Device Driver User's Guide

ADIN1100

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INTRODUCTION

This document describes the ADIN1100 software device drivers and their usage with the target evaluation board.

The ADIN1100 is a 10BASE-T1L Ethernet PHY device with an MDIO host interface.

This version of the user's guide documents version 1.0.0 of the software drivers.

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DRIVER OVERVIEW

The ADIN1100 software driver implements an API for Ethernet PHY features such as link bring-up, auto-negotiation, link status query, etc.

The ADIN1100 may be used with different host processors and operating systems. To accommodate the different applications, the ADIN1100 software driver is implemented in a platform-independent fashion, where the access to the underlying hardware is done via a HAL API.

The ADN1100 driver architecture is shown in the picture below.

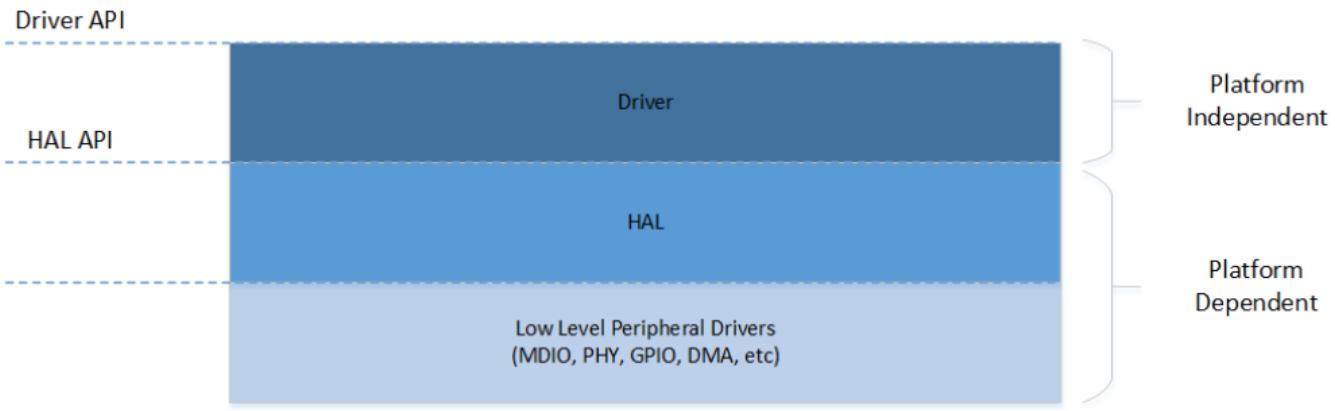

Figure 1. Driver Partitioning

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REVISION HISTORY

07/20—Revision 0.1.0: Initial Version

06/21—Revision 0.3.0: Features added

07/22 – Revision 0.4.0: Add support for link quality, test modes, frame generator and checker
08/12 – Revision 1.0.0: Interrupt handling, update evaluation board

GETTING STARTED

The ADIN1100 device driver is delivered as an installer, containing all the source code and documentation described in this document.

Prior to running the installer, the following software needs to be installed on the target machine:

- IAR Embedded Workbench version 8.32.4 or later (www.iar.com)
- Segger J-Link software pack version 6.46h or later (www.segger.com)
- When using Eval-ADIN1100EBZ board:
    - ARM CMSIS 5.7.0 (https://www.keil.com/dd2/Pack/)
    - Analog Devices ADuCM4x50 Device Support 3.3.0 (https://www.keil.com/dd2/Pack/)

After running the installer, the following structure is created in the installation directory:

- **inc**: ADIN1100 driver header files
- **src**: ADIN1100 driver sources
- **doc**: documentation, including this user's guide document
- **common**: includes the HAL API definition and ports to supported target platforms
- **examples/adin1100**: ADIN1100 examples
- **examples/bsp**: board support software

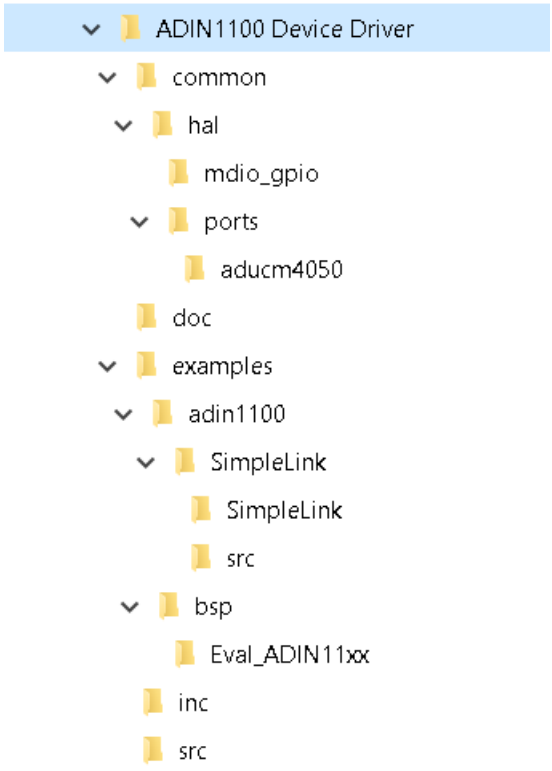

Figure 2. Directory Structure

This user's guide is found in the **doc** directory. In addition, the **doc** directory also contains the driver API reference manual in HTML format.

