M4K Group (1)
Application Note
CRC Calculation Circuit
(CRC-A)

Outlines

This application note is a reference material for developing products using the CRC calculation circuit (CRC) function of M4K Group (1).
This document helps the user check operation of the product and develop its program.

Target sample program: CRC_TSPI_M4K4A

Table of Contents

1. Preface

This sample program is used to check the operation of the CRC calculation circuit function.
The character string “TOSHIBA” and its CRC code is transmitted and received using a 2-channel TSPI.
The received data is displayed on a screen of the terminal software.

2. Reference Document

1. Datasheet
   TMPM4K Group (1) datasheet Rev2.0 (Japanese edition)
2. Reference manual
   CRC Calculation Circuit (CRC-A) Rev1.0 (Japanese edition)
   Asynchronous Serial Communication Circuit (UART-C) Rev3.0 (Japanese edition)
   Serial Peripheral Interface (TSPI-B) Rev3.0 (Japanese edition)
3. Application note
   M4K Group (1) Application Note Startup (CMSIS System & Clock Configuration) Rev1.0
4. Other reference document
   TMPM4KxA Group Peripheral Driver User Manual (Doxygen) V1.0.4.0

3. Function to Use

IP	Channel	Port	Function/Operation mode
CRC Calculation Circuit	—	—	—
Asynchronous Serial Communication Circuit	ch0	PK0 (UT0RXD) PK1 (UT0TXDA)	UART mode
Serial Peripheral Interface	ch1	PA0 (TSPI1TXD) PA2 (TSPI1SCK)	SIO mode Transmission
	ch3	PC1 (TSPI3RXD) PC2 (TSPI3SCK)	SIO mode Reception

4. Target Device

The target devices of this application note are as follows;

TMPM4K4FYAUG	TMPM4K4FWAUG	TMPM4K4FUAUG	TMPM4K4FSAUG
TMPM4K4FYAFG	TMPM4K4FWAFG	TMPM4K4FUAFG	TMPM4K4FSAFG
TMPM4K2FYADUG	TMPM4K2FWADUG	TMPM4K2FUADUG	TMPM4K2FSADUG
TMPM4K1FYAUG	TMPM4K1FWAUG	TMPM4K1FUAUG	TMPM4K1FSAUG
			TMPM4K0FSADUG

* This sample program operates on the evaluation board of TMPM4K4FYAUG.
If other function than the TMPM4K4 one is checked, it is necessary that CMSIS Core related files (the startup file and I/O header file) should be changed properly.
Additionally, the name of microcontroller which is set to the project should be changed.
The BSP related file is dedicated to the evaluation board (TMPM4K4FYAUG). If other function than the TMPM4K4 one is checked, the BSP related file should be changed properly.

5. Operation Confirmation Condition

Used microcontroller	TMPM4K4FYAUG
Used board	TMPM4K4 evaluation board (Product of ESP-kikaku Co. Ltd.)
Integrated development environment	IAR Embedded Workbench for ARM 8.22.2
Integrated development environment	Arm® Keil® MDK Version 5.24.2.0
Terminal software	Tera Term V4.96
Sample program	v1.0.0

