Application Note

CG_EXINT

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1. Preface

This application note describes sample software for the switches between NORMAL mode and low power consumption mode using clock control and operation mode functions.
This document helps the user check operation of a product under development and develop its program.

2. Technical Term

Term/Abbreviation	Definition
BSP	Board Support Package
CG	Clock Control and Operation Mode
EXCEPT	Except
FLASH	Flash Memory
SIWDT	Clock Selective Watchdog Timer
Timer	T32A:32-bit Timer Event Counter

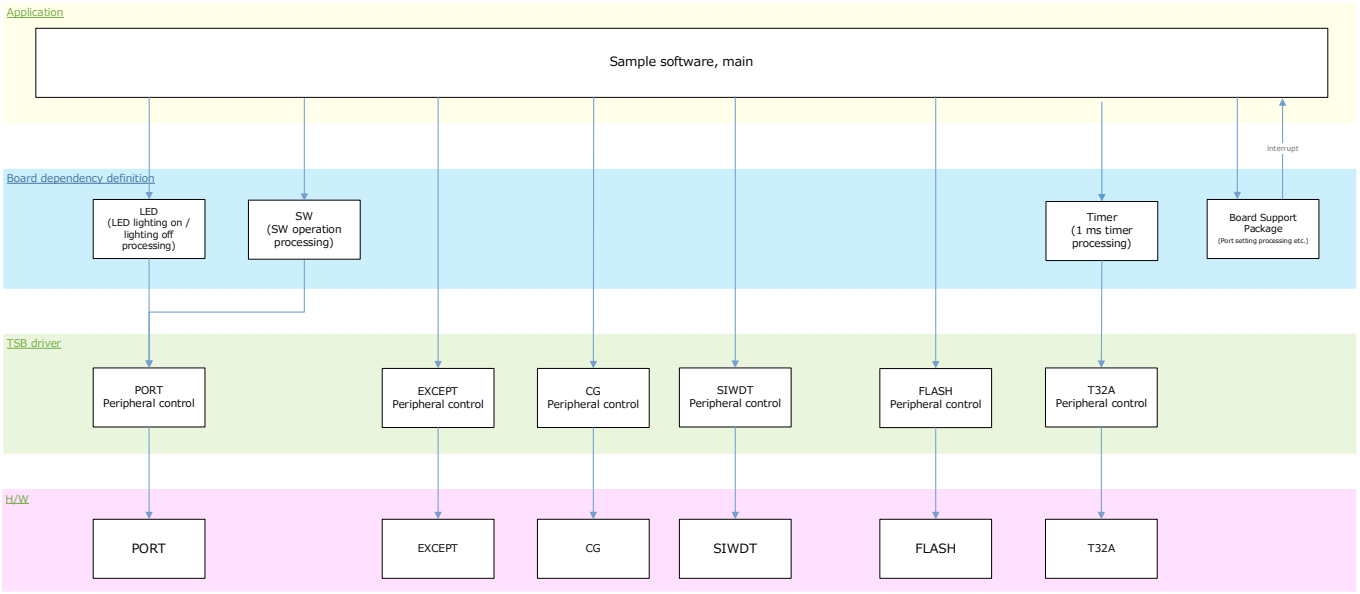
3. Reference Document

Document	Notes
Data sheet	Refer to the data sheet of MCU to be used.
Reference manual	Refer to the reference manual of each IP to be used.
Application note MCU User Guide	Refer to the MCU user guide to be used.

4. Target Sample Program

Sample Program	Outline
CG_EXINT	Sample program of clock control and operation mode switching

5. Configuration Diagram



6. Sample Program:CG_EXINT

This is the sample software that uses CG operation mode transition function to shift to the low-power consumption mode and return to NORMAL mode according to the pressed switches.
Visualizes the operation mode by LED.

6.1. Outlines of Operation

Switches (NORMAL/IDLE/STOP1/STOP2) when pressed.

When BSP_PSW_1 is pressed, IDLE mode is entered.
However, it is invalid when pressed during low power consumption mode.

When BSP_PSW_2 is pressed, STOP1 mode is entered.
However, it is invalid when pressed during low power consumption mode.

When BSP_PSW_3 is pressed, STOP2 mode is entered.
However, it is invalid when pressed during low power consumption mode.

When BSP_PSW_5 is pressed, NORMAL mode is entered.
However, if it is pressed during NORMAL, it is disabled.

LED is turned on and off according to the selected mode.
NORMAL mode:BSP_LED_1 blink at a constant Duty for a fixed period. All other LED are turned off.
IDLE mode:BSP_LED_2 is turned on. All other LED are turned off.
STOP1 mode:BSP_LED_3 is turned on. All other LED are turned off.
STOP2 mode:BSP_LED_4 is turned on. All other LED are turned off.

6.2. Function to Use

The functions to use are as follows:
For the Port assignment of each BSP channel, refer to the MCU user guide.

IP	Channel	Objective
PORT(Push Switch)	BSP_PSW_1	Event trigger
	BSP_PSW_2	Event trigger
	(Note1) BSP_PSW_3	(Note1) Event trigger
	(Note2) BSP_PSW_5	(Note2) Event trigger
PORT(LED)	BSP_LED_1	For operation check
	BSP_LED_2	For operation check
	BSP_LED_3	For operation check
	BSP_LED_4	For operation check
T32A	BSP_T32A_TIMER_1	Interval timer

Note1: SBK-M4KN does not support STOP2 and does not have BSP_PSW_3.
Note2: SBK-M4KN substitutes BSP_SSW_1.

6.3. Interrupt to Use

Interrupt	Outlines
INT21	External interrupt when pressing BSP_PSW_5. For canceling low power consumption mode
INTT32A00A	T32A Timer A Timer counter increments every 1ms for Switch / LED processing

6.4. Configuration

"main.c" configuration setting.

