Application Note

TSPI_MASTER_TRANS
(TSPI-E)

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1. Preface

This application note describes the sample software for TSPI_MASTER_TRANS using Serial Peripheral Interface (SPI).
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
CRC	Cyclic Redundancy Check
DMA	Direct Memory Access
Timer	T32A:32-bit Timer Event Counter
TSPI	TOSHIBA Serial Peripheral Interface

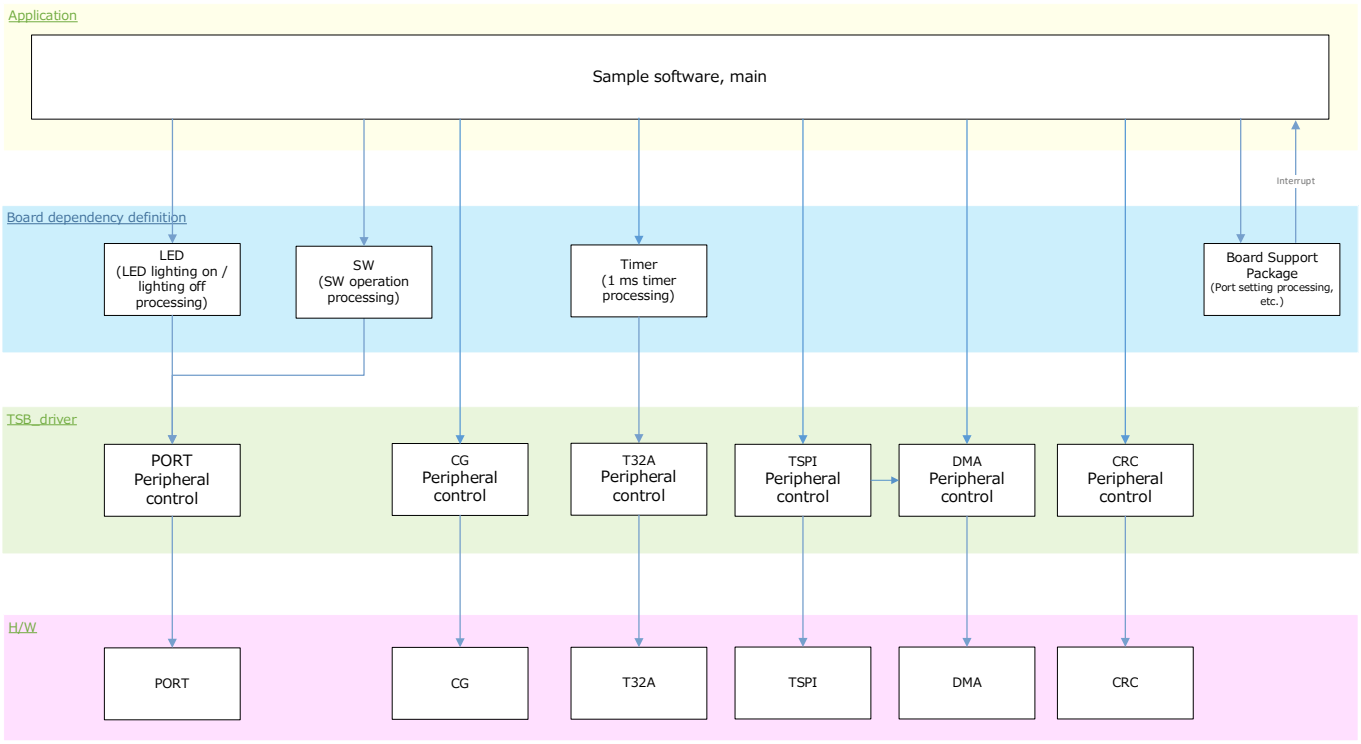
3. Reference Document

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
TSPI_MASTER_TRANS	Sample program of SPI function (Master Trans)

5. Configuration Diagram



6. Sample Program:TSPI_MASTER_TRANS

This sample software that uses the Master transmission processing function of the SPI communication function to send a character string when the switch is pressed, and switches the LED turn on / turn off each time data transmission is completed.
This sample software allows you to select FIFO_MODE or DMA_MODE.

6.1. Outlines of Operation

Turns off BSP_LED_1 and BSP_LED_3.
When BSP_PSW_1 is pressed, BSP_LED_3 is turned off and character string 1 is sent.
Switches the lighting status (lighting on / lighting off) of BSP_LED_1.
When an SPI write 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
TSPI	BSP_TSPI_1	SPI Communication
T32A	BSP_T32A_TIMER_1	Interval timer
PORT(Push-Switch)	BSP_PSW_1	Event Trigger
PORT(LED)	BSP_LED_1	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 SW processing
*1	SPI Transmit interrupt
*2	SPI error interrupt
INTDMAATC	DMA Transmit interrupt
INTDMAAERR	DMA error interrupt

*1 For SBK-M4KN, "INTSC0TX", for AdBun-M3HQF10, "INTT1TX"
*2 For SBK-M4KN, "INTSC0ERR", for AdBun-M3HQF10, "INTT1ERR"

6.4. Configuration

“main.c” configuration setting.

Configuration	Current Value	Description
MCU_NAME	*1	Character string
DATA_LENGTH	14	Data send size (Unit: byte) Set to 16 by setting the compile switch CHK_CODE
CHK_CODE	CHK_CODE_CRC16	CHK_CODE_CRC16 and CHK_CODE_CRC32 can be switched
TX_MODE	FIFO_MODE	FIFO_MODE and DMA_MODE can be switched
TX_FILL_LEVEL	3	Send Fill level setting

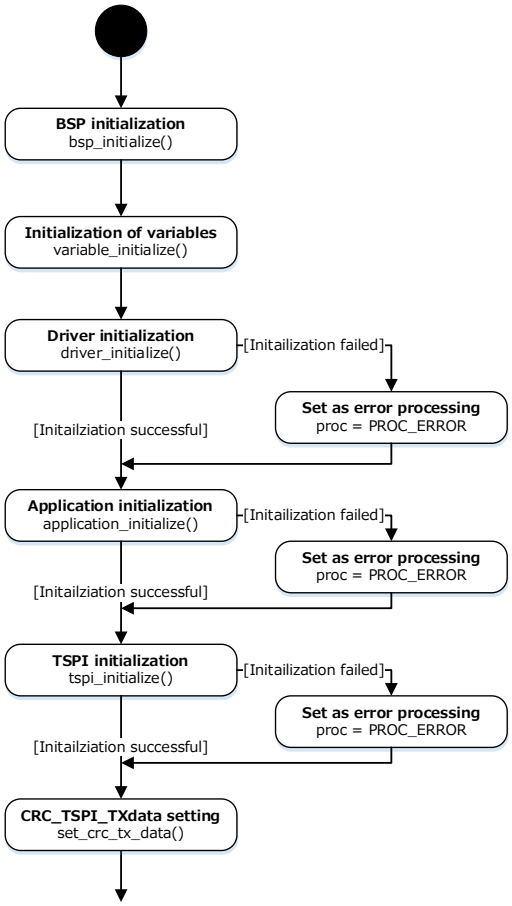
*1 For SBK-M4KN, " TMPM4KNFYA ", for AdBun-M3HQF10, " TMPM3HQF10"