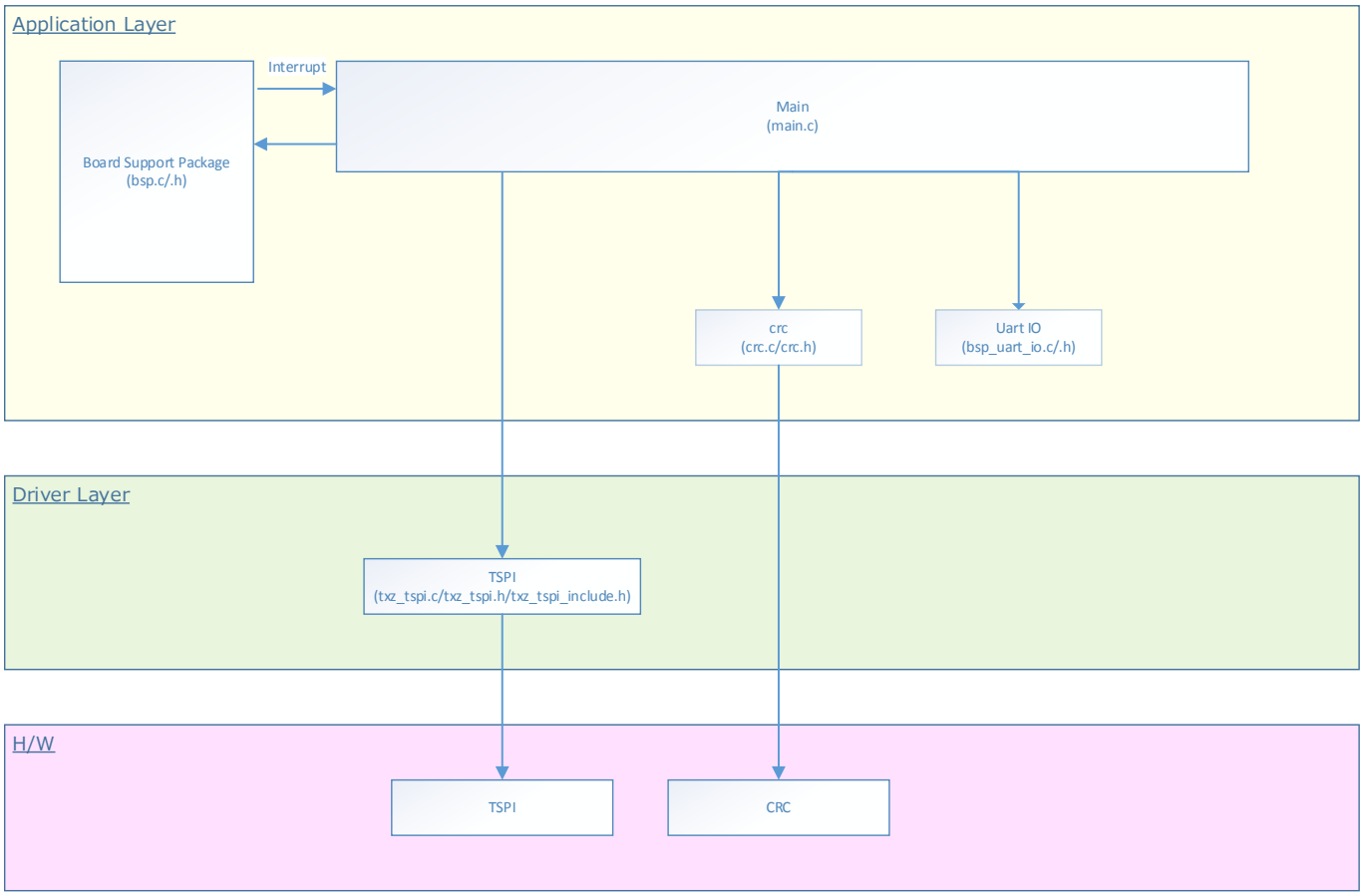
6. Evaluation Board Operation

The USB_UART pin on the evaluation board should be connected to a PC with a USB cable.
The terminal software should be started up.
For the details of the setting, refer to the terminal software setting example.
The reset button should be pushed down on the evaluation board.
The communication starts according to the command input.
For the details of the command input operation, refer to “Main operation”.

7. Sample Program

7.1. Structure Diagram of Sample Program

The structure diagram of the sample program is shown below.



7.2. Startup Routine

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

7.3. Main Operation

After the initialization, the “main” function is executed, and the following initialization is done.
The initialization of the BSP is done.
The initialization of the variables is done.
The initialization of the application software is done.
The initialization of the input and output pins of the TSPI is done.
The command process starts.

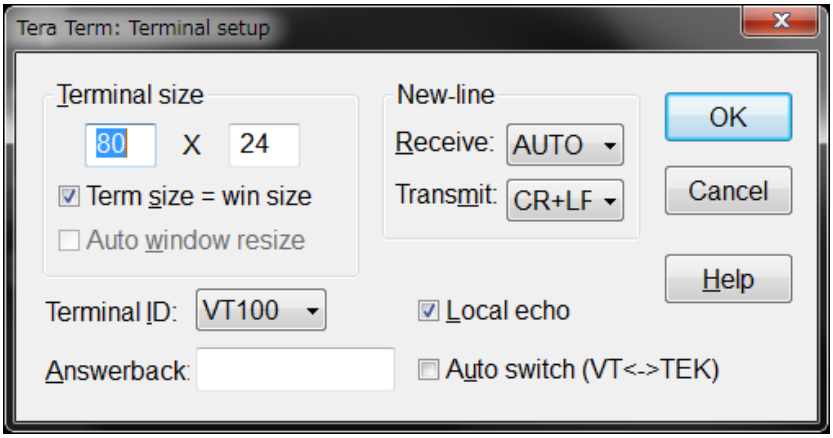
“command >” is displayed on the Tera Term screen. “send” should be input to transmit data. When “send” command is input, the character string “TOSHIBA” and its CRC code are transmitted. The CRC value and its check result are displayed on the Tera Term screen. And at last, the received character string is displayed. Then, “command >” is displayed again.

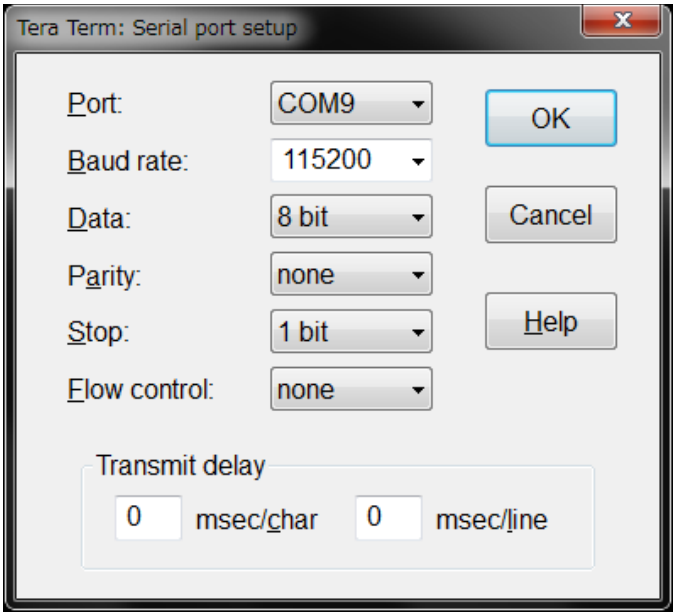
7.4. Output Example of Terminal Software

When the sample program is executed, the command result is displayed as follows;

