Application Note

MDMA_UART_Echo

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1. Preface

This application note describes the sample software of MDMA_UART_Echo using Multi-function Direct Memory Access Controller (MDMAC). 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
MDMA	Multi-function Direct Memory Access
UART	Universal Asynchronous Receiver Transmitter

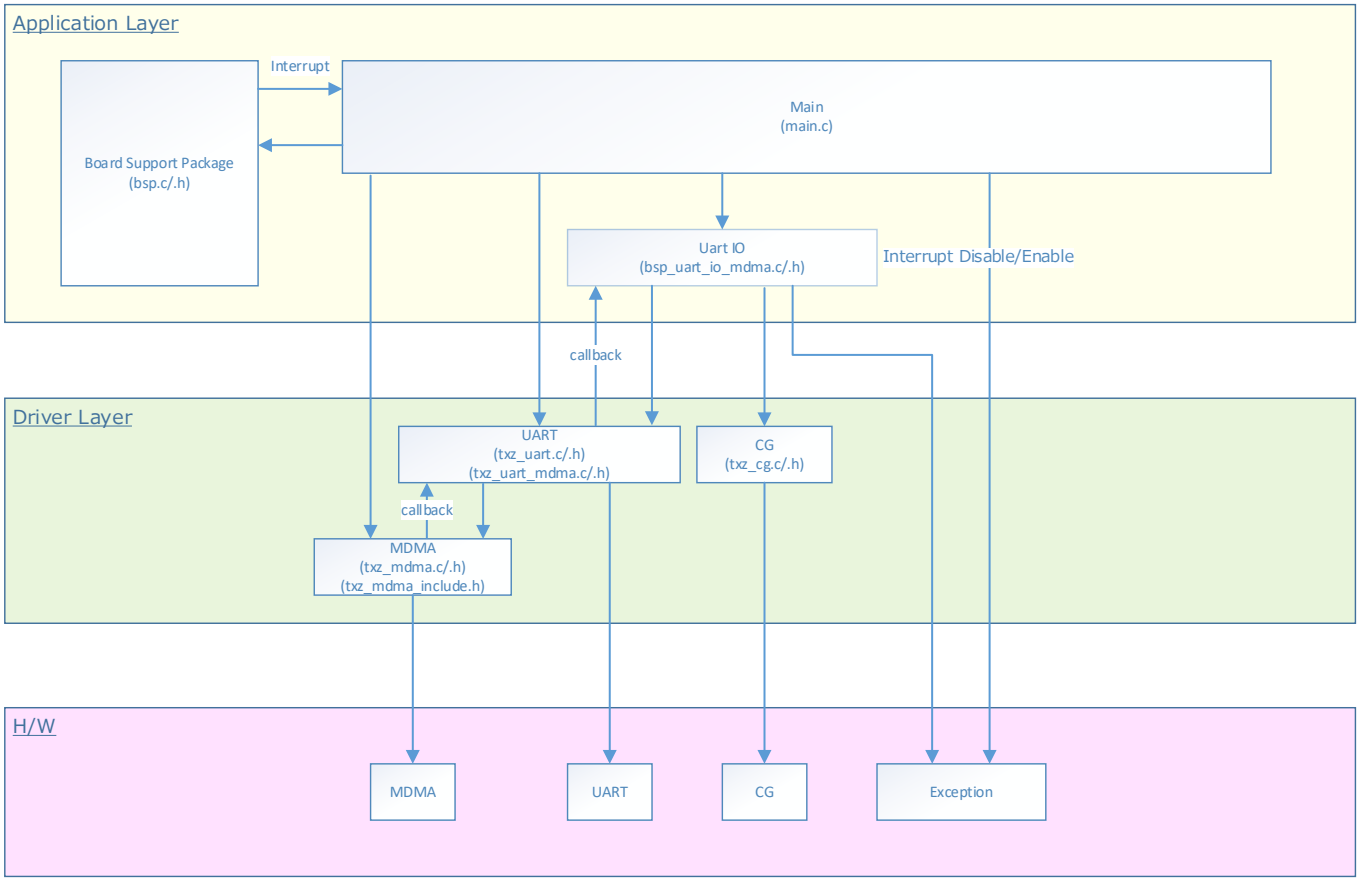
3. Reference Document

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 manual to be used.