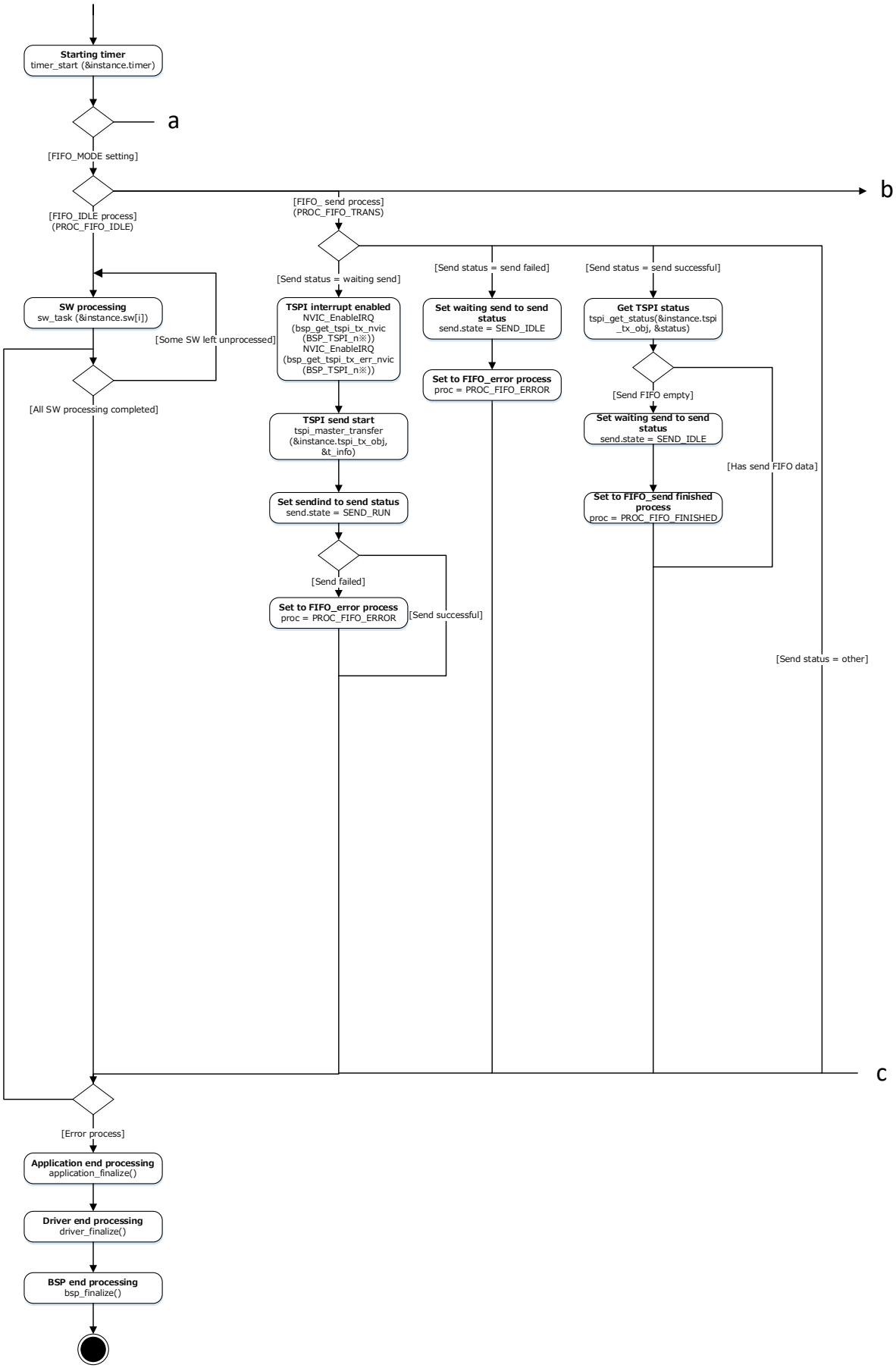
6.5. Example of Terminal Emulator Output

Nothing.