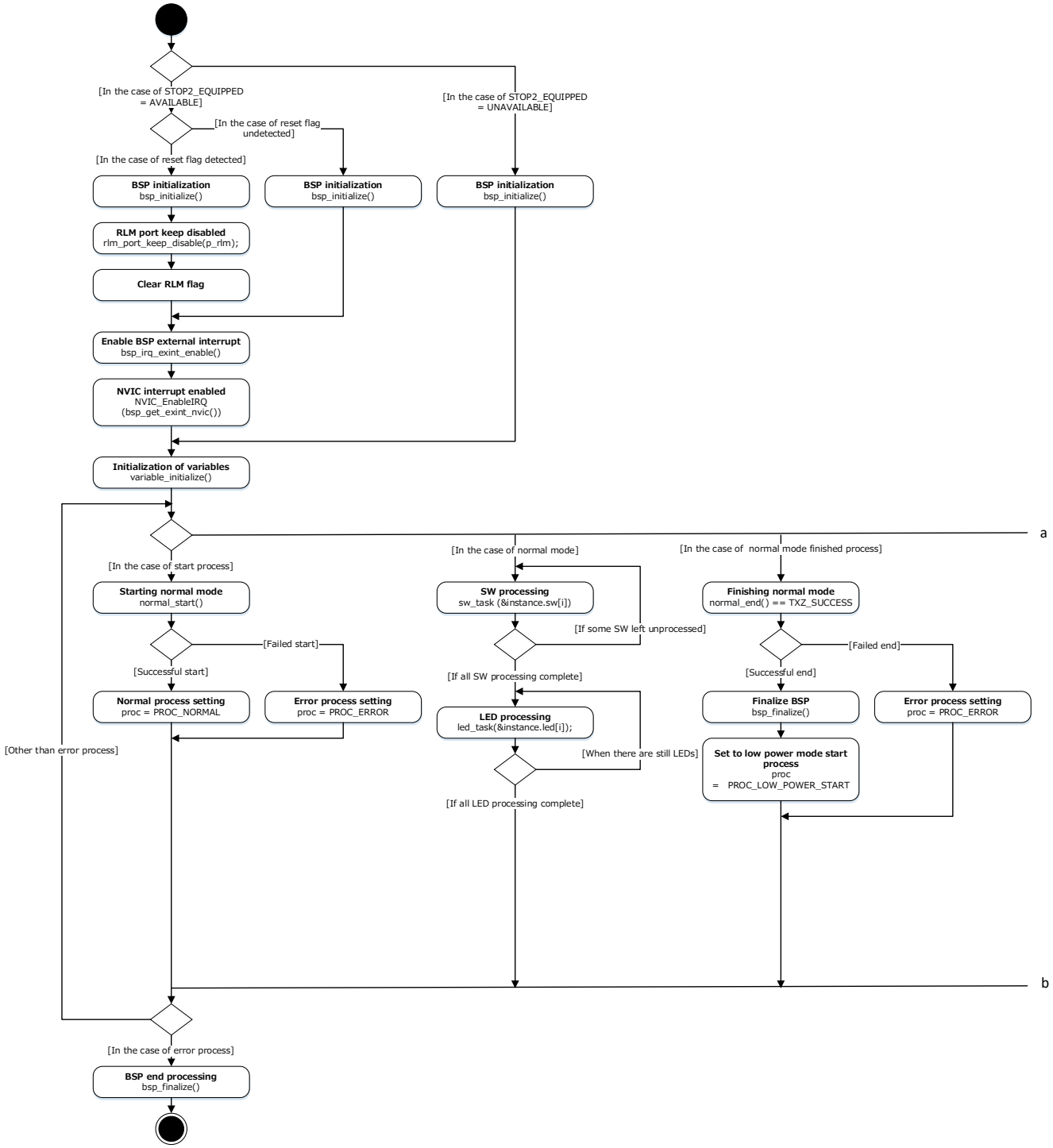
Configuration	Current Value	Description
CFG_LED_BLINK_FRQ	2	LED blink Cycle (Unit:Hz)
CFG_LED_BLINK_DUTY	0.5	LED blink Duty (50%)

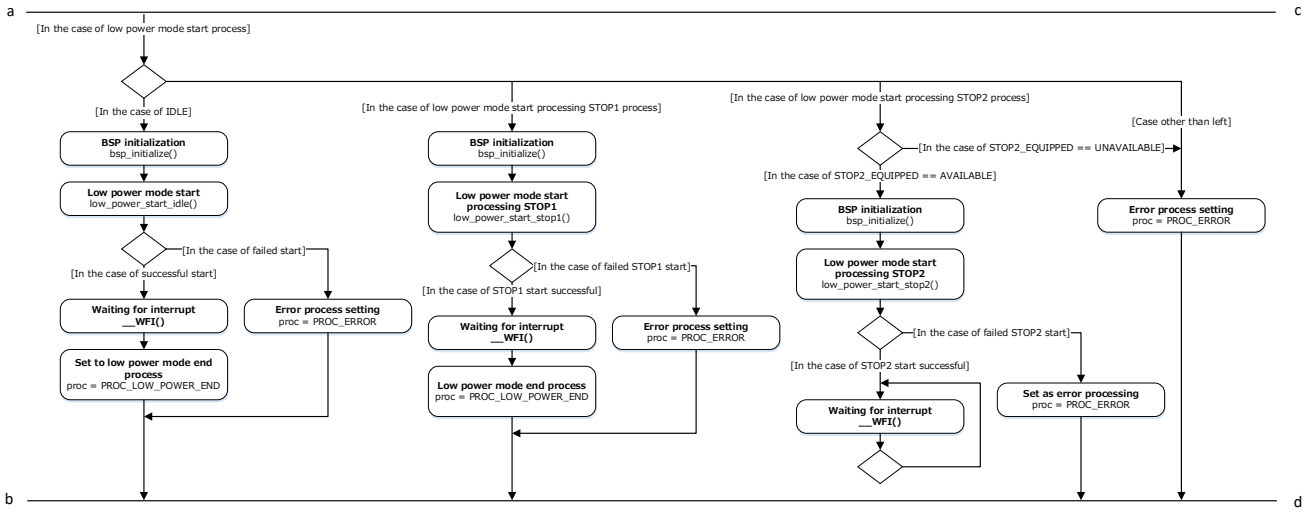
6.5. Example of Terminal Emulator Output

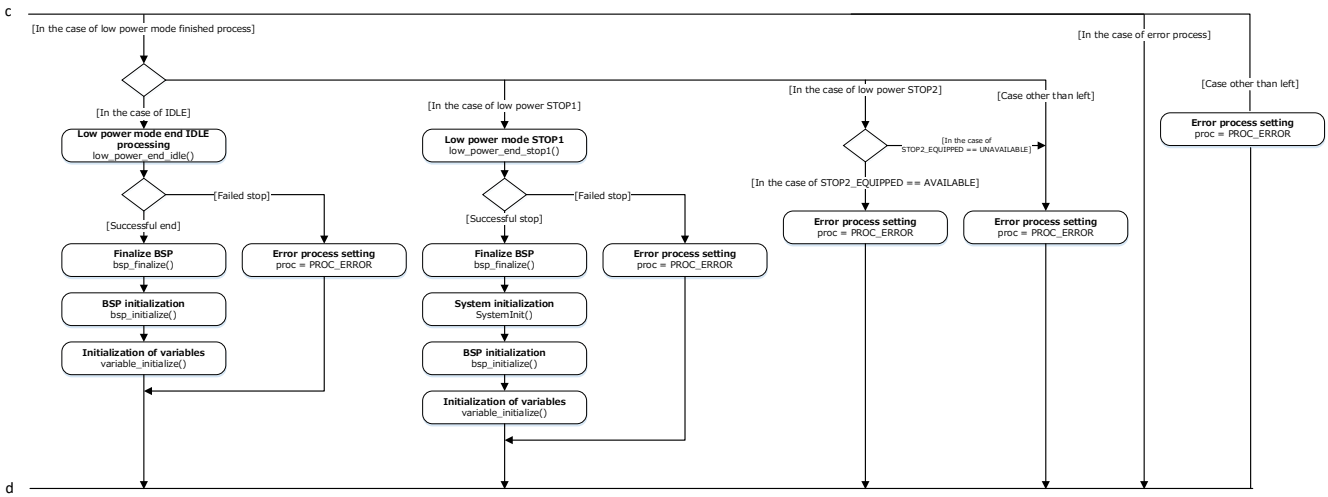
Nothing.

