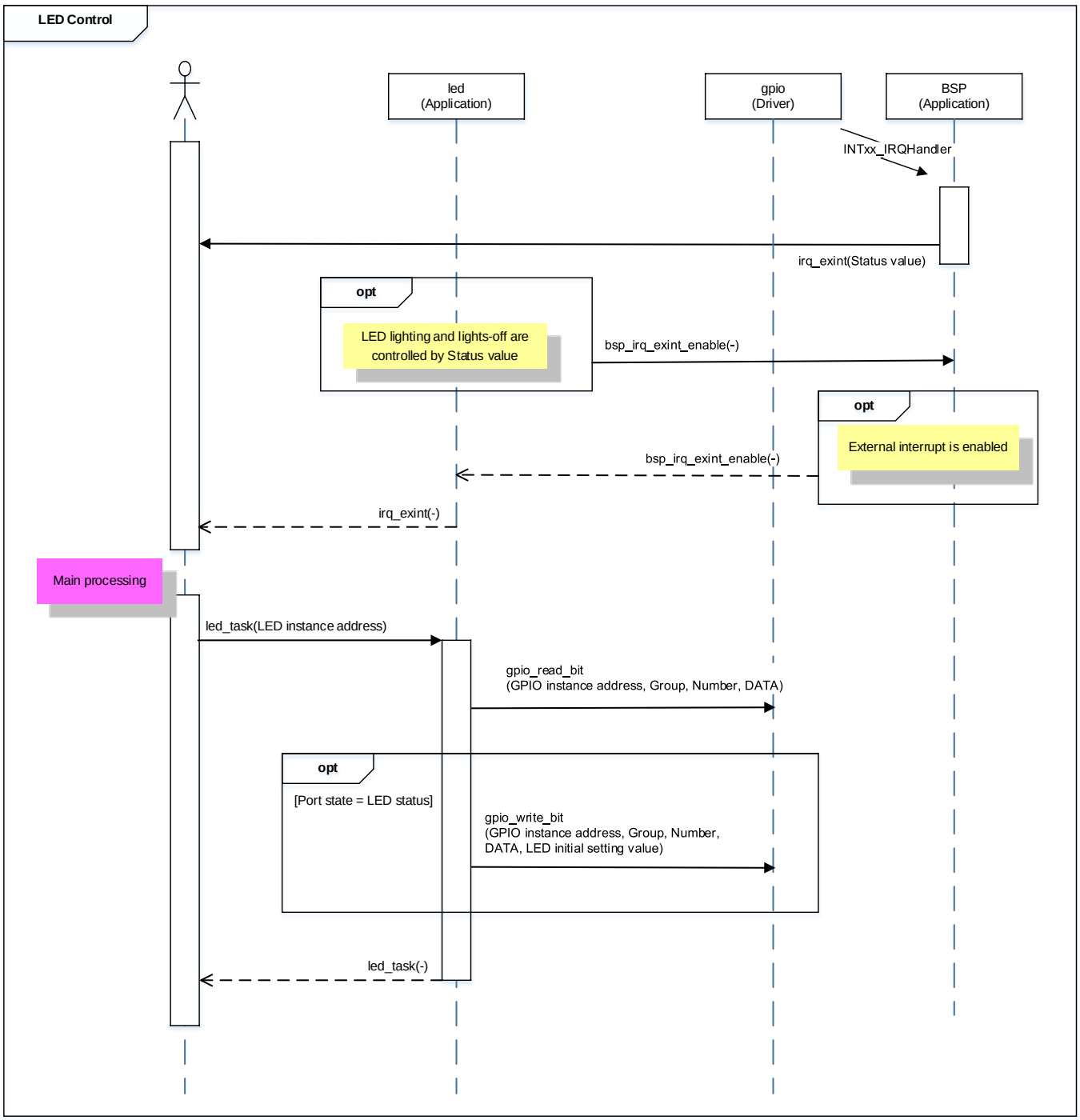
Although initialization setting of 32-bit timer event counter of TMPM3H is done, it is not used in actual operation of this sample program.