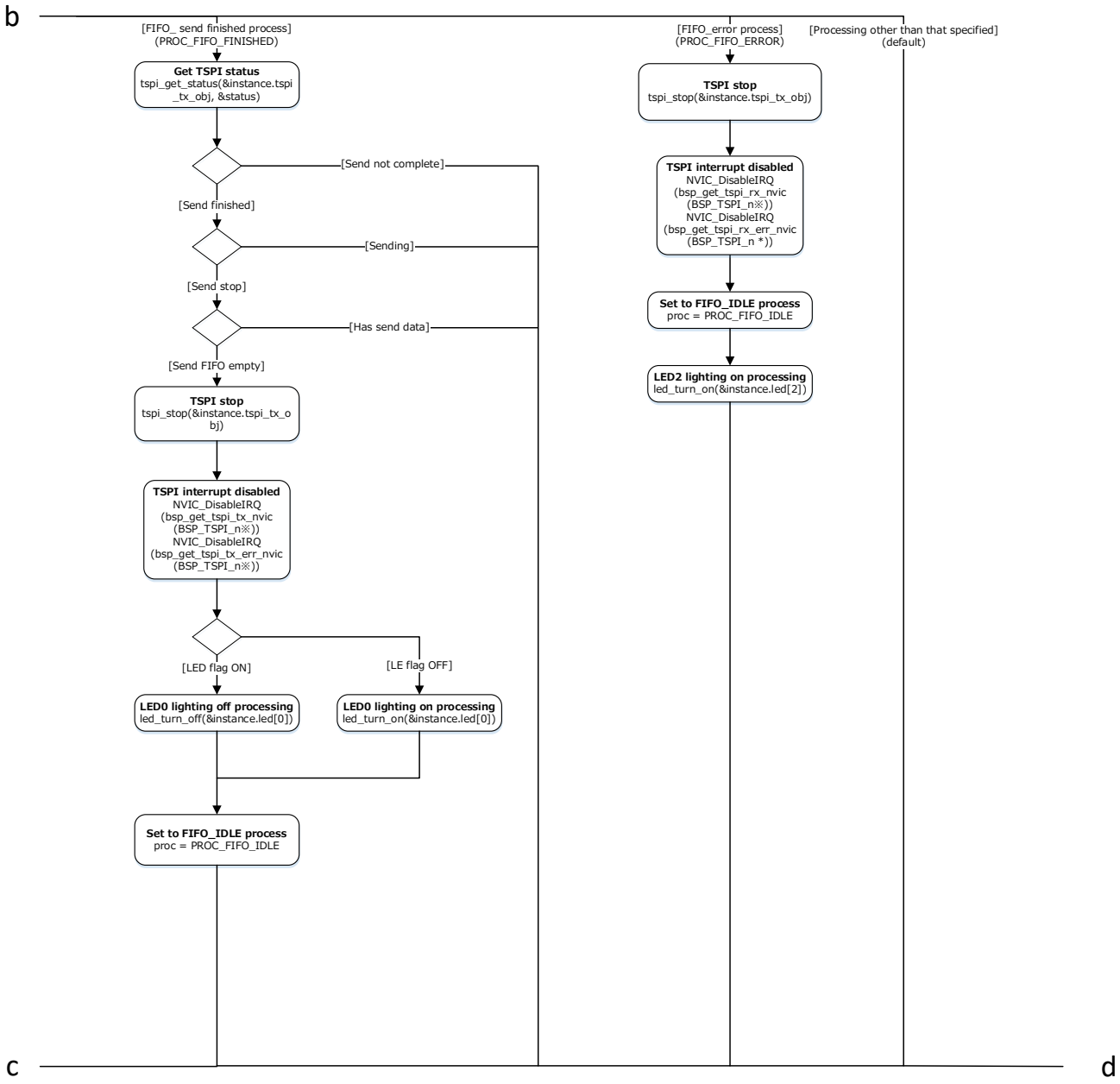
7. Activity diagram

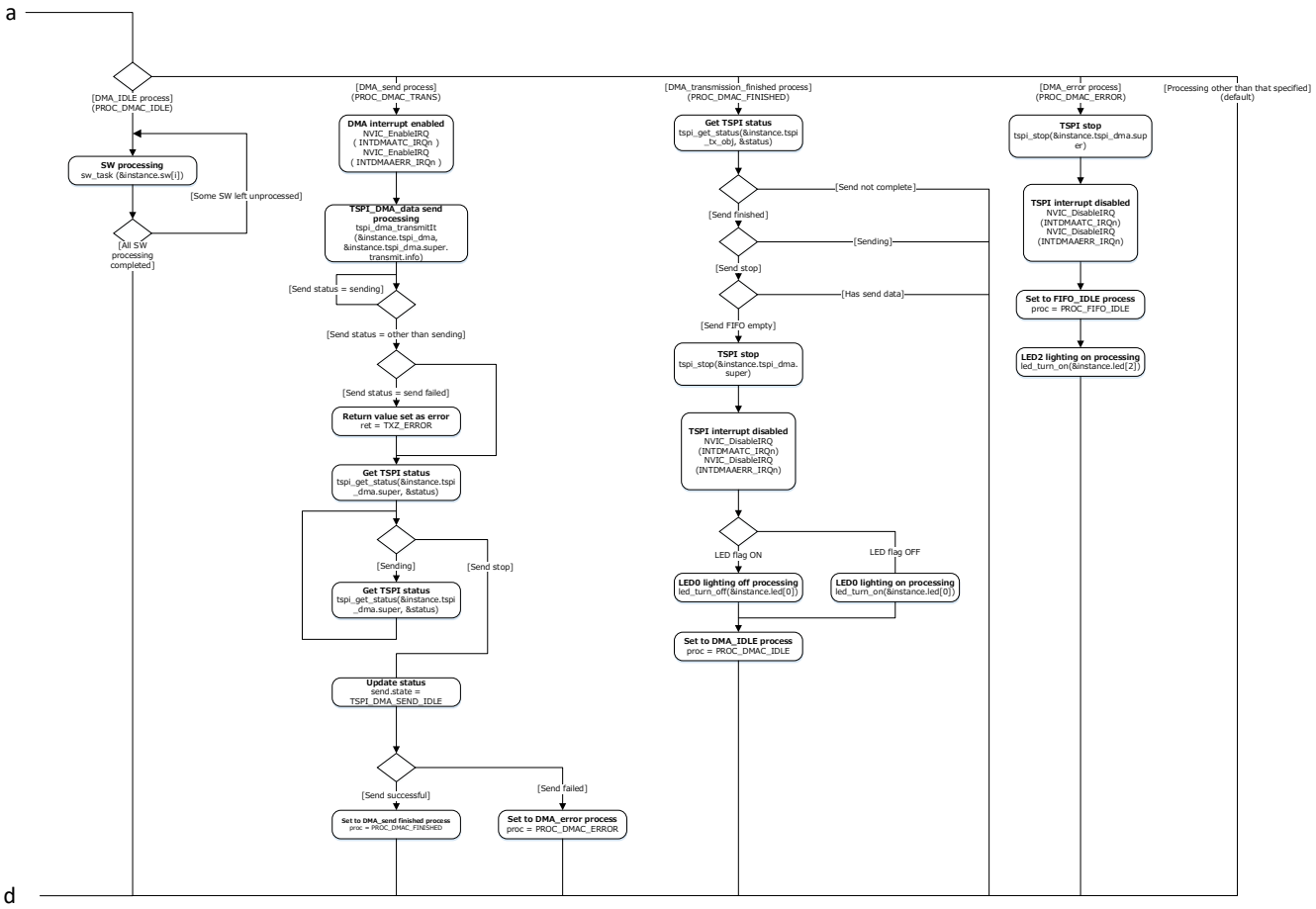
7.1. main



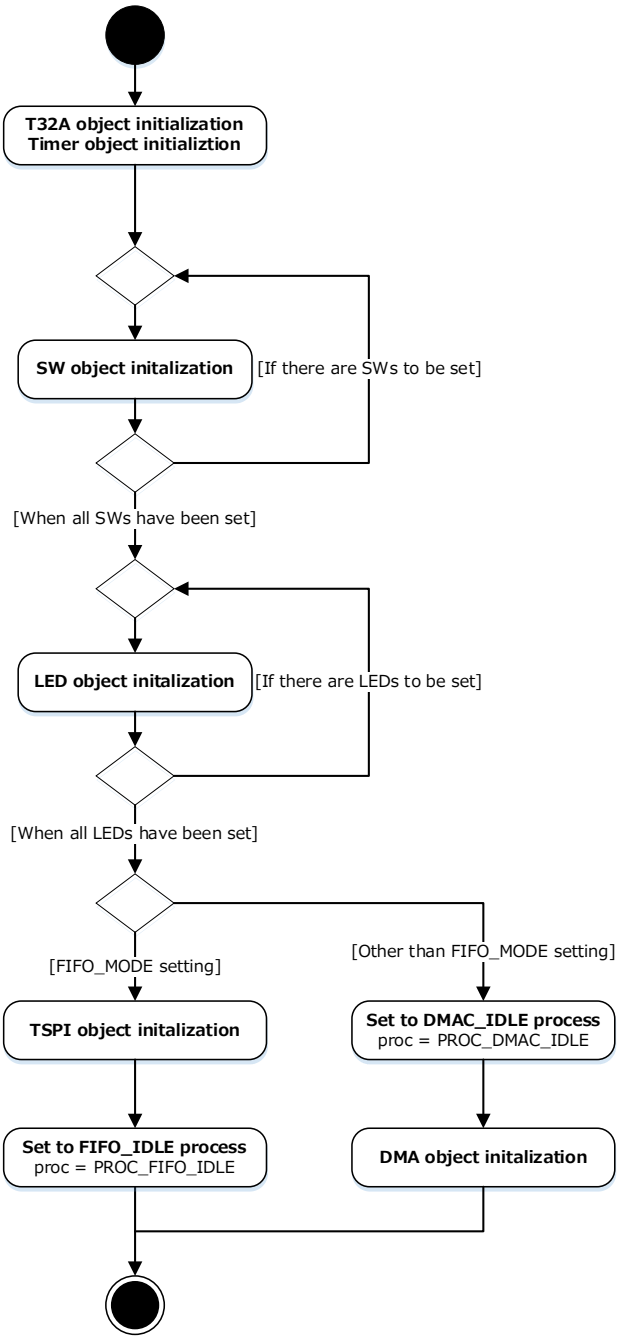


* In the case of M4KN/MN, n=0; in the case of M3H, n=1

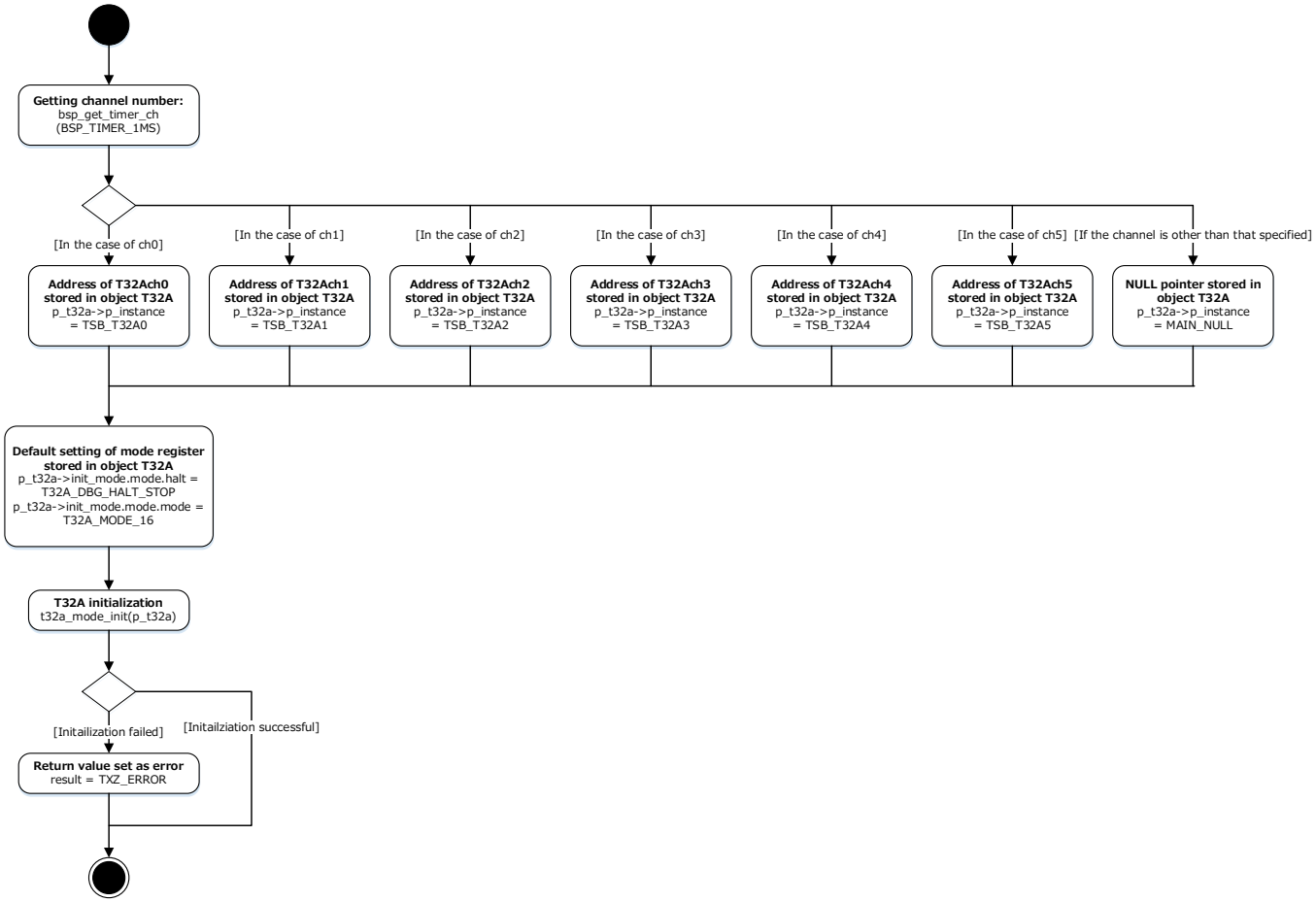

b
[FIFO_ send finished process]
(PROC_FIFO_FINISHED)
Get TSPI status
tspi_get_status(&instance.tspi_tx_obj, &status)
[Send not complete]
[Send finished]
[Sending]
[Send stop]
[Has send data]
[Send FIFO empty]
TSPI stop
tspi_stop(&instance.tspi_tx_obj)
TSPI interrupt disabled
NVIC_DisableIRQ
(bsp_get_tspi_tx_nvic
(BSP_TSPI_n※))
NVIC_DisableIRQ
(bsp_get_tspi_tx_err_nvic
(BSP_TSPI_n※))
[LED flag ON]
[LE flag OFF]
LED0 lighting off processing
led_turn_off(&instance.led[0])
LED0 lighting on processing
led_turn_on(&instance.led[0])
Set to FIFO_IDLE process
proc = PROC_FIFO_IDLE
[FIFO_error process]
(PROC_FIFO_ERROR)
TSPI stop
tspi_stop(&instance.tspi_tx_obj)
TSPI interrupt disabled
NVIC_DisableIRQ
(bsp_get_tspi_rx_nvic
(BSP_TSPI_n※))
NVIC_DisableIRQ
(bsp_get_tspi_rx_err_nvic
(BSP_TSPI_n *))
Set to FIFO_IDLE process
proc = PROC_FIFO_IDLE
LED2 lighting on processing
led_turn_on(&instance.led[2])
[Processing other than that specified]
(default)
c
d


a
[DMA_IDLE process]
(PROC_DMAC_IDLE)
SW processing
sw_task (&instance.sw[i])
[Some SW left unprocessed]
[All SW processing completed]
[DMA_send process]
(PROC_DMAC_TRANS)
DMA interrupt enabled
NVIC_EnableIRQ
(INTDMAATC_IRQn)
NVIC_EnableIRQ
(INTDMAAERR_IRQn)
