

**M3H Group(1)**  
**Application Note**  
**Oscillation Frequency Detector**  
**(OFD-A)**

**Outlines**

This application note is a reference material for developing products using the Oscillation Frequency Detector (OFD) function of M3H Group(1).

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

Target sample program: OFD-LED

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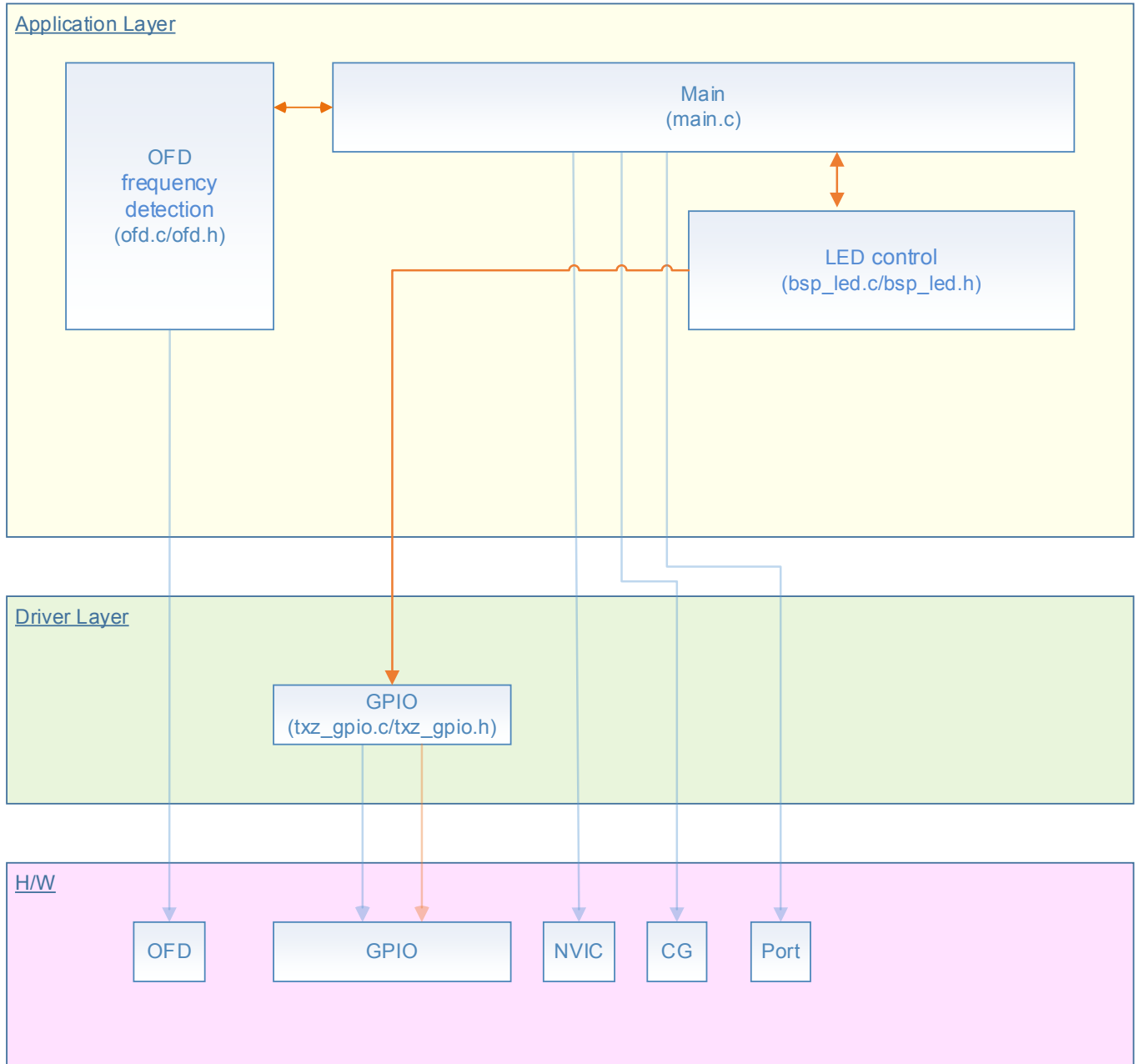
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## 1. Preface

This sample program is used to check the operation of the OFD function.

