



radino CC1101

The In-Circuit radino CC1101 combines an Arduino Micro with Microchip'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)
- Microchip 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/







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.













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	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	$RXLED/\overline{SS}$	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{CS}
-	CC1101-GDO0	9	PB5	connected to internal radio section Signal: GDO0
-	not used	A4	PF1	not connected





Detailed Interconnection diagram







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
Reset	-0.5	13	V
Other Terminal Voltages	-0.3	V _{CC} +0.3	V

Recommended Operating Conditions

Environmental conditions

Rating	Min	Тур.	Max	Unit
Operating Temperature	-40		85	°C
V _{cc}	2.7	3.3	3.6	V

DC Characteristics

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

Symbol	Rating	Min	Тур.	Max	Unit
V _{IL}	Input Low Voltage, except Reset pin	-0.3		0.2V _{CC} -0.1V	V
V _{IL2}	Input Low Voltage, Reset pin	-0.5		0.1V _{cc}	V
V _{IH}	Input High Voltage, except Reset pin	0.2V _{CC} +0.9V		V _{CC} + 0.5	V
V_{IH1}	Input High Voltage, 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°C to +85°C.

Symbol	Rating	Min	Тур.	Max	Unit
l _{on}	Full on		20		mA
l _s	Deep sleep		<20		μΑ
	(WDT enabled, Pin-INT enabled)				





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)

 \rightarrow 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.

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

o sketch	_oct13a	Ardu	uino 1.0.5-r2	_ 🗆 🗙
File Edit	Sketch	Tools	Help	
00				<mark>.⊘</mark> .
sketch	_oct13a			
7				
•				
1			In-Circuit r.	adino nRF8001 on COM29





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

\rightarrow 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.

 \rightarrow 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'.:

	, Ordner suchen	? X
Assistent für das Suchen neuer Hardware	Wählen Sie den Ordner, der die Treiber für die	
Wahlen Sie die Such- und Installationsoptionen.	Hardwarekomponente enthalt.	-
Diese Quellen nach dem zutreffendsten Treiber durchsuchen	The second	
Verwenden Sie die Kontrollkästchen, um die Standardsuche zu erweitern oder	Conrig.Msi Documents and Settings	
einzuschränken. Lokale Pfade und Wechselmedien sind in der Standardsuche mit einbegriffen. Der zutreffendste Treiber wird instelliert	Control to and Sectings December 2 and Sectings	
	🖂 🗀 My Documents	
💭 Wechselmedien durchsuchen (Diskette, CD,)	🖃 🚞 Arduino	
Folgende Quelle ebenfalls durchsuchen:	🗆 🗀 hardware	
C:\Documents and Settings\yourl IserName\Mu Doc Durchsuchen	🗆 🧰 ICT_Boards	
	E Dootloaders	
O Nicht suchen, sondern den zu installierenden Treiber selbst wählen	🖵 driver	
Verwenden Sie diese Ontion, um einen Gerätetreiber aus einer Liste zu wählen. Es wird	E Carlos	_
nicht garantiert, dass der von Ihnen gewählte Treiber der Hardware am besten entspricht.		
	Klicken Sie auf ein Pluszeichen, um Unterordner anzuzeigen.	
<zurück weiter=""> Abbrechen</zurück>		
	OK Abbrech	en

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 \rightarrow Run \rightarrow type 'devmgmt.msc' \rightarrow Enter) The radino in this example got the COM-port COM30:

🚇 Geräte-Manager	
Datei Aktion Ansicht ?	
$\leftarrow \rightarrow \mathbb{I} \implies \implies \mathbb{R}$	
 Anschlüsse (COM und LPT) ECP-Druckeranschluss (LPT1) In-Circuit radino nRF8001 (COM30) Kommunikationsanschluss (COM1) STMicroelectronics Virtual COM Port (COM3) Audio-, Video- und Gamecontroller Computer DVD/CD-ROM-Laufwerke Eingabegeräte (Human Interface Devices) 	
Grafikkarte IDE ATA/ATAPI-Controller IDE ATA/ATAPI-Controller	•





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

 \rightarrow Open Arduino IDE and select one of the various available example sketches for your radius