SOFTWARE REQUIREMENTS

The following tools and version are used for development and testing of the software driver and example code:

- IAR Embedded Workbench version 8.32.4 (www.iar.com)
- Segger J-Link software pack version 6.46h (www.segger.com)

In addition, each of the supported platforms has its own software requirements, detailed in the platforms section later in this document.

DRIVER USAGE

The ADIN1100 driver implements control to the PHY via MDIO management interface. Management access is done via MDIO clause 22 or clause45.

The following sequence of driver API calls shows a typical usage of the driver:

1. adin1100_Init() - driver initialization
2. adin1100_RegisterCallback() -registers the callback function on selected interrupt events
3. adin1100_ExitSoftwarePowerdown() – release the PHY for normal operation
4. adin1100_GetLinkStatus() – retrieves the link status information
5. adin1100_UnInit() - uninitializes the ADIN1100 PHY device

More details of the driver APIs can be found in the "ADIN1100 Device Driver API Reference Manual" HTML document, installed in the same directory as the user's guide,

The example project "SimpleLink" shows an implementation of the typical initialization and usage of the drivers.

MDIO IMPLEMENTATION

By default, the driver implements MDIO communication using a host SPI peripheral. The C functions used in the MDIO SPI implementations can be found in **common\hal\ports\aducm4050\adi_platform.c**:

- Clause 45:
  - mdioRead45Clause()
  - mdioWrite45Clause()
  - mdioAddr45Clause()
- Clause 22:
  - mdioGPIOWrite_cl22()
  - mdioGPIORead_cl22()

Note that MDIO Clause 22 accesses are not available on ADIN1100-U1.

It is not always possible to use a host SPI interface to implement the MDIO communication, for example if all SPI peripherals in the host MCU are already used by the application. For such cases, an alternative implementation of the MDIO functions listed above is provided, using GPIO bit-banging instead of a SPI interface. The GPIO bit-bang implementation can be found in **common\hal\mdio_gpio\mdio_gpio.c**, and can be selected by defining the symbol **MDIO_GPIO**, as shown later in this document.

Note that the SPI and GPIO bit-banging implementations are mutually exclusive.

Selection of MDIO Clause 22 could be done by defining the symbol **MDIO_CL22**.

INTERRUPT HANDLING

The recommended way to handle interrupts is to register a callback using the adin1100_RegisterCallback() interrupt. This callback will be executed when the ADIN1100 triggers an interrupt on the INT_N output pin.

By default, during the initialization routine adin1100_Init() the driver unmasks the hardware reset interrupt, as well as various bits in the CRSM_IRQ_STATUS register that indicate a hardware error has occurred. Additional interrupt sources, such as the link status change, can be unmasked by adding the corresponding event to the cbEvents argument of adin1100_RegisterCallback().

Note that when reading the interrupt status, either through calling adin1100_ReadIrqStatus() or direct reading of CRSM_IRQ_STATUS/PHY_SUBSYS_IRQ_STATUS registers, one or more interrupt sources in CRSM_IRQ_STATUS corresponding to

ADI_PHY_CRSM_HW_ERROR (defined in adi_phy.h) may be set. This denotes a potential unrecoverable hardware error, and when encountered it is recommended to reset and reconfigure the device.

The example project SimpleLink uses the callback functionality for hardware reset and link status change as a usage example.

HARDWARE PLATFORMS

The ADIN1100 device driver is designed to facilitate porting to different hardware platforms. It also includes out of the box support for specific hardware platforms.

SUPPORTED PLATFORMS

The following describes the hardware platforms supported out of the box, and additional requirements specific to each platform.

Eval-ADIN1100EBZ

Eval-ADIN1100EBZ is based on the ADuCM4050 (ARM Cortex-M4F MCU), please consult the evaluation board user's guide for evaluation board details.

The Eval-ADIN1100EBZ specific software requires the following CMSIS packs to be installed:

- Analog Devices ADuCM4x50 Device Support 3.3.0
- ARM CMSIS 5.7.0

They are available for download from https://www.keil.com/dd2/Pack/ or through the IAR Embedded Workbench CMSIS Manager.

PORTING TO A NEW PLATFORM

To port the driver to another platform, the HAL API needs to be implemented, providing access to registers using MDIO (Clause 45 or 22) and interrupt handling.

The HAL API is documented in the "ADIN1100 Device Driver API Reference Manual" HTML document.