7.4.1. Setting Example of Terminal Software

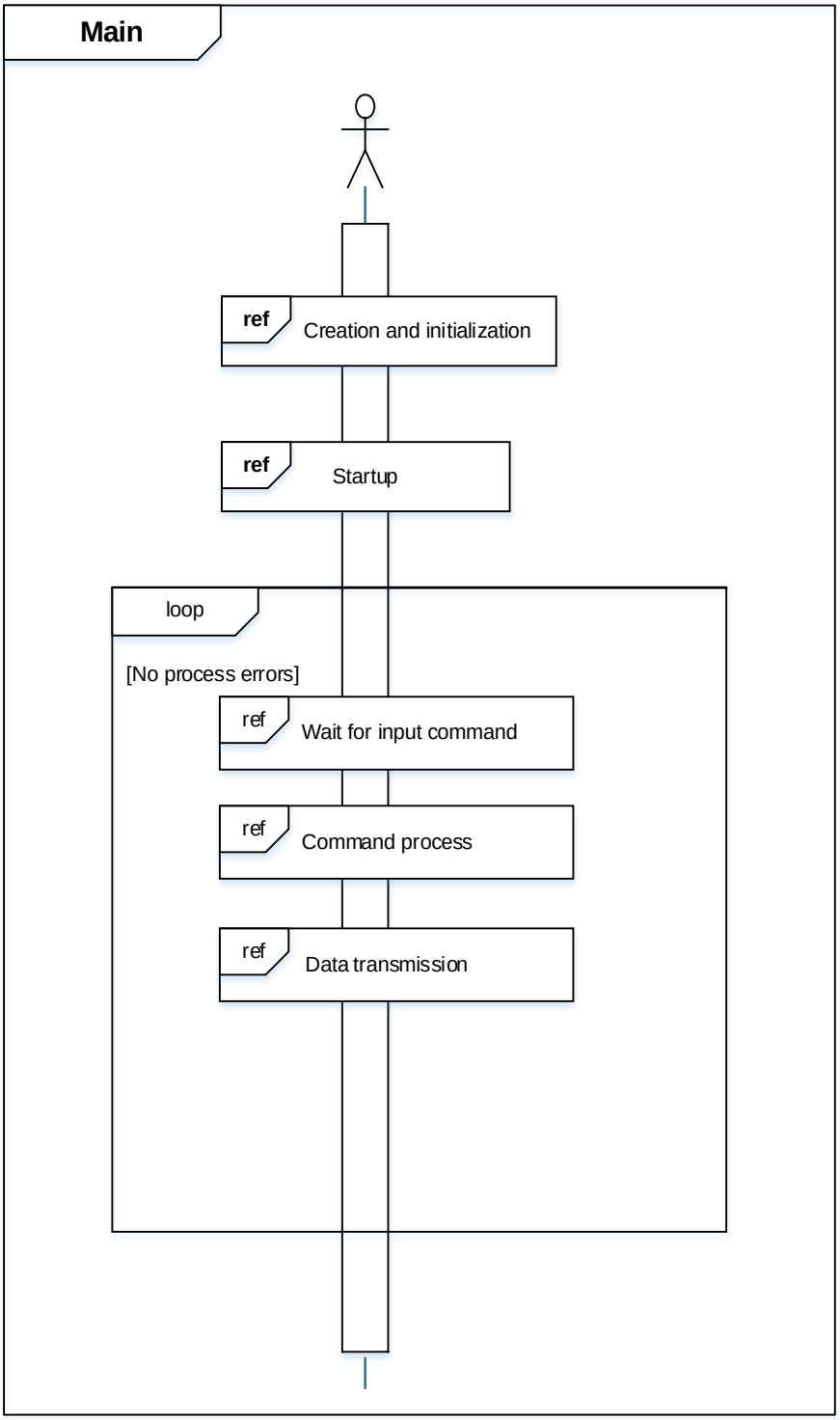
The operation of the terminal software (Tera Term) has been checked with the following settings.