4. Target Sample Program

Sample Program	Outlines
MDMA_UART_Echo	Sample of Multifunctional DMA controller (MDMAC).

5. Configuration Diagram



6. Sample Program: MDMA_UART_Echo

This sample software does echo-back output of data input from the terminal emulator using MDMA function.

6.1. Outlines of Operation

Date input from the terminal emulator is echoed back.

- “Input =” is displayed on the terminal emulator.
- Any characters should be input.
- "Echo =" is displayed on the terminal emulator and the characters are shown continuously.
- Infinite transfer end if “E” is input after inputting 16-byte.
  If except for “E” is input, it returns to the input from the first byte.

6.2. Function to Use

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

IP	Channel	Objective
MDMAC	BSP_MDMAC_0	UART transmission DMA request
	BSP_MDMAC_1	UART reception DMA request
UART	BSP_UART_0	Log output

6.3. Interrupt to Use

Interrupt	Outlines
UART Interrupt	UART reception interrupt
	UART transmission interrupt
	UART ERROR interrupt
MDMAC Interrupt	MDMAC transfer end interrupt
	MDMAC bus error interrupt
	MDMAC descriptor error interrupt

6.4. Configuration

Nothing.

6.5. Example of Terminal Emulator Output

6.5.1. Normal Operation

6.5.1.1. Single Normal Transfer

Output initial display

```
Input =
```

Output when inputting “Enter” after inputting character.

```
Input = 123456
```

Output echo-back.

```
Input = 123456
  Echo = 123456
```

6.5.1.2. Chain Transfer

Output UART after transferring 256-byte data

・256-byte alphabet characters are prepared in RAM in alphabetical order. The character data is transferred to another RAM. Then it is output to the UART.

```
ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCD
EFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHI
JKLMNOPQRSTUVWX
YZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZAB
CDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEF
GHIJKLMNOPQRSTUV
```

Output first 16 bits after transferring 256-byte data

・The 256-byte reception data from the URAT is transferred to a different RAM. Then the first 16-byte data is output.

```
0123456789abdefOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHI
JKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOP
QRSTUVWX
YZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDE
FGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLM
NOPQRSTUV
W
0123456789abcdef
```

6.5.1.3. Infinite Transfer

Update 16-byte

・16-byte ring buffer is updated sequentially using the reception data from the UART.

```
0123456789abcdef
P
P123456789abcdef
Q
PQ23456789abcdef
R
PQR3456789abcdef
S
PQRS456789abcdef
```

6.5.2. Case of Error Occurrence

Nothing.

7. MDMAC Driver

7.1. List of Drivers

The MDMAC is controlled by using the following drivers.
For an example of use, refer to the source code.

Interface Name	Control Outlines
mdma_basic_start_ch	Basic transfer start channel
mdma_ch_deinit	MDMA channel object is released.
mdma_ch_init	MDMA channel object is initialized.
mdma_deinit	MDMA object is released.
mdma_desc_ch_configure	MDMA descriptor start address setting
mdma_desc_chain_set	MDMA descriptor chain setting
mdma_enable_ch	MDMA enabled channel
mdma_end_clear_ch	MDMA end interrupt flag is cleared.
mdma_force_stop_ch	Forcibly stopped channel
mdma_init	MDMA object is initialized.
mdma_mask_ch	MDMA Mask channel
mdma_request_ch	MDMA Request channel
mdma_restart_ch	MDMA Suspend channel
mdma_stop_ch	MDMA Stop channel
mdma_suspend_ch	MDMA Suspend channel
mdma_transfer_end_interrupt_disable_ch	Transfer and interrupt disable channel setting
mdma_transfer_end_interrupt_enable_ch	Transfer and interrupt enable channel setting
mdma_unmask_ch	MDMA Unmasked channel

8. Revision History

Revision	Date	Description
1.0	2021-11-01	First release

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