TSPI_DMA_data send processing
tspi_dma_transmitIt
(&instance.tspi_dma,
&instance.tspi_dma.super.
transmit.info)
[Send status = sending]
[Send status = other than sending]
[Send status = send failed]
Return value set as error
ret = TXZ_ERROR
Get TSPI status
tspi_get_status(&instance.tspi
_dma.super, &status)
[Sending]
[Send stop]
Get TSPI status
tspi_get_status(&instance.tspi
_dma.super, &status)
Update status
send.state =
TSPI_DMA_SEND_IDLE
[Send successful]
[Send failed]
Set to DMA_send finished process
proc = PROC_DMAC_FINISHED
Set to DMA_error process
proc = PROC_DMAC_ERROR
[DMA_transmission_finished process]
(PROC_DMAC_FINISHED)
Get TSPI status
tspi_get_status(&instance.tspi
_tx_obj, &status)
[Send not complete]
[Send finished]
[Sending]
[Send stop]
[Has send data]
[Send FIFO empty]
TSPI stop
tspi_stop(&instance.tspi_dma.
super)
TSPI interrupt disabled
NVIC_DisableIRQ
(INTDMAATC_IRQn)
NVIC_DisableIRQ
(INTDMAAERR_IRQn)
LED flag ON
LED flag OFF
LED0 lighting off processing
led_turn_off(&instance.led[0])
LED0 lighting on processing
led_turn_on(&instance.led[0])
Set to DMA_IDLE process
proc = PROC_DMAC_IDLE
[DMA_error process]
(PROC_DMAC_ERROR)
TSPI stop
tspi_stop(&instance.tspi_dma.sup
er)
TSPI interrupt disabled
NVIC_DisableIRQ
(INTDMAATC_IRQn)
NVIC_DisableIRQ
(INTDMAAERR_IRQn)
Set to FIFO_IDLE process
proc = PROC_FIFO_IDLE
LED2 lighting on processing
led_turn_on(&instance.led[2])
[Processing other than that specified]
(default)
d