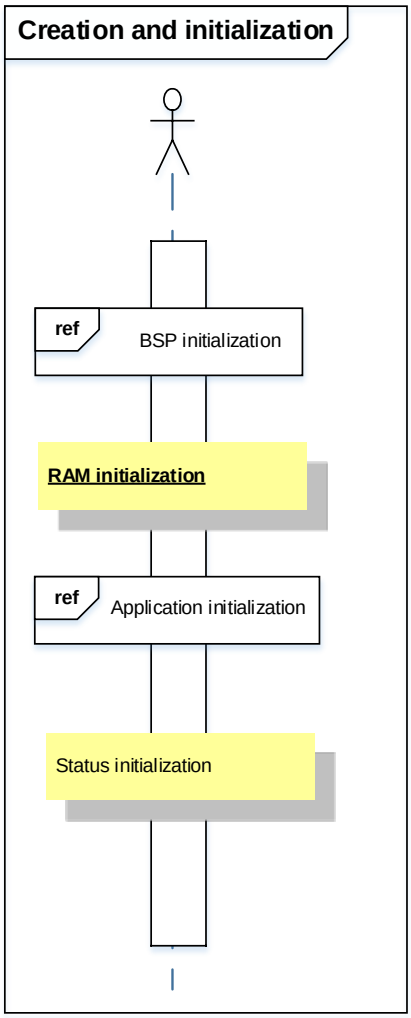


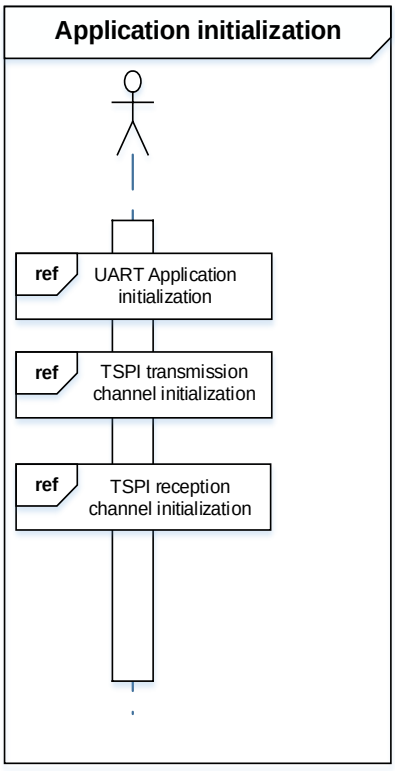


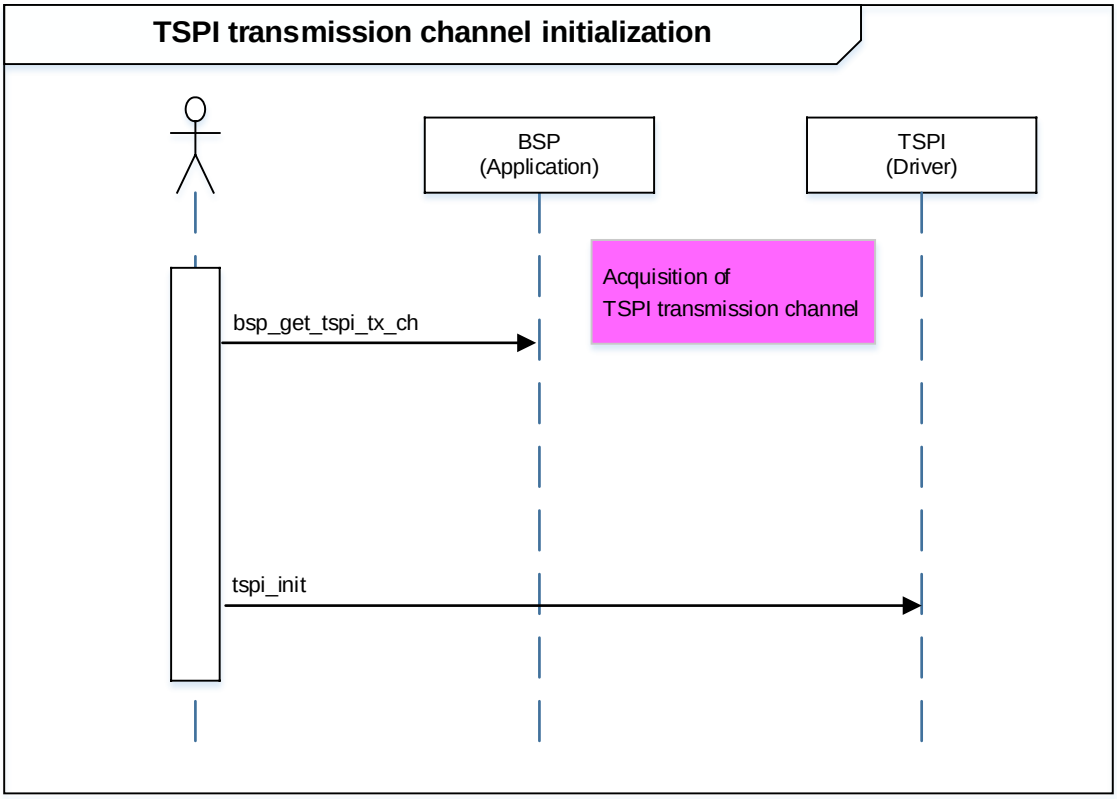