7. Activity diagram

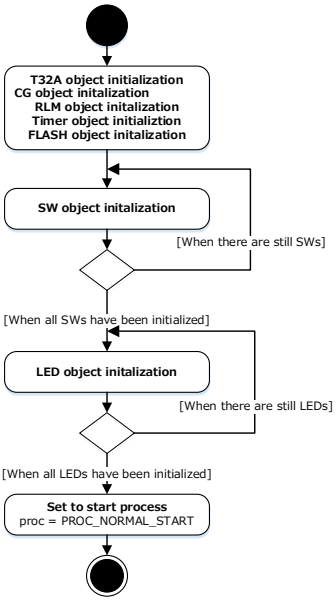
7.1. main



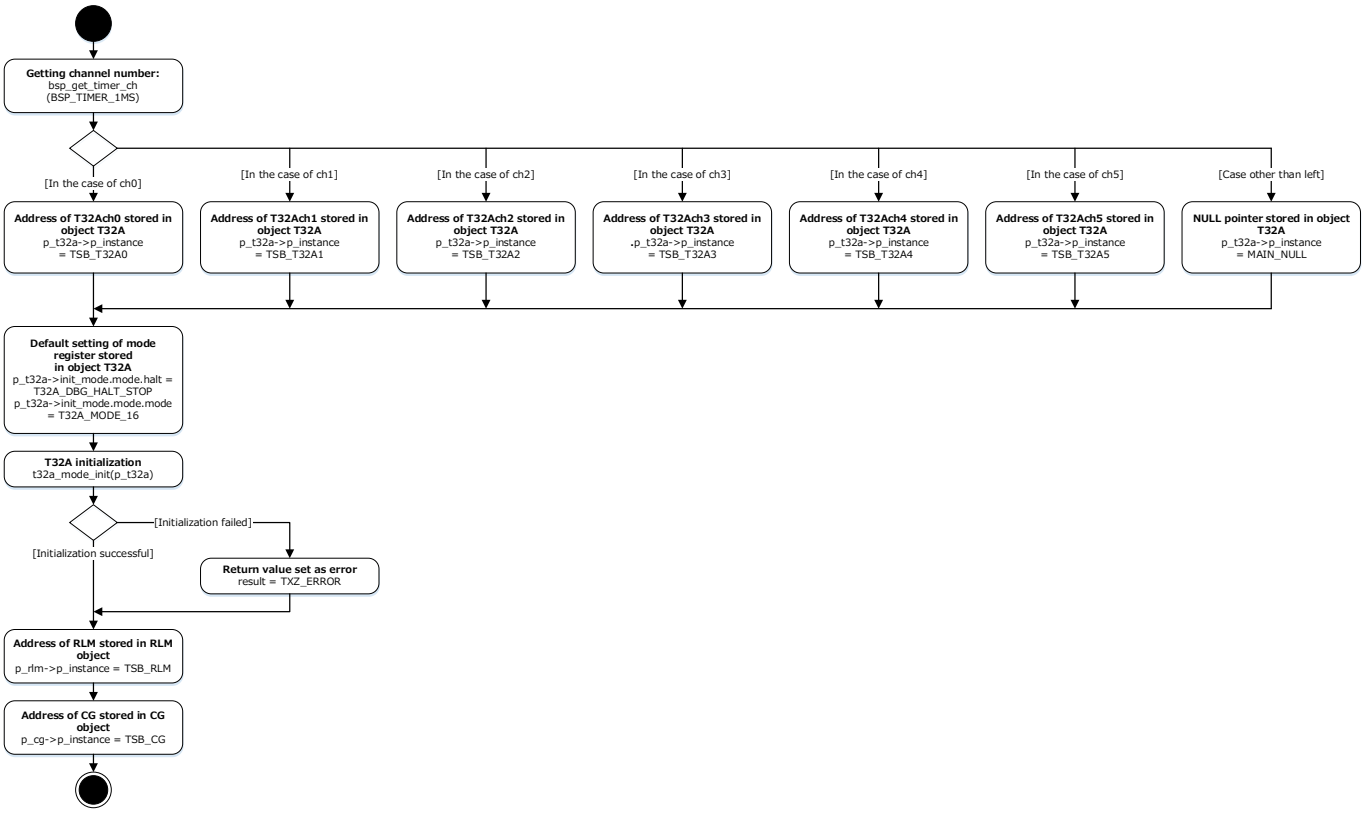

a
c
[In the case of low power mode start process]
[In the case of IDLE]
BSP initialization
bsp_initialize()
Low power mode start
low_power_start_idle()
[In the case of failed start]
[In the case of successful start]
Waiting for interrupt
__WFI()
Set to low power mode end process
proc = PROC_LOW_POWER_END
Error process setting
proc = PROC_ERROR
[In the case of low power mode start processing STOP1 process]
BSP initialization
bsp_initialize()
Low power mode start processing STOP1
low_power_start_stop1()
[In the case of failed STOP1 start]
[In the case of STOP1 start successful]
Waiting for interrupt
__WFI()
Error process setting
proc = PROC_ERROR
Low power mode end process
proc = PROC_LOW_POWER_END
[In the case of low power mode start processing STOP2 process]
[In the case of STOP2_EQUIPPED == UNAVAILABLE]
[Case other than left]
[In the case of STOP2_EQUIPPED == AVAILABLE]
BSP initialization
bsp_initialize()
Low power mode start processing STOP2
low_power_start_stop2()
[In the case of failed STOP2 start]
[In the case of STOP2 start successful]
Waiting for interrupt
__WFI()
Set as error processing
proc = PROC_ERROR
Error process setting
proc = PROC_ERROR
b
d


c
[In the case of low power mode finished process]
[In the case of error process]
[In the case of IDLE]
Low power mode end IDLE processing
low_power_end_idle()
[Failed stop]
[Successful end]
Finalize BSP
bsp_finalize()
BSP initialization
bsp_initialize()
Initialization of variables
variable_initialize()
Error process setting
proc = PROC_ERROR
[In the case of low power STOP1]
Low power mode STOP1
low_power_end_stop1()
[Failed stop]
[Successful stop]
Finalize BSP
bsp_finalize()
System initialization
SystemInit()
BSP initialization
bsp_initialize()
Initialization of variables
variable_initialize()
Error process setting
proc = PROC_ERROR
[In the case of low power STOP2]
[Case other than left]
[In the case of STOP2_EQUIPPED == UNAVAILABLE]
[In the case of STOP2_EQUIPPED == AVAILABLE]
Error process setting
proc = PROC_ERROR
Error process setting
proc = PROC_ERROR
[Case other than left]
Error process setting
proc = PROC_ERROR
d