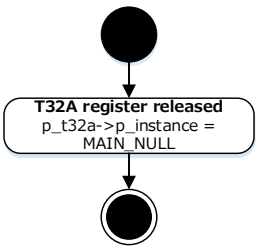
7.2. variable_initalize



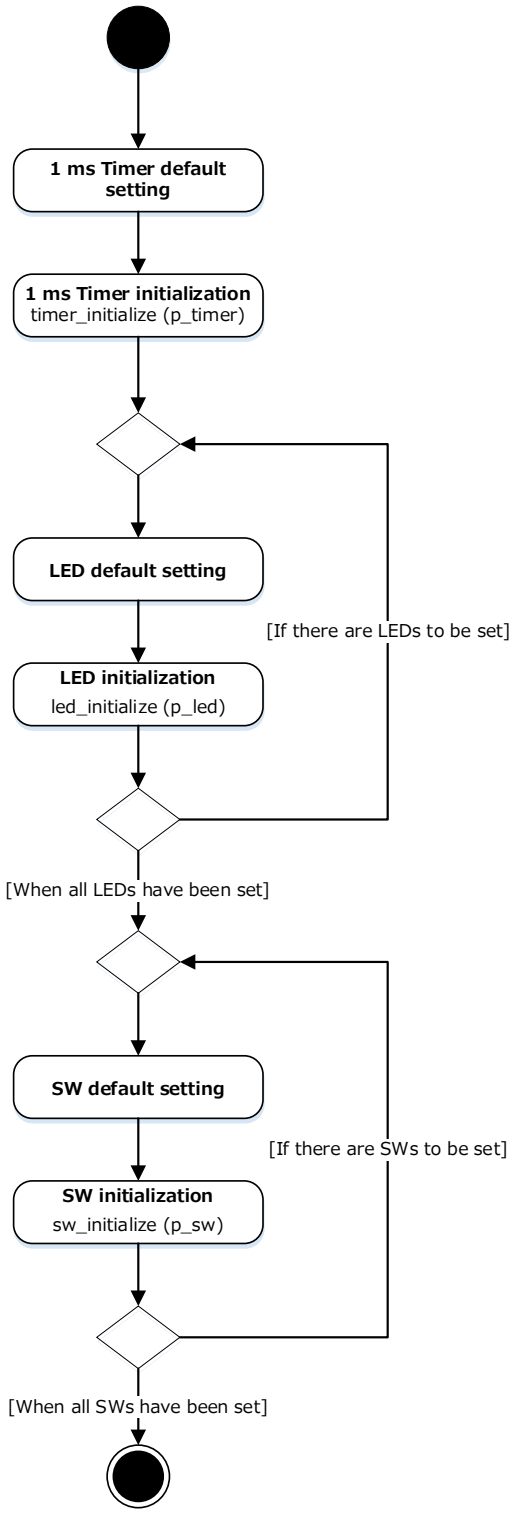
7.3. driver_initialize



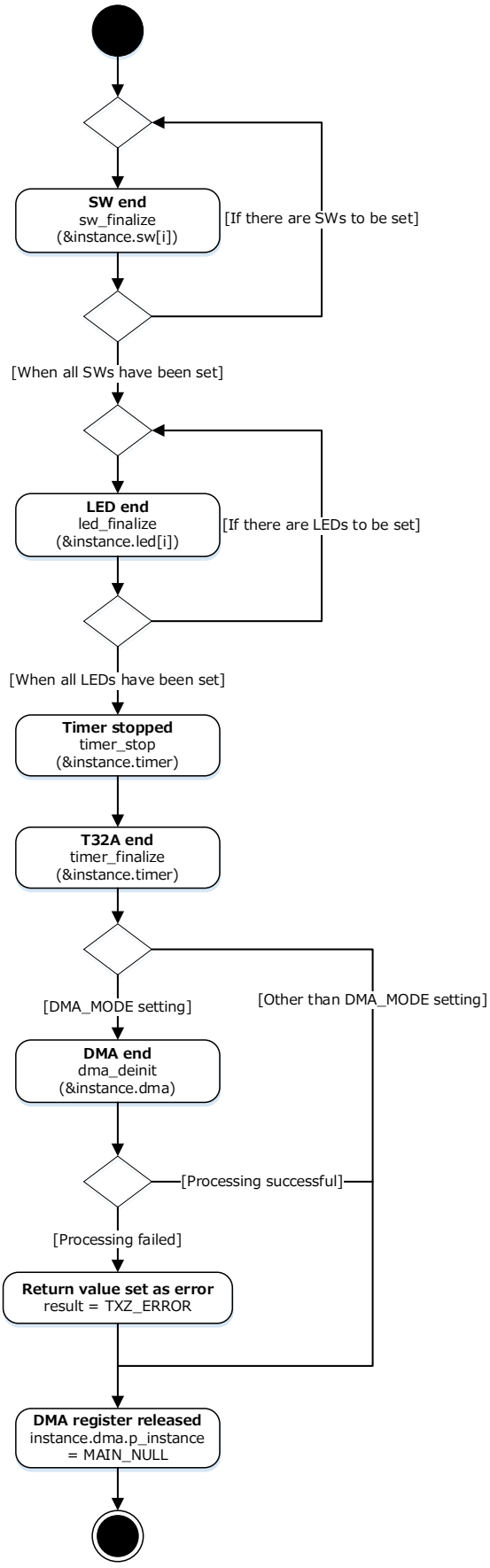