RUNNING THE EXAMPLES

All example projects are located under “examples/adin1100” in the device driver installation directory.

They have been developed and tested using IAR Embedded Workbench 8.32.4.

Each example has a “readme.txt” file in the project directory which provides project specific information, such as expected LED behavior, UART output, configuration options, etc.

SYMBOLS DEFINITION

It is sometimes necessary to manipulate preprocessor symbols to control features of the driver/example code. One such instance is related to the MDIO implementation, where an implementation using GPIO bit-banging can be used instead of the default implementation using a SPI interface. Defining the symbol **MDIO_GPIO** will select the implementation using GPIO bit-banging. Defining **MDIO_CL22** will select implementation of MDIO clause 22 access to the PHY.

Symbols are defined in Project Options->C/C++ Compiler/Preprocessor, and the figure below shows the symbol being defined for SimpleLink:

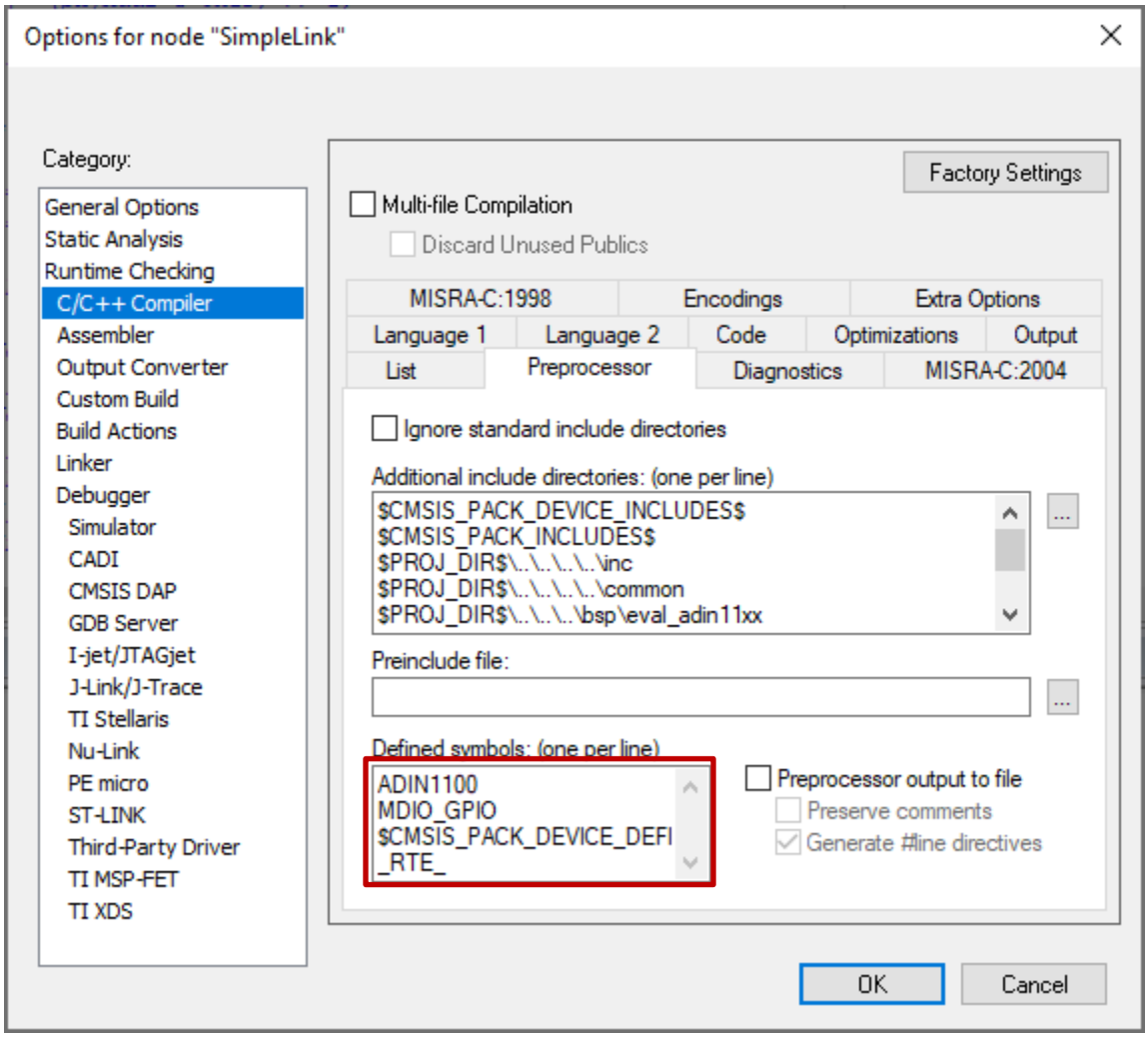

Figure 3 Symbols definition

ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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