The frequency of a selected clock signal can be monitored by the Oscillation Frequency Detector and checked if it is in the normal range or not.

Structure diagram of Sample program



## 2. Reference Document

- Datasheet  
TMPM3H group (1) datasheet Rev2.0 (Japanese edition)
- Reference manual  
Oscillation Frequency Detector (OFD-A) Rev2.1 (Japanese edition)
- Other reference document  
TMPM3H(1) Group Peripheral Driver User Manual (Doxygen)

### 3. Function to Use

IP	Channel	Port	Function/Operation mode
Oscillation Frequency Detector	-	-	Detection of an abnormal clock frequency
32-bit timer event counter	Timer A ch0	-	Interval timer
Input and Output ports	-	PB4 (Output Port) PB5 (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.

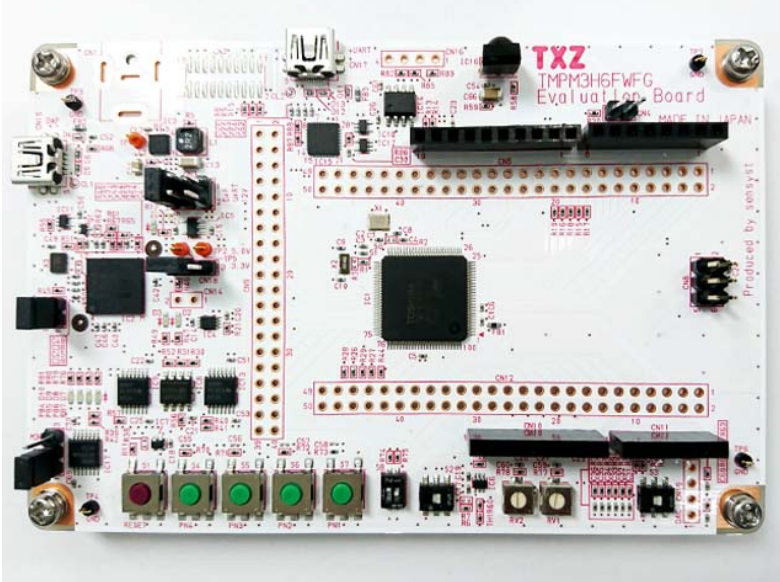
If other function than the TMPM3H6 one is checked, it is necessary that CMSIS Core related files (C startup file and IO header file) should be changed properly.

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)

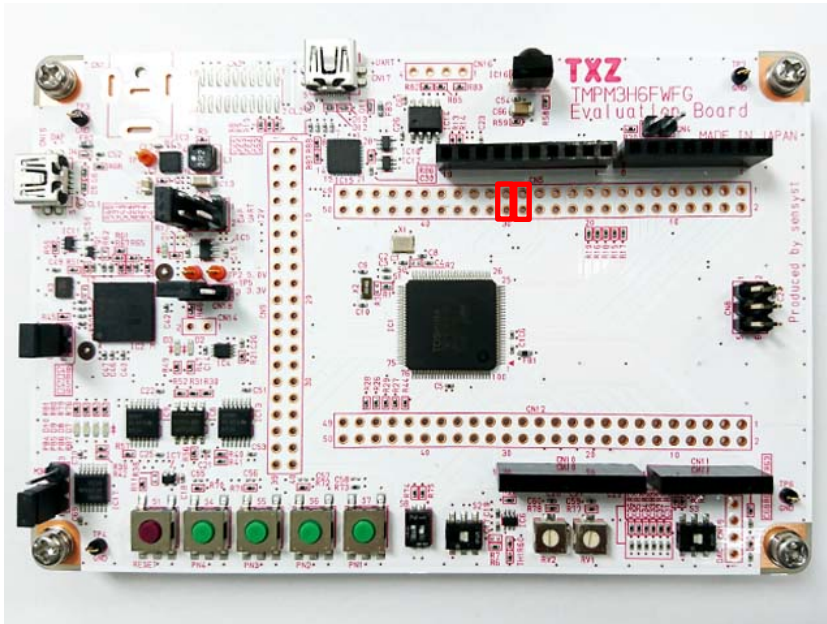


For purchasing the board, refer to the following homepage. (<http://www.chip1stop.com/>)

### 6. Evaluation Board Setting

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

CN5		
Use	Through-hole No.	Setting
LED (D10)	27-28	Connection
LED (D9)	29-30	Connection



### 7. Outline of OFD Function

The Oscillation Frequency Detector (OFD) is used to detect abnormal status of the clock. The target clock is selected between External high-speed clock ( $f_{EHOSC}$ ) and High-speed clock ( $f_c$ ). The frequency of the selected clock is measured by using the built-in reference clock ( $f_{IHOSC2}$ ). If the frequency is out of the set range, the internal reset signal is generated.

