Application Note

UART_TRANS
(UART-C)

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1. Preface

This application note describes the sample software of UART_TRANS using Universal Asynchronous Receiver Transmitter (UART).
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
DMA	Direct Memory Access
Timer	T32A:32-bit Timer Event Counter
UART	Universal Asynchronous Receiver Transmitter

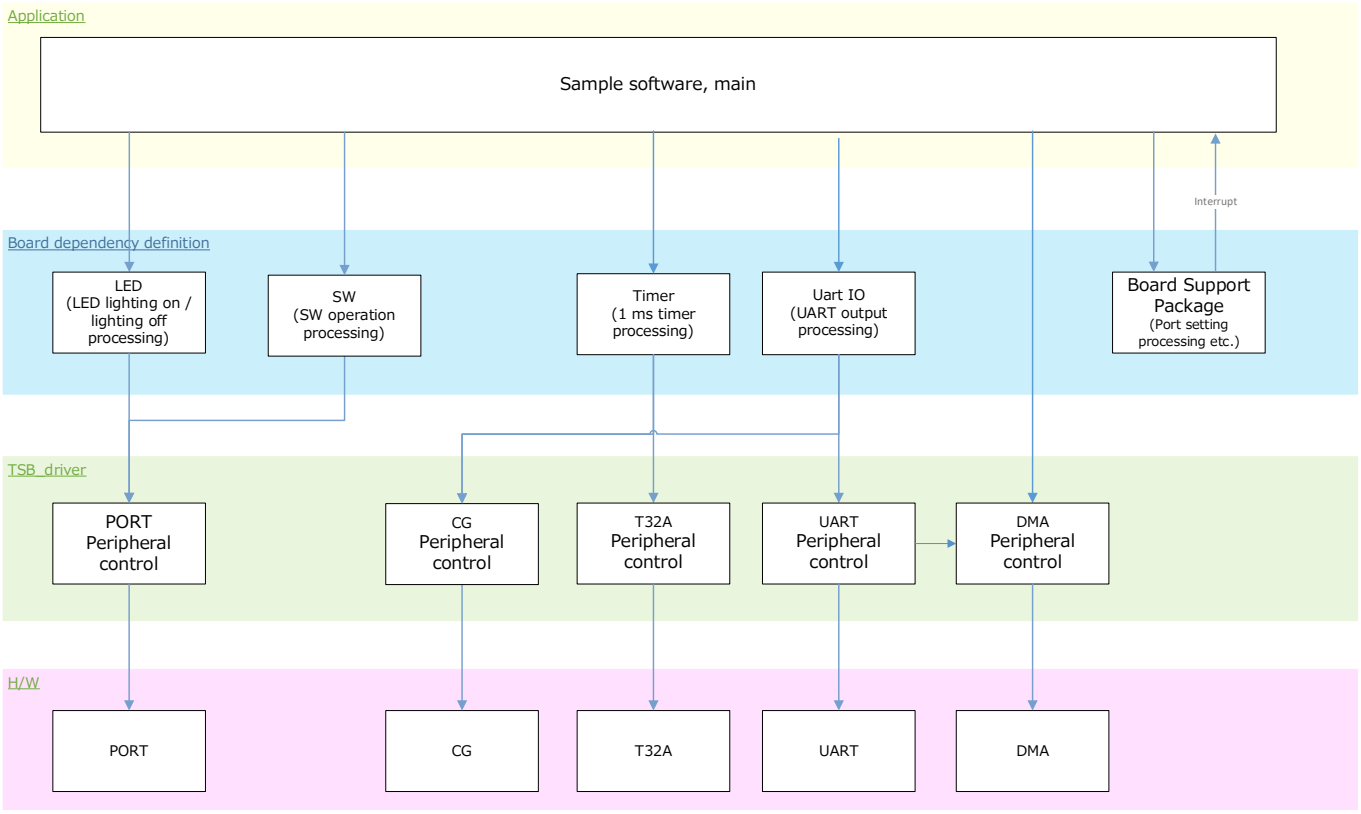
3. Reference Document

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
UART_TRANS	Sample program of UART function (UART Trans)

5. Configuration Diagram



6. Sample Program:UART_TRANS

This sample software that uses the transmission function of the UART communication function to send logs to the terminal emulator triggered by pressing a switch, and switches the LED turn on / turn off for each UART transmission.

6.1. Outlines of Operation

Wait for BSP_PSW_1 to be pressed.
When BSP_PSW_1 is pressed, the log is transmitted by UART, BSP_LED_2 is turned on / off, and BSP_LED_3 is turned off.
When an error occurs, BSP_LED_3 is turn on.

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
UART	BSP_UART_1	For terminal emulator communication
T32A	BSP_T32A_TIMER_1	Interval timer
PORT(Push-Switch)	BSP_PSW_1	Event Trigger
PORT(LED)	BSP_LED_2	For operation check
	BSP_LED_3	For operation check

6.3. Interrupt to Use

Interrupt	Outlines
INTT32A00A	T32A Timer A Timer counter increment every 1ms for switch processing
*1	UART transmit interrupt
*2	UART error interrupt

*1 For SBK-M4KN/SBK-M4KN10, "INTSC0TX", for AdBun-M3HQF10/AdBun-M3HQA, "INTUART0TX"
*2 For SBK-M4KN/SBK-M4KN10, "INTSC0ERR", for AdBun-M3HQF10/AdBun-M3HQA, "INTUART0ERR"

6.4. Configuration

“main.c” configuration setting.

Configuration	Current Value	Description
Character string 1	*1	Character string to send
Communication control selection	*2 NODMAC	Switchable between NODMAC (does not use DMAC) and DMA (uses DMAC)

*1 For SBK-M4KN/SBK-M4KN10, "TMPM4KNFYA¥n"
For AdBun-M3HQF10, "TMPM3HQF10"
For AdBun-M3HQA, "TMPM3HQFDA"
*2 For details on how to switch when using DMAC, see Chapter 6.6.

6.5. Example of Terminal Emulator Output

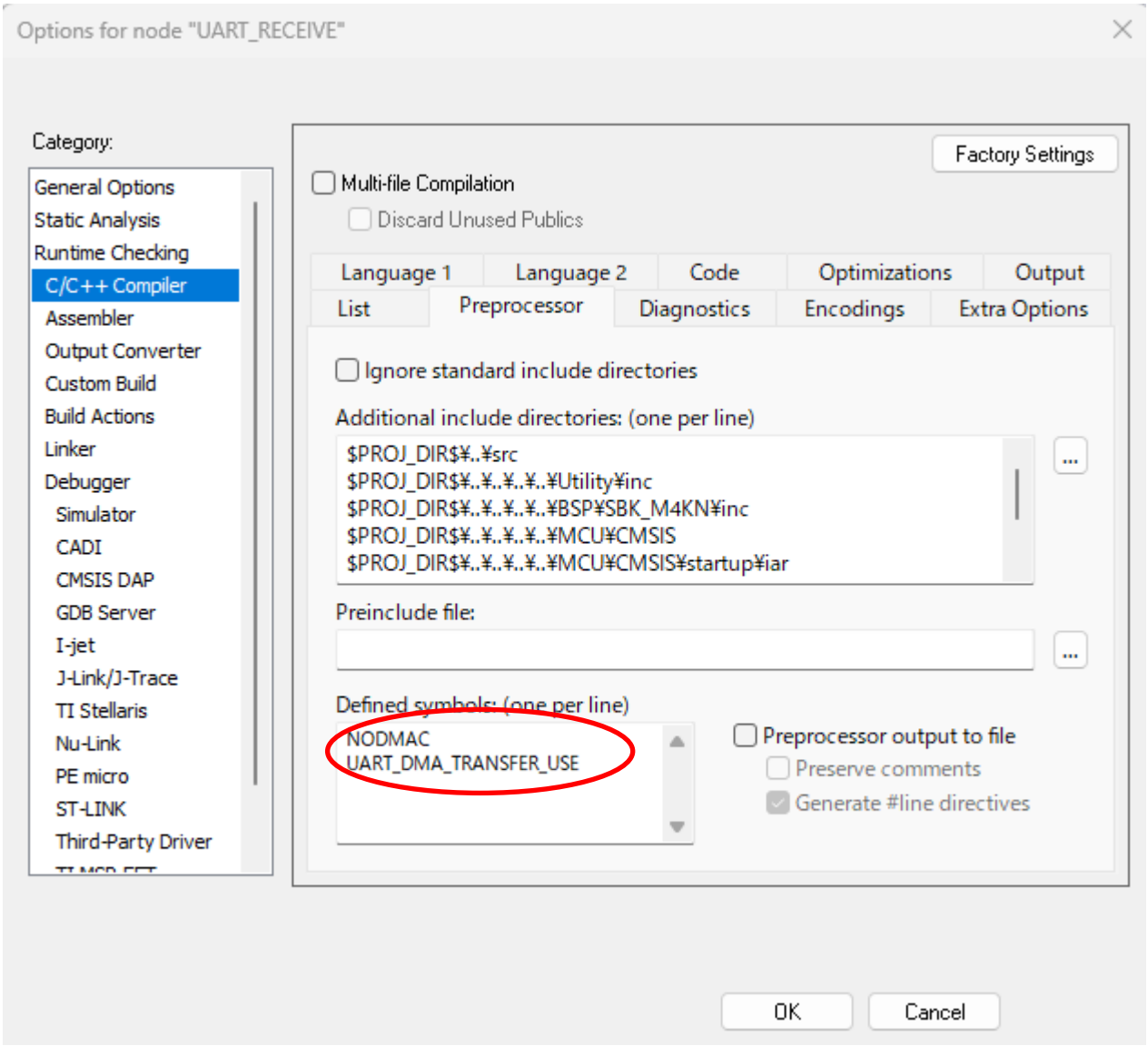
Outputs the sent character string

```
TMPM4KNFYA
TMPM4KNFYA
```

6.6. How to switch DMAC function

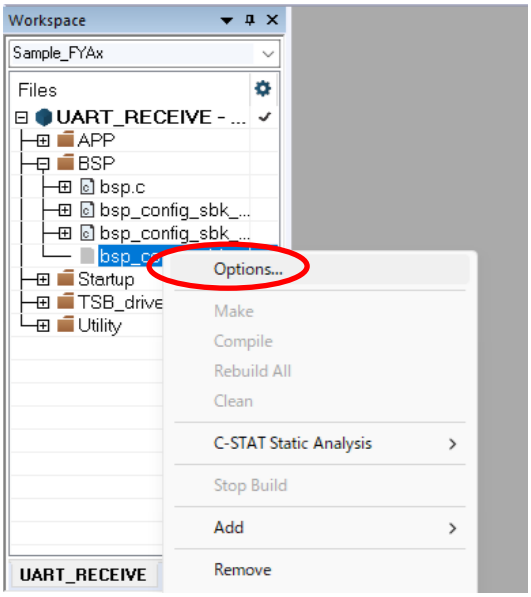
Follow the steps below to enable/disable the DMAC function.