7.4. driver_finalize



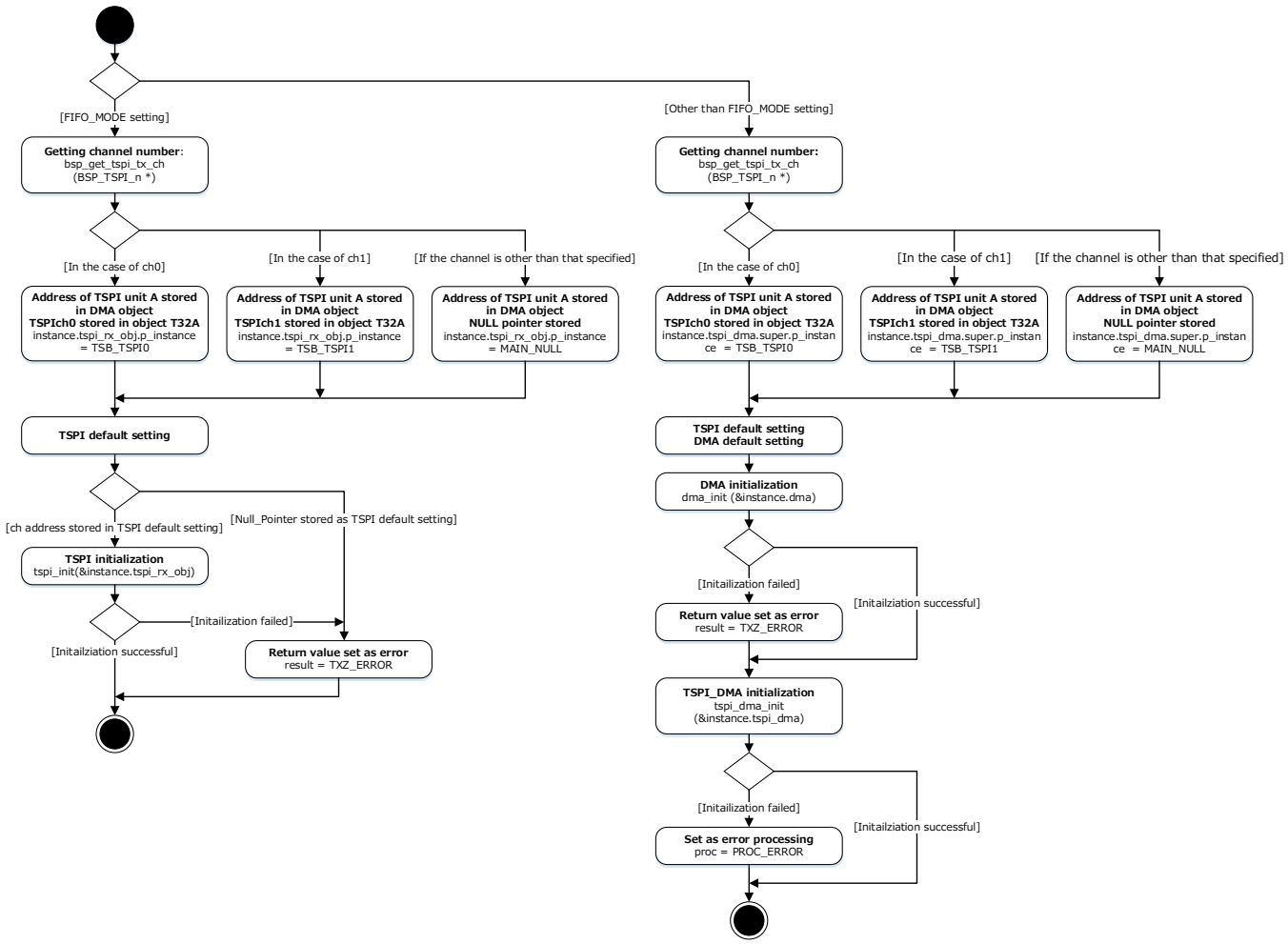
7.5. application_initialize



7.6. application_finalize

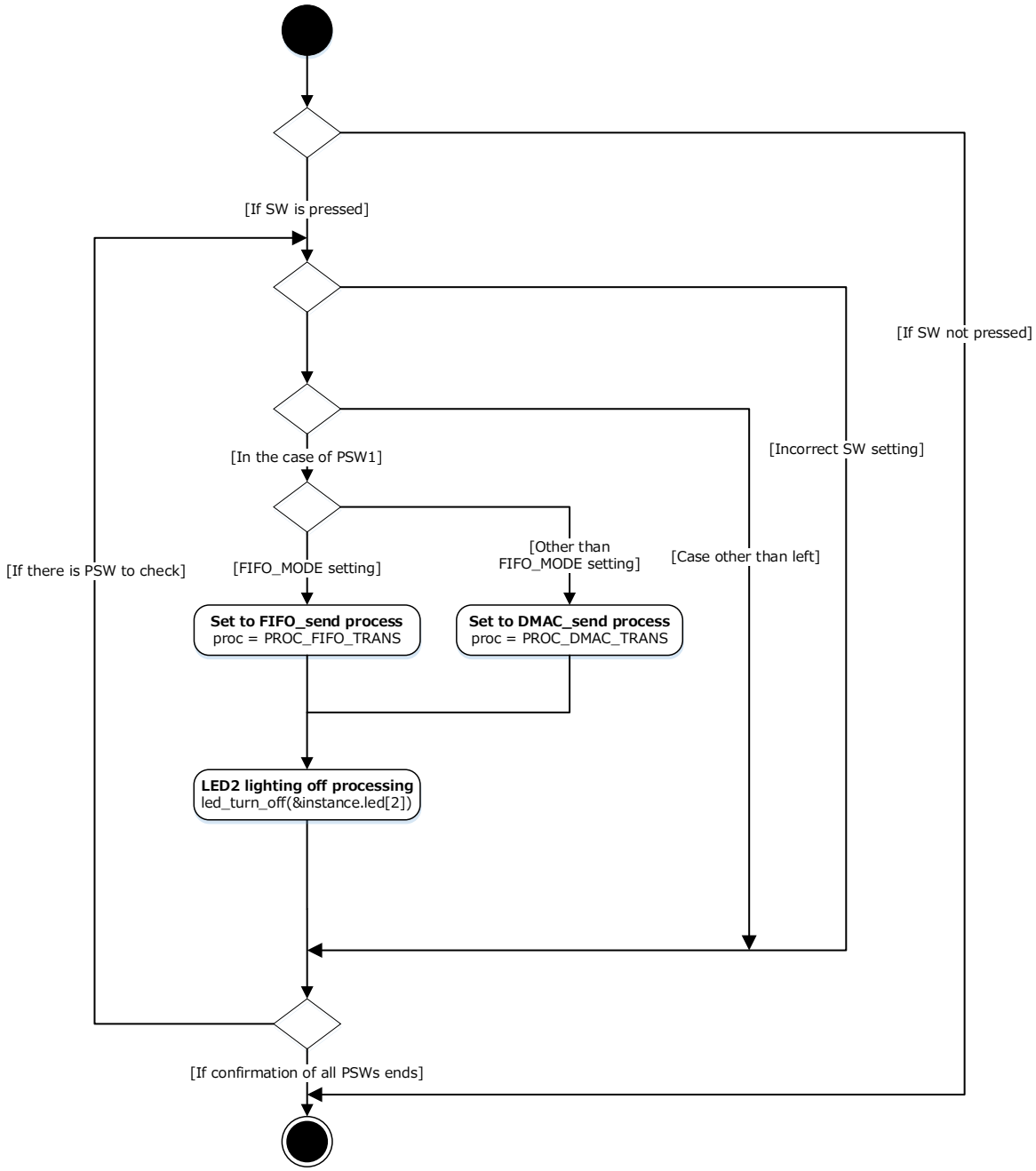


