UART_DMA_Transfer_1 for KIT_AURIX_TC375_LK

UART data transfer via DMA

AURIX™ TC3xx Microcontroller Training
V1.0.0

Please read the Important Notice and Warnings at the end of this document

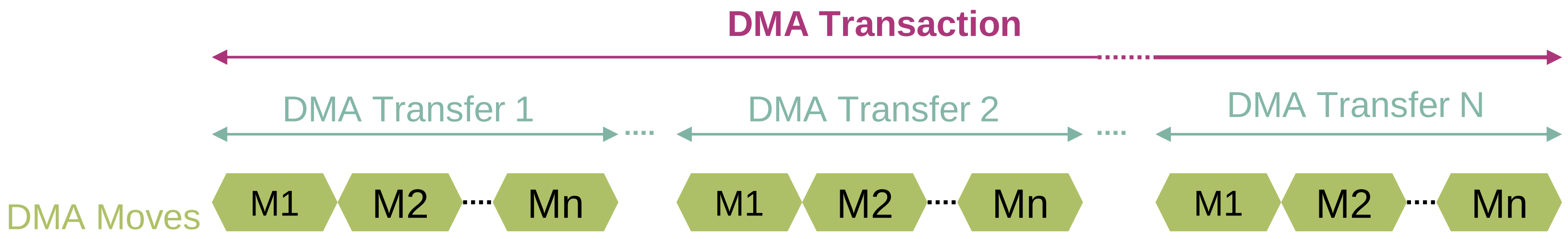
Scope of work

The DMA module is used to transfer data received from the UART to Distributed Local Memory Unit (DLMU) RAM of CPU0.

The CPU sends a message via UART in loopback mode. When it receives the message back, it triggers an interrupt which starts the data transfer via DMA.

Introduction

- The **Direct Memory Access (DMA)** transfers data from data source locations to data destination locations without intervention of the CPU or other on-chip devices
- A DMA channel performs **transactions**. One transaction is made of **transfers**. One transfer is made of up to 16 **moves**. This structure divides the data into several parts and increases the application's efficiency



- A transaction can be interrupted, however once a transfer is started, it cannot be interrupted
- Any DMA move engine can service a DMA request **from any of the 128 DMA channels**. Channel 127 has the highest priority
- DMA requests can be triggered by Hardware or Software

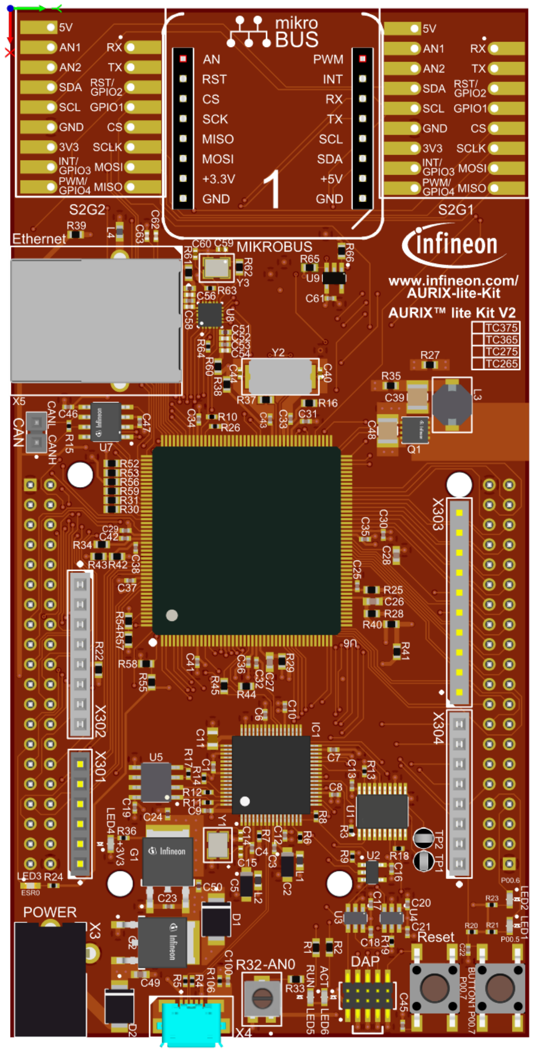
Introduction

- The **Asynchronous/Synchronous Interface (ASCLIN)** module provides asynchronous serial communication with external devices, using data-in and data-out signals only

- For test purposes in this example, the transmit pin (TX) and receive pin (RX) can be shorted internally on-chip (loopback mode)

Hardware setup

This code example has been developed for the board KIT_A2G_TC375_LITE.