## 8. Sample Program

The status of the output of the Oscillation Frequency Detector is shown on the LED's.  
When the frequency is in the normal region, LED (D10) blinks.  
When the frequency is not in the normal region, LED (D9) lights.

### 8.1. Initialization

The following initialization is done after power is supplied.  
The initialization of each clock setting and the watchdog timer setting is done.

### 8.2. Sample program main operation

OFD reset flag is cleared.  
The settings of GPIO's for the LED's are done.  
Timer setting is done. This sample program uses Timer-A ch0.  
1-second interval for the LED lighting is generated by the timer.

The OFD setting is done after the other settings complete.  
The detection frequency range should be set. The abnormal frequency status can be detected by acquiring **[OFDSTAT]** value.

### 8.3. OFD Setting Change

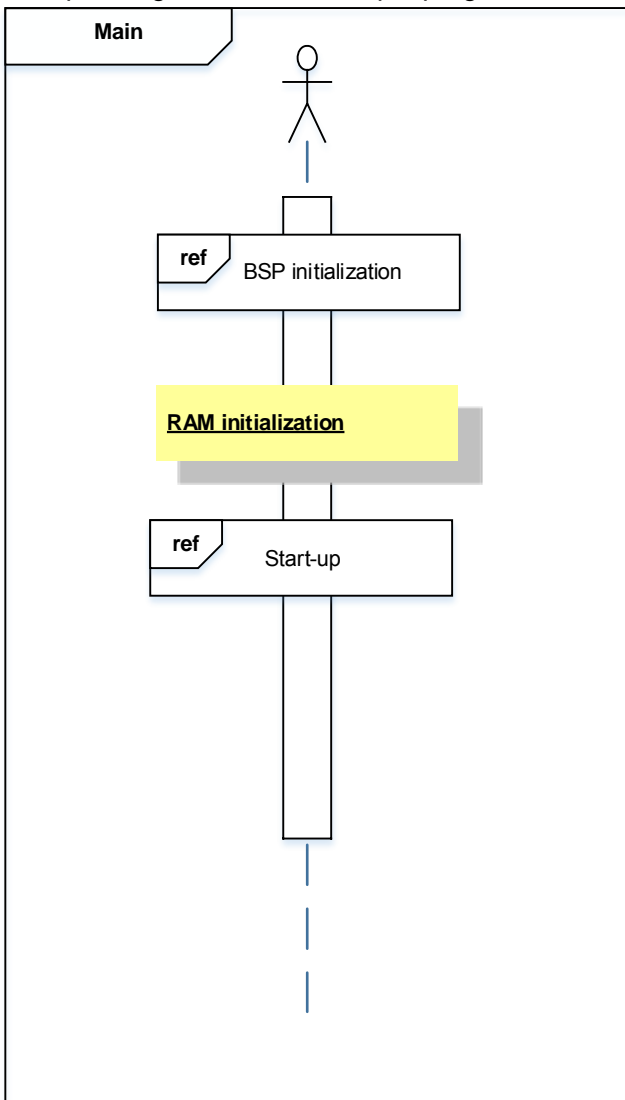
When the frequency range of the OFD is changed in the sample program, the following items should be changed properly.

```
#define OFD_LOWER_COUNT ((uint32_t)0x1CDU)  
#define OFD_HIGHER_COUNT ((uint32_t)0x23EU)  
#define OFD_LOWER_COUNT_EXTERNAL ((uint32_t)0x45U)  
#define OFD_HIGHER_COUNT_EXTERNAL ((uint32_t)0x56U)
```

