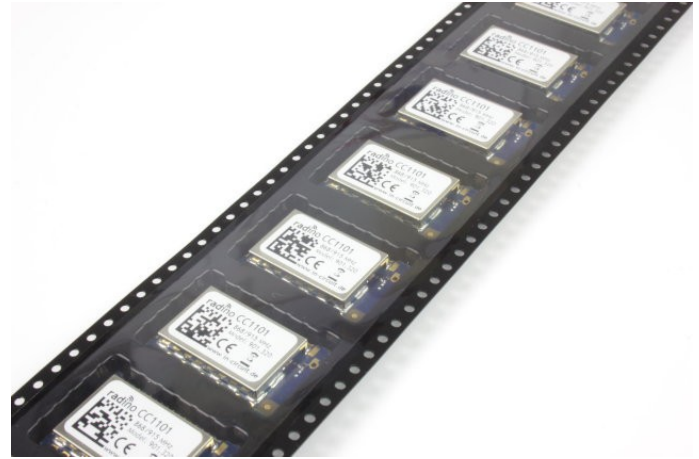


radino CC1101

The In-Circuit radino CC1101 combines an **Arduino Micro** with TI's **CC1101** in a small form-factor **EMC-compliant** enclosure.

It's part of the radino-series, which provides full-Arduino-compatible wireless communication devices in a small form factor, all **pin-compatible** to each other.



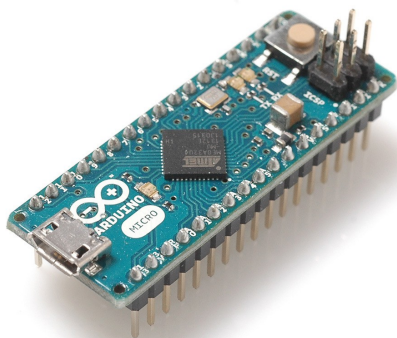
Features

- Arduino-compatible (Arduino Micro / Leonardo)
- TI CC1101 (<http://www.ti.com/lit/ds/symlink/cc1101.pdf>)
- Wide range of possible protocols
- Available for 433MHz / 868MHz /915MHz (assembly option for BALUN)
- 15 GPIOs (5 PWM, 5 Analog IN)
- I²C, SPI, UART
- USB (HUID Keyboard & Mouse, virtual UART)
- High-Performance, Low-Power Microcontroller
- Arduino Demo Applications available in our library!

Applications

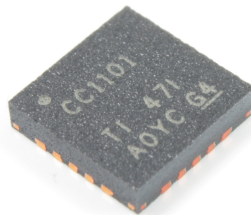
- Ultra low power wireless applications operating in the 433/868/915 MHz ISM/SRD bands
- Wireless alarm and security systems
- Industrial monitoring and control
- Wireless sensor networks
- AMR – Automatic Meter Reading
- Home and building automation
- Wireless MBUS

For more information visit:
<http://www.in-circuit.de/>
<http://www.radino.cc/>



Arduino Micro

+



CC1101

=

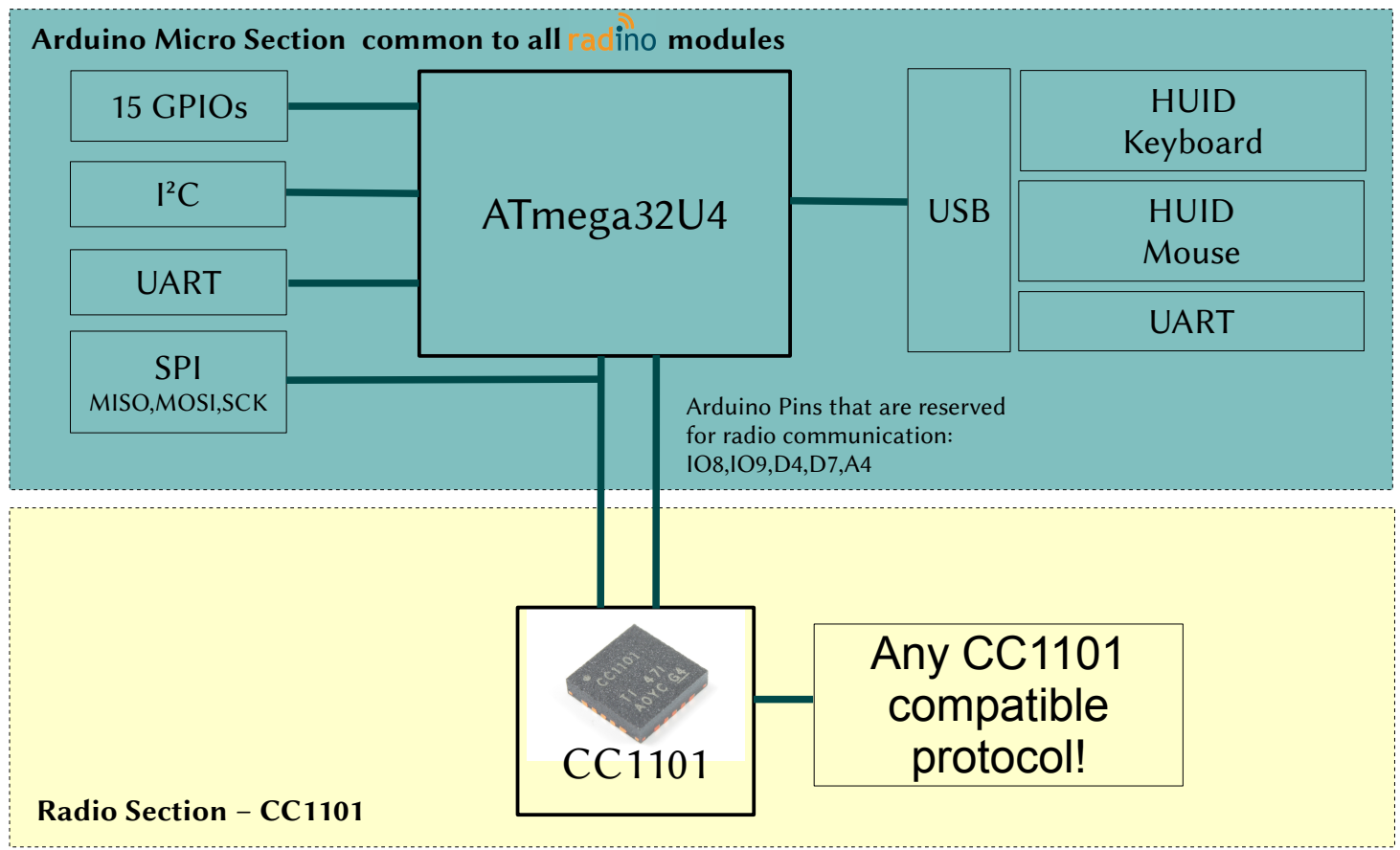


radino CC1101

Overview

The In-Circuit radino CC1101 combines an Arduino Micro with CC1101. Despite its small form factor, the radino CC1101 offers great connectivity. It's a perfect core for any CC1101 project, almost all GPIOs, interfaces and connections of the ATmega32U4 can be connected to external circuitry.

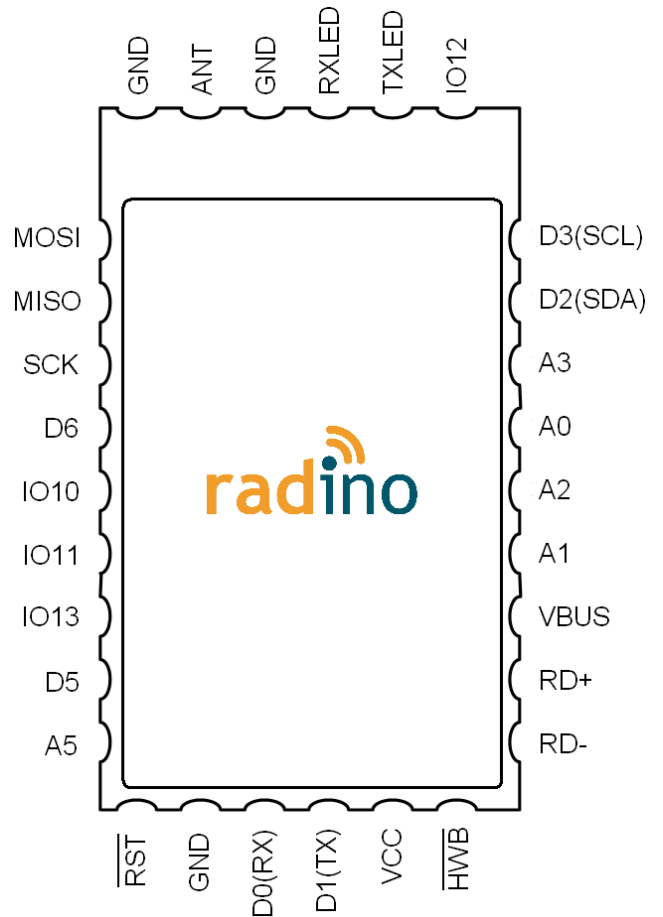
A modified Arduino Micro Bootloader is pre-installed on the radino CC1101. This enables easy programming by using the Arduino IDE (<http://www.arduino.cc/>). Refer to section "First steps with radino" for more information.



