

ATtiny104 Xplained Nano

USER GUIDE

Preface

The Atmel® ATtiny104 Xplained Nano evaluation kit is a hardware platform to evaluate the ATtiny104 microcontroller.

Supported by the Atmel Studio integrated development platform, the kit provides easy access to the features of the Atmel ATtiny104 and explains how to integrate the device in a custom design.

The Xplained Nano MCU series evaluation kits include an on-board mini embedded programmer, and no external tools are necessary to program the ATtiny104.

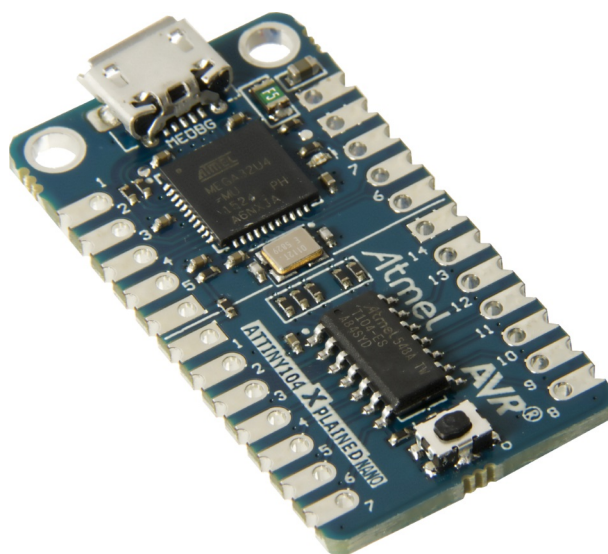


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2. Getting Started

2.1. Xplained Nano Quick Start

Steps to start exploring the Atmel Xplained Nano platform:

1. Download [Atmel Studio](#).
2. Launch Atmel Studio.
3. Connect a USB cable (Standard-A to Micro-B or Micro-AB) between the PC and the USB port on the kit.

When the Xplained Nano kit is connected to your computer for the first time, the operating system will perform a driver software installation. The driver file supports both 32- and 64-bit versions of Microsoft® Windows® XP, Windows Vista®, Windows 7, Windows 8, and Windows 10. The drivers for the kit are included with [Atmel Studio](#).

Once the Xplained Nano board is powered the green status LED will blink and Atmel Studio will auto detect which Xplained Nano board is connected. Atmel Studio will present relevant information like datasheets and kit documentation. The ATtiny104 device is programmed by the on-board Mini Embedded Debugger and therefore no external programmer tool is required.

2.2. Design Documentation and Relevant Links

The following list contains links to the most relevant documents and software for the ATtiny104 Xplained Nano.

- **Xplained products** - Atmel Xplained evaluation kits are a series of easy-to-use evaluation kits for Atmel microcontrollers and other Atmel products. For low pin-count devices the Xplained Nano series provides a minimalistic solution with access to all I/O pins of the target microcontroller. Xplained Mini kits are for medium pin-count devices and adds Arduino Uno compatible header footprint and a prototyping area. Xplained Pro kits are for medium to high pin-count devices, they features advanced debugging and standardized extensions for peripheral functions. All these kits have on board programmers/debuggers which creates a set of low-cost boards for evaluation and demonstration of features and capabilities of different Atmel products.
- **Atmel Studio** - Free Atmel IDE for development of C/C++ and assembler code for Atmel microcontrollers.
- **Atmel sample store** - Atmel sample store where you can order samples of devices.
- **Atmel Data Visualizer** - Atmel Data Visualizer is a program used for processing and visualizing data. Data Visualizer can receive data from various sources such as the Embedded Debugger Data Gateway Interface found on Xplained Pro boards and COM ports.
- **Design Documentation** - Package containing CAD source, schematics, BOM, assembly drawings, 3D plots, layer plots etc.
- **Hardware Users Guide in PDF format** - PDF version of this User Guide.