7.5. Operating Flow of Sample Program

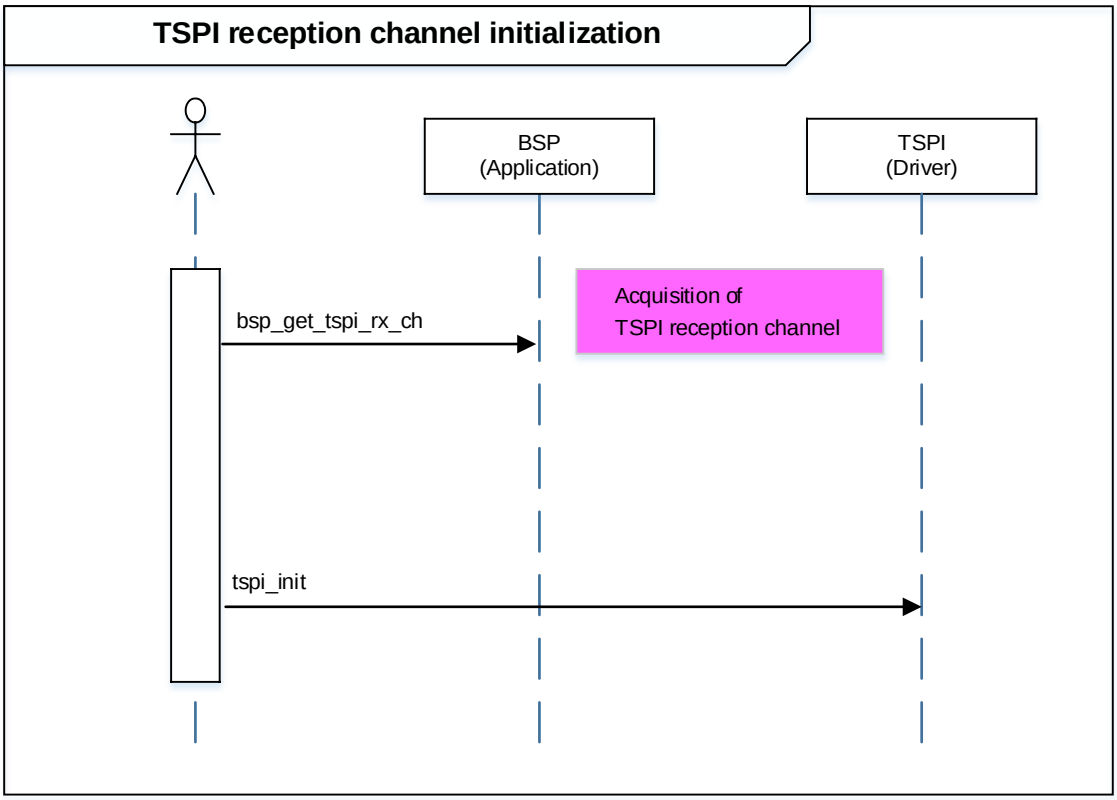
The basic operating flows of the sample program are shown in the following;

