

ADC_Group_Scan_1

ADC group scan source

AURIX™ TC2xx Microcontroller Training
V1.0.0



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Scope of work

The Versatile Analog-to-Digital Converter (VADC) is configured to measure multiple analog signals in a sequence using scan request.

The Auto Scan mode of the Versatile Analog to Digital Converter (VADC) module is enabled over the channels 0 to 4 of the Group 0. Additionally, the converted results are checked with the Valid Flag (VF) of the Result Register, and then sent to the PC via UART.

Introduction

- › An analog to digital converter is a module that converts an analog signal, such as a voltage sent by an analog sensor, into a digital signal.
- › The Versatile Analog to Digital Converter module (VADC) of the AURIX™ TC29x comprises 11 independent analog to digital converters. Each of them can do conversions with a resolution of up to 12-bits.
- › Analog/Digital conversions can be requested by several request sources:
 - **Queued scan** request source, specific to a single group
 - Channel scan request source, which comprises:
 - **Group scan** source, specific to a single group
 - **Background scan** source, which can request all channels of all groups
- › Each request source can trigger up to three conversion modes:
 - **Fixed Channel Conversion**
 - **Channel Sequence Conversion**
 - **Auto Scan Conversion**
- › The **Auto Scan Conversion** mode enables the conversion of a configurable linear sequence of all available channels and it can only be triggered by the **Group Scan Request Source** or by the **Background Scan Request Source**.

Hardware setup

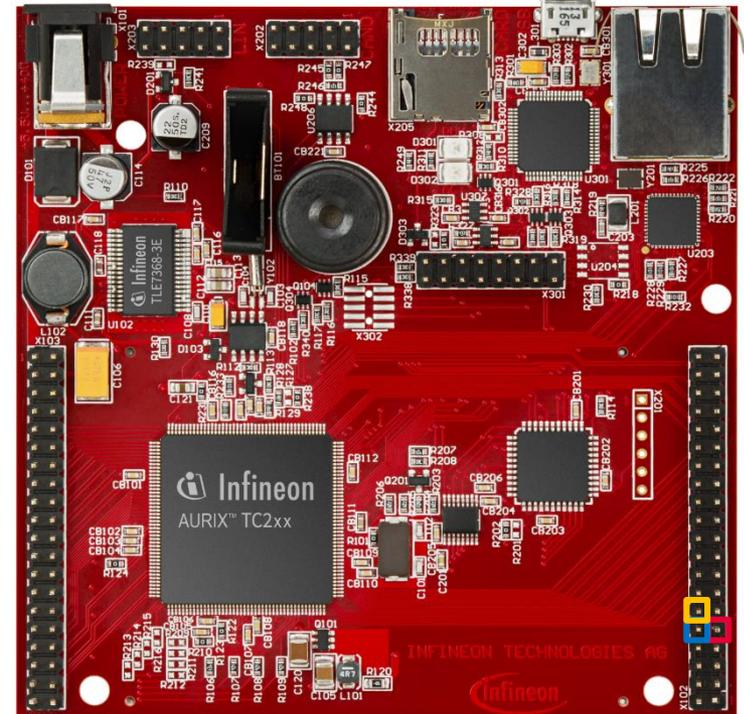
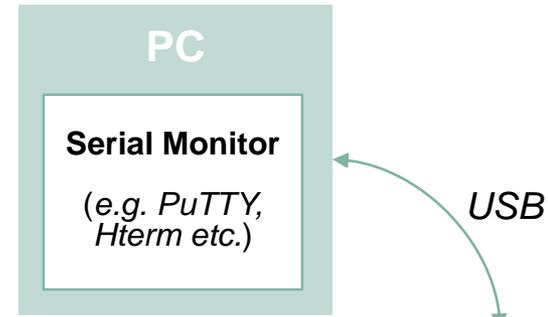
This code example has been developed for the board KIT_AURIX_TC297_TFT_BC-Step.

The board should be connected to the PC via USB, in order to allow UART communication.