3. Xplained Nano

Xplained Nano is an evaluation platform that provides a set of small boards with access to all microcontroller I/O's. The platform consists of a series of low pin-count Microcontroller (MCU) boards, which are integrated with Atmel Studio to present relevant user guides, application notes, datasheets, and example code through Atmel Studio. The platform also features a Virtual COM port for serial communication to a host PC.

3.1. Mini Embedded Debugger

The ATtiny104 Xplained Nano contains the Atmel Mini Embedded Debugger (mEDBG) for on-board programming. The mEDBG is a composite USB device of two interfaces; a debugger and a Virtual COM Port.

Together with Atmel Studio, the mEDBG debugger interface can program the ATtiny104. On ATtiny104 Xplained Nano, the TPI interface is connected between the mEDBG and the ATtiny104.

The Virtual COM Port is connected to a UART on the ATtiny104 and provides an easy way to communicate with the target application through terminal software. It offers variable baud rate, parity, and stop bit settings.

Note: The settings on the ATtiny104 must match the settings given in the terminal software.



Info: The virtual COM port in the mEDBG requires the terminal software to set the data terminal ready (DTR) signal to enable the UART pins connected to the ATtiny104. If the DTR signal is not enabled the UART pins on the mEDBG is kept in high-z (tristate) rendering the COM port unusable. The DTR signal is set automatically by some terminal software, but it may have to be manually enabled in your terminal.

The mEDBG controls one status LED on ATtiny104 Xplained Nano. The table below shows how the LED is controlled in different operation modes.

Table 3-1. mEDBG LED Control

| Operation mode | Status LED |
|------------------|---------------------------------------------------------------------------|
| Power up | LED is lit briefly |
| Normal operation | LED is not lit |
| Programming | Activity indicator; LED flashes when programming/debugging with the mEDBG |

3.1.1. Xplained Nano Clock Output

The mEDBG output its CPU clock to the *CLK* pin 8 as shown in [Xplained Nano Standard Pin-out](#). The clock output can be used to feed the target device with a more accurate clock if this is needed for the application.

3.2. Power Sources

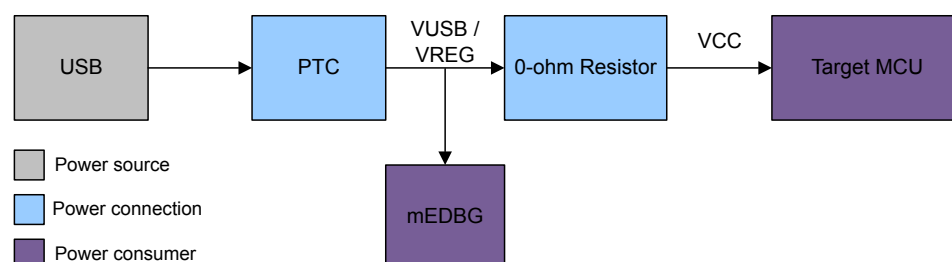
The ATtiny104 Xplained Nano kit can be powered by different sources. By default the kit will have a 5V supply and the voltage is taken directly from the USB port through a 500mA PTC fuse. The voltage from the USB connector can vary between 4.4V to 5.25V (according to USB spec).

If other voltages are required, the kit must be disconnected from the USB to avoid damage or contention to the USB power. The mEDBG must also be disconnected from the target section of the board. The board can be power by applying a voltage to one of the power connections on the board according to the table below. To avoid any power leakage through the mEDBG, this should also be disconnected by removing the resistors shown in [Figure 3-3](#). For placement of power connections, see [Xplained Nano Standard Pin-out](#).

Table 3-2. Power Connections

| Power Connection | Description |
|------------------|------------------------------------------------------------------------------------------------------------------------------------|
| VUSB | USB Voltage output when USB is connected (behind a PTC fuse). Can be used as power input when USB is not used. |
| VREG | Regulated voltage from VUSB. If the kit does not have a regulator, this is directly connected to VUSB. |
| VCC | Target voltage supply. By default connected to VREG through a 0Ω resistor. Apply external voltage here if the resistor is removed. |

Figure 3-1. Power Supply Block Diagram



3.3. Xplained Nano Standard Pin-out

Xplained Nano kits have a standard pin-out in the mEDBG section as shown in the tables and figure below. The program/debug pins will change depending on the target interface, but will remain at the same locations.