Implementation

The example works as follows:

1. The CPU sends a character string (12-bytes) on the UART Tx: “Hello World!”

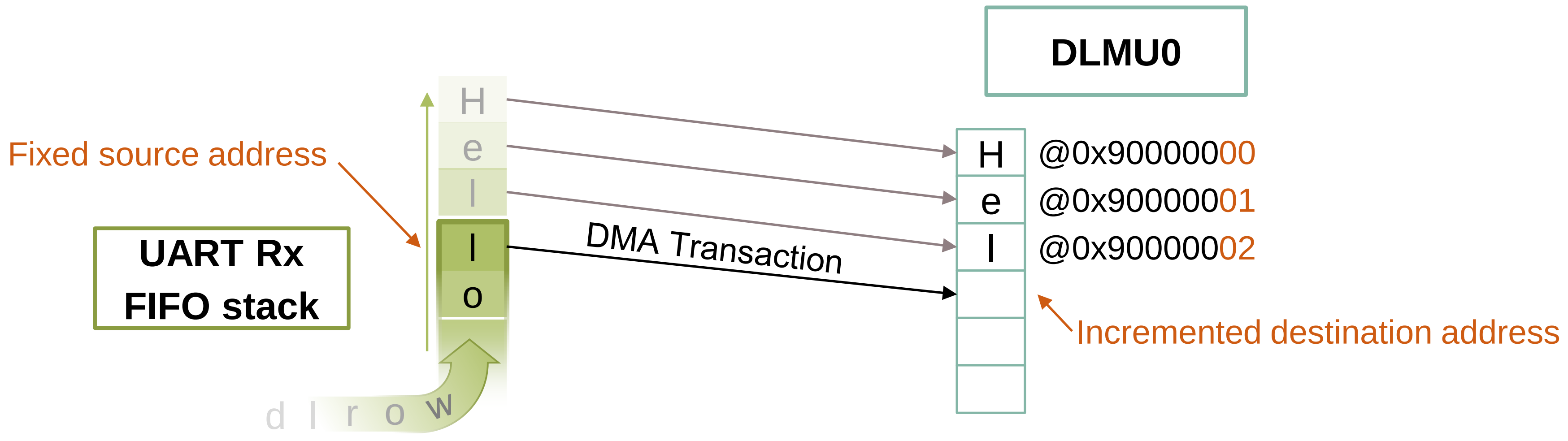
2. Via the loopback (Tx-Rx shorted internally), the **Asclin Rx interrupt** is triggered

3. The interrupt enables the reception of the data and therefore calls the DMA to transfer it to the DLMU0

Implementation

Configuration of the DMA

In this example, a **12-byte message**, which is a **sequence of twelve 8-bit characters**, needs to be transferred.
Twelve transactions composed of **one transfer** made of one **8-bit word move** is then a possible solution. All this can be achieved with a **single DMA channel**, here channel 12.



Implementation

Configuration of the DMA

The needed iLLD functions for DMA configuration are called from ***init_dma()***:

1. ***IfxDma_Dma_initModuleConfig()*** generates the default module configuration
2. ***IfxDma_Dma_initModule()*** initializes the DMA module with the defined parameters
3. ***IfxDma_Dma_initChannelConfig()*** generates the default channel configuration

The following parameters can be then defined at this point:

   - ***channelId***: 12
   - ***transferCount*** (number of transfer per transaction): 1
   - ***moveSize***: 8-bit
   - ***blockMode*** (number of move per transfer): 1
   - ***requestMode***: Complete a full transaction on request
   - ***source/destinationAddress***: Set the source and destination memory locations
   - ***source/destinationCircularBufferEnabled***: Define if the address is fixed or should be incremented

For more detailed information, please check the source code.