Pinout and Terminal Description



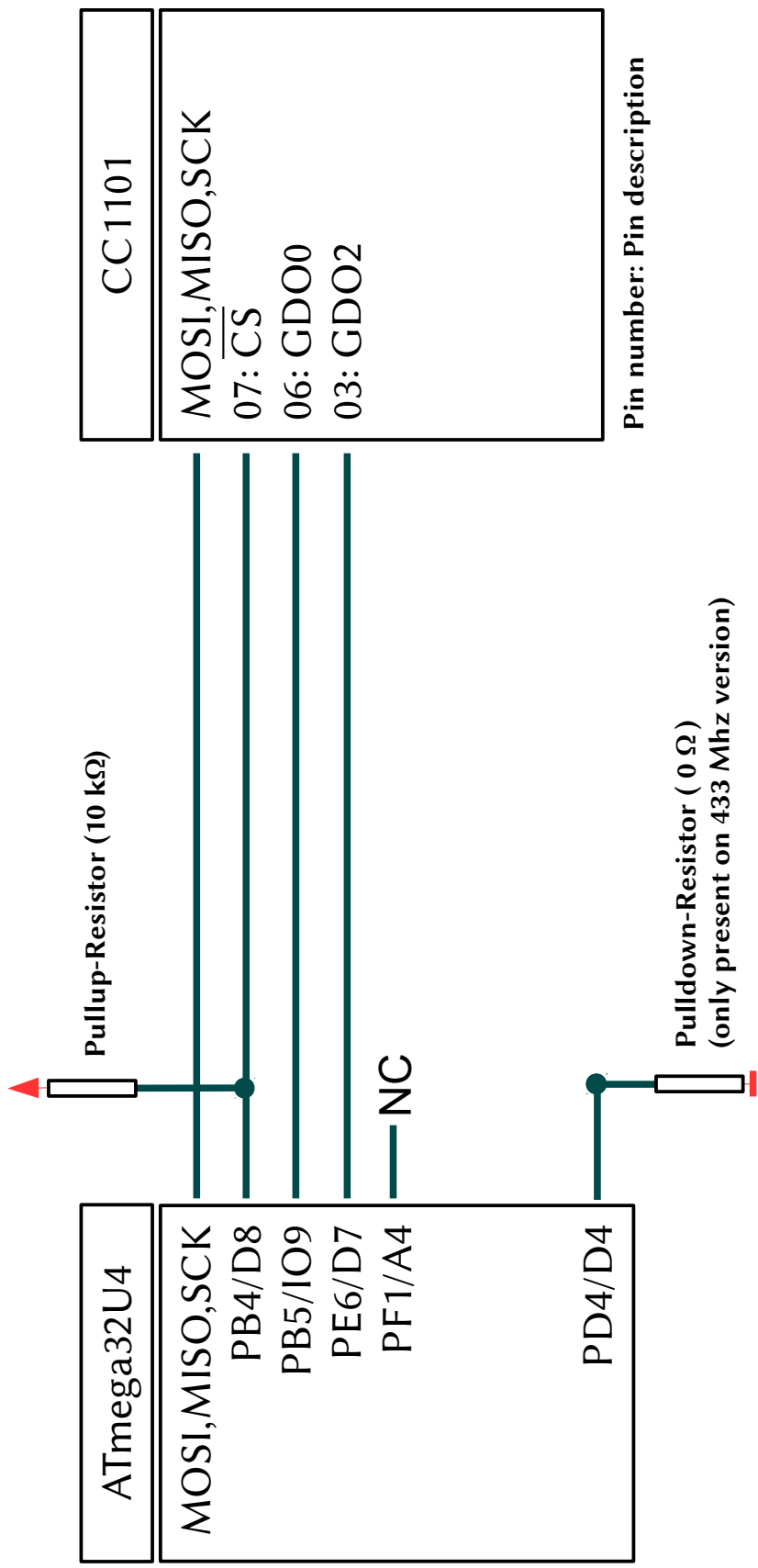
Top View



| radino Pin No. | Name | Arduino Pin No. | Atmega32U4 Port | Description / Function (bold = main function) |
|----------------|-------|-----------------|-----------------|---|
| 1 | MOSI | 16 | PB2 | SPI-MOSI (also connected to internal radio section) GPIO; PCINT2 |
| 2 | MISO | 14 | PB3 | SPI-MISO (also connected to internal radio section) GPIO; PCINT3 |
| 3 | SCK | 15 | PB1 | SPI-SCK (also connected to internal radio section) GPIO; PCINT1 |
| 4 | D6 | 6 A7 | PD7 | GPIO; PWM ADC10 |
| 5 | IO10 | 10 A10 | PB6 | GPIO; PWM; PCINT6; ADC13 |
| 6 | IO11 | 11 | PB7 | GPIO; PWM; PCINT7; UART-RTS |
| 7 | IO13 | 13 | PC7 | GPIO; PWM |
| 8 | D5 | 5 | PC6 | GPIO; PWM |
| 9 | A5 | A5 23 | PF0 | ADC0 GPIO |
| 10 | Reset | - | Reset | Reset of Atmega32U4 |
| 11 | GND | - | GND | Ground |

| radino Pin No. | Name | Arduino Pin No. | Atmega32U4 Port | Description / Function (bold = main function) |
|----------------|----------------------------------|-----------------|-----------------|--|
| 12 | D0(RX) | 0 | PD2 | UART-RX GPIO; INT2 |
| 13 | D1(TX) | 1 | PD3 | UART-TX GPIO; INT3 |
| 14 | V _{CC} | - | VCC | Power supply |
| 15 | $\overline{\text{HWB}}$ | - | PE2 | Hardware-Bootloader-Enable; Low-Active |
| 16 | RD- | - | RD- | USB-D- |
| 17 | RD+ | - | RD+ | USB-D+ |
| 18 | V _{BUS} | - | VBUS | USB voltage IN (VBUS will NOT supply the module. Connect VCC on Pin 14 to supply the module.) |
| 19 | A1 | A1 19 | PF6 | ADC6 GPIO |
| 20 | A2 | A2 20 | PF5 | ADC5 GPIO |
| 21 | A0 | A0 18 | PF7 | ADC7 GPIO |
| 22 | A3 | A3 21 | PF4 | ADC4 GPIO |
| 23 | D2(SDA) | 2 | PD1 | SDA GPIO; INT1 |
| 24 | D3(SCL) | 3 | PD0 | SCL GPIO; PWM; INT0 |
| 25 | IO12 | 12 A11 | PD6 | GPIO; PWM ADC9 |
| 26 | TXLED | - | PD5 | TXLED GPIO; UART-CTS |
| 27 | RXLED/ $\overline{\text{SS}}$ | 17 | PB0 | RXLED GPIO; SS; PCINT0 |
| 28 | GND | - | GND | Ground |
| 29 | ANTENNA | - | - | Antenna pin |
| 30 | GND | - | GND | Ground |
| - | Input, determine assembly option | 4 | PD4 | connected to internal radio section refer to section "Detailed interconnection diagram" |
| - | CC1101-GDO2 | 7 | PE6 | connected to internal radio section Signal: GDO2 |
| - | CC1101-SS | 8 | PB4 | connected to internal radio section Signal: $\overline{\text{CS}}$ |
| - | CC1101-GDO0 | 9 | PB5 | connected to internal radio section Signal: GDO0 |
| - | not used | A4 | PF1 | not connected |