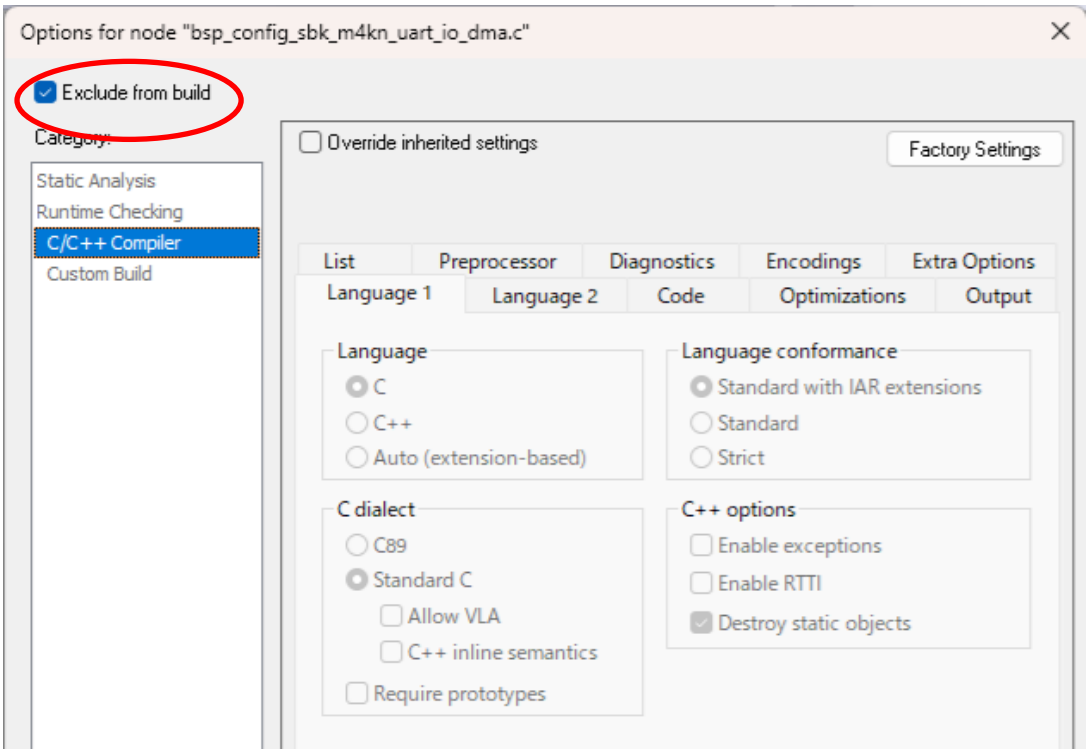
6.6.1. IAR Embedded Workbench



Open "Project" → "Options" → "C/C++ Compiler" → "Preprocessor".
Change "Defined symbol" as follows:

- If you do not use DMAC: “NODMAC”
- When using DMAC: “DMA” and "UART_DMA_TRANSFER_USE"





Right-click the file you want to configure, open options, and change "Exclude from build".
If you want to use the file, uncheck "Exclude from build", otherwise uncheck "Exclude from build".

DMAC disabled:

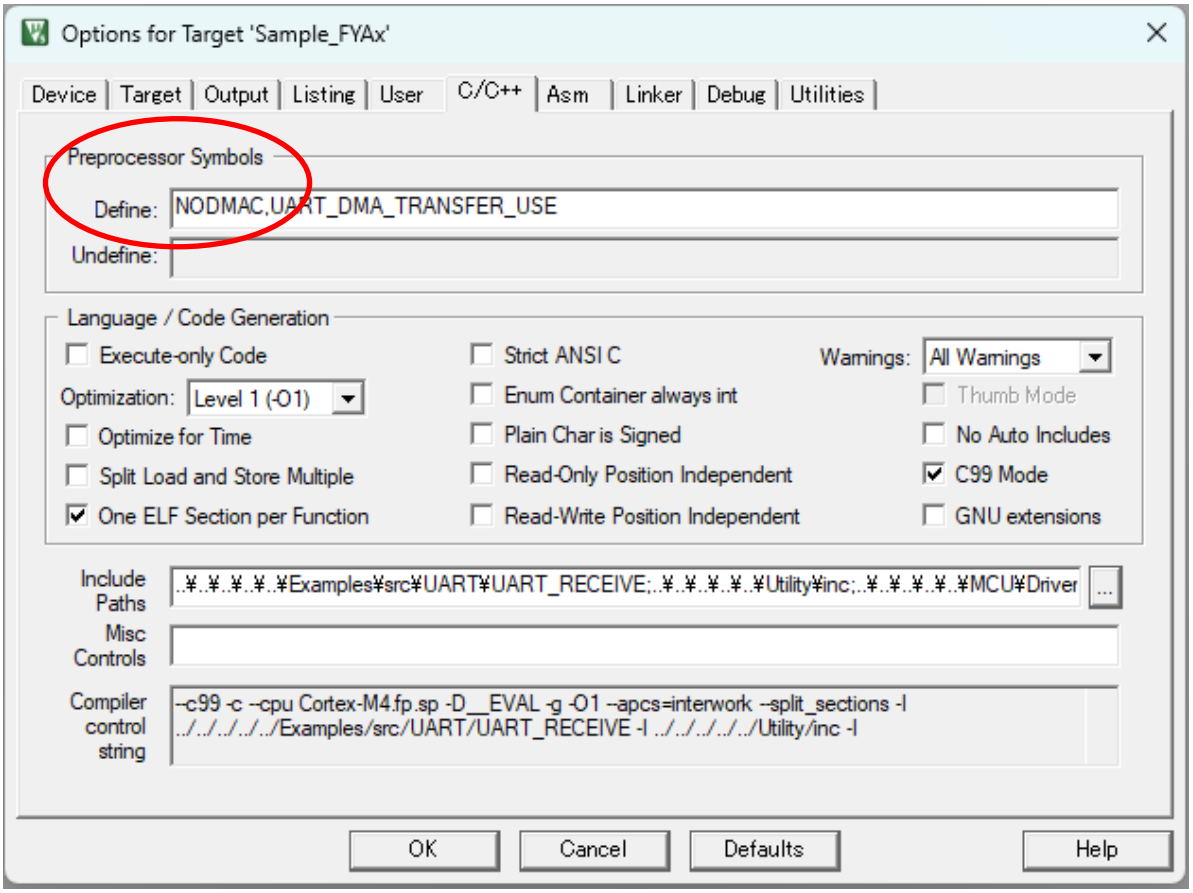
bsp_config_sbk_m4xn_uart_io.c	Use files
bsp_config_sbk_m4xn_uart_io_dma.c	Don't use files

DMAC enabled:

bsp_config_sbk_m4xn_uart_io.c	Don't use files
bsp_config_sbk_m4xn_uart_io_dma.c	Use files

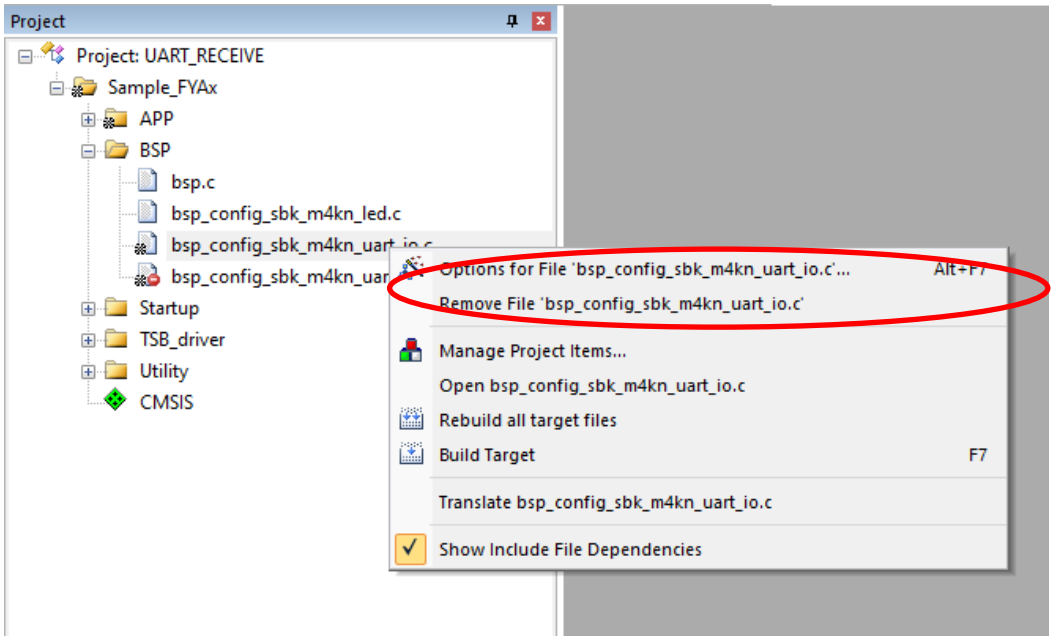
Please build after changing the settings.