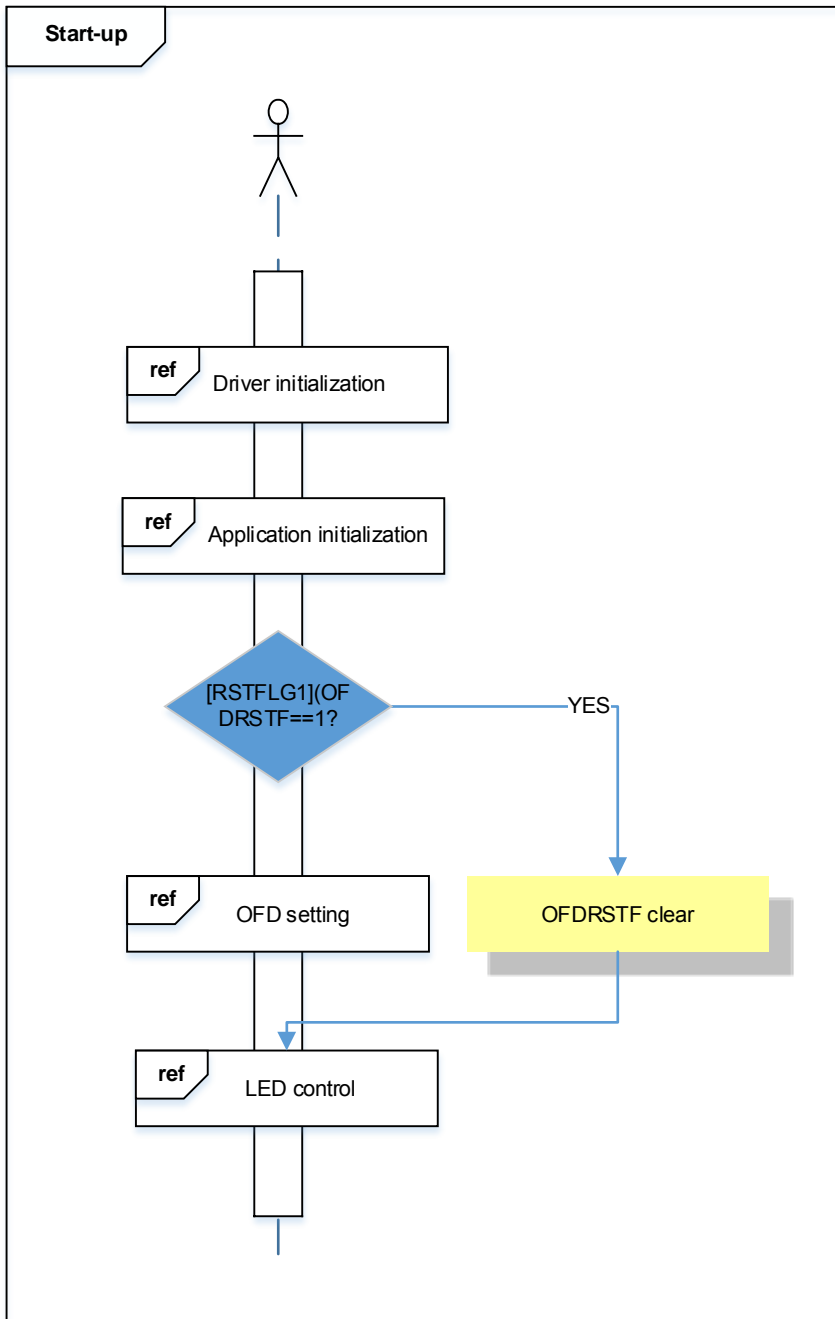
The detected frequency range can be changed by updating those setting values.  
For the calculation method for the setting values, refer to Reference manual.