4. ***IfxDma_Dma_initChannel()*** initializes the channel with the defined parameters

Implementation

Configuration of the UART

The initialization of the UART communication is done via the function ***init_asclin_uart()***, which contains:

1. The iLLDs function ***IfxAsclin_Asc_initModuleConfig()*** generates the default configuration. This configuration is then modified with the needed parameters:
   - The priority levels of the Rx and Tx interrupts are defined through the ***interrupt.txPriority*** and ***interrupt.rxPriority*** parameters
   - The Rx and Tx pins are defined in this function
   - The Interrupt Service Provider is defined by the ***interrupt.typeOfService*** parameter. The defined ISR is **CPU0** for both Tx and Rx since the iLLD only has one parameter
2. The ***IfxAsclin_Asc_initModule()*** function is called to initialize the module with the defined parameters
3. The Service Provider is therefore manually modified for the Rx interrupt, in order to assign it to the DMA

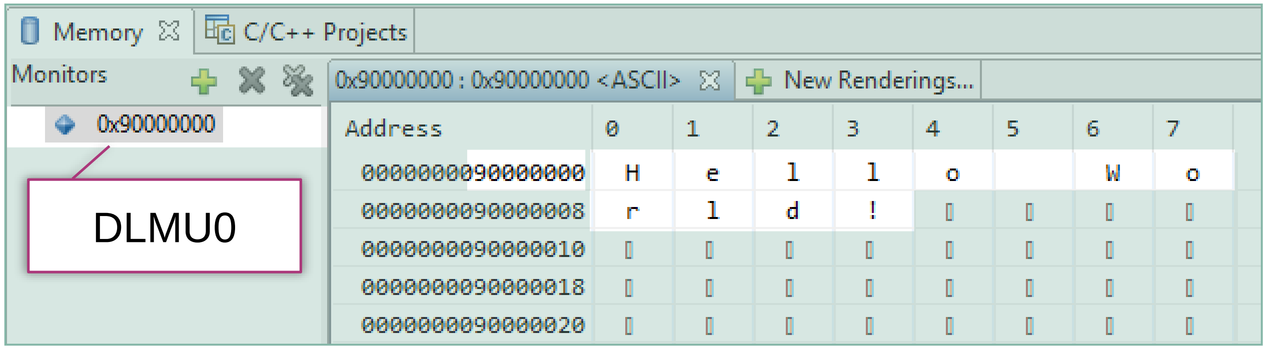
The transmission of data is triggered by the function ***send_data()***: calls the iLLDs function ***IfxAsclin_Asc_write()*** which sends the data, specified in the parameters, over the UART Tx.

Note: The ***IfxAsclin_Asc_read()*** iLLDs function is not used, because there is no need to copy the received data in a global variable. As soon as received, the data is directly transferred to the DLMU0 via DMA.

Run and Test

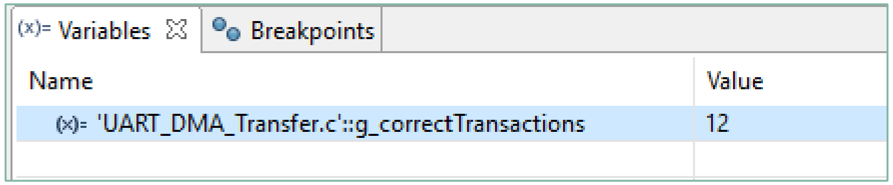
After code compilation and flashing the device, perform the following steps:

- Connect the board to the PC
- Run the code
- Add the DLMU0 address (0x90000000) to the memory window
- Check using the debugger:
  - The message has been properly copied in the DLMU0



Address	0	1	2	3	4	5	6	7
0000000090000000	H	e	l	l	o		W	o
0000000090000008	r	l	d	!	▯	▯	▯	▯
0000000090000010	▯	▯	▯	▯	▯	▯	▯	▯
0000000090000018	▯	▯	▯	▯	▯	▯	▯	▯
0000000090000020	▯	▯	▯	▯	▯	▯	▯	▯

  - As expected, 12 transactions were needed to transfer the message



Name	Value
'UART_DMA_Transfer.c'::g_correctTransactions	12

References

- AURIX™ Development Studio is available online:
- https://www.infineon.com/aurixdevelopmentstudio
- Use the „*Import...*“ function to get access to more code examples.

- More code examples can be found on the GIT repository:
- https://github.com/Infineon/AURIX_code_examples

- For additional trainings, visit our webpage:
- https://www.infineon.com/aurix-expert-training

- For questions and support, use the AURIX™ Forum:
- https://www.infineonforums.com/forums/13-Aurix-Forum

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