	X102		
P14.5	40	39	P14.4
P20.10	38	37	P20.9
P15.7	36	35	P15.6
P15.5	34	33	P15.4
P15.3	32	31	P15.2
P22.3	30	29	P22.2
P22.1	28	27	P22.0
P33.11	26	25	P23.4
P23.3	24	23	P23.2
P23.1	22	21	P23.0
P33.6	20	19	P33.8
P33.12	18	17	P33.1
P33.2	16	15	P33.3
P33.4	14	13	P33.5
AN0	12	11	AN8
AN2	10	9	AN3
AN32	8	7	AN33
AN20	6	5	AN21
GND	4	3	GND
V_UC(+5V)	2	1	VCC_IN

Group 0 - Channel 0
Group 0 - Channel 2

Group 0 - Channel 3



Note: For this Application Kit, not all pins are available. Therefore, the AN1 and AN4 pins of this example cannot be used.

Implementation

Configuration of the VADC module

This example performs Auto Scan conversions over the channels 0 to 4 of the group 0.

› *init_vadc()*

In this function, the VADC module is initialized and configured. Then, Group0 is selected and configured.

For the conversions to be done repeatedly, the ***autoscanEnabled*** parameter of the ***adcGroupConfig*** has to be set.

The following iLLD functions are used in the initialization:

- ***IfxVadc_Adc_initModuleConfig()*** initializes the module structure with the default values
- ***IfxVadc_Adc_initModule()*** initializes the VADC to run with the expected frequency and calibration
- ***IfxVadc_Adc_initGroupConfig()*** initializes the group buffer with the default configuration
- ***IfxVadc_Adc_initGroup()*** initializes the VADC group specified in the parameters

The iLLD functions mentioned above can be found in the header file ***IfxVadc_Adc.h***.

Implementation

Configuration of the VADC module

› *run_vadc()*

In this function, the channel sequence that is used for conversions is chosen. A first loop over the channels is needed to configure, initialize and set them up. Then, the ADC can be started. The initialization and configuration of each channel is done via the two iLLD functions:

- › *IfxVadc_Adc_initChannelConfig()*, which initializes the buffer with the default channel configuration
- › *IfxVadc_Adc_initChannel()*, which initializes the specified channel with the user configuration

Therefore, the channels are added to the scan sequence via *IfxVadc_Adc_setScan()* and the conversions start by calling the function *IfxVadc_Adc_startScan()*.

A second loop is performed afterwards, in order to check that new results are available and that they have not been read before.

The iLLD functions mentioned above can be found in the header file *IfxVadc_Adc.h*.

Finally, the *send_vadc()* function sends the result of the conversions of channels 0 to 4 to the serial monitor via UART.

Implementation

Configuration of the UART

In this tutorial, the UART connection is used to make the debugging more convenient and easier to understand. Since Auto Scan mode of the ADC is enabled, a new conversion is started as soon as the previous one is completed. It is then easier to debug and visualize the results if they are sent only when the user requests them.

› *init_uart()*

The iLLD function ***IfxAsclin_Asc_initModuleConfig()*** fills the configuration **ascConf** structure with the default values. Then, the parameters are set, depending on the needed connection: baudrate, Tx and Rx buffer size, Tx and Rx pin configuration etc.

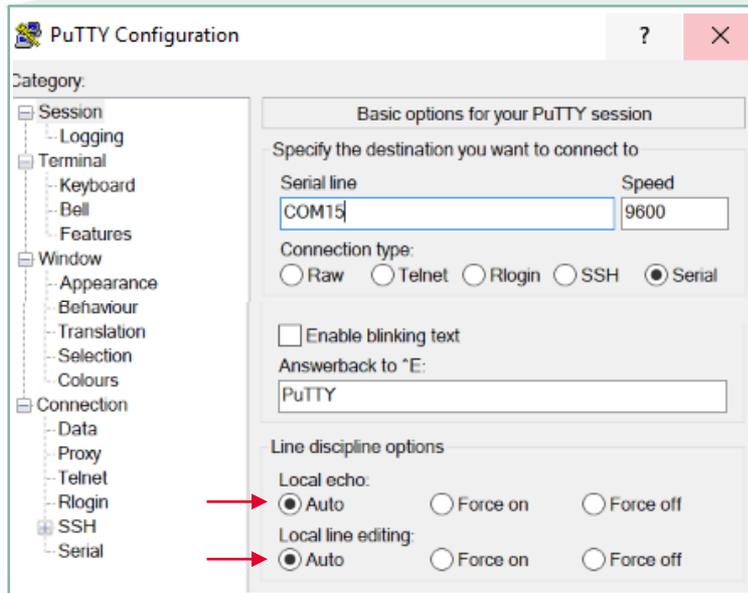
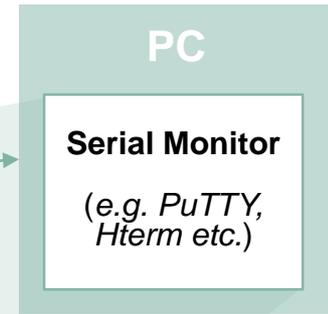
Finally, ***IfxAsclin_Asc_initModule()*** initializes the module with the user configuration previously done.