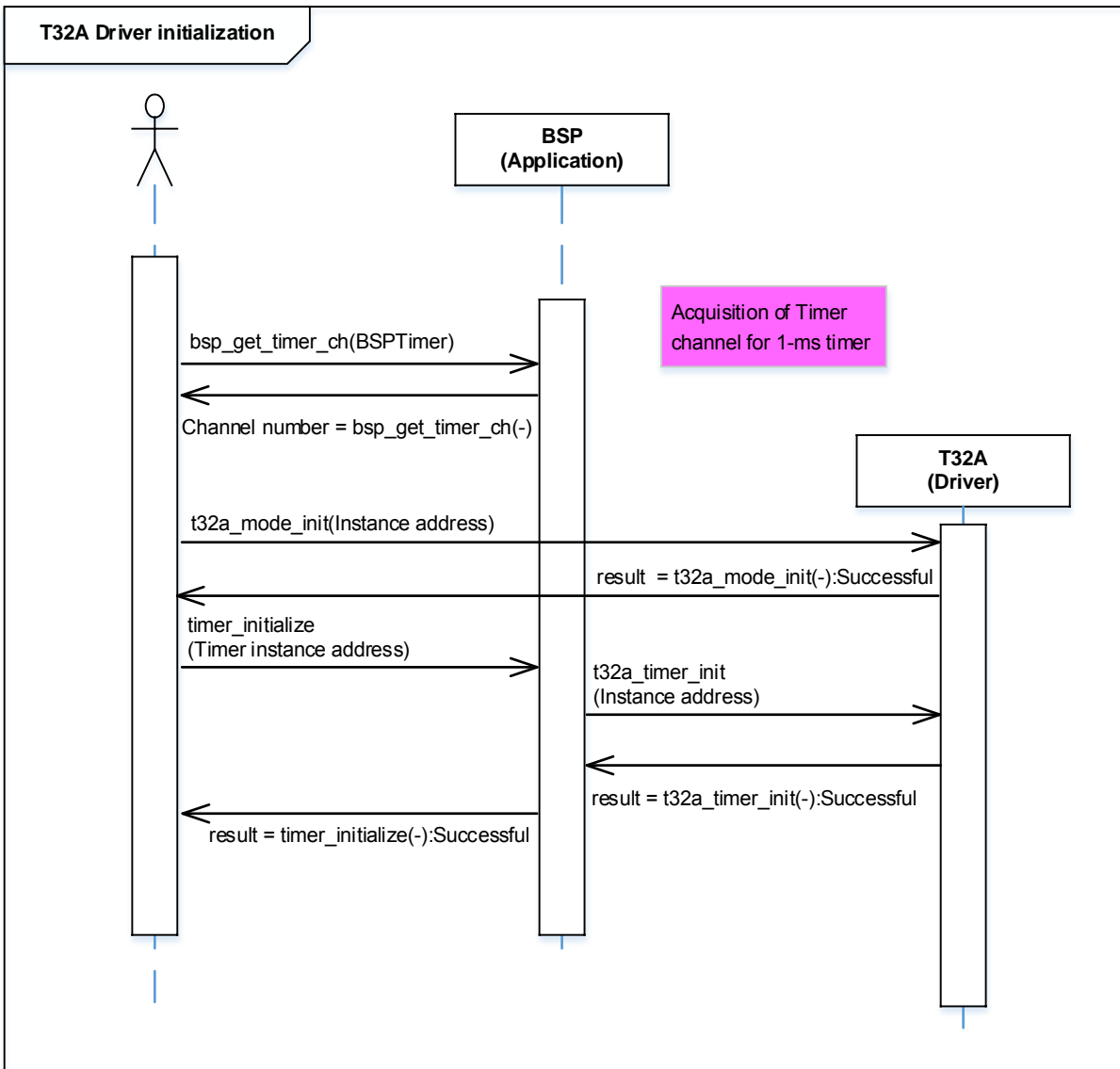
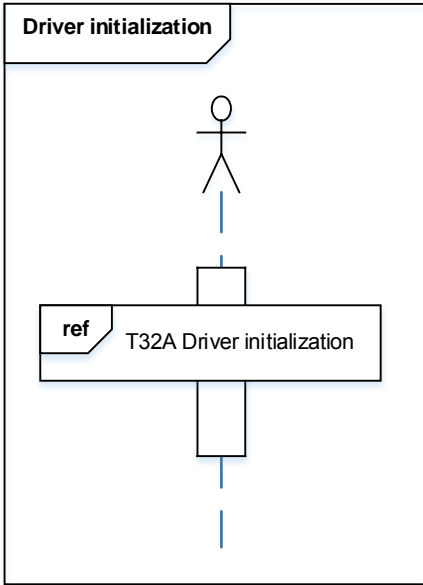
### 8.4. Operating Flow of Sample Program