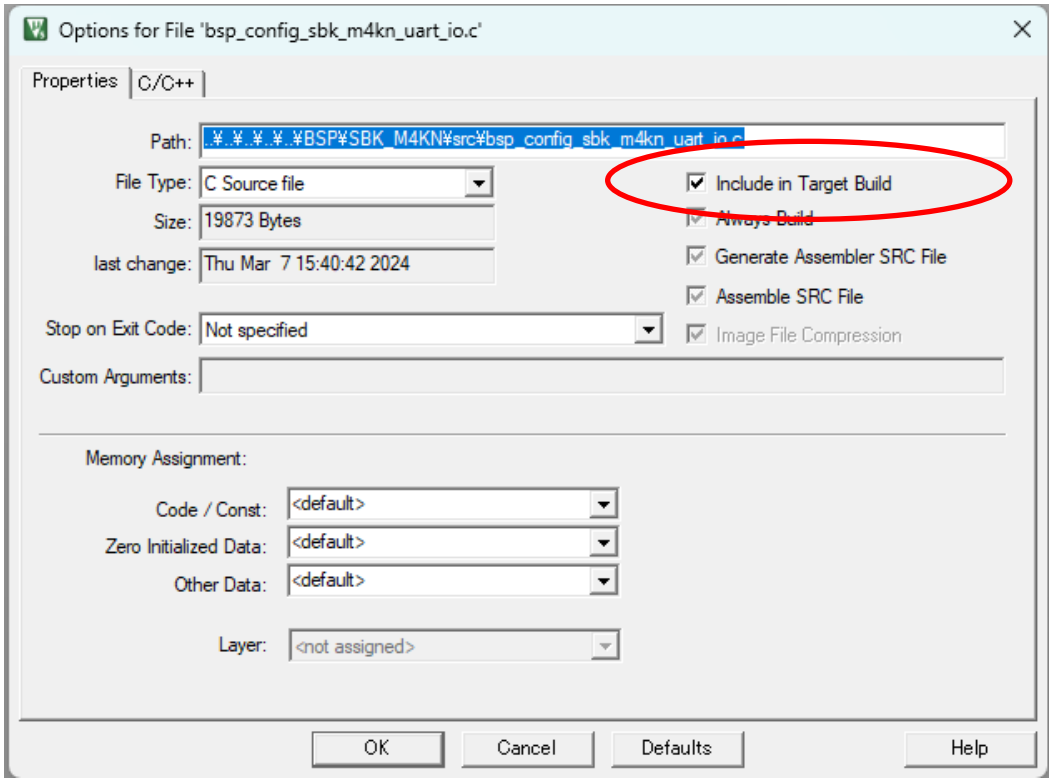
6.6.2. Keil µVision



Open “Project” → “Options for Target ‘Sample’” → “C/C++”.
Change "Define:" of "Preprocessor Symbols" as shown below.

- If you do not use DMAC, select "NODMAC"
- "DMA" and "UART_DMA_TRANSFER_USE" when using DMAC





Right-click the file you want to configure, open Options for File ‘xxxx.c’ and change “Include in Target Build”. If you want to use the file, check "Include in Target Build", otherwise uncheck "Include in Target Build".

DMAC disabled:

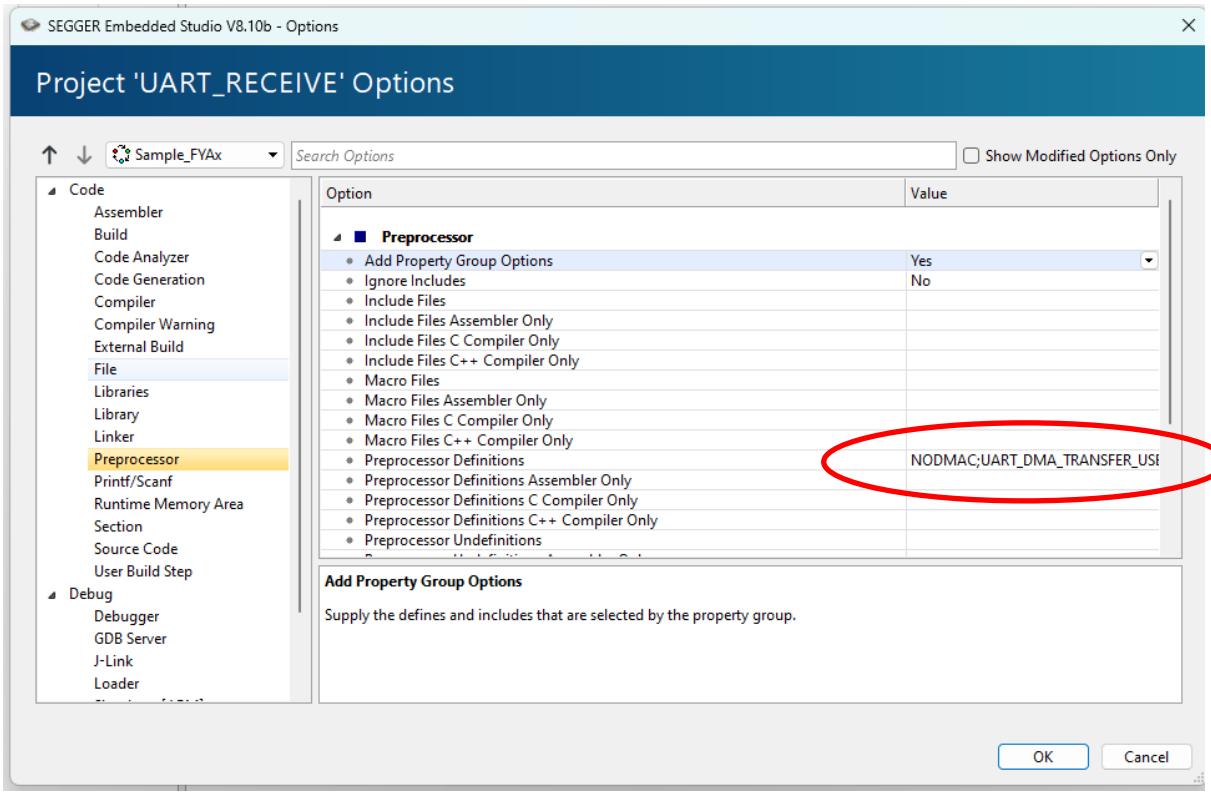
bsp_config_sbk_m4xn_uart_io.c	Use files
bsp_config_sbk_m4xn_uart_io_dma.c	Don't use files

DMAC enabled:

bsp_config_sbk_m4xn_uart_io.c	Don't use files
bsp_config_sbk_m4xn_uart_io_dma.c	Use files

Please build after changing the settings.