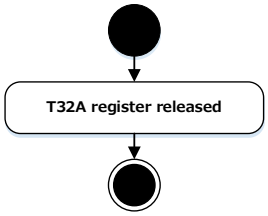
7.2. vaiable_initialize



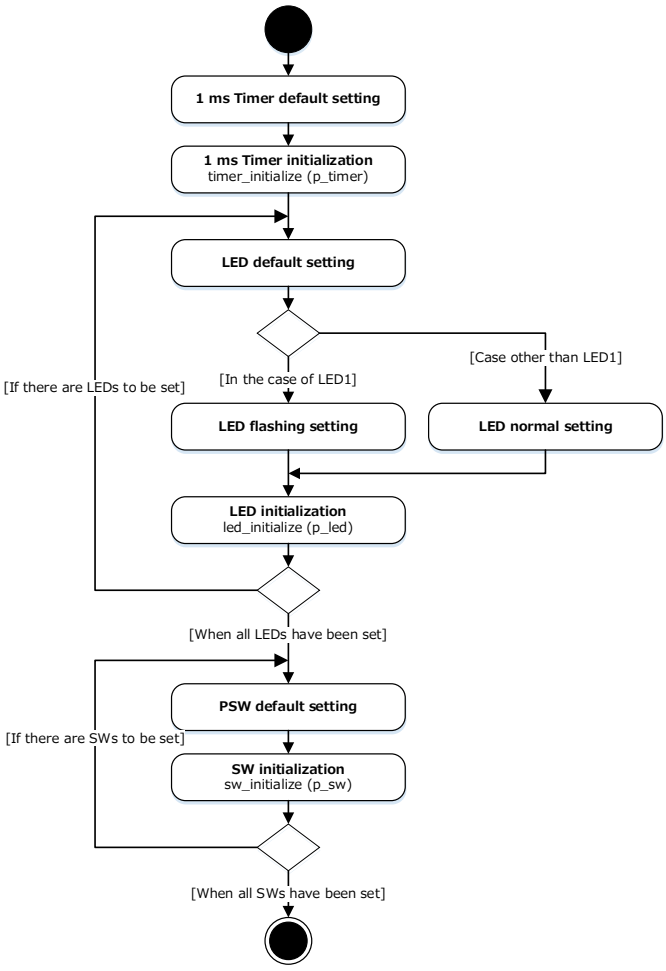
7.3. driver_initialize_normal



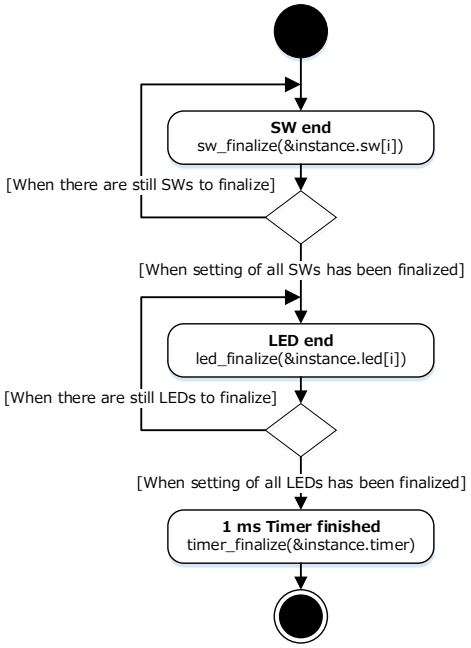
7.4. driver_finalize_normal



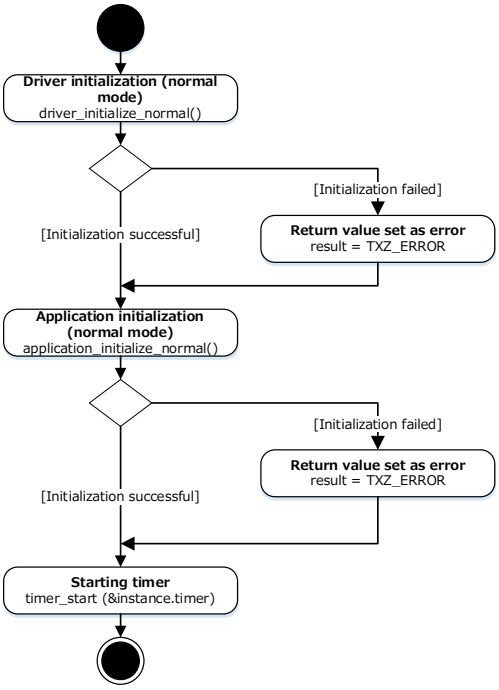
7.5. application_initialize_normal



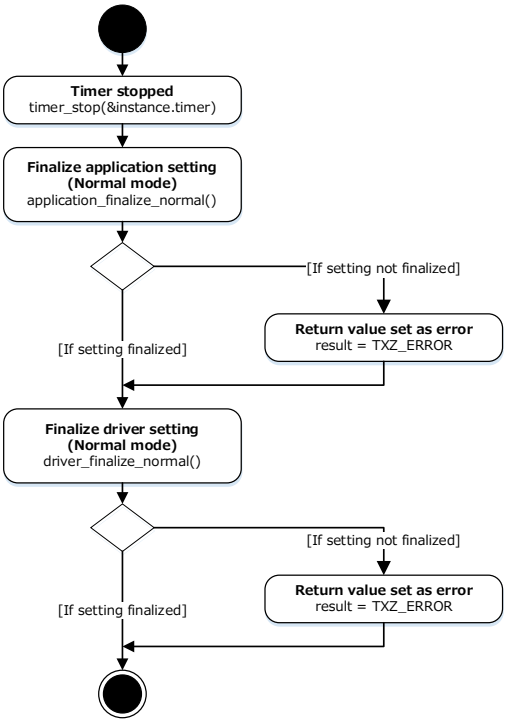
7.6. application_finalize_normal



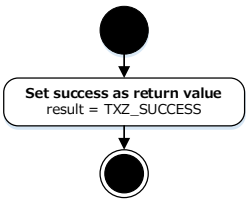
7.7. noraml_start



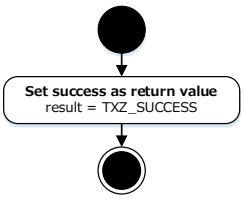
7.8. normal_end



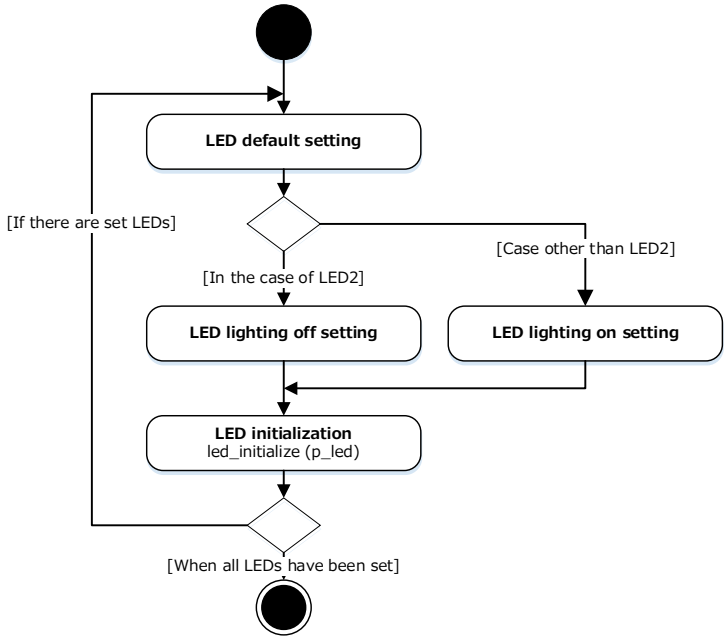
7.9. driver_initialize_idle



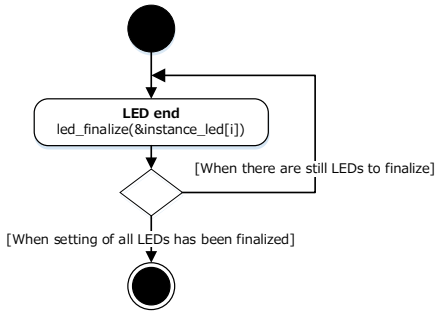