Detailed Interconnection diagram



Pin number: Pin description

Electrical Characteristics

Absolut Maximum Ratings

Note: These are absolute maximum ratings beyond which the module can be permanently damaged. These are not maximum operating conditions.

| Rating | Min | Max | Unit |
|---------------------------|------|--------------|------|
| Storage Temperature | -50 | 125 | °C |
| V_{CC} | -0.3 | 3.6 | V |
| V_{BUS} | -0.5 | 6 | V |
| $\overline{\text{Reset}}$ | -0.5 | 13 | V |
| Other Terminal Voltages | -0.3 | $V_{CC}+0.3$ | V |

Recommended Operating Conditions

Environmental conditions

| Rating | Min | Typ. | Max | Unit |
|-----------------------|-----|------|-----|------|
| Operating Temperature | -40 | | 85 | °C |
| V_{CC} | 2.7 | 3.3 | 3.6 | V |

DC Characteristics

$T_A = -40^\circ\text{C}$ to 85°C , $V_{CC} = 2.7\text{V}$ to 3.6V (unless otherwise noted)

| Symbol | Rating | Min | Typ. | Max | Unit |
|-----------|--|-------------------------|------|-------------------------|------|
| V_{IL} | Input Low Voltage, except $\overline{\text{Reset}}$ pin | -0.3 | | $0.2V_{CC}-0.1\text{V}$ | V |
| V_{IL2} | Input Low Voltage, $\overline{\text{Reset}}$ pin | -0.5 | | $0.1V_{CC}$ | V |
| V_{IH} | Input High Voltage, except $\overline{\text{Reset}}$ pin | $0.2V_{CC}+0.9\text{V}$ | | $V_{CC} + 0.5$ | V |
| V_{IH1} | Input High Voltage, $\overline{\text{Reset}}$ pin | $0.9V_{CC}$ | | $V_{CC} + 0.5$ | V |
| V_{OL} | Output Low Voltage | | | 0.5 | V |
| V_{OH} | Output High Voltage | 2.3 | | | V |

Current consumption parameters

Operation conditions: $V_{CC}=3.3V$, $T_A=-40^{\circ}C$ to $+85^{\circ}C$.

| Symbol | Rating | Min | Typ. | Max | Unit |
|----------|--|-----|------|-----|---------|
| I_{on} | Full on | --- | 20 | --- | mA |
| I_s | Deep sleep (WDT enabled, Pin-INT enabled) | --- | <20 | --- | μA |

First steps with radino

The core of radino is an Arduino Micro, so the programming is as easy as programming an Arduino Micro. Visit <http://www.arduino.cc/> for more information about the Arduino project.

1. Download & Install Arduino IDE

Arduino IDE is the development environment for Arduino. It's recommended to use this IDE when developing software for an Arduino-based module like radino. Nevertheless you can also use tools like Atmel Studio or any similar tool for Atmel microcontrollers to program these devices. (If they are based on an Atmel microcontroller like ATmega32U4 on radino).

→ Visit <http://www.arduino.cc/en/Main/Software> and download the latest version of Arduino IDE
(We can't guarantee full functionality with BETA builds of Arduino IDE)

→ Install Arduino IDE on your computer

Arduino IDE requires a main Sketch-folder where new sketches/projects will be saved to by default. Also all additional libraries and hardware-files have to be put into this folder to be recognized by the Arduino IDE.

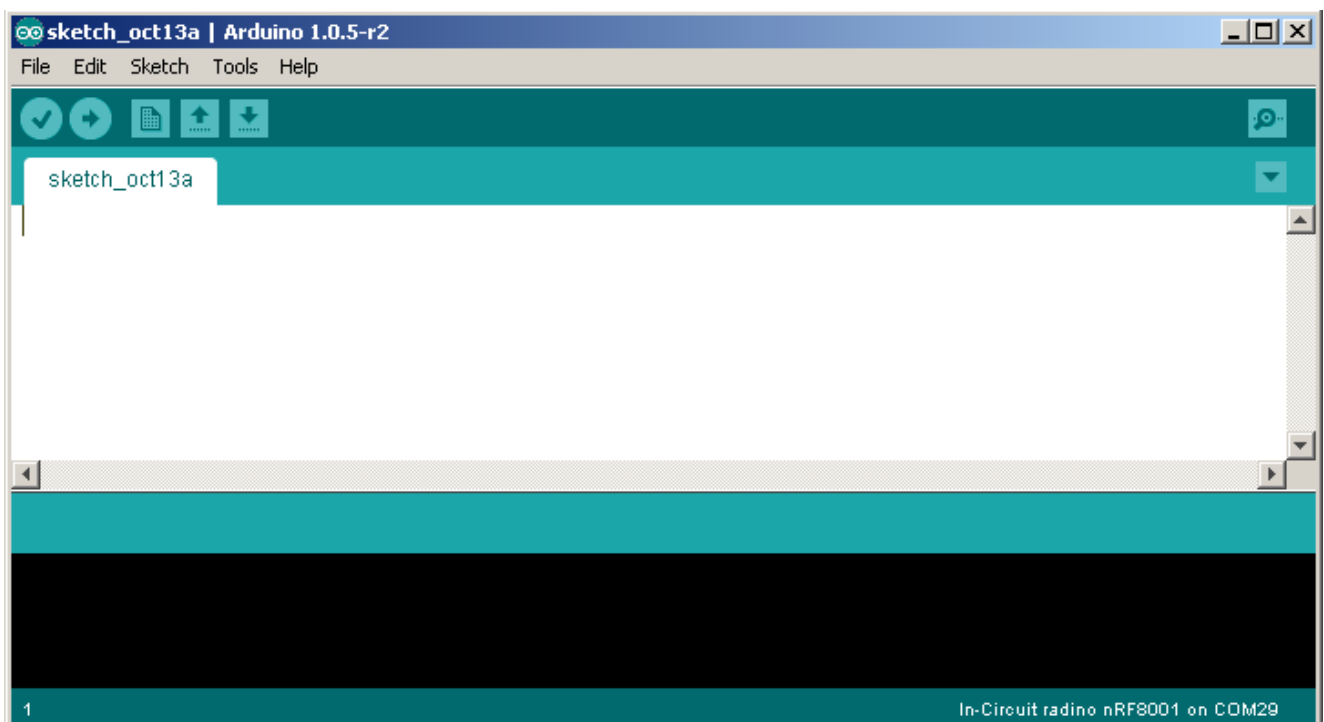
Default paths for this Sketch-folder are:

My Documents\Arduino
C:\Documents and Settings\yourUserName\My Documents\Arduino
C:\Users\yourUserName\Documents\Arduino

German computers:
Eigene Dateien\Arduino
C:\Dokumente und Einstellungen\ihrBenutzerName\Eigene Dateien\Arduino
C:\Benutzer\ihrBenutzerName\Eigene Dateien\Arduino

You can also define a specific path when installing Arduino IDE.

→ Now start Arduino IDE. If installed properly, a window like this should open:



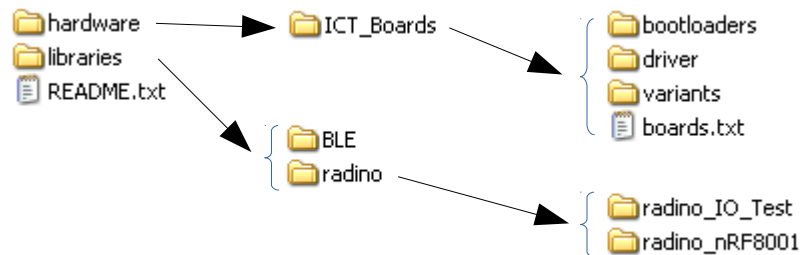
2. Download & Install radino support files

We provide a general Arduino support package for all our Arduino based products, which also includes support for the radino series. This includes required libraries, hardware files and example sketches for an easy start with radino

→ Visit <http://www.in-circuit.de/> or <http://www.radino.cc/> to download the latest In-Circuit Arduino SW Support Package

→ Unzip the downloaded file

You now have 2 folders ('hardware' and 'libraries') and a file called 'README.txt'. The content of these folders could look like the following structure:



Folder 'hardware' contains all hardware information required by the Arduino IDE to recognize and program the radino
The subfolder 'driver' contains all required USB-drivers for radino

Folder 'libraries' contains all example sketches provided for radino.