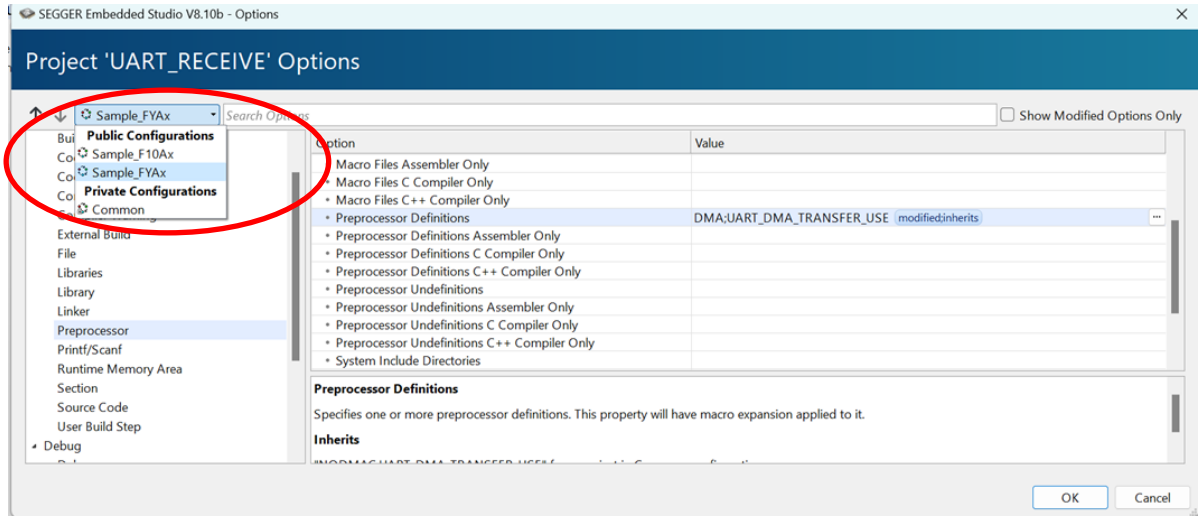
6.6.3. SEGGER Embedded Studio

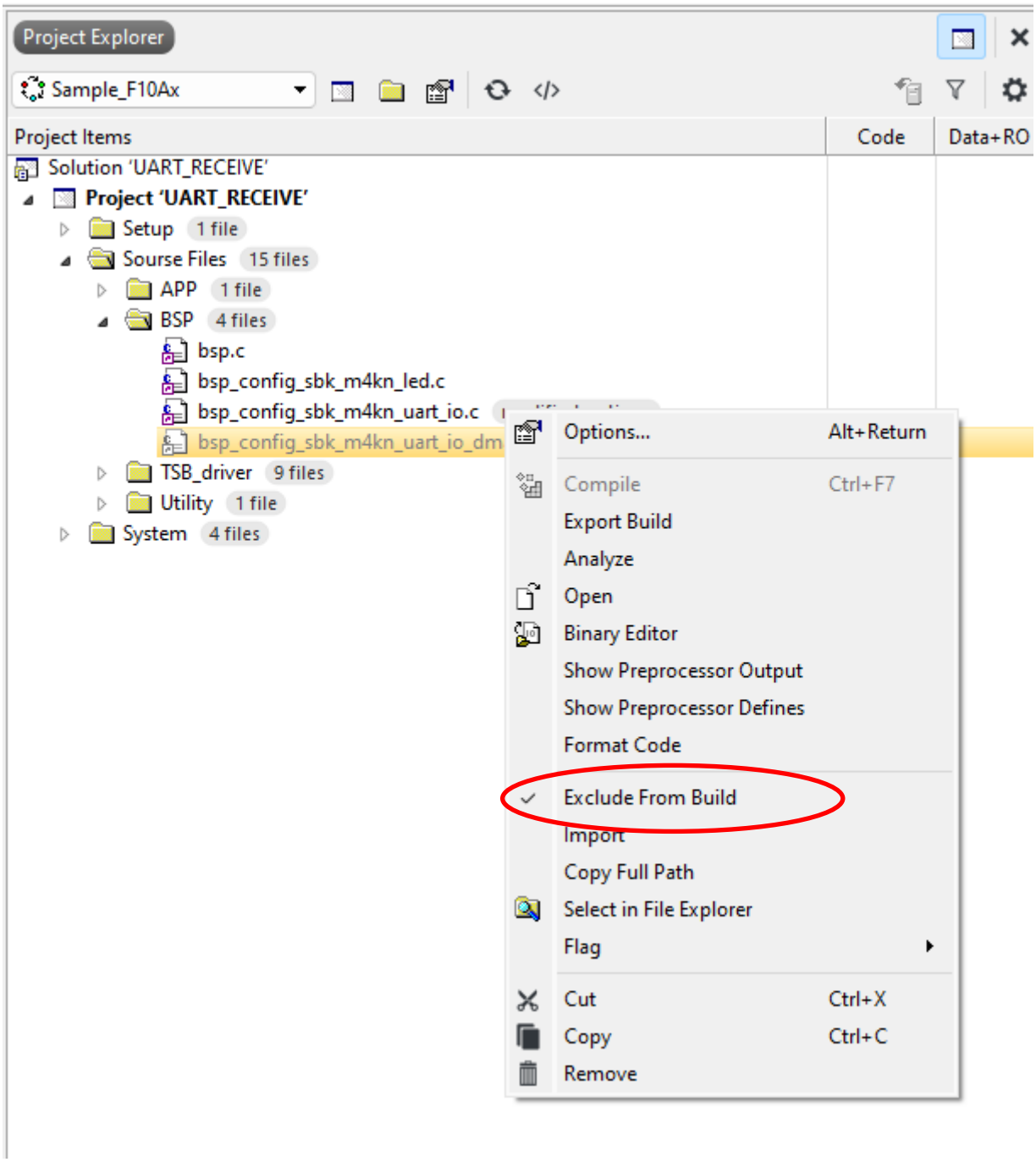


Open "Project" → "Options" → "Preprocessor".
Change "Preprocessor Definitions" as shown below.

- If you do not use DMAC, select "NODMAC"
- "DMA" and "UART_DMA_TRANSFER_USE" when using DMAC

*Change "Common" as well as "Sample_xxx".





Right-click the file you want to configure and change "Exclude From Build".
If you want to use a file, uncheck "Exclude From Build", otherwise check "Exclude From Build".

DMAC disabled:

bsp_config_sbk_m4xn_uart_io.c	Use files
bsp_config_sbk_m4xn_uart_io_dma.c	Don't use files

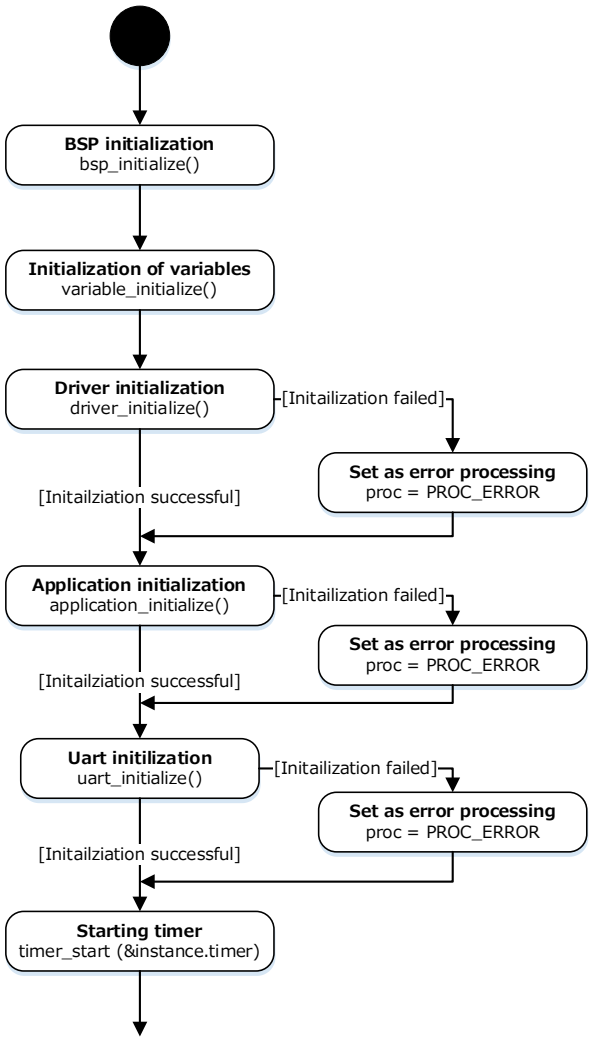
DMAC enabled:

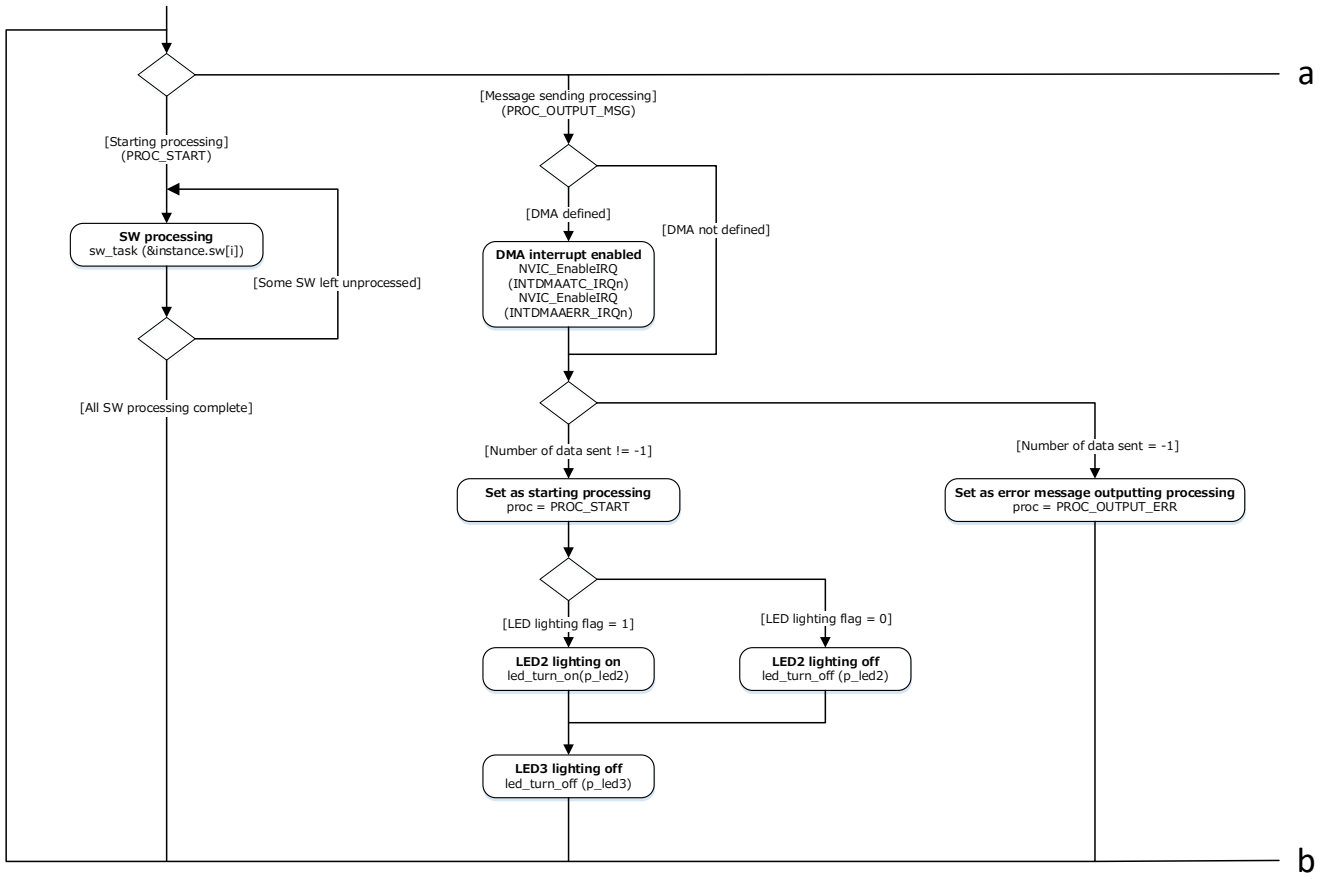
bsp_config_sbk_m4xn_uart_io.c	Don't use files
bsp_config_sbk_m4xn_uart_io_dma.c	Use files