7.7. tspi_initialize

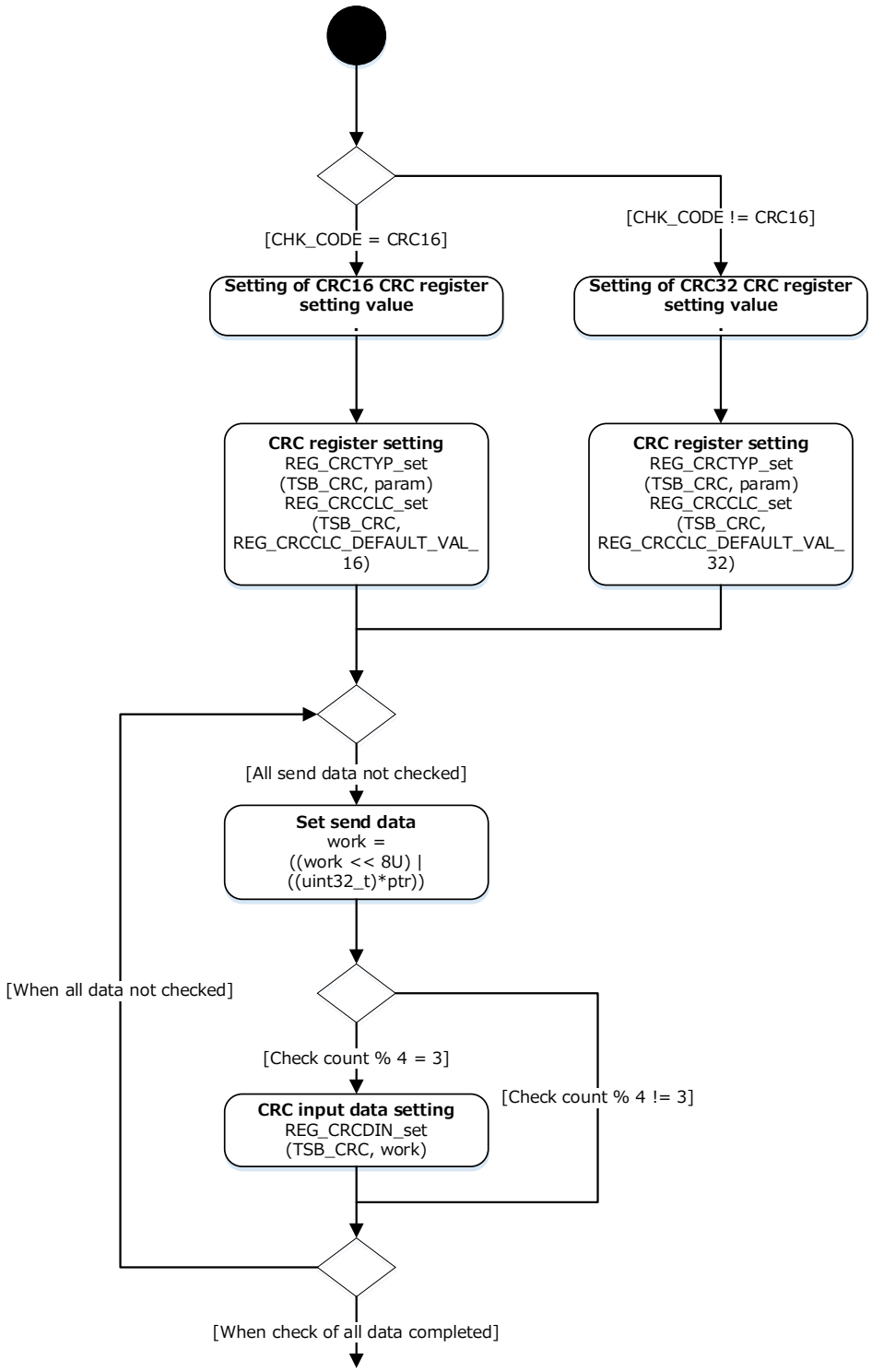


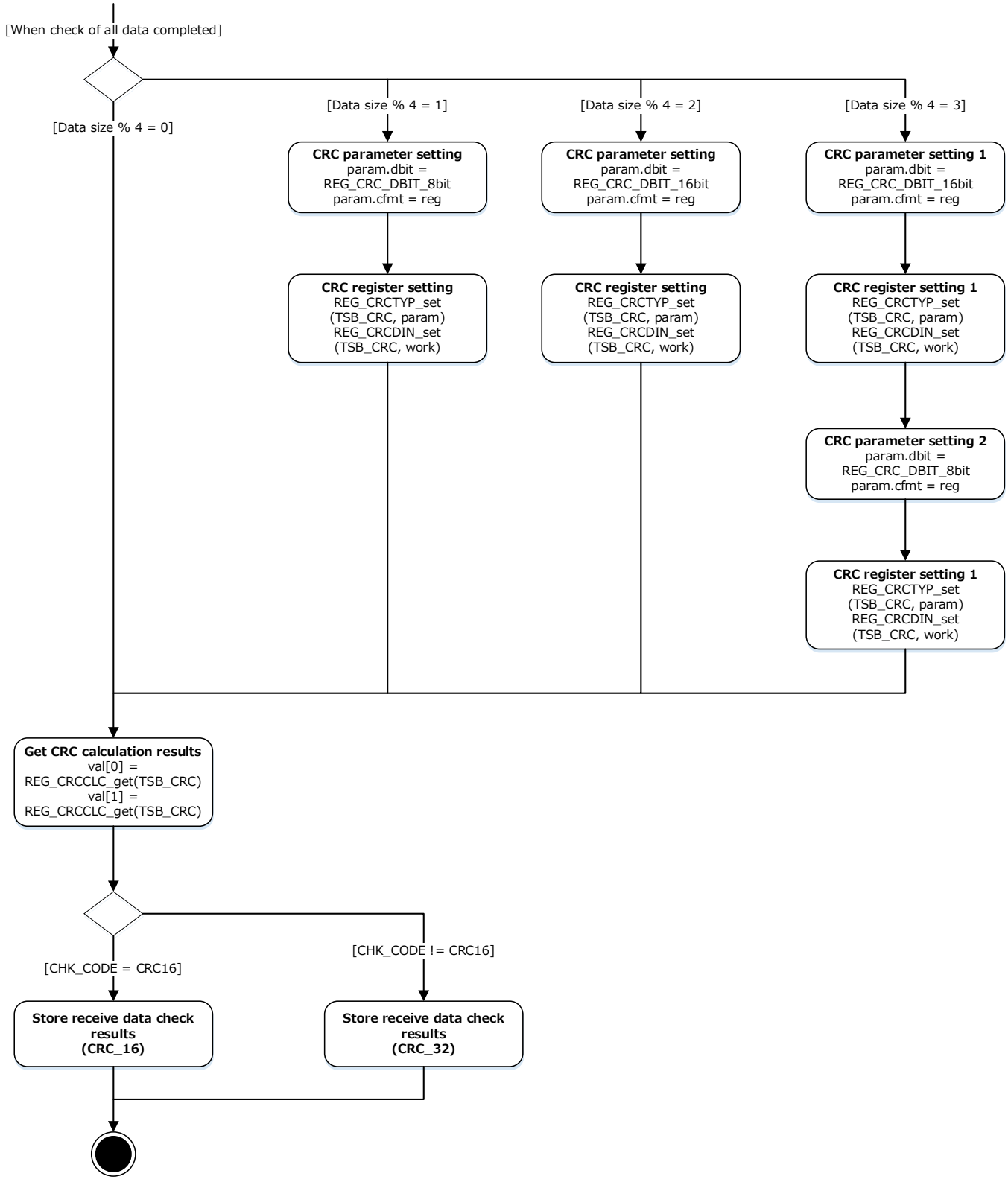
* In the case of M4KN/MN, n=0; in the case of M3H, n=1