7.10. driver_finalize_idle



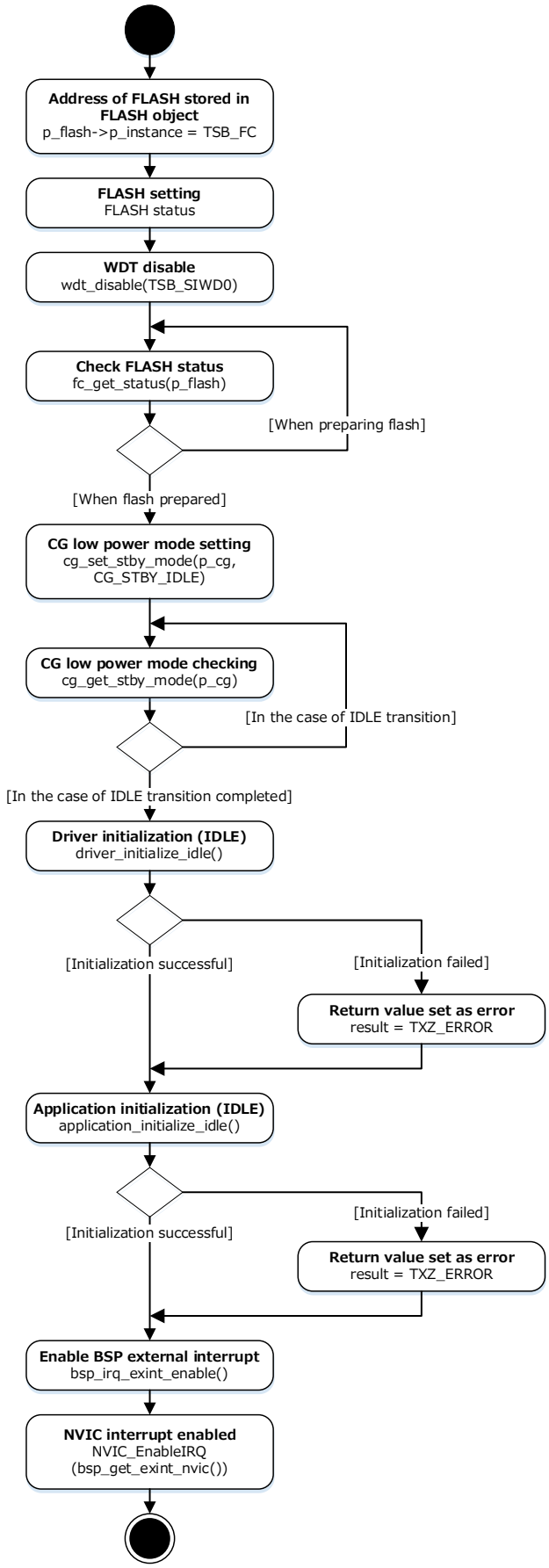
7.11. application_initialize_idle



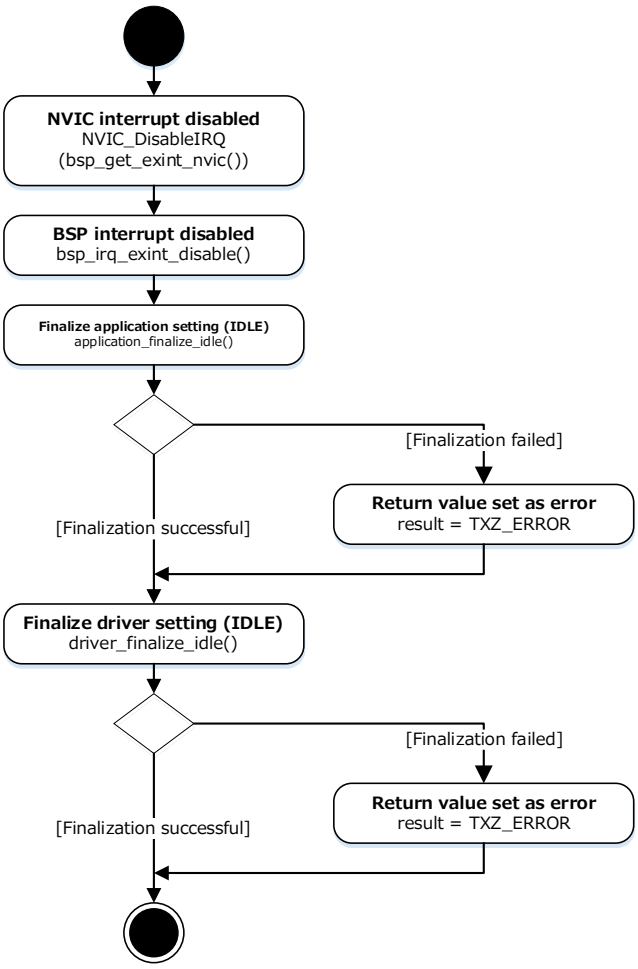
7.12. application_finalize_idle



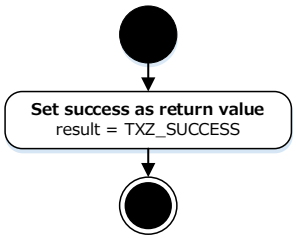
7.13. low_power_start_idle



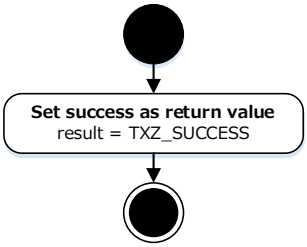
7.14. low_power_end_idle



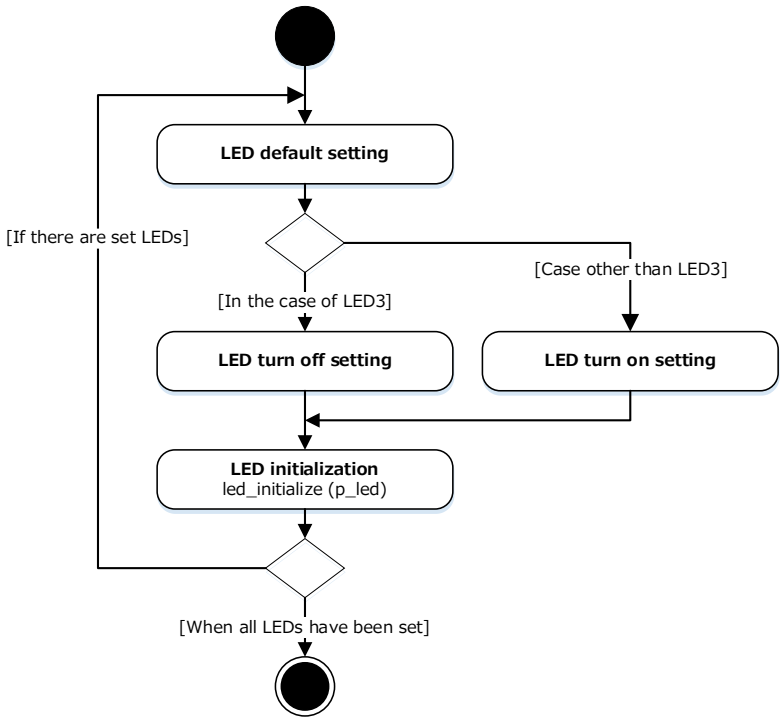
7.15. driver_initialize_stop1



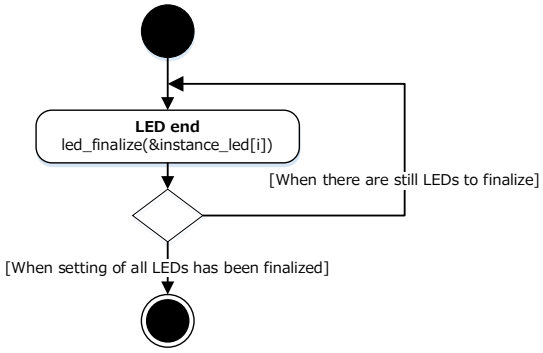
7.16. driver_finalize_stop1



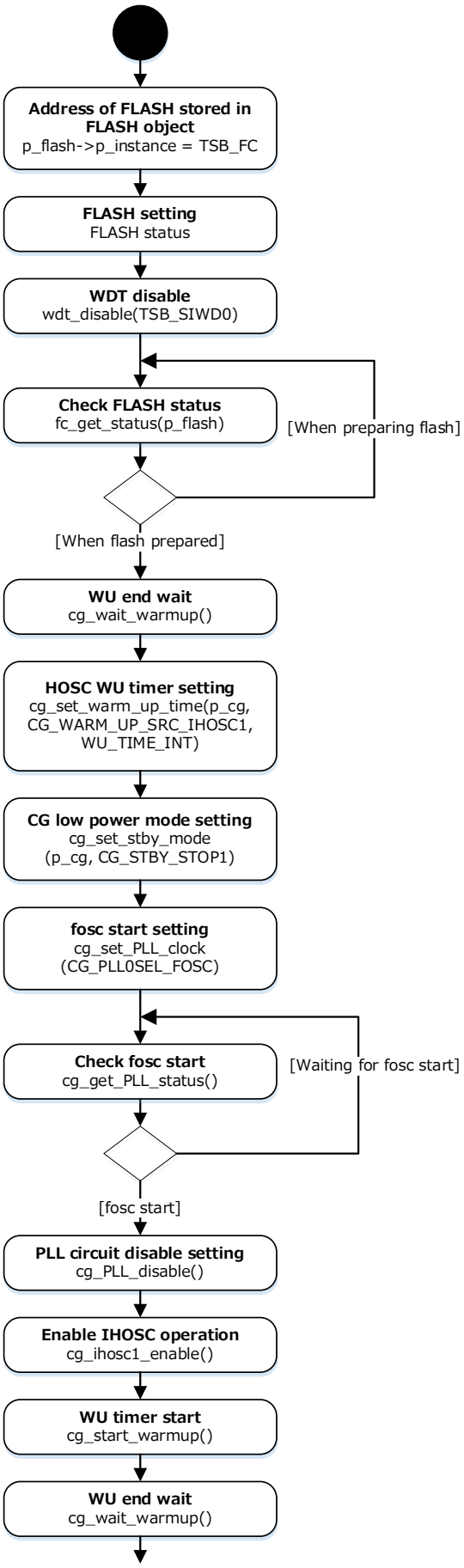
7.17. application_initialize_stop1

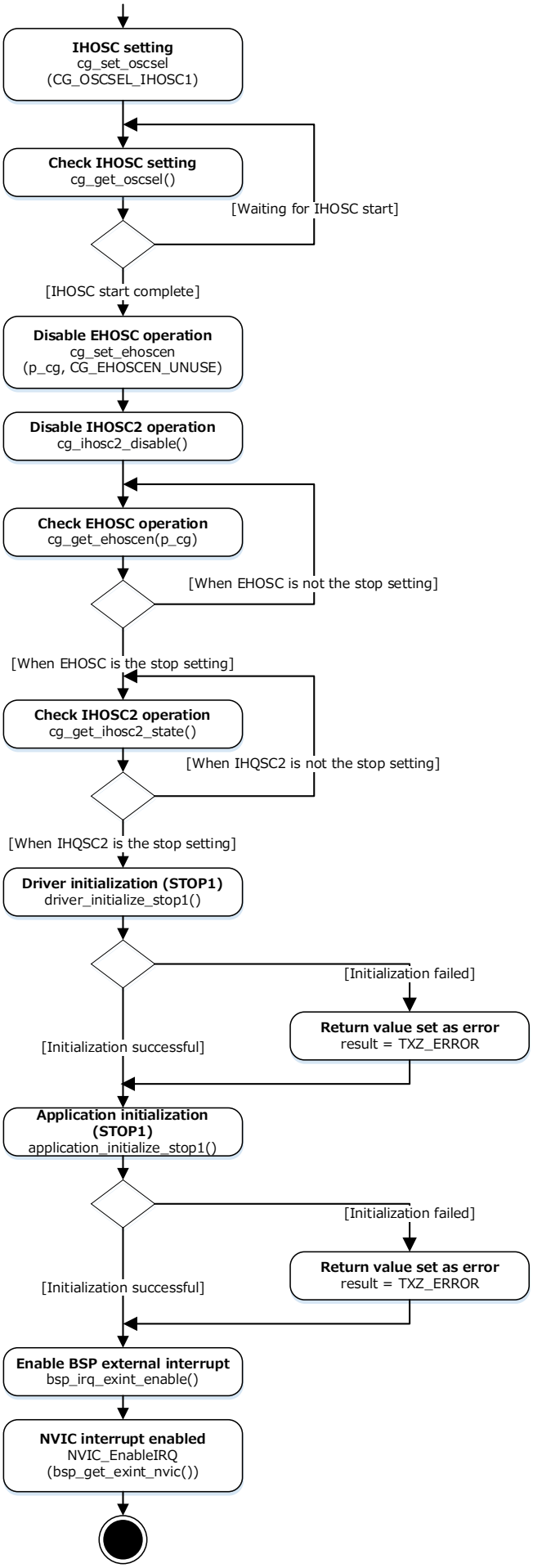