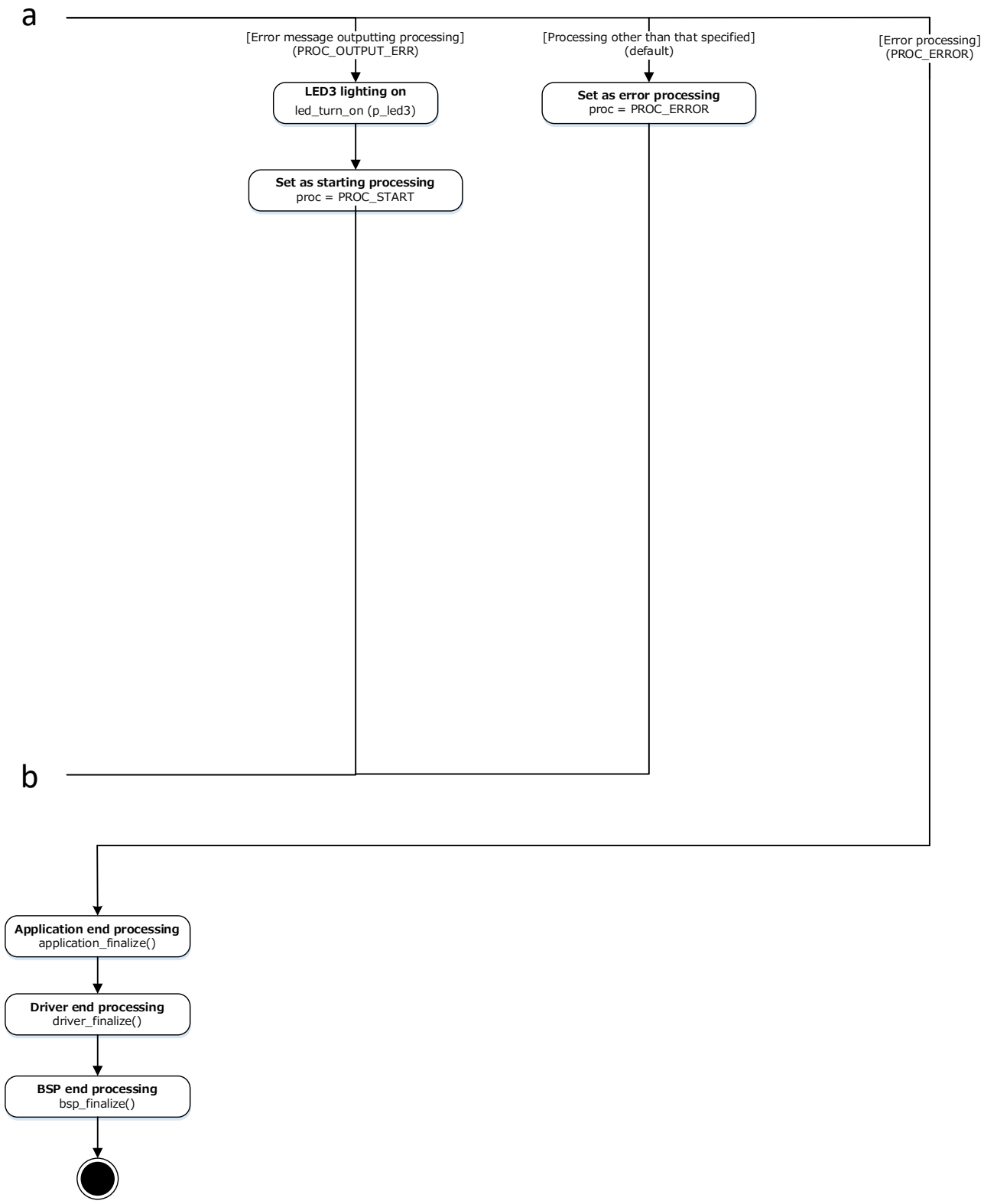
Please build after changing the settings.

