Bus_Register_Protection_1 for KIT_AURIX_TC334_LK

Register access protection

AURIX™ TC3xx Microcontroller Training
V1.0.0

Scope of work

This example shows how to protect registers from unintended write access by using AURIX™ register access protection mechanisms.

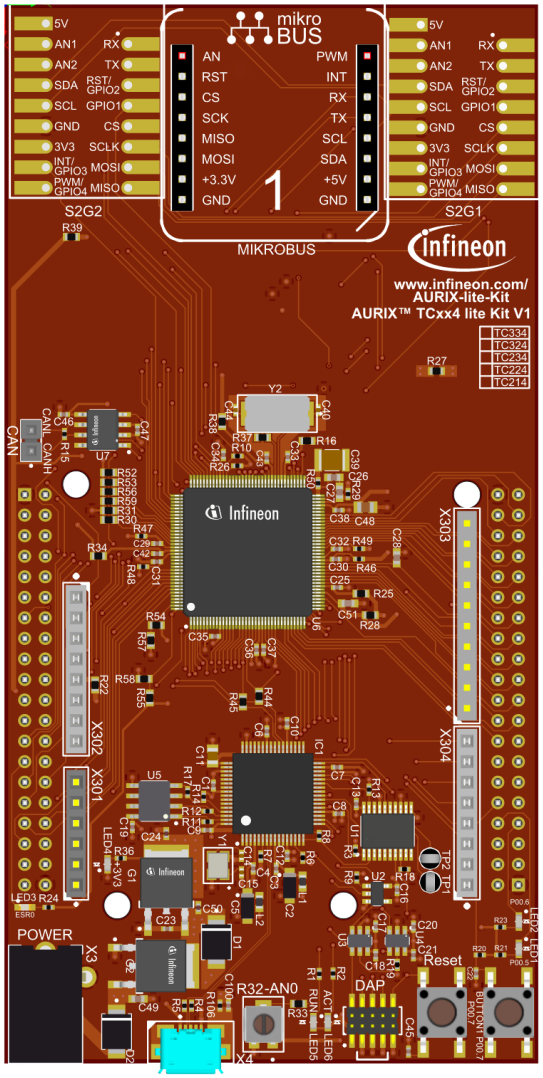
The CPU0 tries to make a write access to an ASCLIN0 module register two times: when the access is enabled for CPU0 and when the access is disabled for CPU0. During the second register write access, a Trap is expected to be raised, to inform about the illegal write access.

Introduction

- Write accesses of any master to any slave's registers can be enabled/disabled for safety reasons using the register access protection mechanism (ACCEN)
- Each master is identified via a unique TAG ID when accessing the system bus
- Based on the masters' TAG IDs, the application can select which master is allowed to perform register write operation to a slave
- If a master attempts to write to a protected register, then a bus error trap event is generated and the write operation is blocked

Hardware setup

This code example has been developed for the board KIT_A2G_TC334_LITE.



Implementation

Initialize the used peripherals:

- As first step, the port pins are configured to General Output Push-Pull Mode. To enable LEDs‘ usage, the following function is used:
  IfxPort_setPinModeOutput()

- Then the module **ASCLIN0** is enabled in order to demonstrate the access protection mechanism through the function:
  IfxAsclin_enableModule()

Implementation

Register access protection implementation:

- Clear Safety EndInit protection
  - Get Safety Watchdog password: ***IfxScuWdt_getSafetyWatchdogPassword()***
  - Clear Safety EndInit using the safety watchdog password ***IfxScuWdt_clearSafetyEndinit()***
- Disable all accesses of CPU0 master to slave module **ASCLIN0** by resetting the corresponding access enable bit (**ENx**) of the **ACCEN0** register as following:
  - set ***MODULE_ASCLIN0.ACCEN0.B.EN1 = 0x0;*** (0 to disable access and 1 to enable access, by default access is enabled)

  Note: *ACCEN0.B.ENx bits* are correlated to TAG IDs (EN0 corresponds to TAG ID 000000_B, ..., EN31 corresponds to TAG ID 011111_B)
  - TAG ID 000001_B corresponds to CPU0, therefore EN1 is the bitfield that has to be modified
- Restore Safety EndInit protection using the safety watchdog password ***IfxScuWdt_setSafetyEndinit()***

Implementation

Trap Service Routine implementation:

Writing to protected registers leads to a Bus Error Trap generation. For this reason, a Trap Service Routine (TSR) is needed.

- All TSRs are already implemented within the iLLD drivers and they contain a hook which enables specific user code to be added inside each TSR function, using the following steps:
  - In ***Ifx_Cfg.h*** file, the ***IFX_CFG_EXTEND_TRAP_HOOKS*** macro needs to be un-commented to enable the possibility to overwrite the default hooks
  - Add a new file called ***Ifx_Cfg_Trap.h*** which contains the redirection of the default hook function to the implemented one:
    - Default Bus Error TSR hook ***IFX_CFG_CPU_TRAP_BE_HOOK()*** is replaced by the implemented hook ***busErrorTSRHook()***
  - The hook source code is implemented in order to verify if the register value was modified or the write access was denied. An LED indicates the execution result

Implementation

Trap Service Routine implementation (Cont.):

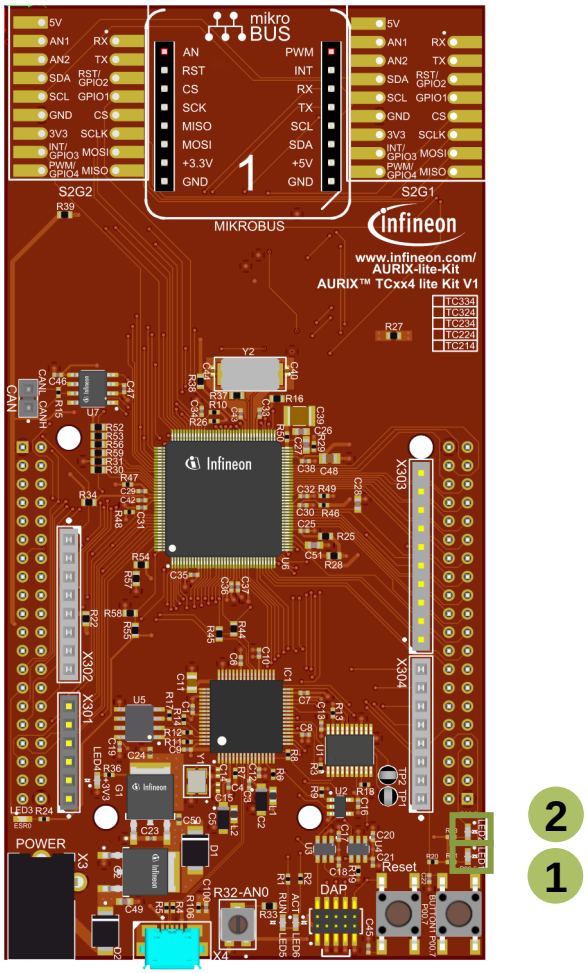
Please note that in Debug mode, the iLLD TSR stops the program execution by calling the DEBUG instruction, this can be avoided by defining the ***IFX_CFG_CPU_TRAP_DEBUG*** macro inside the ***Ifx_Cfg_Trap.h*** file.

Run and Test

After code compilation and flashing the device, observe the behavior of the LEDs.

Check that ***LED1*** (1) and ***LED2*** (2) are switched on:

- ***LED1*** switches on to indicate that the register write access was successful when the access protection is disabled
- ***LED2*** switches on to indicate that a Trap is generated and the register write access was denied when the access protection is enabled



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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