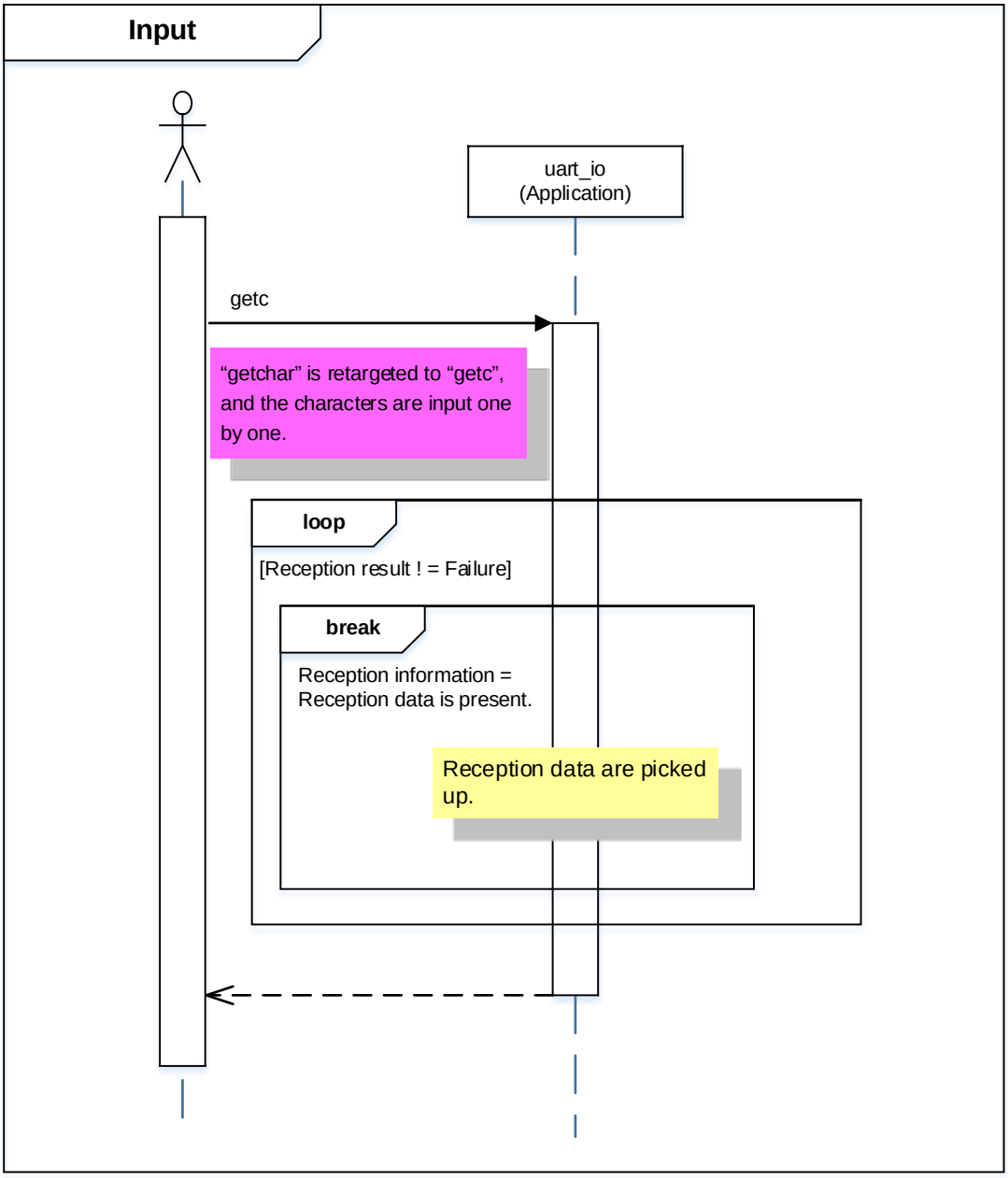


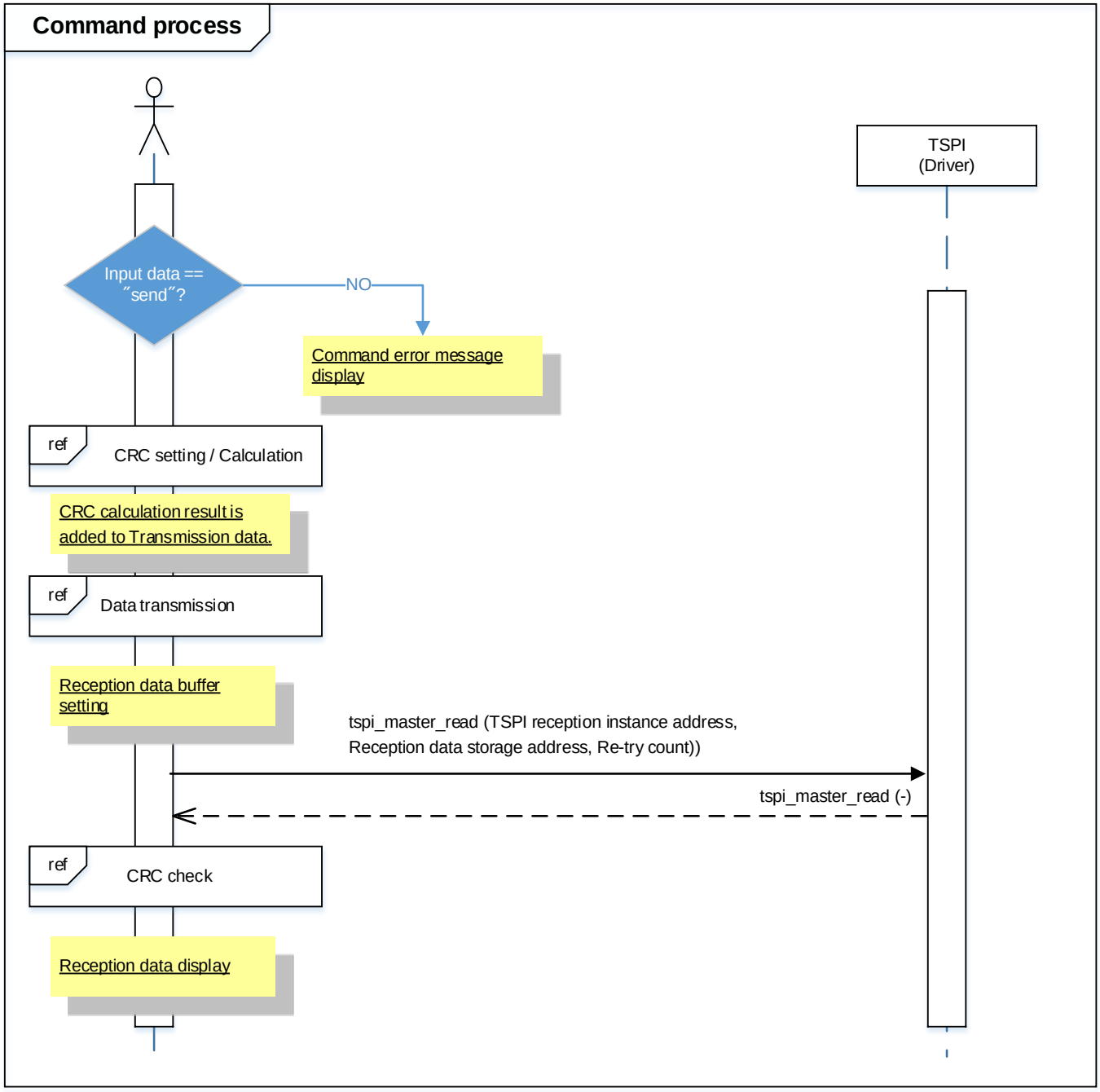

Creation and initialization
ref
BSP initialization
RAM initialization
ref
Application initialization
Status initialization