7. Activity diagram

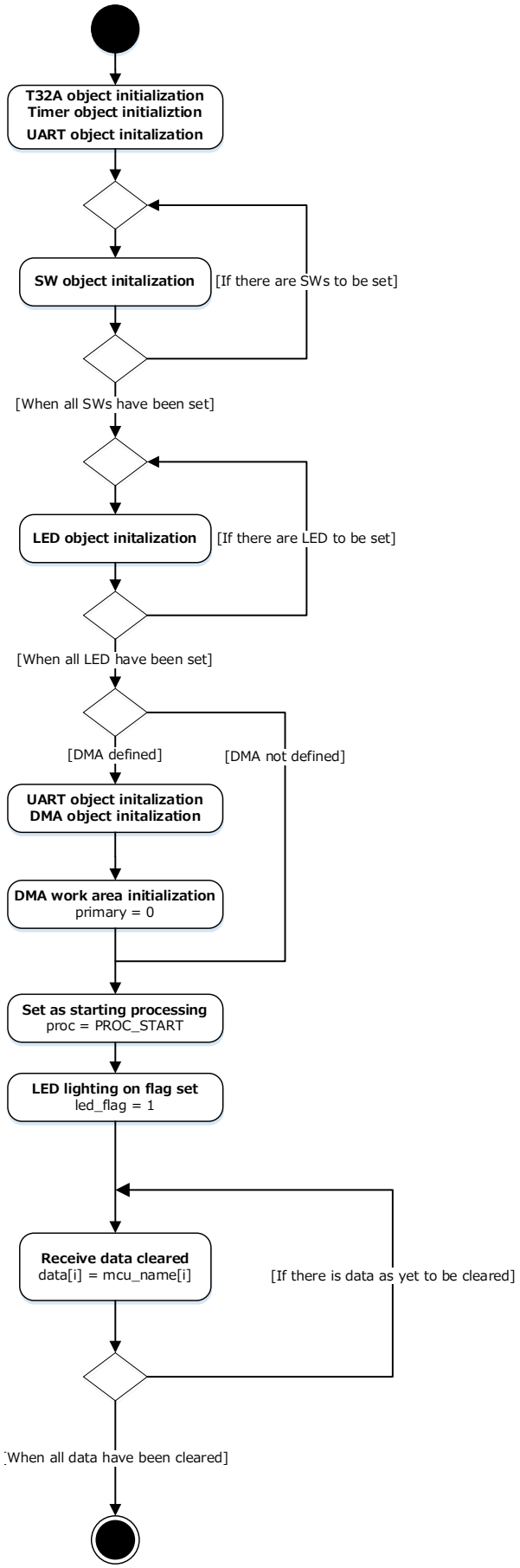
7.1. main



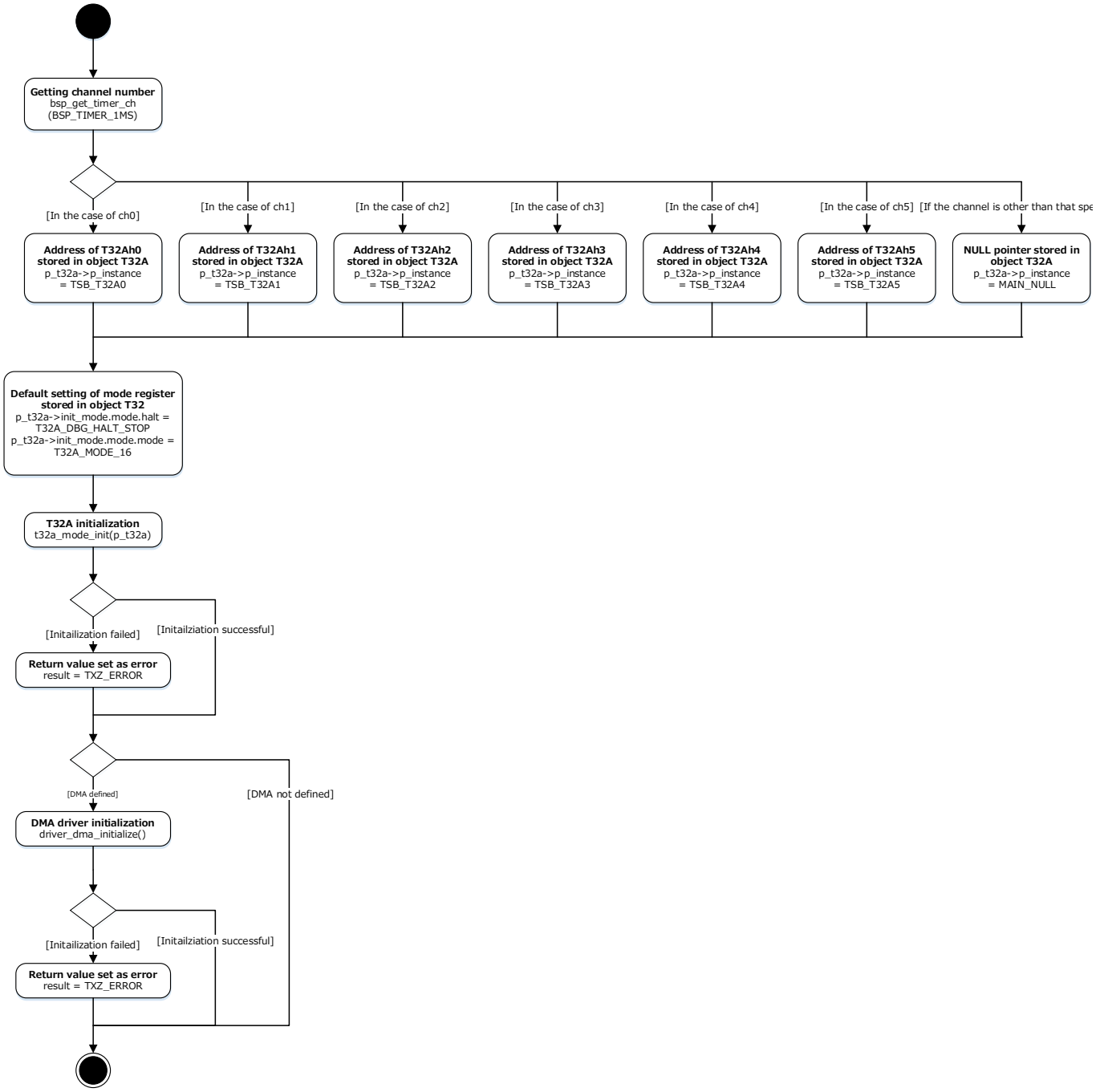




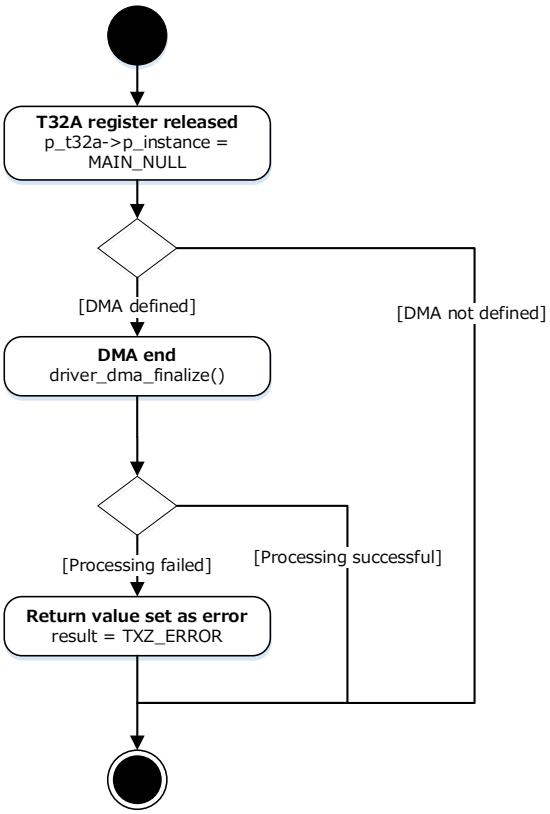
7.2. variable_initalize



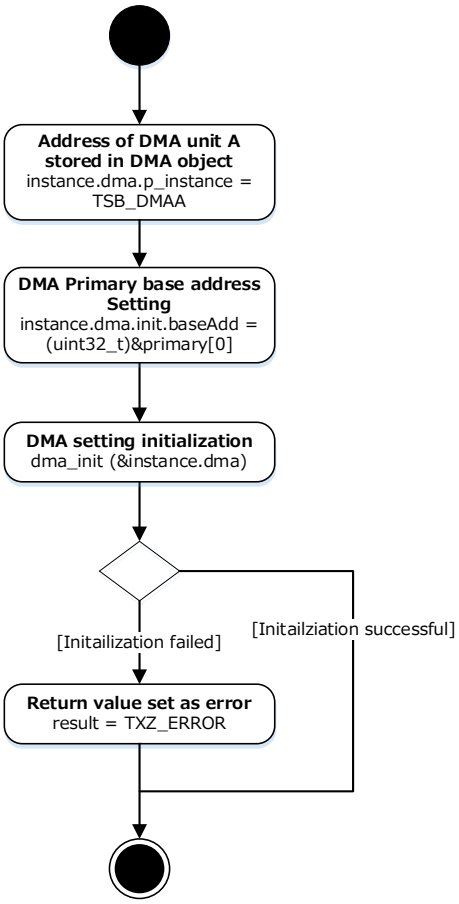
7.3. driver_initialize



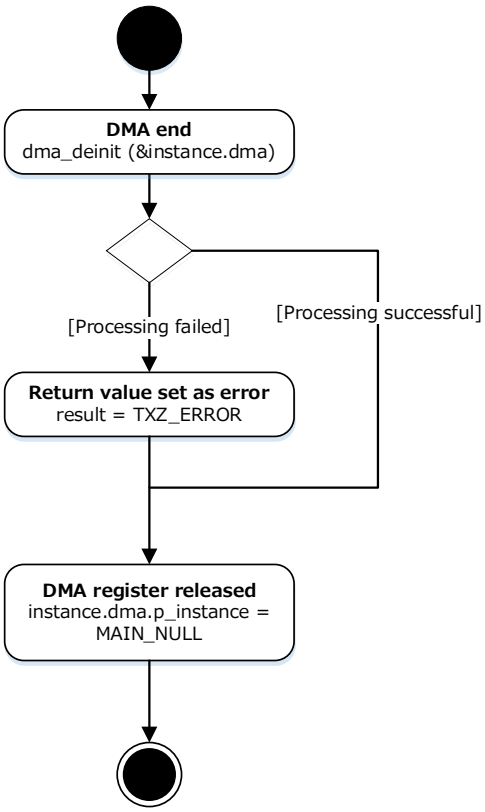
7.4. driver_finalize



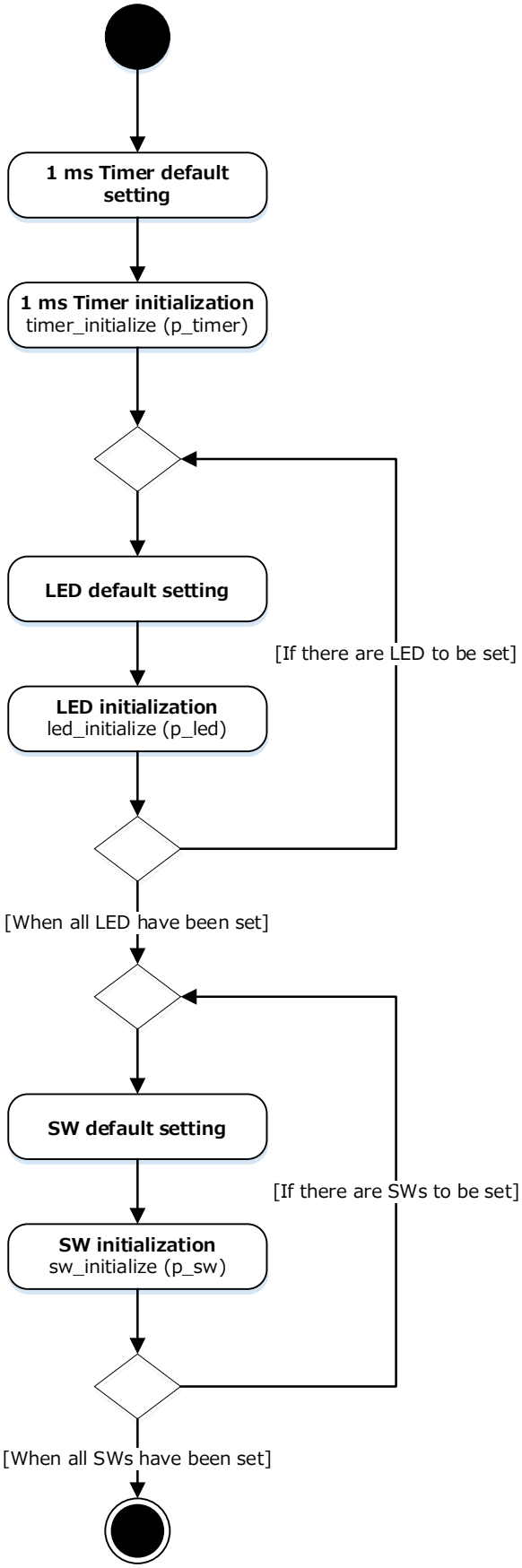
7.5. driver_dma_initialize



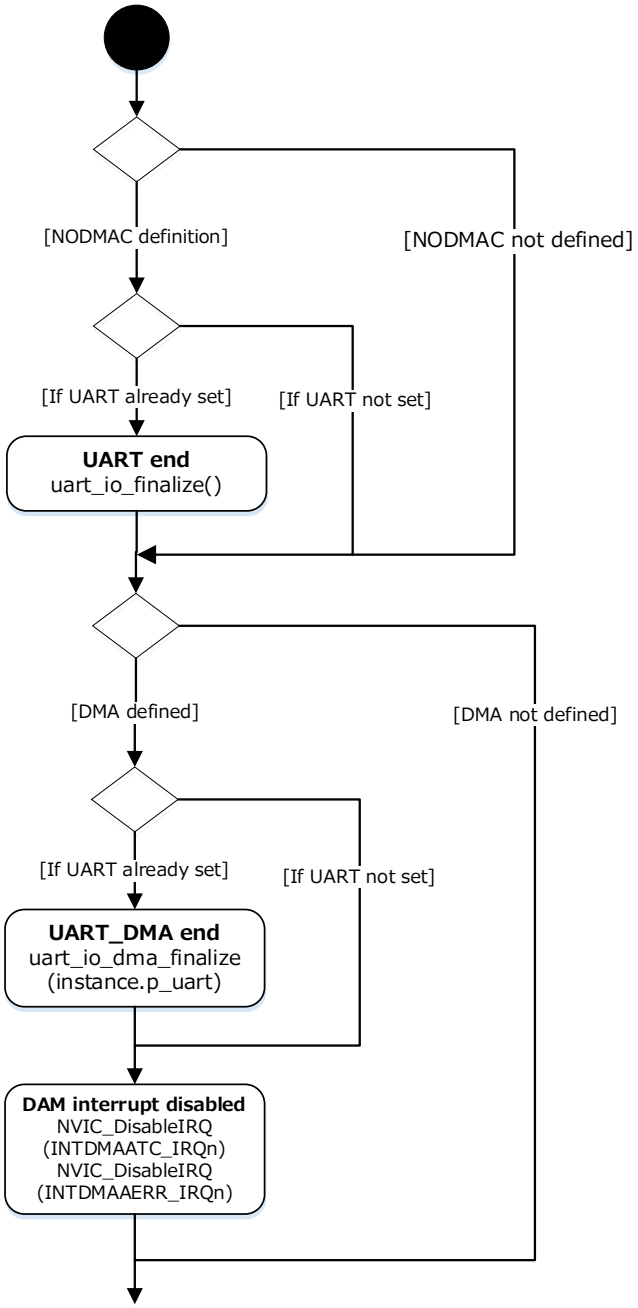
7.6. driver_dma_finalize

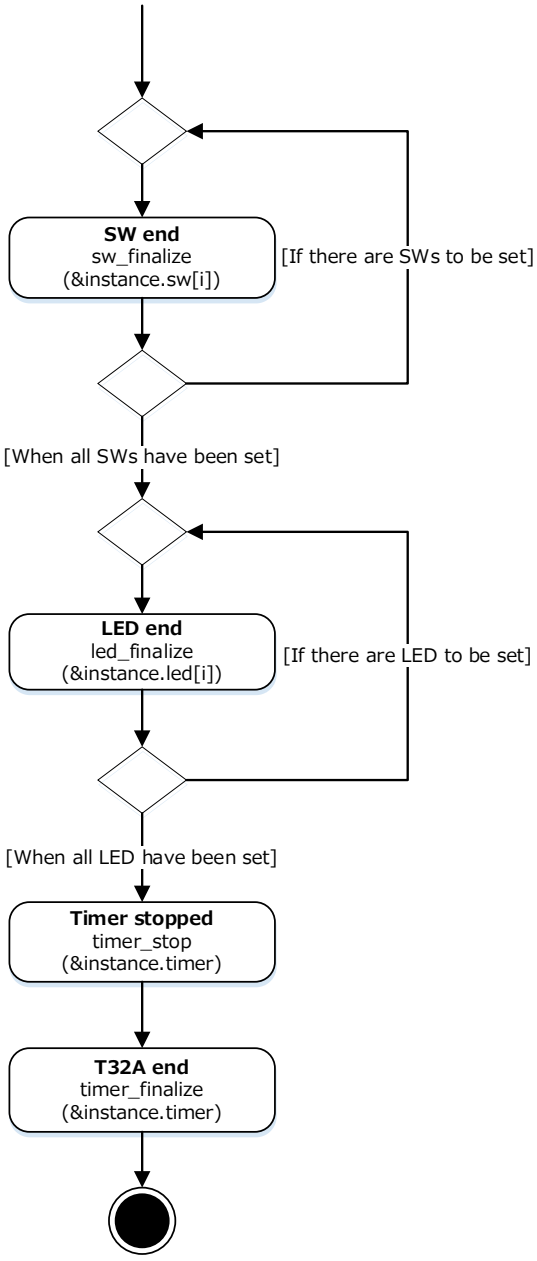