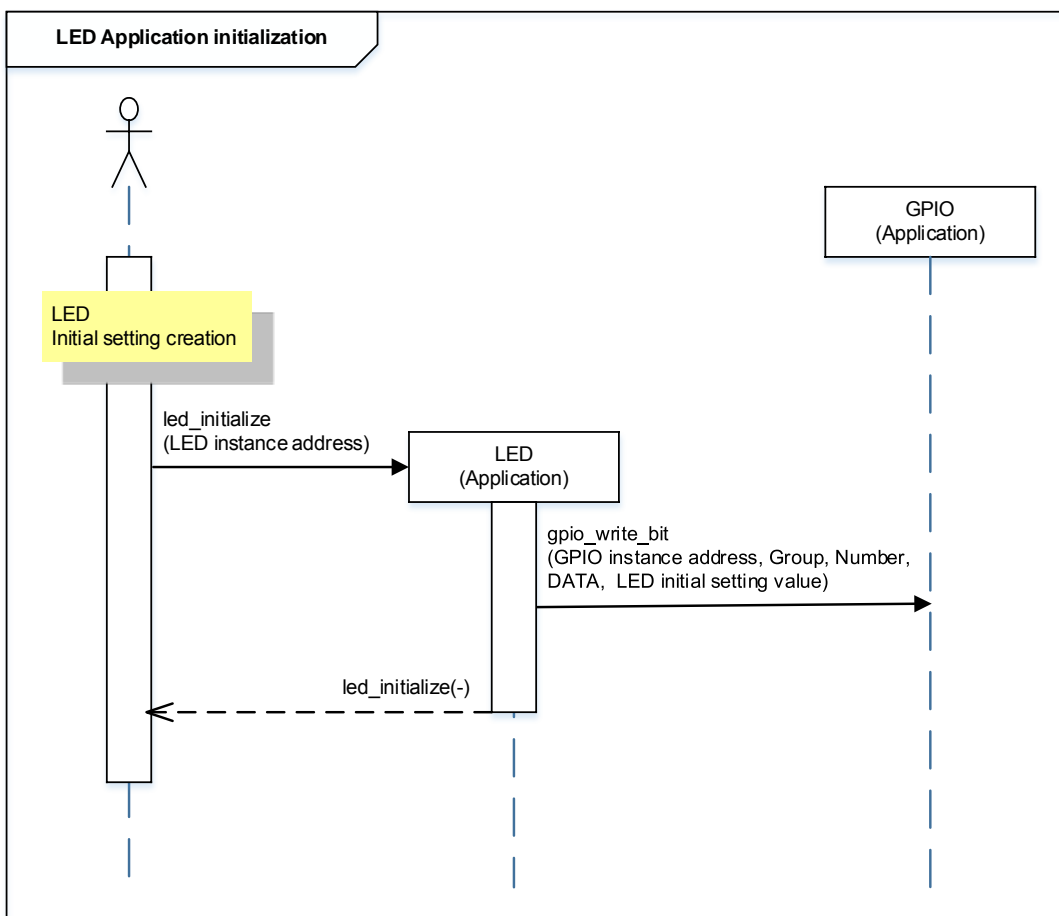
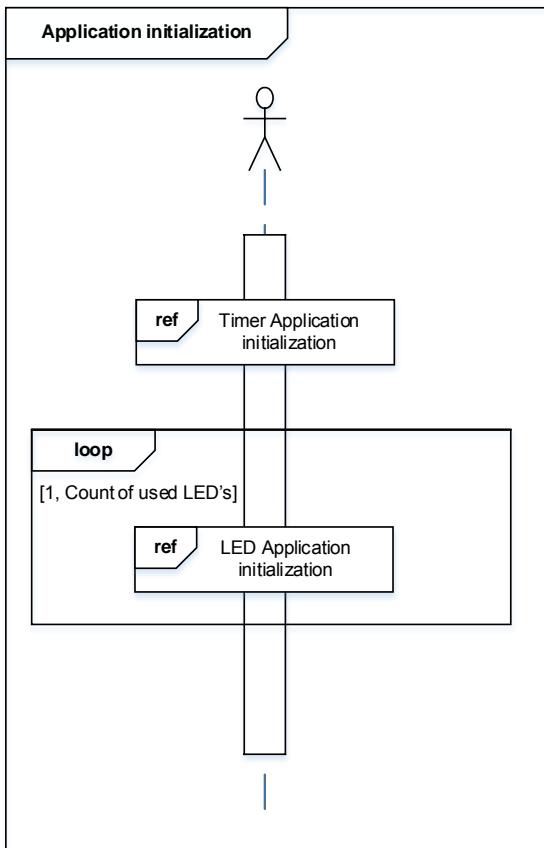
The operating flows of the sample program are shown as follows.