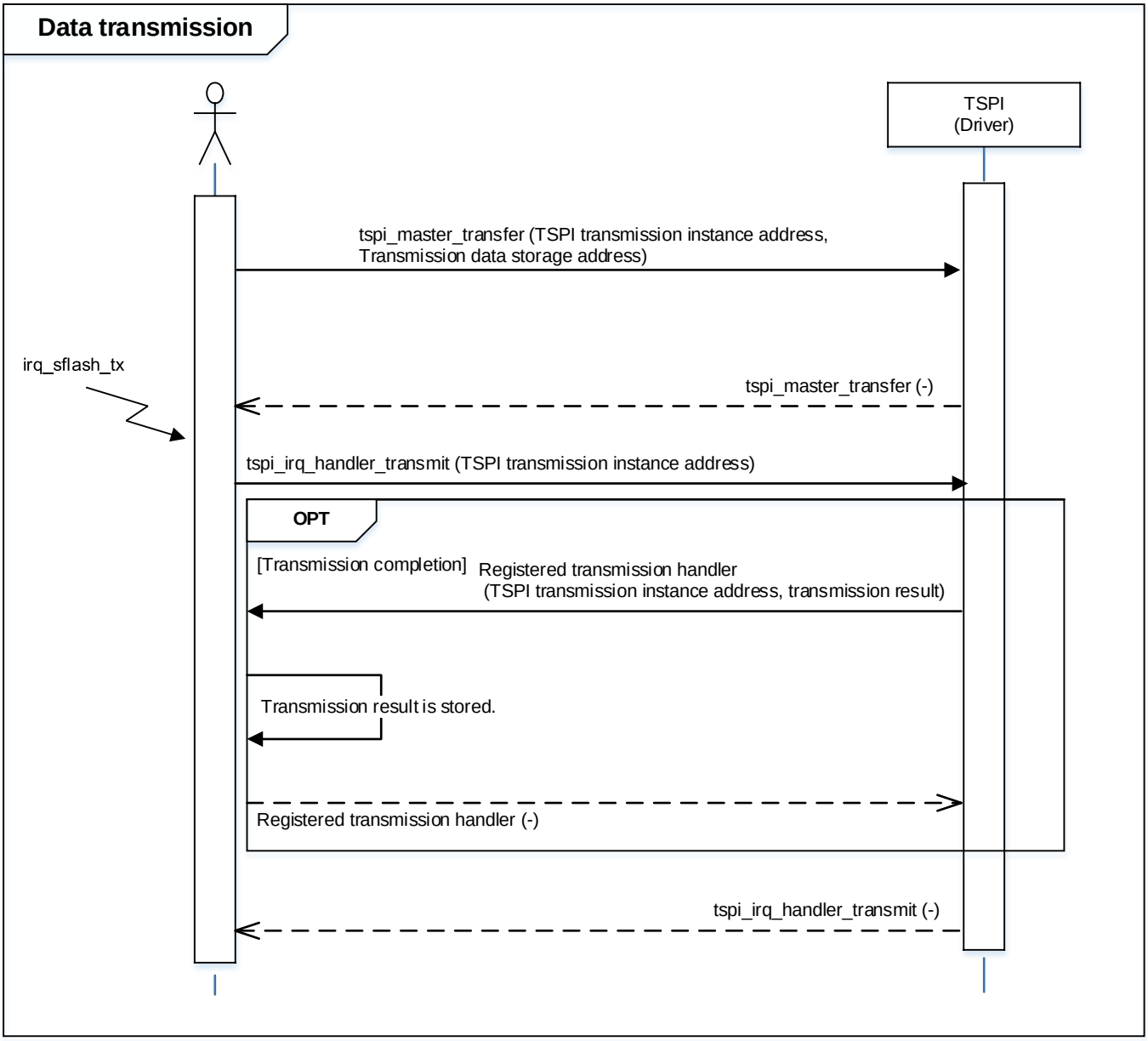

Application initialization
ref
UART Application initialization
ref
TSPI transmission channel initialization
ref
TSPI reception channel initialization

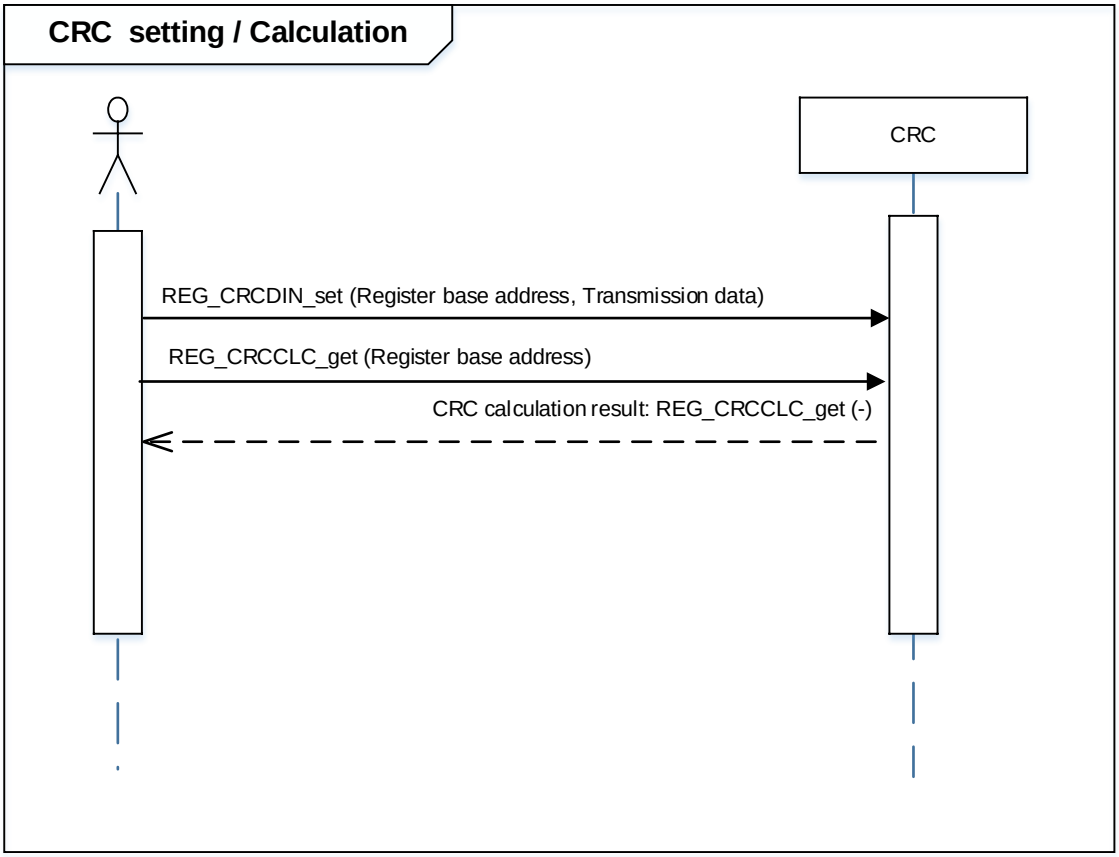

TSPI transmission channel initialization
BSP
(Application)
TSPI
(Driver)
Acquisition of
TSPI transmission channel
bsp_get_tspi_tx_ch
tspi_init