7.8. sw_state_change_handler

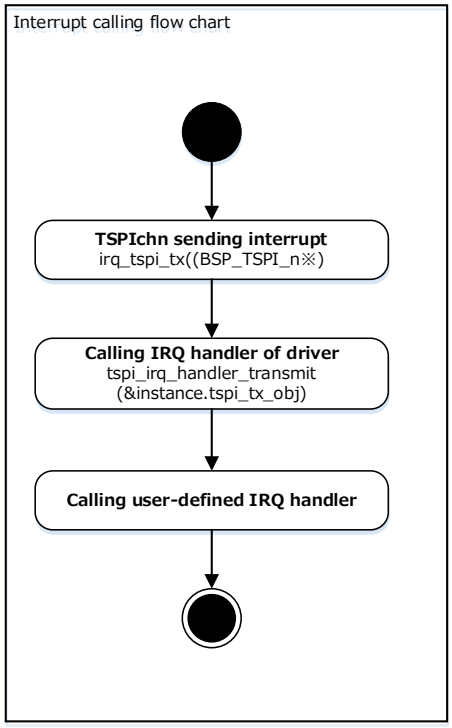


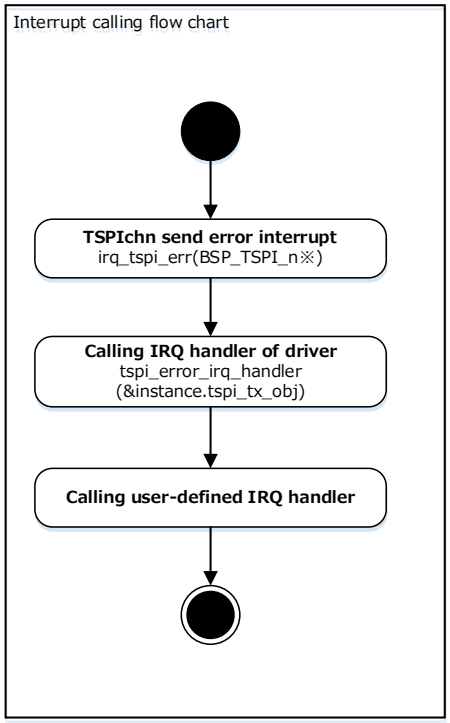
7.9. set_crc_tx_data

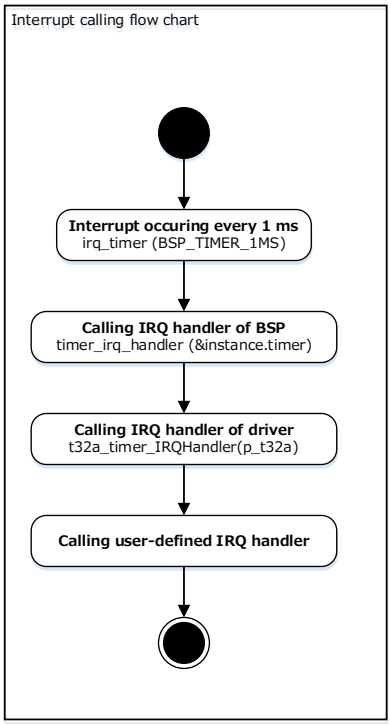


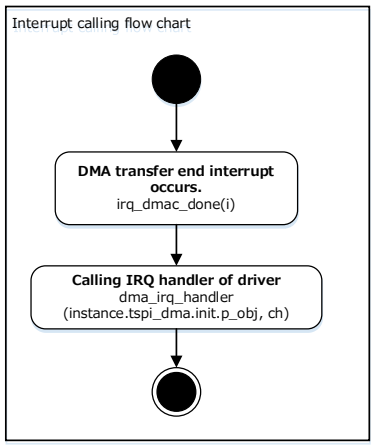


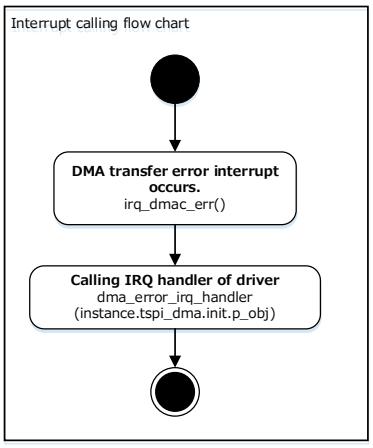
7.10. Interrupt

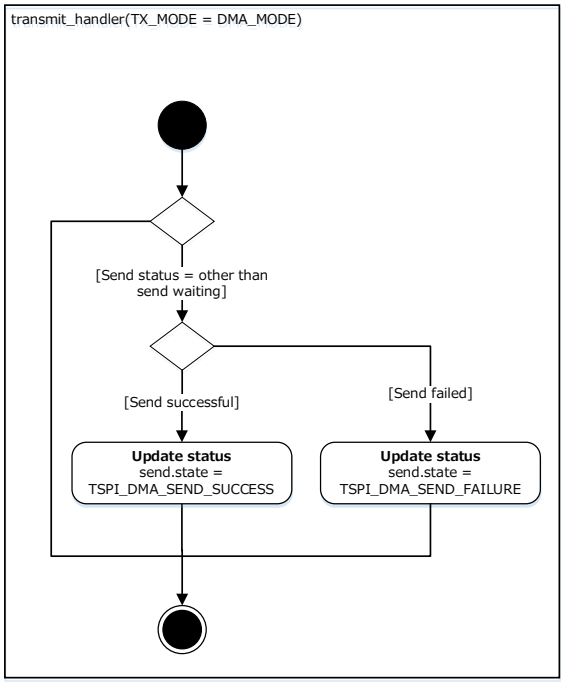




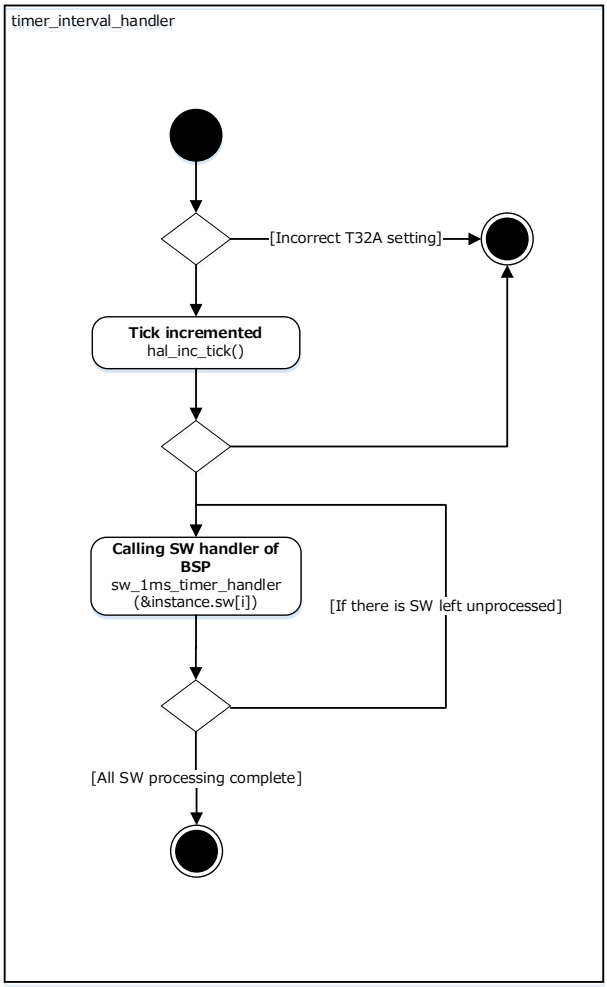


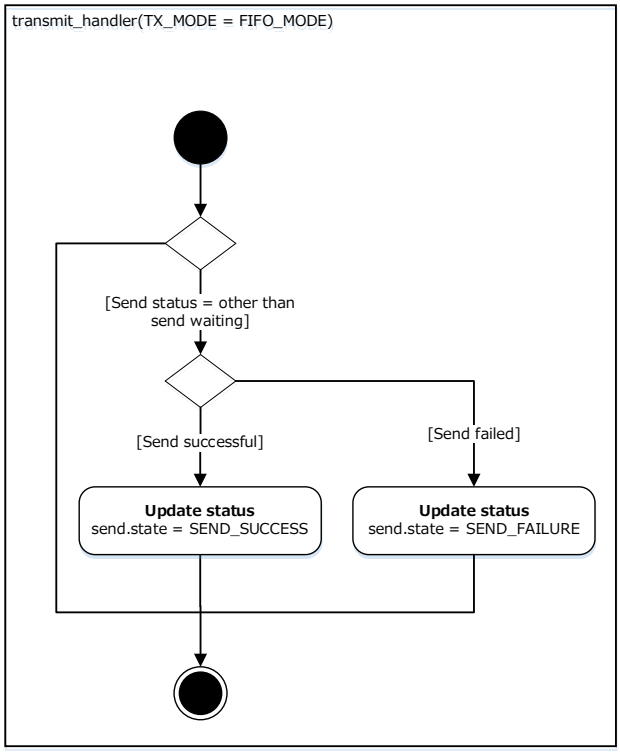


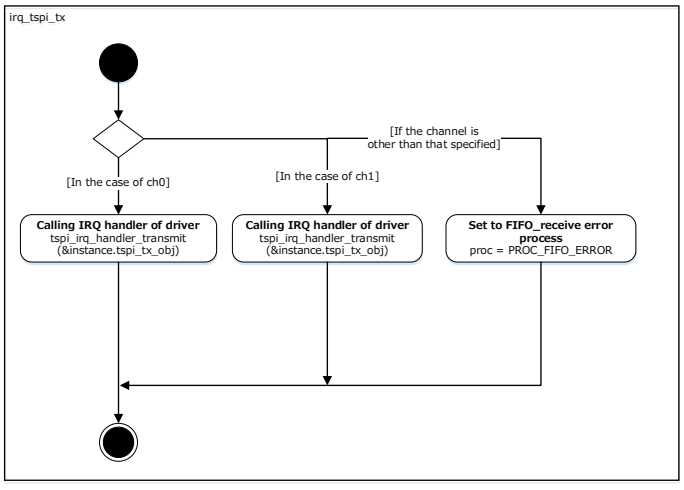


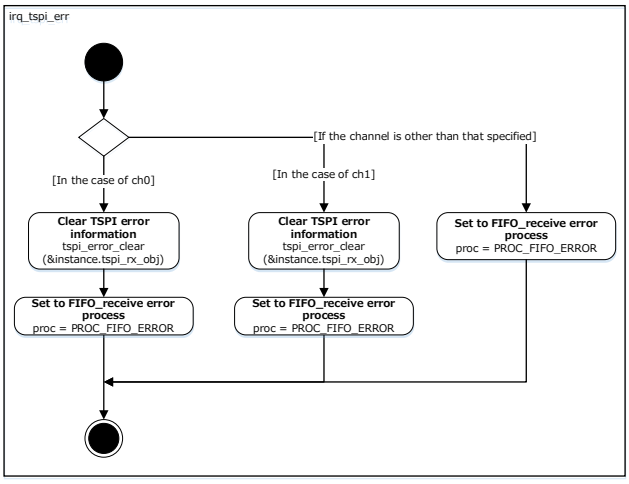


* In the case of M4KN/MN, n=0; in the case of M3H, n=1









8. Revision History

Revision	Date	Description
1.0	2023-10-16	First release

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