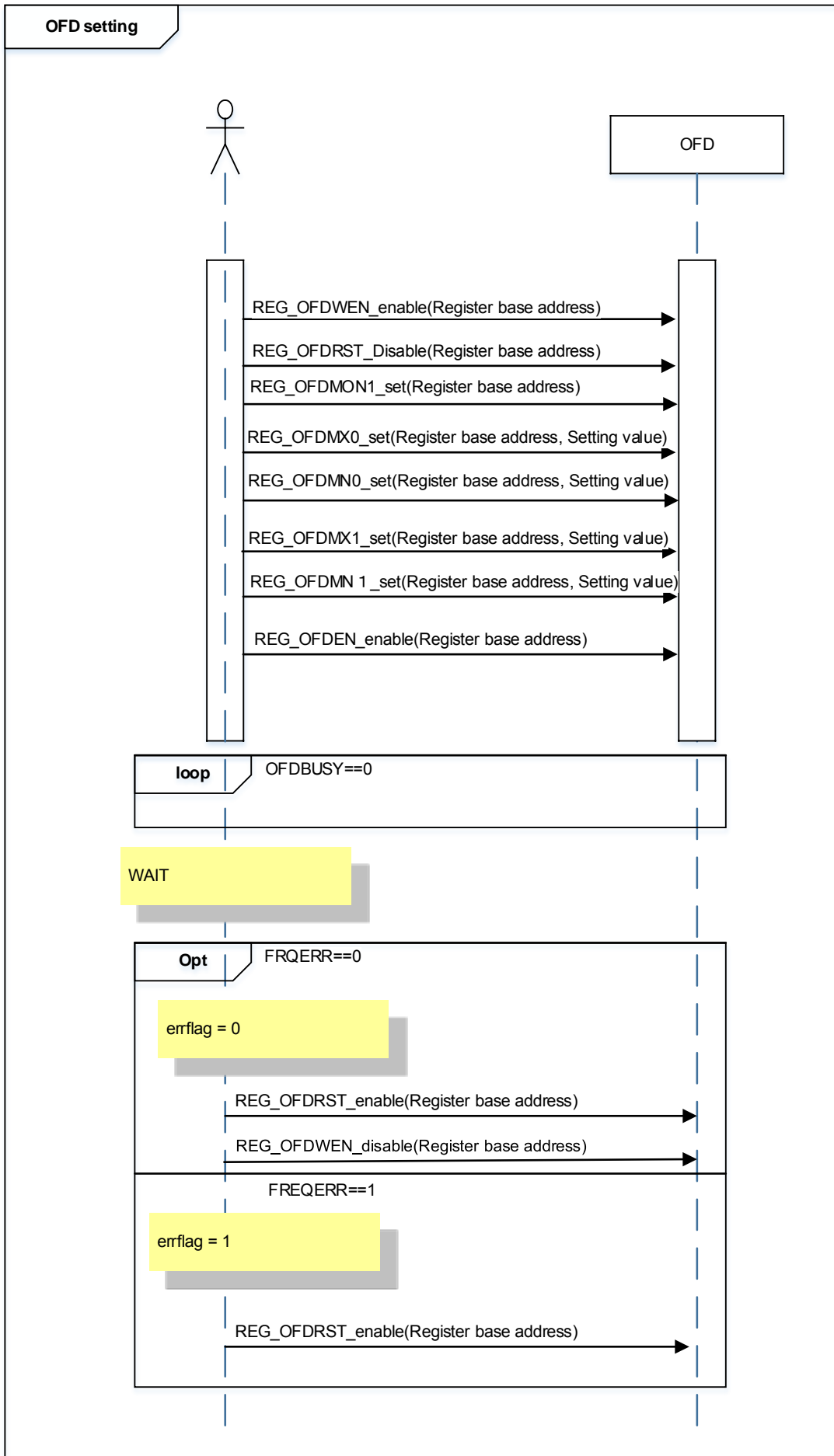


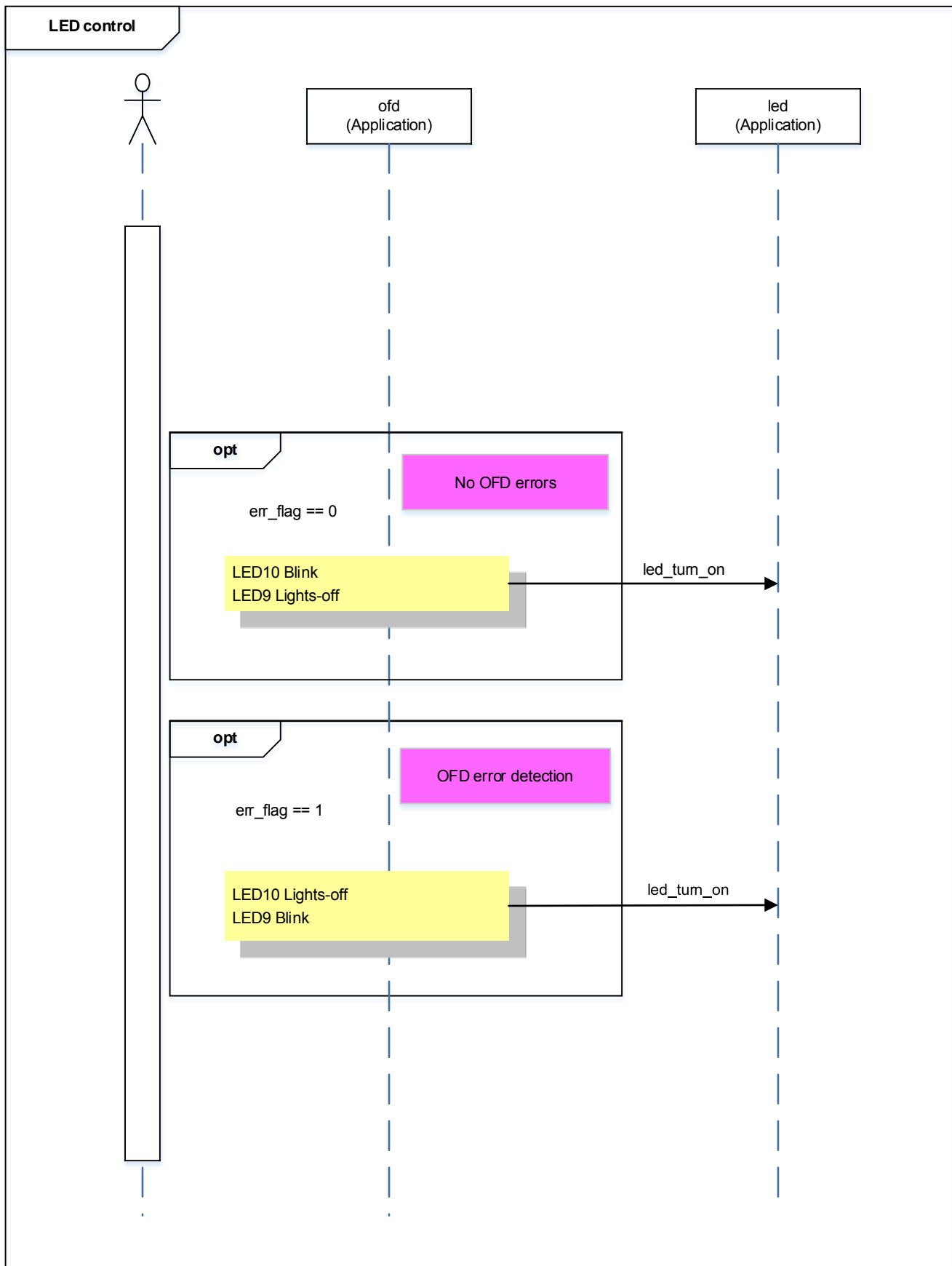












## 9. Precaution

When using the sample program with CPU other than TPM3H6, please check operation sufficiently.

## 10. Revision History

Rev	Date	Page	Description
1.0	2018-03-02	-	First release

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