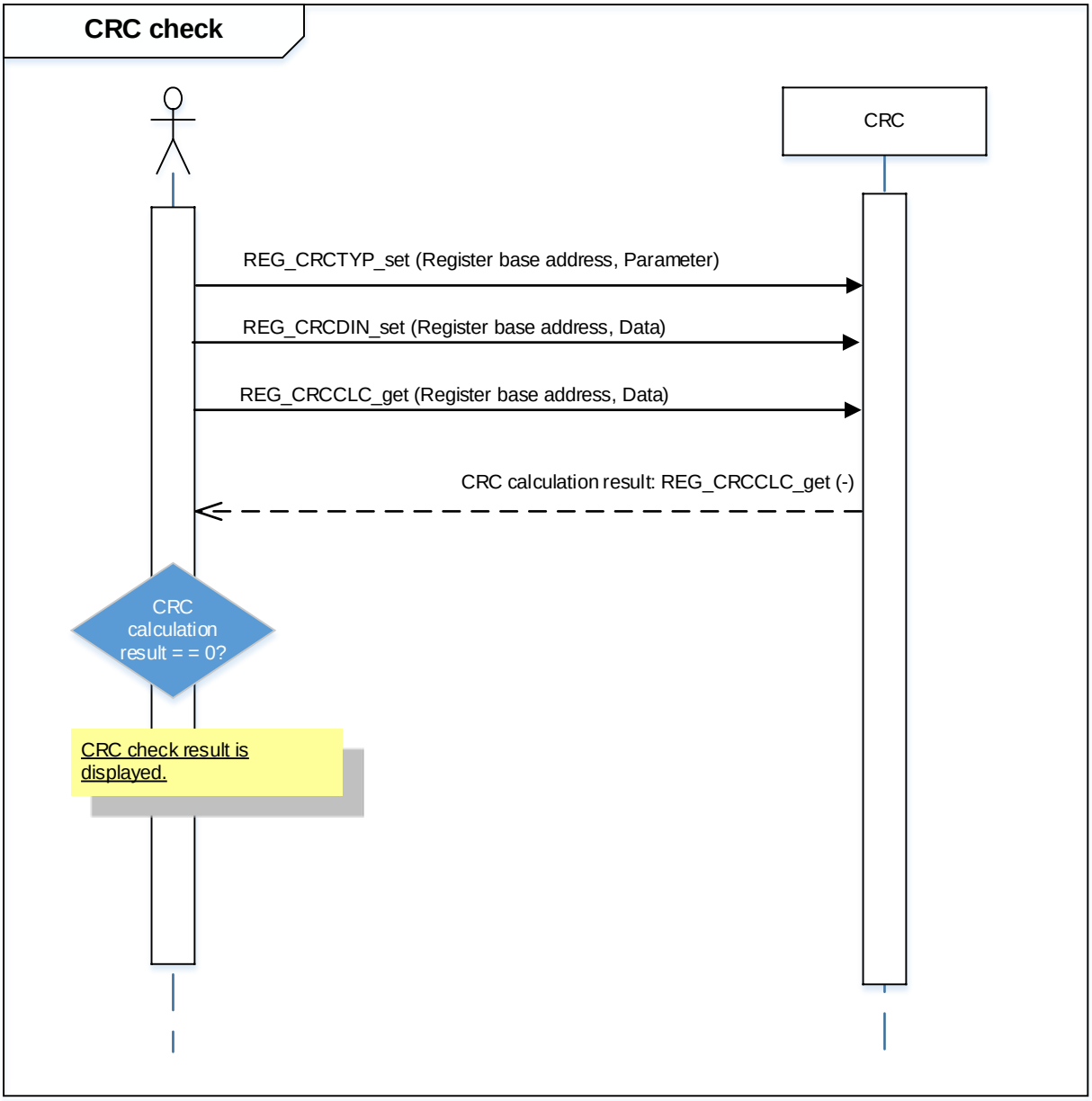

TSPI reception channel initialization
BSP
(Application)
TSPI
(Driver)
Acquisition of
TSPI reception channel
bsp_get_tspi_rx_ch
tspi_init


Input
uart_io
(Application)
getc
“getchar” is retargeted to “getc”, and the characters are input one by one.
loop
[Reception result ! = Failure]
break
Reception information = Reception data is present.
Reception data are picked up.


Command process
TSPI
(Driver)
Input data ==
″send″?
NO
Command error message display
ref
CRC setting / Calculation
CRC calculation result is added to Transmission data.
ref
Data transmission
Reception data buffer setting
tspi_master_read (TSPI reception instance address,
Reception data storage address, Re-try count))
tspi_master_read (-)
ref
CRC check
Reception data display


Data transmission
TSPI
(Driver)
tspi_master_transfer (TSPI transmission instance address,
Transmission data storage address)
irq_sflash_tx
tspi_master_transfer (-)
tspi_irq_handler_transmit (TSPI transmission instance address)
OPT
[Transmission completion]
Registered transmission handler
(TSPI transmission instance address, transmission result)
Transmission result is stored.
Registered transmission handler (-)
tspi_irq_handler_transmit (-)


CRC setting / Calculation
CRC
REG_CRCDIN_set (Register base address, Transmission data)
REG_CRCCLC_get (Register base address)
CRC calculation result: REG_CRCCLC_get (-)


CRC check
CRC
REG_CRCTYP_set (Register base address, Parameter)
REG_CRCDIN_set (Register base address, Data)
REG_CRCCLC_get (Register base address, Data)
CRC calculation result: REG_CRCCLC_get (-)
CRC calculation result = = 0?
CRC check result is displayed.

8. Points to Remember on Handling of Sample Programs

When using the sample program with other than "Operation Confirmation Condition", please check the operation sufficiently.

9. Revision History

Revision	Date	Description
1.0	2019-10-08	First release

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