7.18. application_finalize_stop1

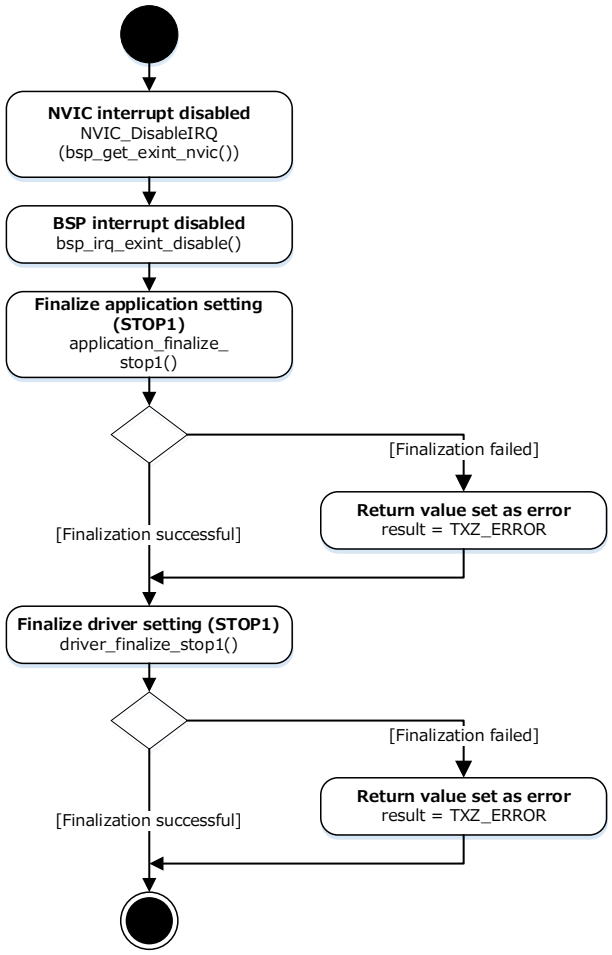


7.19. low_power_start_stop1

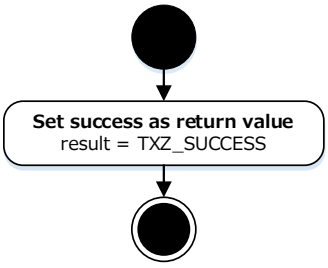




7.20. low_power_end_stop1

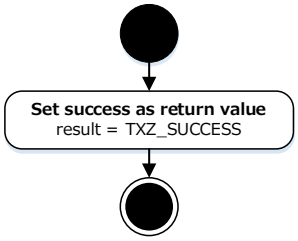


7.21. driver_initialize_stop2



When STOP2_EQUIPPED is defined

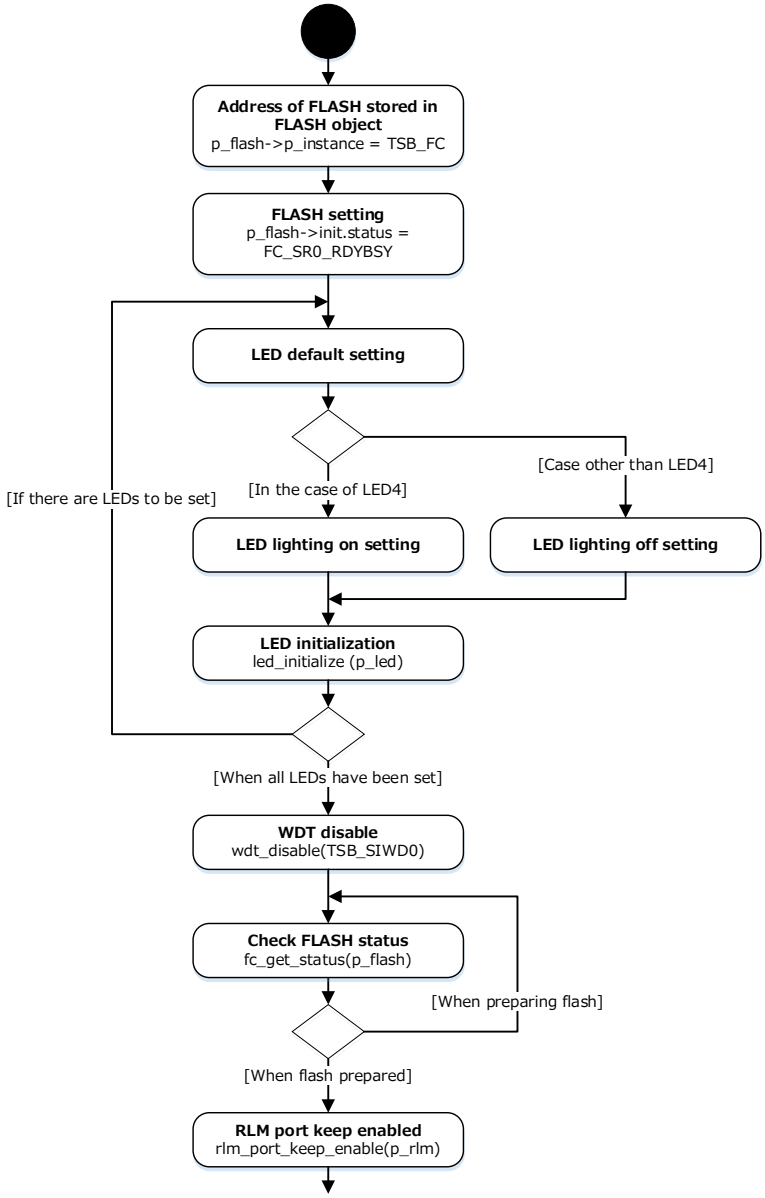
7.22. application_initialize_stop2

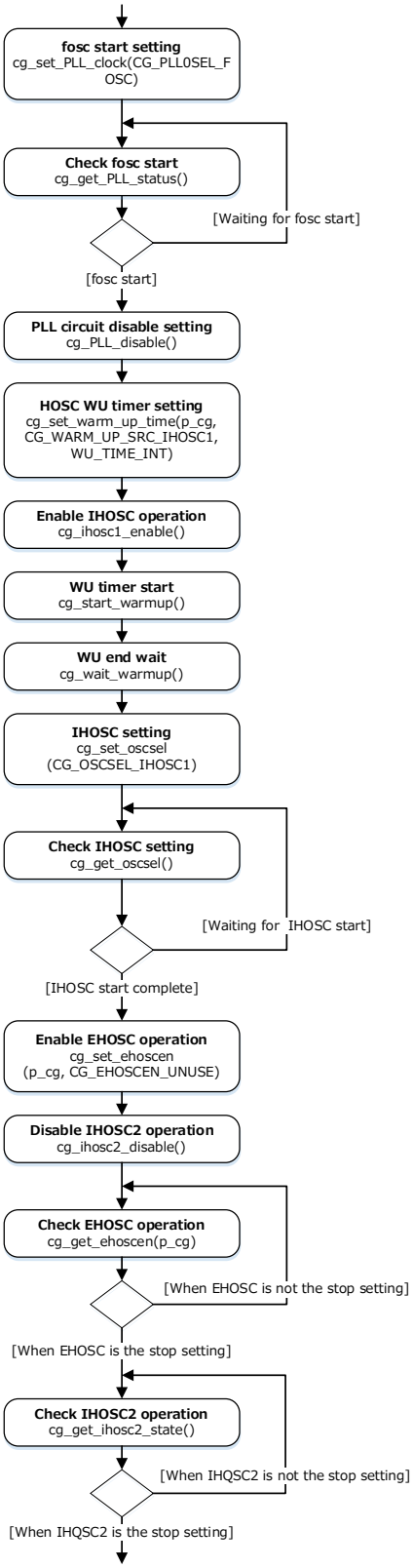


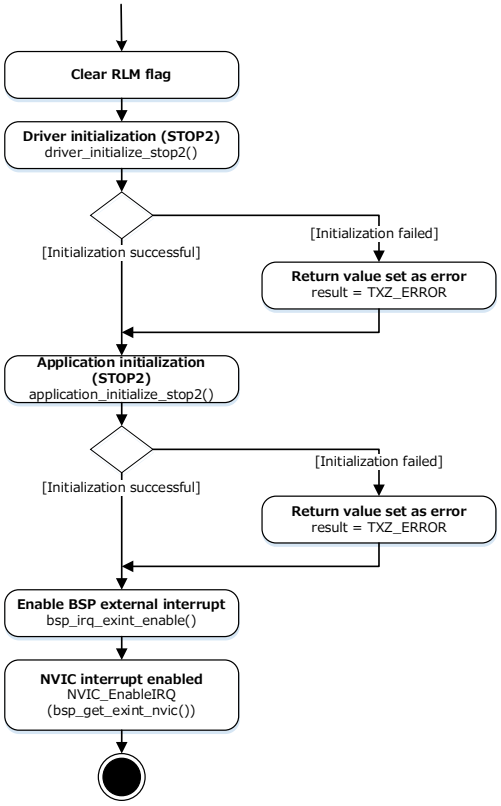
When STOP2_EQUIPPED is defined

7.23. low_power_start_stop2

When STOP2_EQUIPPED is defined

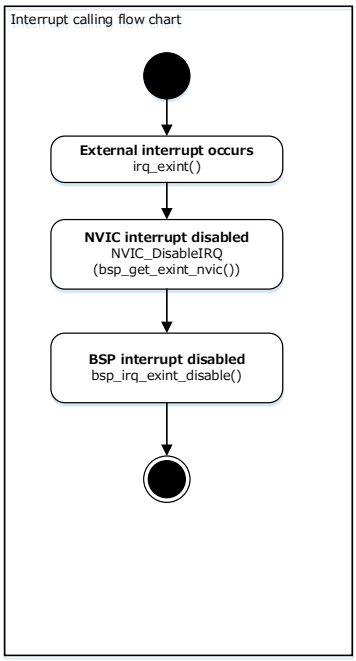