Xplained Nano kits have a target section where all I/O pins will be available and fanned out. Except for the *VCC* and *GND* pins with fixed positions, there are no defined pin functions in this area. The first pin in the target area is the *VCC* pin, located right next to the *VREG* pin of the standard section. The last pin is *GND*, and it's located next to the *CDC RX* pin in the standard section. For reference, see figure below.

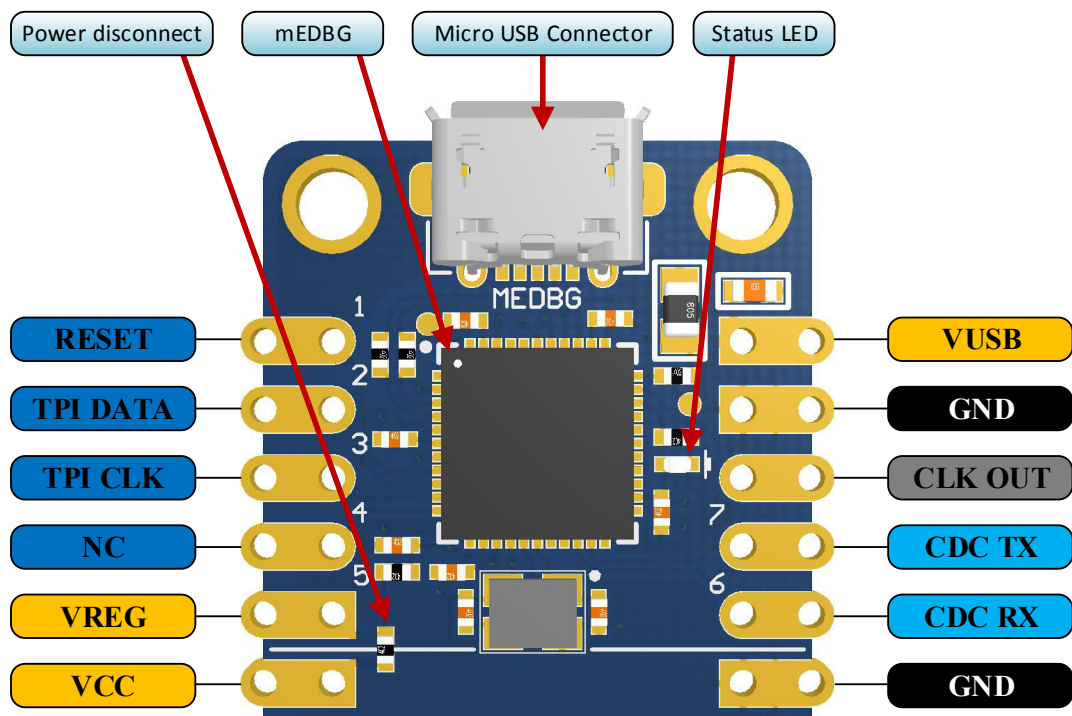
3.3.1. Standard Pin-out for TPI

Table 3-3. Xplained Nano mEDBG Standard Pin-Out

| Pin number | Name | Description |
|------------|------|--------------------------|
| 1 | RST | Reset line |
| 2 | TPID | TPI Program data line |
| 3 | TPIC | TPI Program clock output |

| Pin number | Name | Description |
|------------|---------|---------------------------------------------------|
| 4 | NC | No Connect |
| 5 | VREG | Regulated voltage or VUSB if no regulator present |
| 6 | UART RX | mEDBG UART RX line |
| 7 | UART TX | mEDBG UART TX line |
| 8 | CLK | mEDBG clock output |
| 9 | GND | Ground |
| 10 | VUSB | USB voltage |