7.7. application_initialize

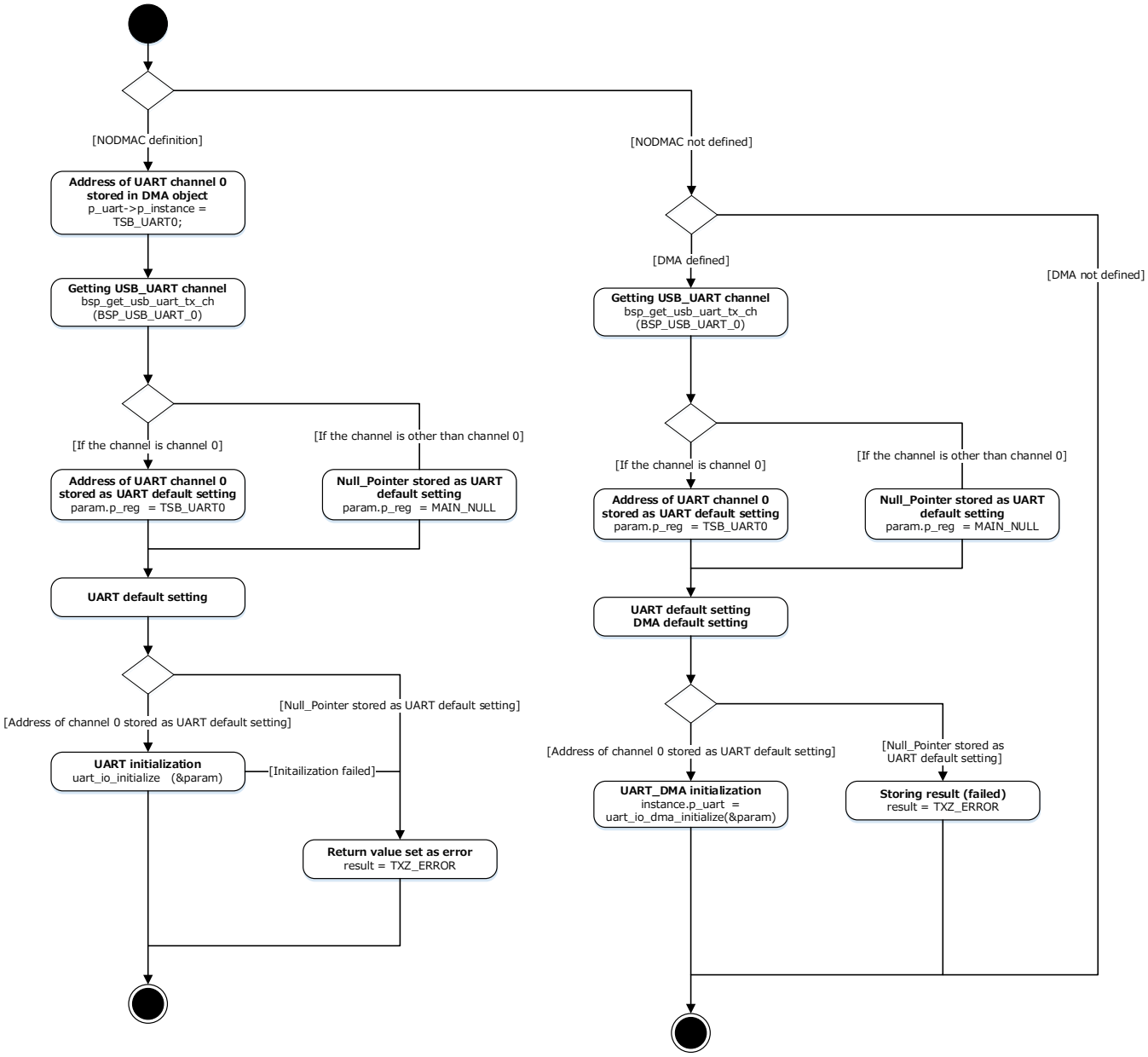


7.8. application_finalize

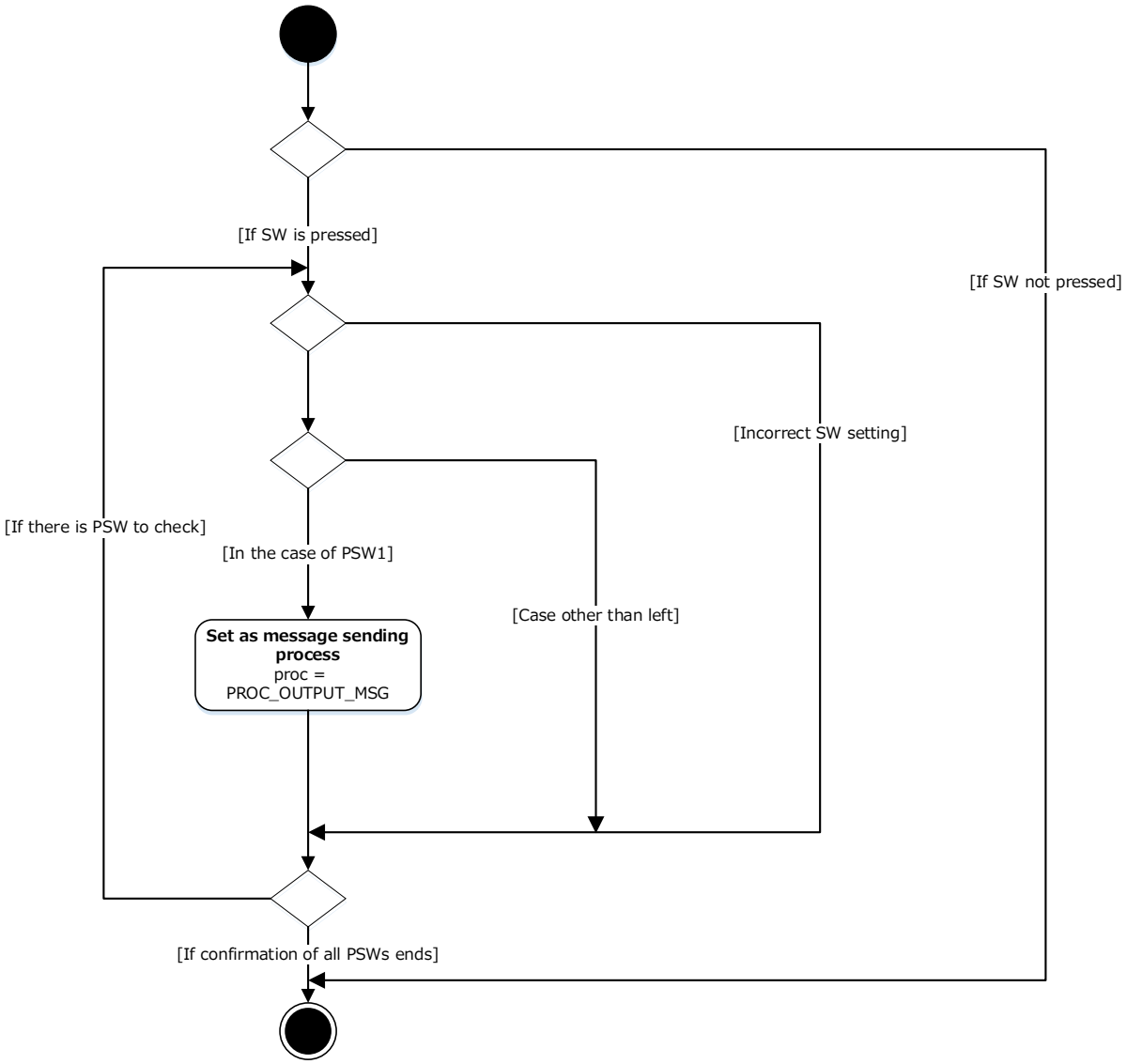




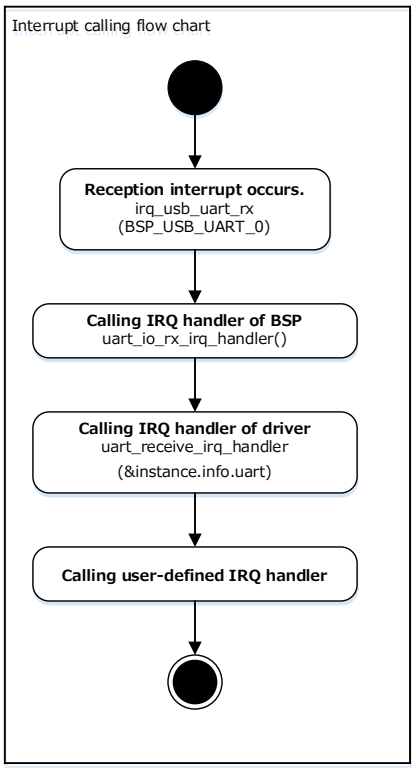
7.9. uart_initialize

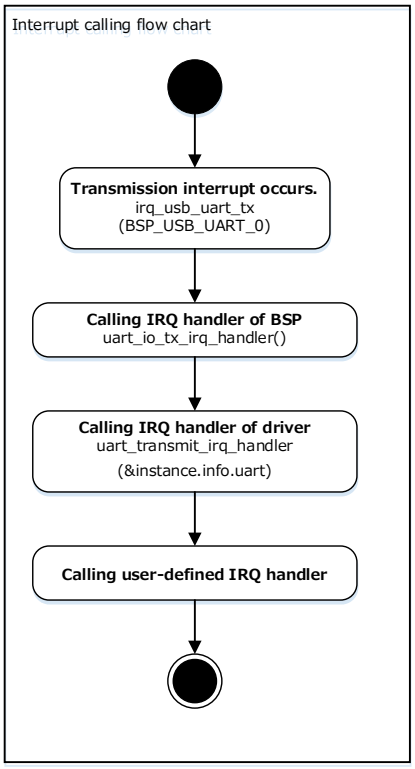


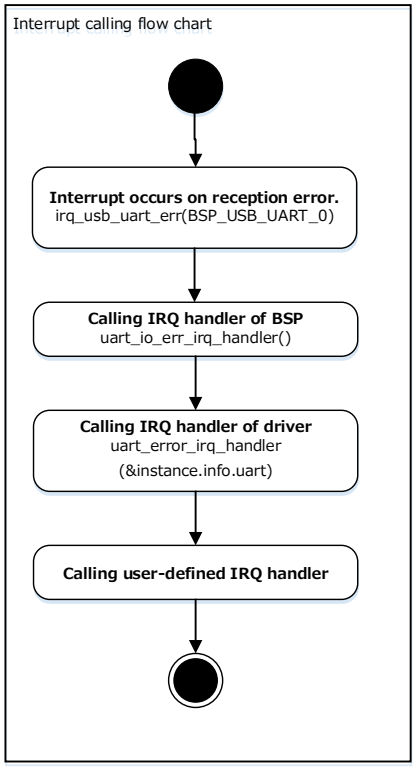
7.10. sw_state_change_handler

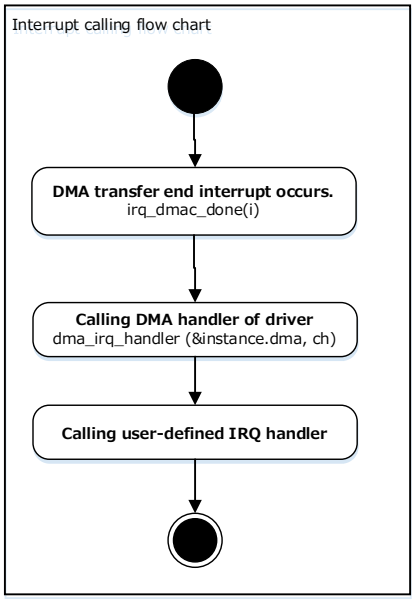


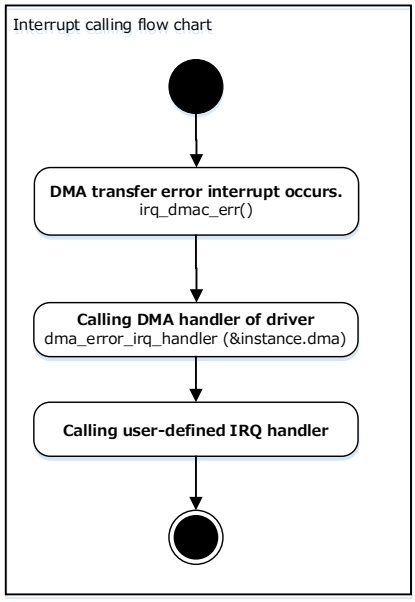
7.11. Interrupt

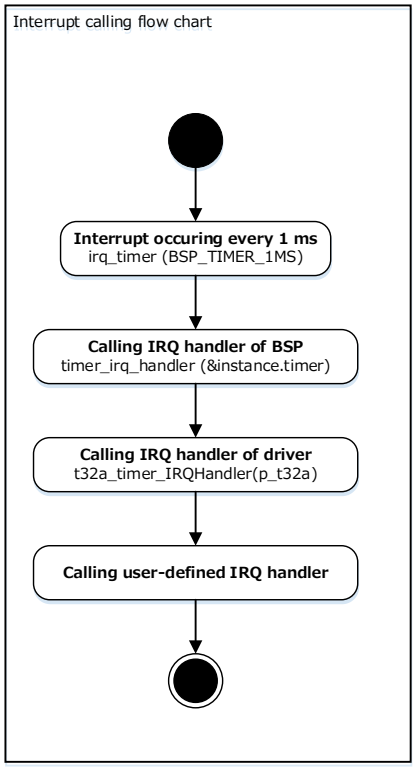