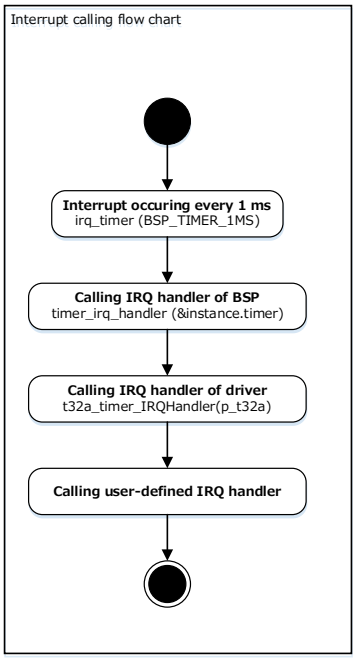

fosc start setting
cg_set_PLL_clock(CG_PLL0SEL_FOSC)
Check fosc start
cg_get_PLL_status()
[Waiting for fosc start]
[fosc start]
PLL circuit disable setting
cg_PLL_disable()
HOSC WU timer setting
cg_set_warm_up_time(p_cg, CG_WARM_UP_SRC_IHOSC1, WU_TIME_INT)
Enable IHOSC operation
cg_ihosc1_enable()
WU timer start
cg_start_warmup()
WU end wait
cg_wait_warmup()
IHOSC setting
cg_set_oscsel
(CG_OSCSEL_IHOSC1)
Check IHOSC setting
cg_get_oscsel()
[Waiting for IHOSC start]
[IHOSC start complete]
Enable EHOSC operation
cg_set_ehoscen