'README.txt' provides general information about installing these 2 folders properly.

→ Now copy both folders into your main Arduino-Sketch folder. As mentioned in '1. Download & Install Arduino IDE', this folder was specially defined or has one of the following default paths:

My Documents\Arduino
C:\Documents and Settings\yourUserName\My Documents\Arduino
C:\Users\yourUserName\Documents\Arduino

German computers:
Eigene Dateien\Arduino
C:\Dokumente und Einstellungen\ihrBenutzerName\Eigene Dateien\Arduino
C:\Benutzer\ihrBenutzerName\Eigene Dateien\Arduino

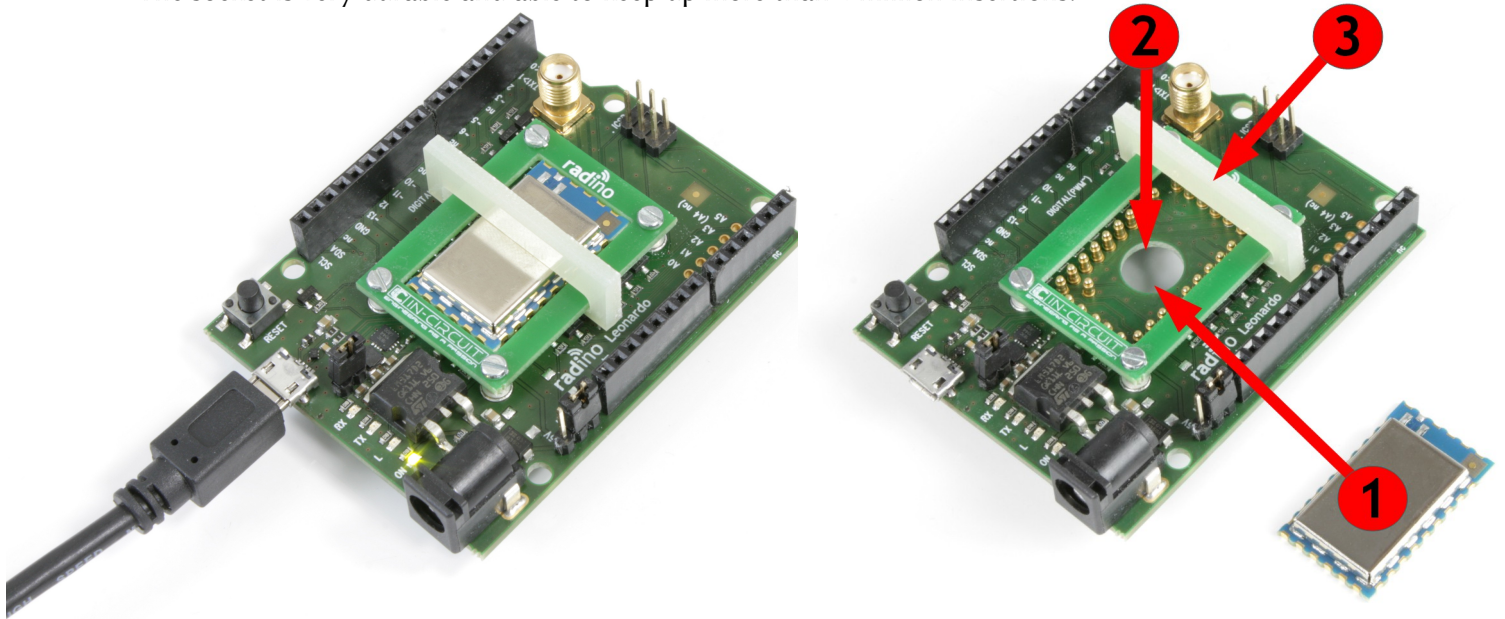
3. Connect your radino

We recommend to use the radino Leonardo for easy programming and development.

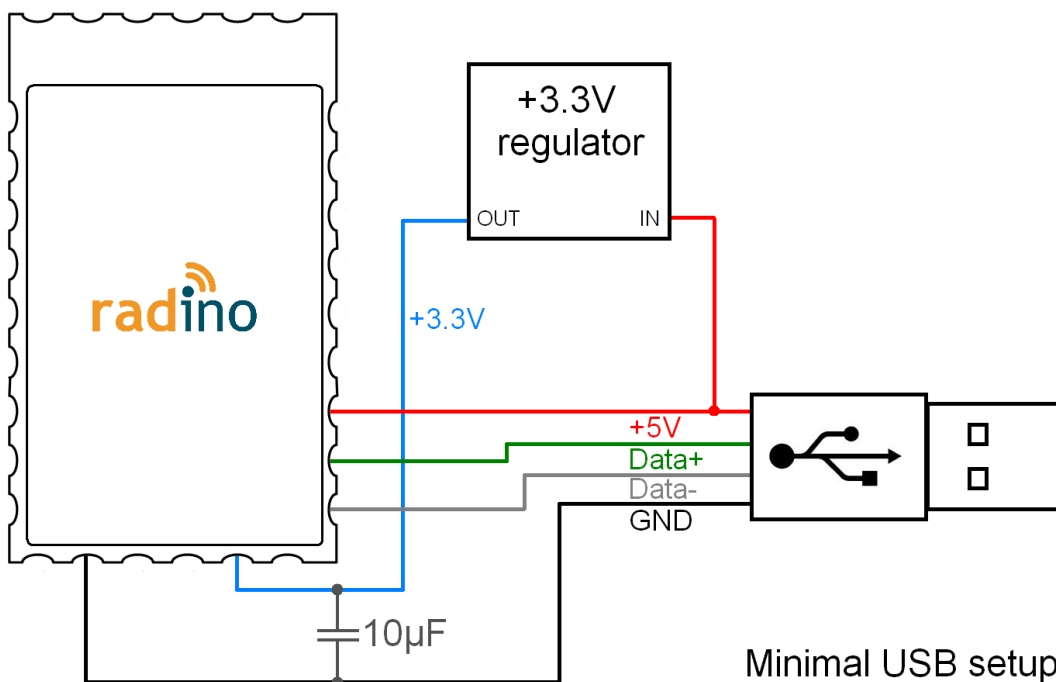
Just plug the radino into the socket on the radino Leonardo board as depicted in the right picture:

- 1.) put the radino into the socket on radino Leonardo ...
 - 2.) press it down
 - 3.) move the fastener to the middle of the radino and stop pressing on module
- The radino is connected reliable now.

Note: You can use the radino Leonardo to pre-program your radino modules before soldering them. The socket is very durable and able to keep up more than 1 million insertions!

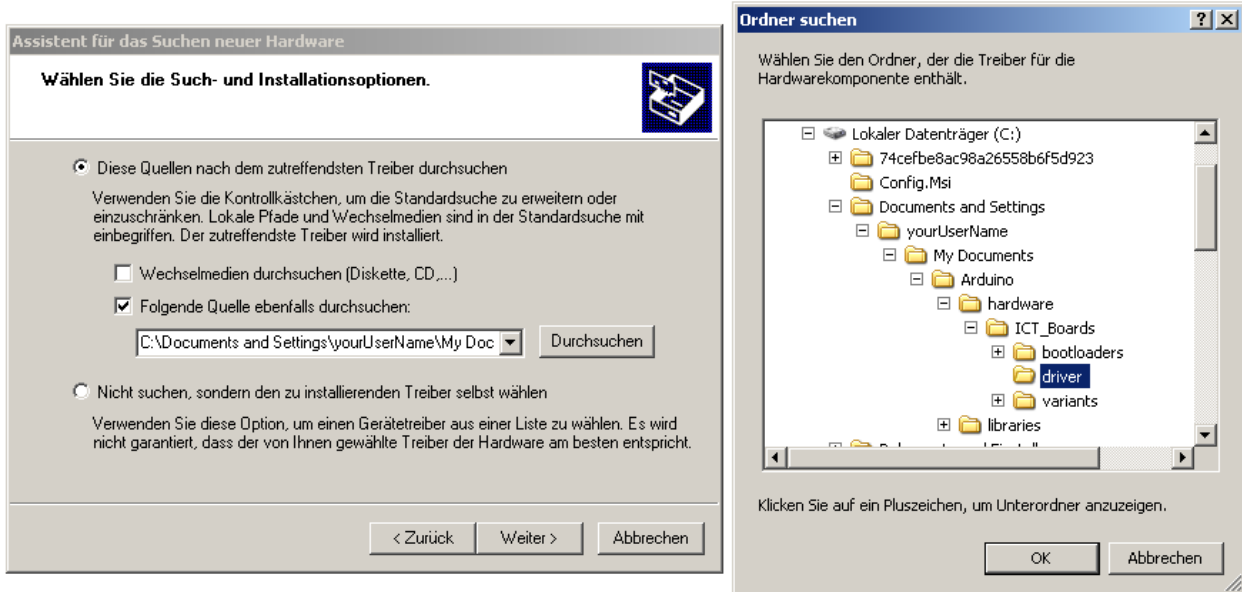


The minimal USB setup is shown in the picture below. This also represents the minimal setup for an USB-to-radio-UART-stick with radino.