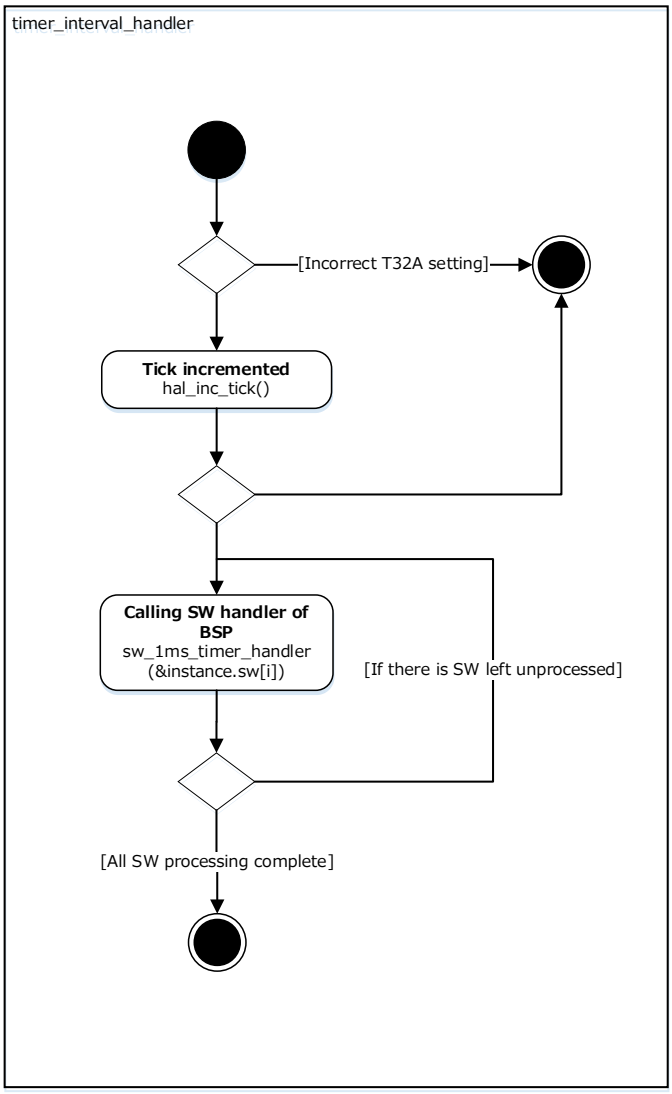











timer_interval_handler
[Incorrect T32A setting]
Tick incremented
hal_inc_tick()
Calling SW handler of BSP
sw_1ms_timer_handler
(&instance.sw[i])
[If there is SW left unprocessed]
[All SW processing complete]

8. Revision History

Revision	Date	Description
1.0	2023-10-16	First release
1.1	2024-03-25	Added method to switch DMAC function
1.2	2024-07-16	Added detailed description of DMAC function switching

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