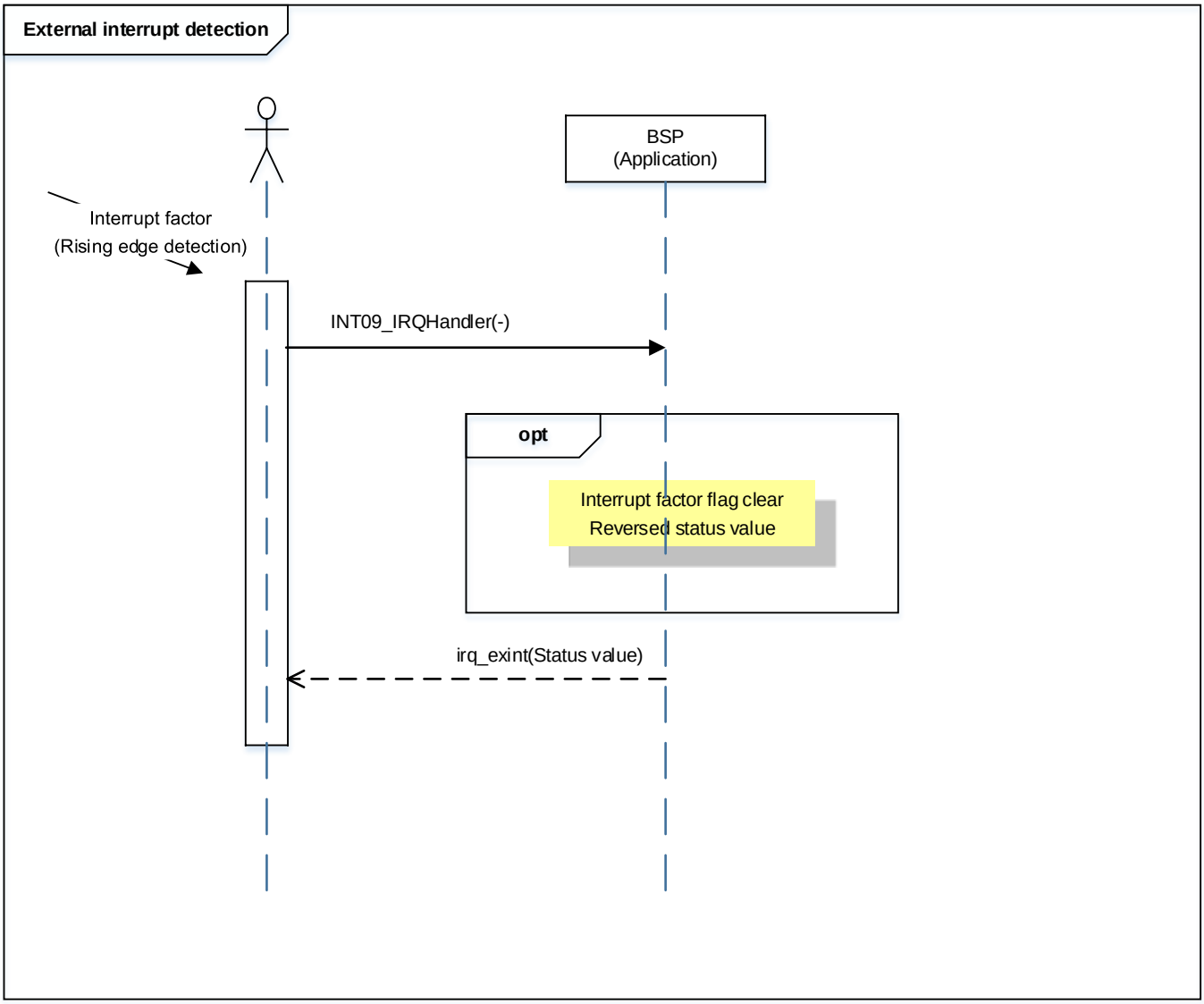


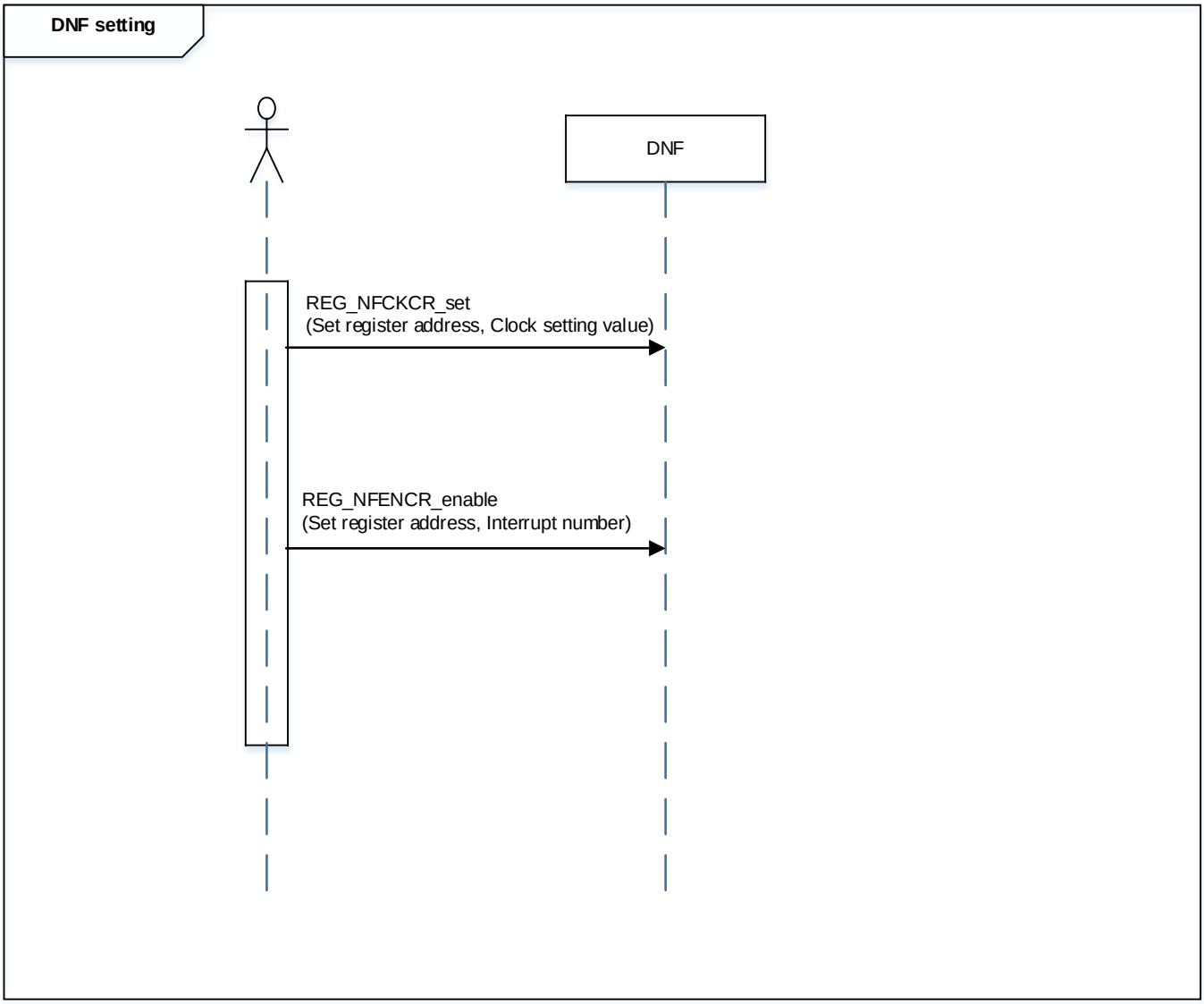

Application initialization
ref
Timer Application initialization
loop
[1, Count of used LED's]
ref
LED Application initialization


SW Application initialization
SW
Generation of SW initial setting
sw_initialize(LED instance address)
SW
(Application)


LED Application initialization
GPIO
(Application)
LED
Generation of LED initial setting
led_initialize
(LED instance address)
LED
(Application)
gpio_write_bit
(GPIO instance address, Group, Number,
DATA, LED initial setting value)
led_initialize(-)


LED Control
led
(Application)
gpio
(Driver)
BSP
(Application)
INTxx_IRQHandler
irq_exint(Status value)
opt
LED lighting and lights-off are
controlled by Status value
bsp_irq_exint_enable(-)
opt
External interrupt is enabled
bsp_irq_exint_enable(-)
irq_exint(-)
Main processing
led_task(LED instance address)
gpio_read_bit
(GPIO instance address, Group, Number, DATA)
opt
[Port state = LED status]
gpio_write_bit
(GPIO instance address, Group, Number,
DATA, LED initial setting value)
led_task(-)


External interrupt detection
BSP
(Application)
Interrupt factor
(Rising edge detection)
INT09_IRQHandler(-)
opt
Interrupt factor flag clear
Reversed status value
irq_exint(Status value)


DNF setting
DNF
REG_NFCKCR_set
(Set register address, Clock setting value)
REG_NFENCR_enable
(Set register address, Interrupt number)

10. Precaution

When using the sample program with CPU other than TMPM3H6, please check operation sufficiently.

11. Revision History

Rev	Date	Page	Description
1.0	2018-03-22	-	First release

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