🔯 sketch_oct13a Ardui	no 1.0.5-r2			
File Edit Sketch Tools	Help			
New Open Sketchbook	Ctrl+N Ctrl+O			
Examples Close Save Save As Upload Upload Using Programmer	Ctrl+W Ctrl+S Ctrl+Shift+S Ctrl+U Ctrl+U	01.Basics > 02.Digital > 03.Analog > 04.Communication > 05.Control > 06.Sensors >		
Page Setup Print Preferences	Ctrl+Shift+P Ctrl+P Ctrl+Comma	07.Display > 08.Strings > 09.USB > 10.StarterKit >		
Quit	Ctrl+Q	ArduinoISP BLE F ICT F radino F Time F TinyGPS	radino_IO_Test radino_nRF8001 ▶	Nordic_BLE-SDK-Examples radino_nRF8001_leonardo_IO_HF_Test

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

🤓 radino_nRF800)1_leonardo_IO_HF_Test	Arduino 1.0	0.5-r2	
File Edit Sketch	Tools Help			
	Auto Format C Archive Sketch	itrl+T		
radino_nRF800	Fix Encoding & Reload		n services_lock.h uart_over_ble.h	
/* Copyright (Serial Monitor C	itrl+Shift+M	ISA	
*	Board	•	 In-Circuit radino nRF8001 	
* Permission	Serial Port	•	Arduino Uno	
* of this sof * in the Soft	Programmer	•	Arduino Duemilanove w/ ATmega328	
* to use, cop	Burn Bootloader		Arduino Diecimia or Dueniianove wy Armega166	
* copies of t	he sortware, and to p	permic per	Arduino Nano W/ ATmega328	
* furnished t	o do so, subject to t	the follow	Arduino Nano w/ ATmega168	
*			Arduino Mega 2560 or Mega ADK	
+ 777 1		-1		





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

🤯 radino_nRF800	🞯 radino_nRF8001_leonardo_IO_HF_Test Arduino 1.0.5-r2						
File Edit Sketch	Tools Help						
	Auto Format Archive Sketch	Ctrl+T					
radino_nRF800	Fix Encoding & Reload		n services_lock.h	uart_over_ble.h			
/* Copyright (Serial Monitor	Ctrl+Shift+M	ISA				
*	Board	•					
* Permission	Serial Port	•	COM1 & person o	btaining a copy			
* of this sof			(the "Sof	tware"), to deal			
* in the Soft	Programmer	•	COM3 put limita	tion the rights			
* to use, cop	Burn Bootloader		✓ COM3Uublicense,	and/or sell			
* copies of t	ne portware, and to	, permit per	sons to whom the Sof	tware is			
* furnished t	o do so, subject to) the follow	ing conditions:				

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

🚥 radino_nRF8001_leonardo_IO_HF_Test	Arduino 1.0.5-i	2			
File Edit Sketch Tools Help					
🔊 🔸 🗈 🖬 🖬				P	
radino_nRF8001_leonardo_IO_HF_Test	services.h	services_lock.h	uart_over_ble.h		
/* Copyright (c) 2014, Nordic Semiconductor ASA *					
* copies of the Software, and to permit persons to whom the Software is					
4					
Uploading					
Binary sketch size: 14,766 bytes (of a 28,672 byte maximum)					
1			In-Circuit rad	lino nRF8001 on COM30	

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

oradino_nRF8001_l File Edit Sketch To	eonardo_IO_HF_Test Arduino 1.0.5-r2 Iols Help		<u>_</u> _X
		Seri	al Monitor 🕫
radino_nRF8001_	20M30		
/* Copyright (c)		Send	_
*	Arduino setup	<u> </u>	
* to use, copy, * conies of the	Set line ending to newline to send data from the serial : Fut Device Started: Satur	monitor	_
•	Evt Device Started: Standby		Þ
Done uploading.	Advertising started	_	
Binary sketch siz	Autoscroll Newline 9600	0 baud 🔽	
1	In-Ci	rcuit radino nRF	8001 on COM30





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 booth 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





In-Circuit GmbH Boltenhagener Str. 124 D-01 109 Dresden





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 <3°C/sec
- peak zone temperature of the module ${<}245^\circ\!\mathrm{C}$
- time in peak zone <40 sec.
- time above 220°C <80 sec.

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