(p_cg, CG_EHOSCEN_UNUSE)
Disable IHOSC2 operation
cg_ihosc2_disable()
Check EHOSC operation
cg_get_ehoscen(p_cg)
[When EHOSC is not the stop setting]
[When EHOSC is the stop setting]
Check IHOSC2 operation
cg_get_ihosc2_state()
[When IHQSC2 is not the stop setting]
[When IHQSC2 is the stop setting]

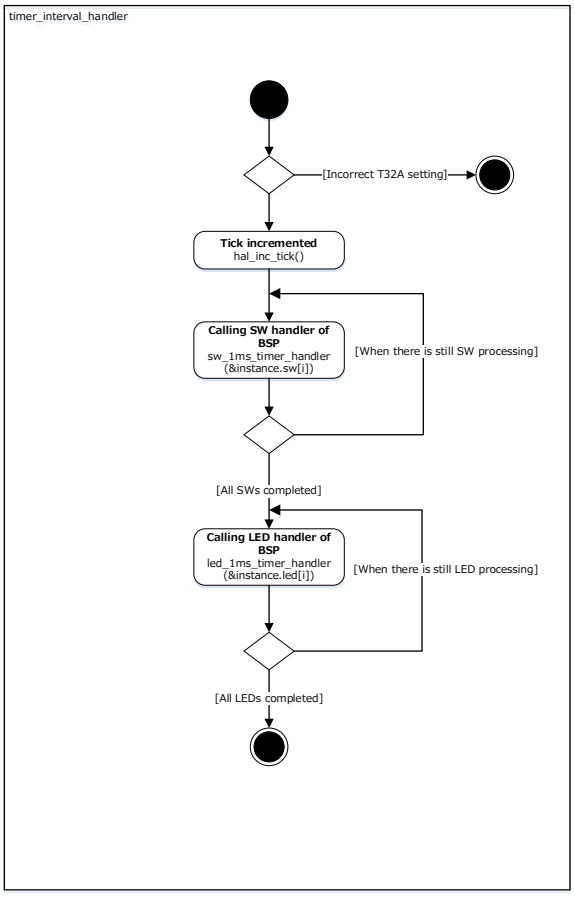


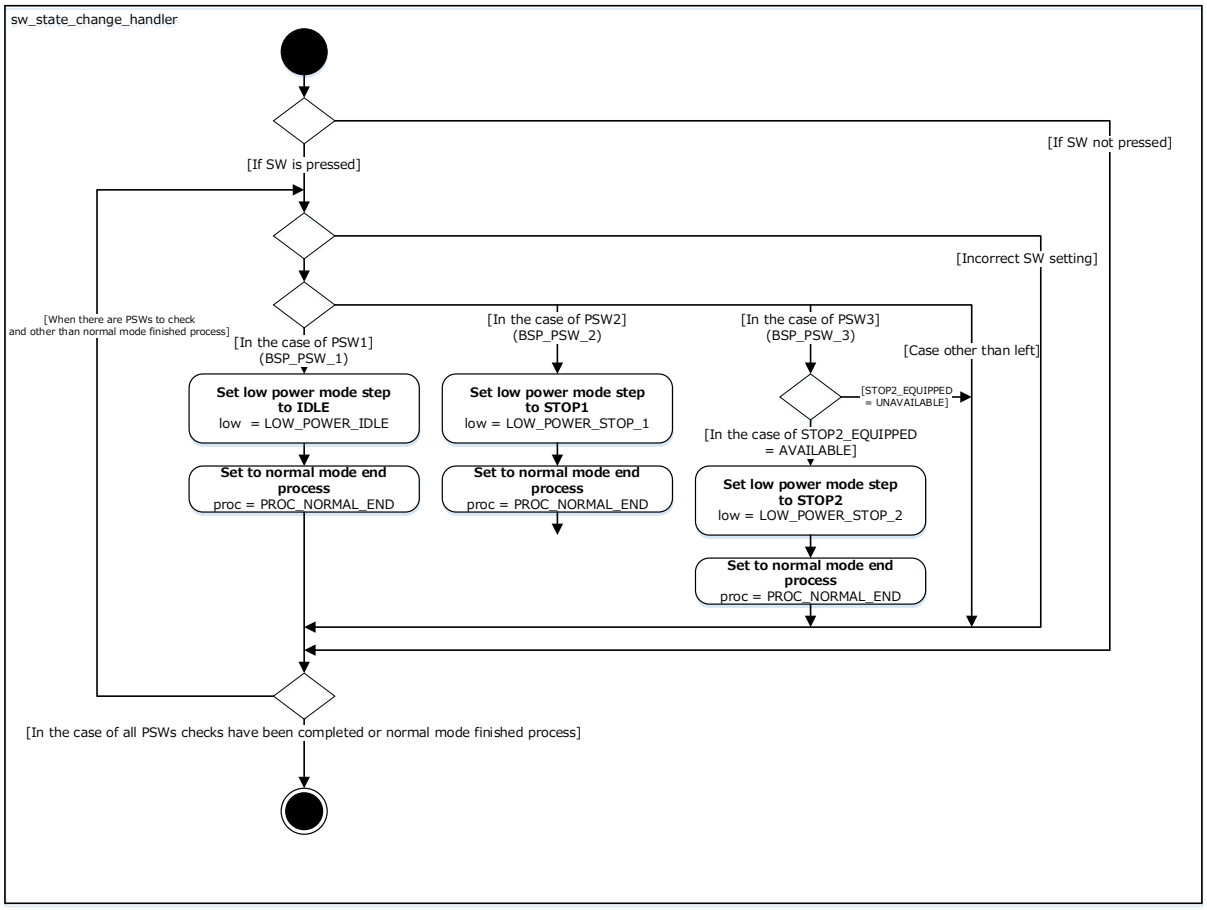
When STOP2_EQUIPPED is defined

7.24. Interrupt









8. Revision History

Revision	Date	Description
1.0	2023-10-16	First release
1.1	2025-01-20	Title Changed

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