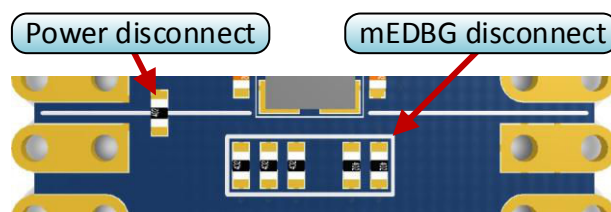
Figure 3-2. Xplained Nano Standard Pin-out for TPI



3.4. Disconnecting mEDBG

The target controller ATtiny104 can be completely separated from the mEDBG, but this requires some small modifications to the board using a soldering iron. By removing the resistors in the sections shown in the figure below, the mEDBG is completely disconnected from the target controller. If desired to connect the mEDBG again, solder in 0Ω resistors or solder in 100-mil headers on the header footprints and use wire-straps to connect the interfaces.

Figure 3-3. Kit Modifications



4. Hardware User Guide

4.1. Connectors

4.1.1. ATtiny104 Xplained Nano Pin-out

The ATtiny104 Xplained Nano has a direct fan-out of the I/O pins of the device and all I/O's are accessible at the edge connectors.

Table 4-1. Edge Connector

| Edge connector | ATtiny104 pin | Functions | Shared functionality |
|----------------|---------------|---------------------------------|----------------------|
| 1 | VCC | Power supply | |
| 2 | PA[0] | PCINT0/ADC0/AIN0/T0/CLKI/TPICLK | mEDBG TPI Clock |
| 3 | PA[1] | PCINT1/ADC1/AIN1/OC0B/TPIDATA | mEDBG TPI Data |
| 4 | PA[2] | PCINT2/RESET | mEDBG Reset |
| 5 | PA[3] | PCINT3/OC0A | |
| 6 | PA[4] | PCINT4/ICP0 | |
| 7 | PA[5] | PCINT5/ADC2/OC0B | User LED |
| 8 | PA[6] | PCINT6/ADC3 | |
| 9 | PA[7] | PCINT7 | |
| 10 | PB[0] | PCINT8/ADC4 | |
| 11 | PB[1] | PCINT9/INT0/ADC5/XCK0/OC0A/CLKO | User button |
| 12 | PB[2] | PCINT10/ADC6/TxD0/ICP0 | mEDBG CDC RX |
| 13 | PB[3] | PCINT11/ADC7/ACO/RxD0/T0 | mEDBG CDC TX |
| 14 | GND | Ground | |

4.2. Current Measurement

The power to the target controller ATtiny104 is connected from the VREG supply to the targets VCC supply with a 0Ω resistor as shown in the figure below. To measure the power consumption of the device, remove the 0Ω resistor and replace it with an ammeter. The ammeter can be connected between the VREG and VCC pads for easy measurement.

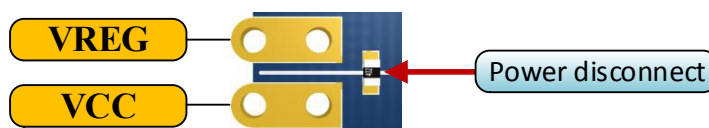


Tip: To connect the two power domains again, solder in a 0Ω resistor on the footprint or a 100-mil header on the header footprint at the edge of the board and place a jumper between VREG and VCC.



Caution: Removing the resistor while the kit is powered without an ammeter or jumper may cause the ATtiny104 to be powered through its I/O pins. This may cause permanent damage to the device.

Figure 4-1. Current Measurement



4.3. Peripherals

4.3.1. LED

There is one yellow LED available on the ATtiny104 Xplained Nano board that can be turned ON and OFF. The LED can be activated by driving the connected I/O line to GND.