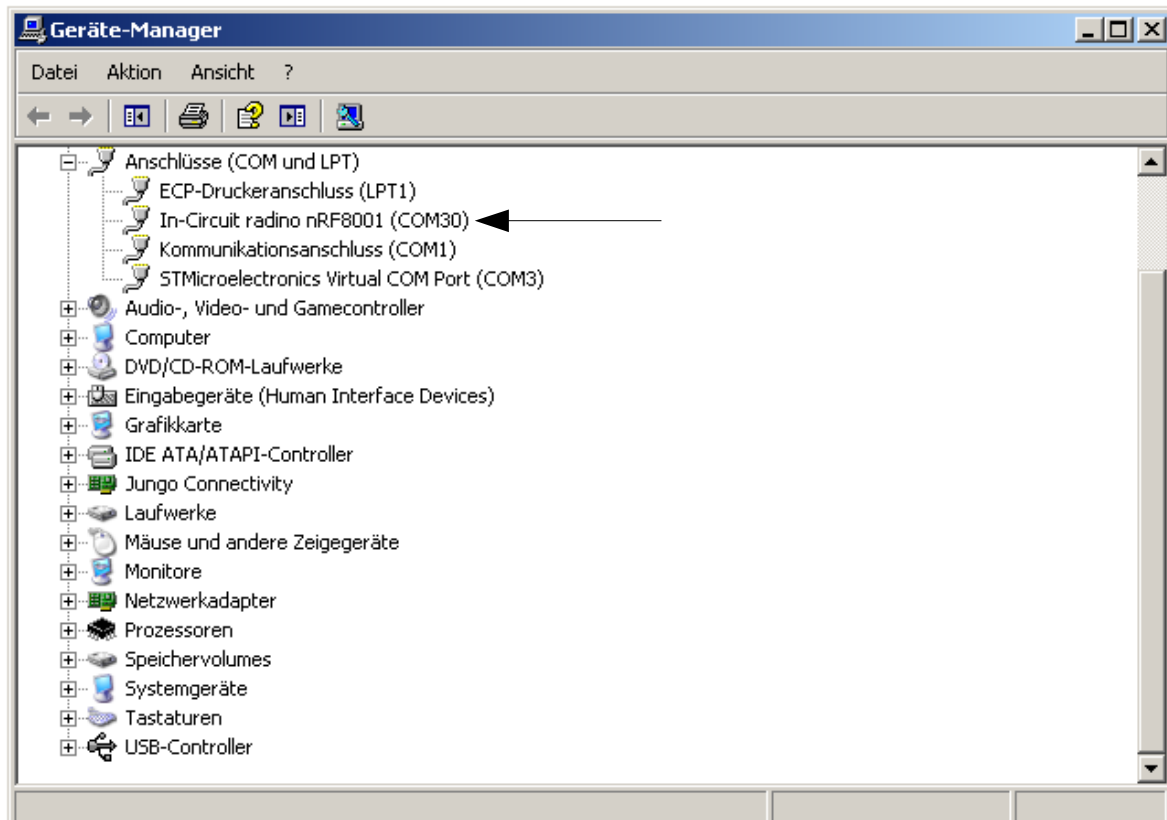


4. Install driver & determine serial port

After connecting radino, your computer will recognize it. When first using radino, a driver installation is required. If asked for the driver, just point the driver installer tool to the radino 'driver' folder mentioned in '2. Download & Install radino support files':



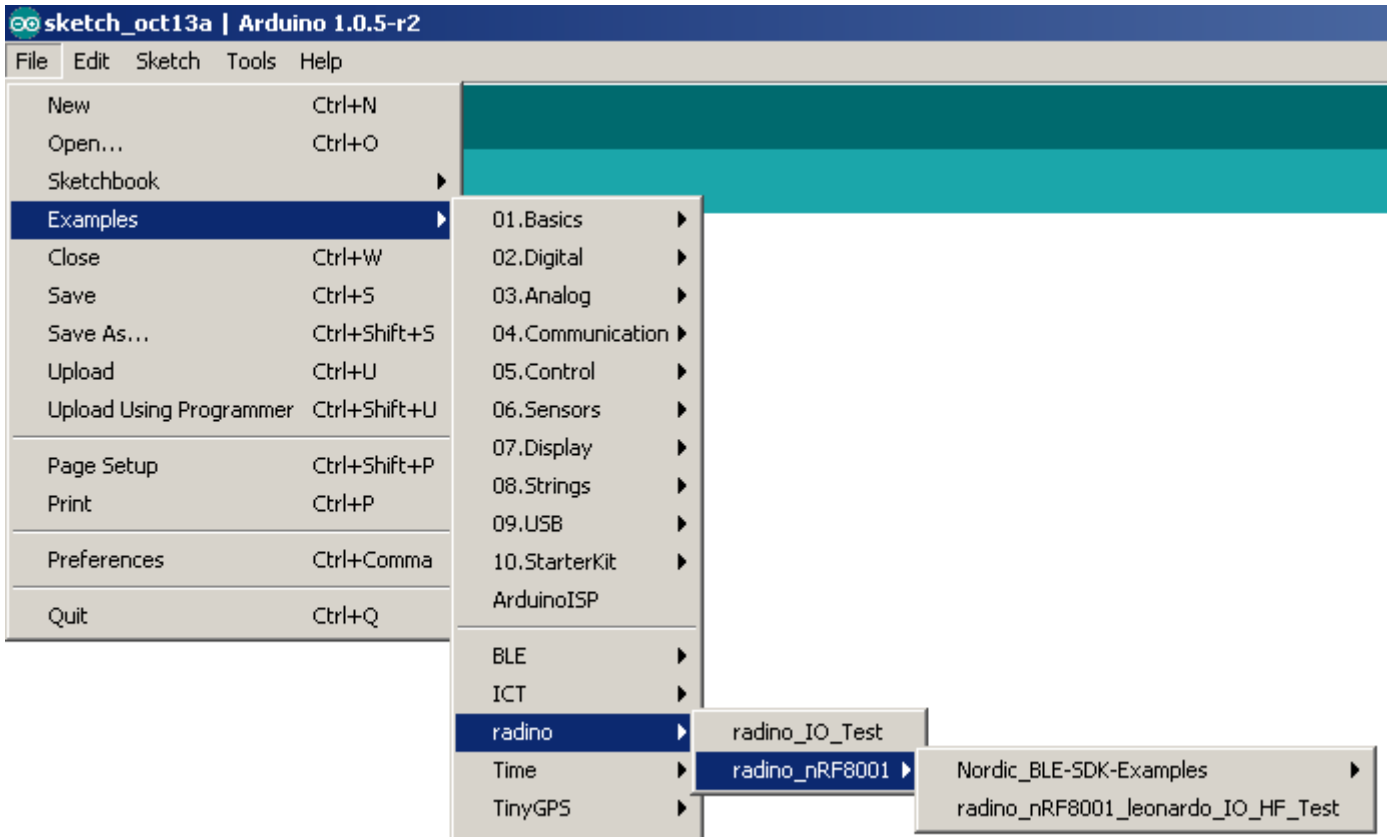
Your computer now assigns a serial port / COM-port. It's important to know the COM-port number of your radino. Therefore open the 'device manager' of Windows. (e.g. by clicking Start → Run → type 'devmgmt.msc' → Enter) The radino in this example got the COM-port COM30:



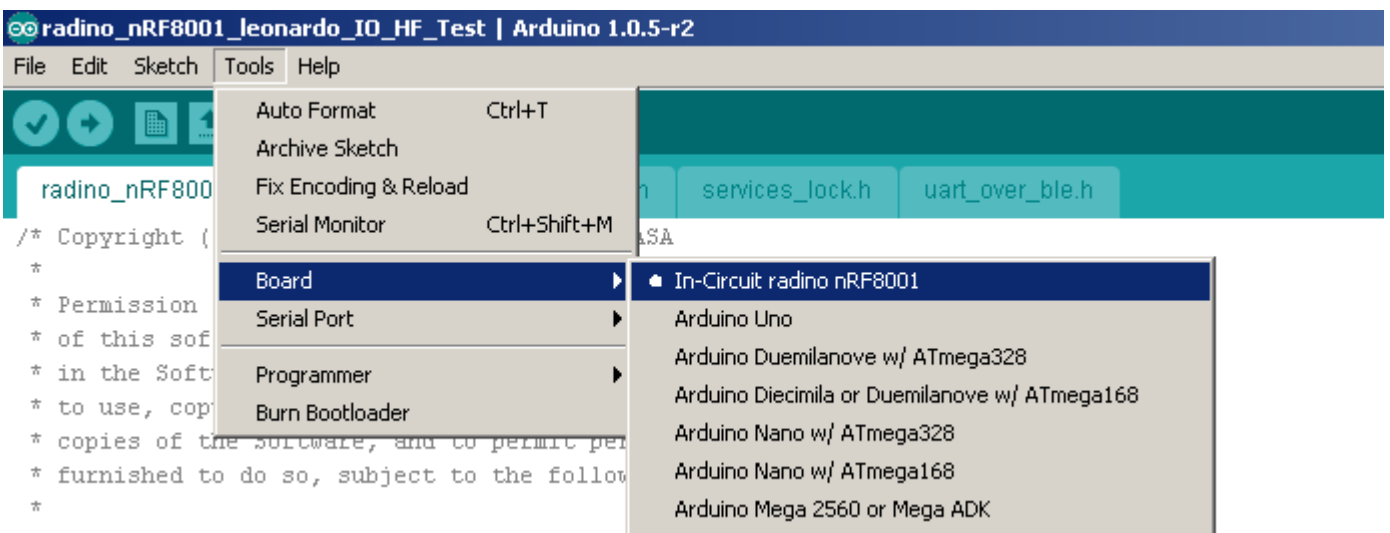
5. Upload your first sketch

If Arduino IDE and the support files were installed properly, it's now time to upload the first sketch to your radino

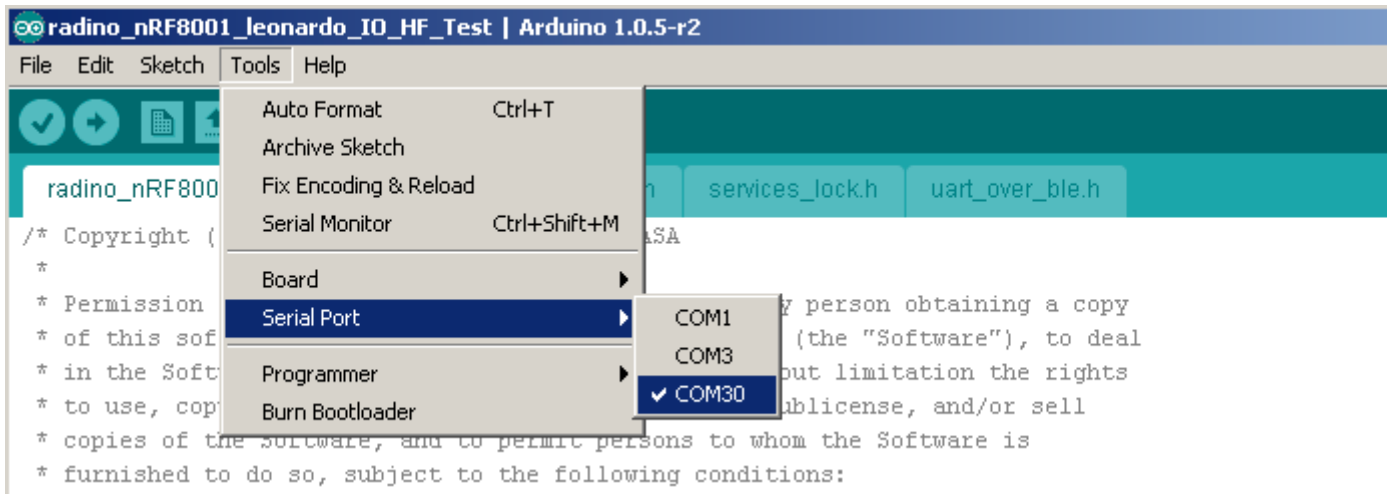
→ Open Arduino IDE and select one of the various available example sketches for your radino:



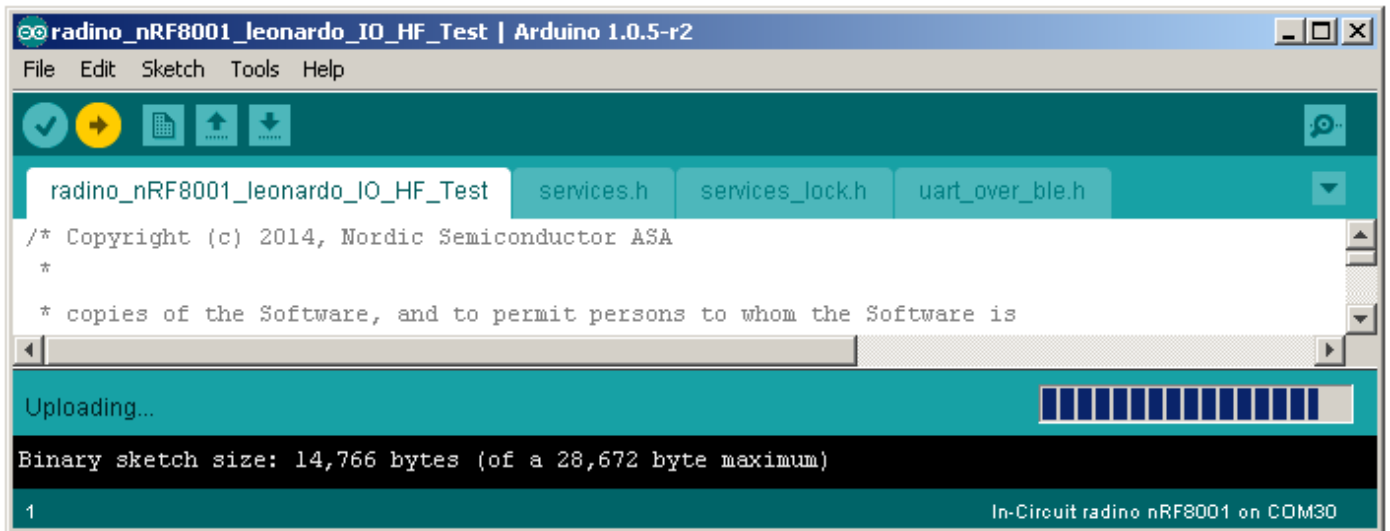
→ Now choose your corresponding radino to which you want to upload the sketch:



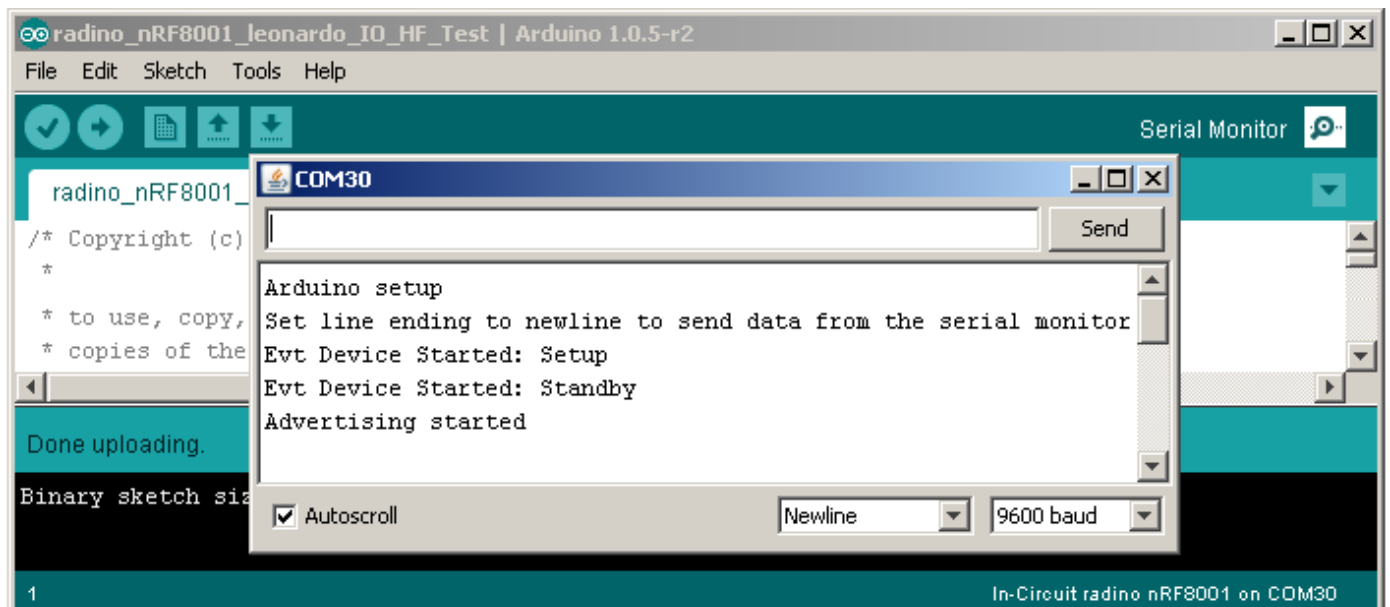
Now select the corresponding serial port / COM-port of radino that was determined in step '4. Install driver & determine serial port':



To upload your sketch simply click on the 'Upload'-Button on the top left corner.

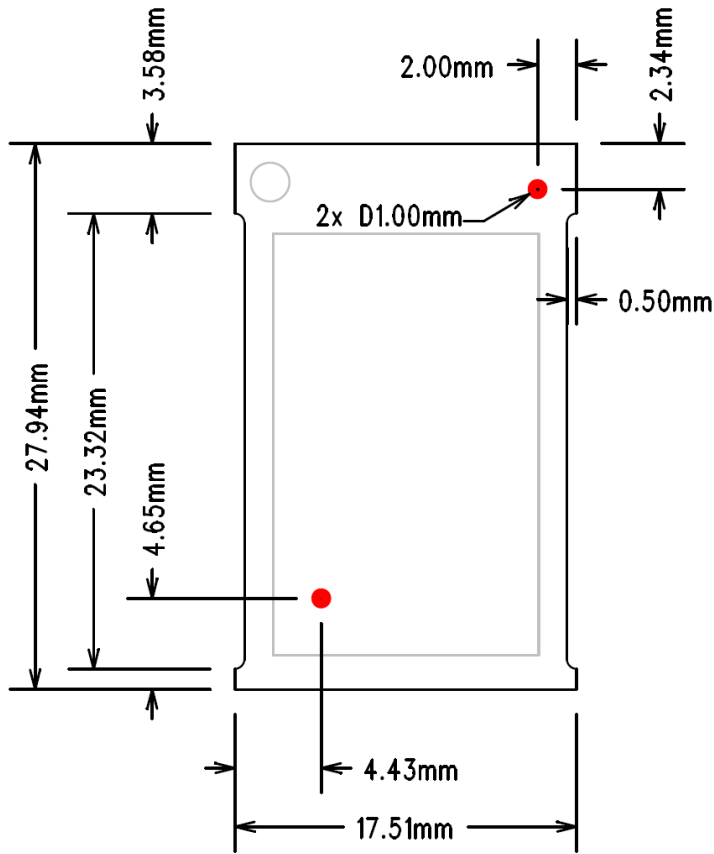


Now you can open the serial monitor to communicate with your radino:

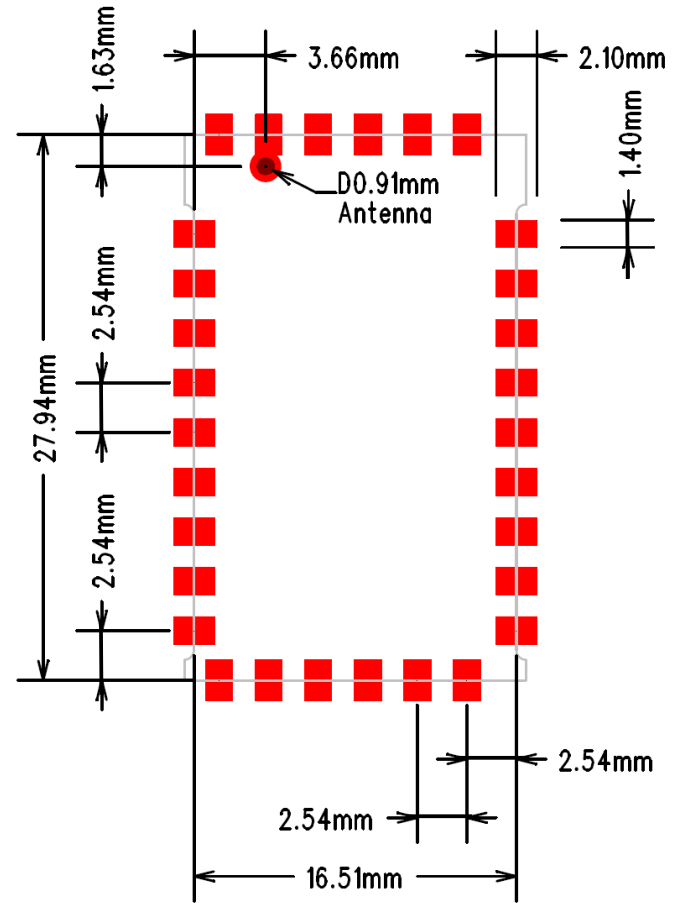


Package Dimensions and recommended PCB Footprint

seen from top side



recommended footprint

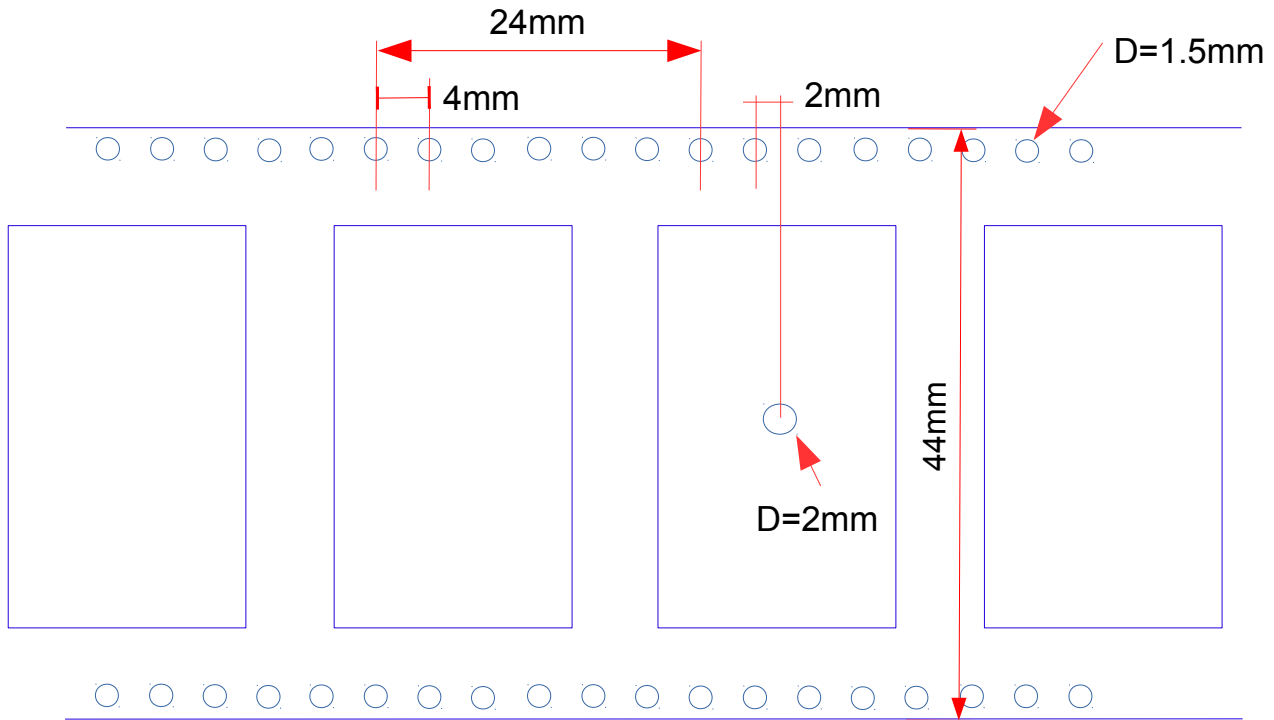


Packaging: tape & reel specification

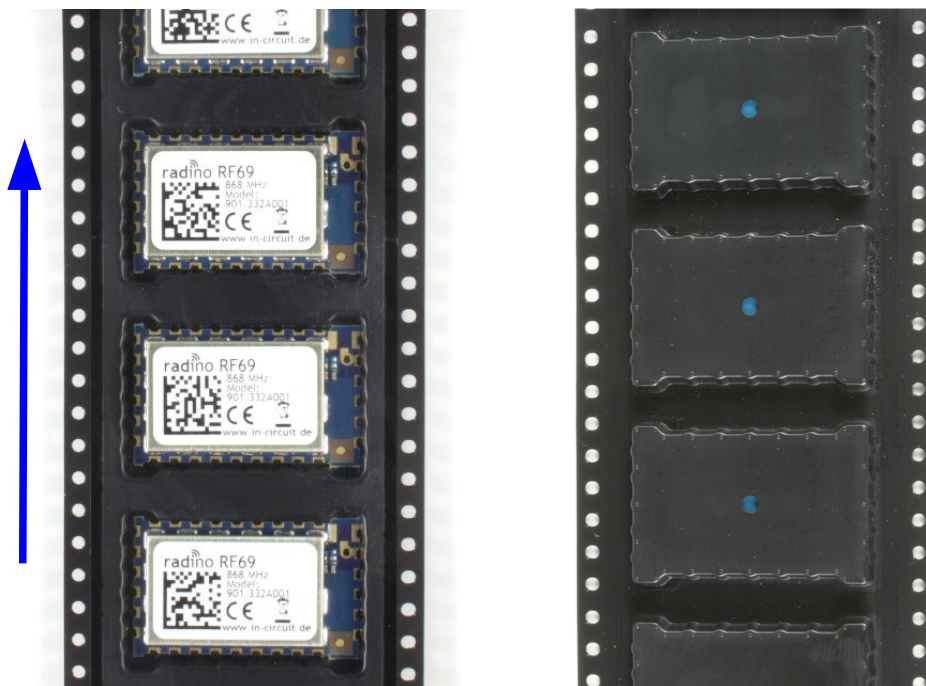
All radino modules come in a tape & reel package suitable for pick and place machines. Small quantities are delivered as cut-tape. There are 2 kinds of reels available with 100pcs and 500pcs per reel (see section ordering information)

Except the number of modules, all parameters are same to both reel sizes:

- 13" reel size
- 44mm tape width
- tape pocket dimensions 29mm x 19mm x 4mm
- module spacing 24mm
- 2mm hole in the middle of the module body
- 1.5mm tape holes for transport



Transport direction
 (Antenna connector
 to the right)

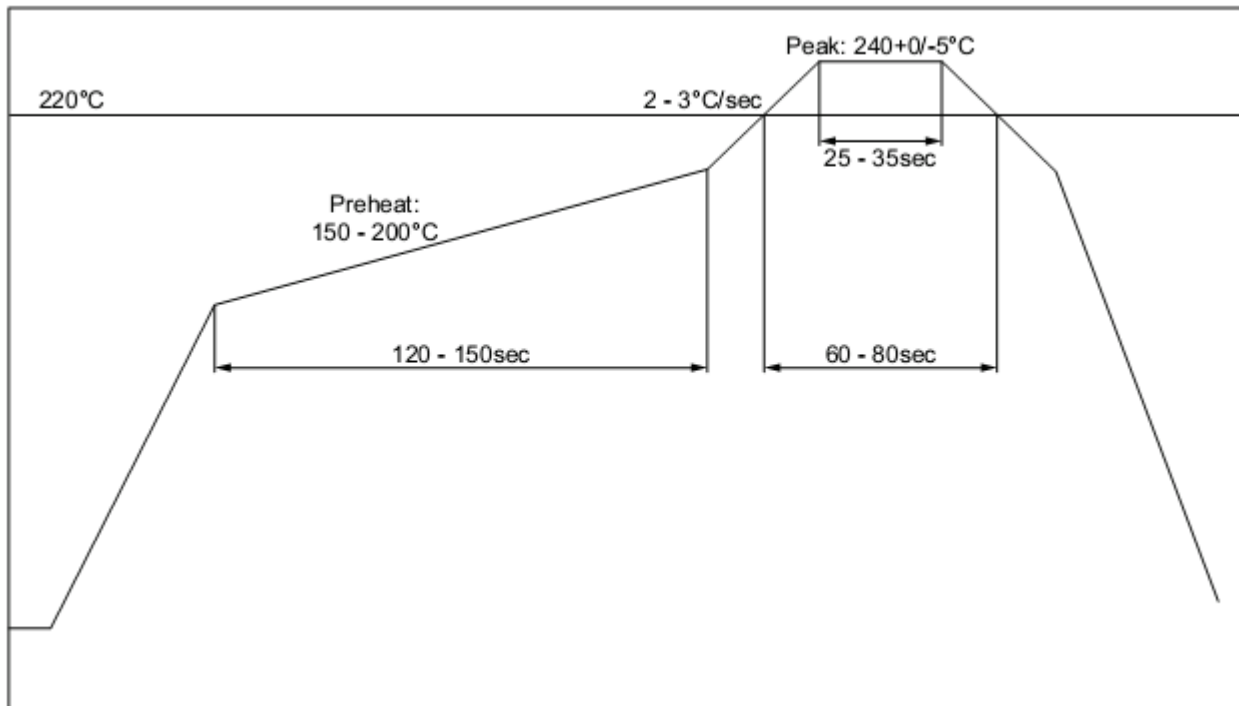


Reflow temperature profile

The single most critical stage in the automated assembly process is the reflow stage. The reflow profile shall not exceed the following maximum ratings:

- heating gradients <math><3^{\circ}\text{C}/\text{sec}</math>
- peak zone temperature of the module <math><245^{\circ}\text{C}</math>
- time in peak zone <math><40\text{ sec.}</math>
- time above 220°C <math><80\text{ sec.}</math>

Excessive temperatures, transport times and shocks during the reflow process **MUST** not be applied to the module.



Recommended reflow temperature profile

Washability

The radino modules are wash-resistant, but are not sealed. In-Circuit recommends manufacturing without washing. If washing is needed make sure that a drying time is provided to the modules before applying electrical power. The drying time should be sufficient to allow any moisture that may have migrated into the module to evaporate, thus eliminating the potential for shorting damage during power-up or testing.

If the wash contains contaminants, the performance may be adversely affected, even after drying.

Ordering Information

| Part | Ordering Code | MOQ | Package |
|---------------------------|---------------|-----|-------------------------|
| radino CC1101, 868/915MHz | 901.320 | 1 | Cut Tape, Reels 100/500 |
| radino CC1101, 433 MHz | 901.320A001 | 1 | Cut Tape, Reels 100/500 |

All radino modules are available online: <http://www.radino.cc/>

Certifications



European R&TTE Directive Statements

The radino CC1101 module has been tested and found to comply with Annex IV of the R&TTE Directive 1999/5/EC and is subject of a notified body opinion. The module has been approved for Antennas with gains of 2 dBi or less.



RoHS / WEEE compliant

WEEE-Reg.-Nr. DE 17225017



| Version | Date | Changes | Editor |
|---------|------------|---------------------------------|--------|
| A | 2014/10/17 | Initial Version | Träger |
| | 2015/01/28 | Pictures, certification updated | Klause |
| | | | |