The iLLD functions mentioned above can be found in the files ***IfxAsclin_Asc.h***.

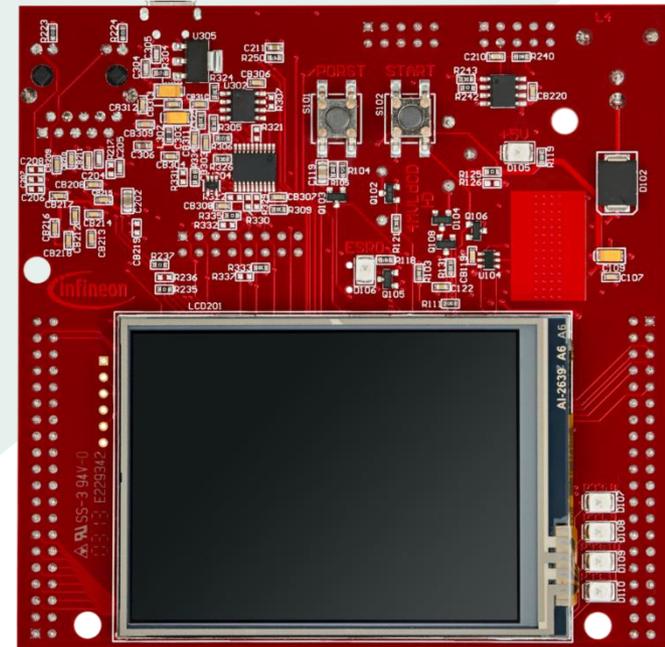
Run and Test

For this training, the serial monitor must be configured with the following parameters to enable the communication between the board and the PC:

- > Speed (baud): 9600
- > Data bits: 8
- > Stop bit: 1



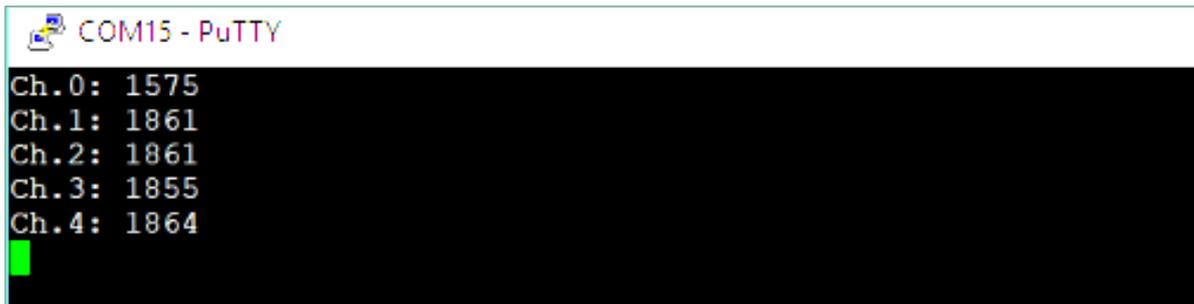
Example on PuTTY



Run and Test

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

- › Open a serial monitor and start the serial communication terminal, linked with the appropriate COMx port (this can be checked in the Device Manager)
- › In order not to overload the readout due to the endless repeated conversions, results are sent out by the AURIX™ only when the user sends the character “1”



```
COM15 - PuTTY
Ch.0: 1575
Ch.1: 1861
Ch.2: 1861
Ch.3: 1855
Ch.4: 1864
█
```

- › The 12-bits integer value, in decimal format (0 - 4095 range), of each channel is then displayed, right after conversion

Note: Due to the fact that no signal is connected to the pins, the shown values represent random analog noise.

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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