Table 4-2. LED Connection

| ATtiny104 pin | Function | Shared functionality |
|---------------|-------------|----------------------|
| PA5 | Yellow LED0 | Edge connector |

4.3.2. Mechanical Buttons

ATtiny104 Xplained Nano contains one mechanical button. This is a generic user configurable button and when a button is pressed it will drive the I/O line to GND.



Info: There is no pull-up resistor connected to the generic user button. Remember to enable the internal pull-up in the ATtiny104 to use the button.

Table 4-3. Mechanical Button

| ATtiny104 pin | Description | Shared functionality |
|---------------|-------------|----------------------|
| PB1 | User button | Edge connector |

5. Embedded Debugger Implementation

ATtiny104 Xplained Nano contains a Mini Embedded Debugger (mEDBG) that can be used to program the ATtiny104 using Tiny Program Interface (TPI). The mEDBG also include a Virtual Com port interface over UART. Atmel Studio can be used as a front end for the Mini Embedded Debugger.

5.1. Tiny Program Interface

The Tiny Program Interface (TPI) uses two pins to communicate with the target. For further information on how to use the programming capabilities of the mEDBG, see [Mini Embedded Debugger](#).

Table 5-1. TPI Connections

| ATtiny104 pin | Function | Shared functionality |
|---------------|-----------|----------------------|
| PA0 | TPI clock | mEDBG |
| PA1 | TPI data | mEDBG |

5.2. Virtual COM Port

The Embedded Debugger acts as a Virtual Com Port gateway by using one of the ATtiny104 UARTs. For further information on how to use the Virtual COM port, see [Mini Embedded Debugger](#).

Table 5-2. Virtual COM Port Connections

| ATtiny104 pin | Function | Shared functionality |
|---------------|------------------------------|----------------------|
| PB2 | UART TXD (ATtiny104 TX line) | mEDBG CDC RX |
| PB3 | UART RXD (ATtiny104 RX line) | mEDBG CDC TX |

6. Hardware Revision History and Known Issues

This user guide is written to reflect the latest available revision of the kit. This chapter contains information about known issues, a revision history of older revisions, and how older revisions differ from the latest revision.

6.1. Identifying Product ID and Revision

The revision and product identifier of Xplained Nano boards can be found in two ways; either through Atmel Studio or by looking at the sticker on the bottom side of the PCB.

By connecting an Xplained Nano board to a computer with Atmel Studio running, an information window will pop up. The first six digits of the serial number, which is listed under kit details, contain the product identifier and revision.

The same information can be found on the sticker on the bottom side of the PCB. Most kits will print the identifier and revision in plain text as A09-nnnn\rr, where nnnn is the identifier and rr is the revision. Boards with limited space have a sticker with only a QR-code, which contains a serial number string.

The serial number string has the following format:

```
"nnnnrrssssssssss"  
n = product identifier  
r = revision  
s = serial number
```

The product identifier for ATtiny104 Xplained Nano is A09-2678.

6.2. Revision 2

The target device U200 on revision 2 of the kit has been changed from engineering samples (ATTINY104-SSNRES) to non-engineering samples (ATTINY104-SSNR).

6.3. Revision 1

Revision 1 is the initially released revision.

Engineering samples are mounted on revision 1 for the target device U200 (ATTINY104-SSNRES).

7. Document Revision History

| Doc. rev. | Date | Comment |
|-----------|---------|-----------------------------|
| 42671B | 08/2016 | Add revision 2 information. |
| 42671A | 02/2016 | Initial document release. |

8. Evaluation Board/Kit Important Notice

This evaluation board/kit is intended for use for **FURTHER ENGINEERING, DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY**. It is not a finished product and may not (yet) comply with some or any technical or legal requirements that are applicable to finished products, including, without limitation, directives regarding electromagnetic compatibility, recycling (WEEE), FCC, CE or UL (except as may be otherwise noted on the board/kit). Atmel supplied this board/kit "AS IS", without any warranties, with all faults, at the buyer's and further users' sole risk. The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies Atmel from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge and any other technical or legal concerns.

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