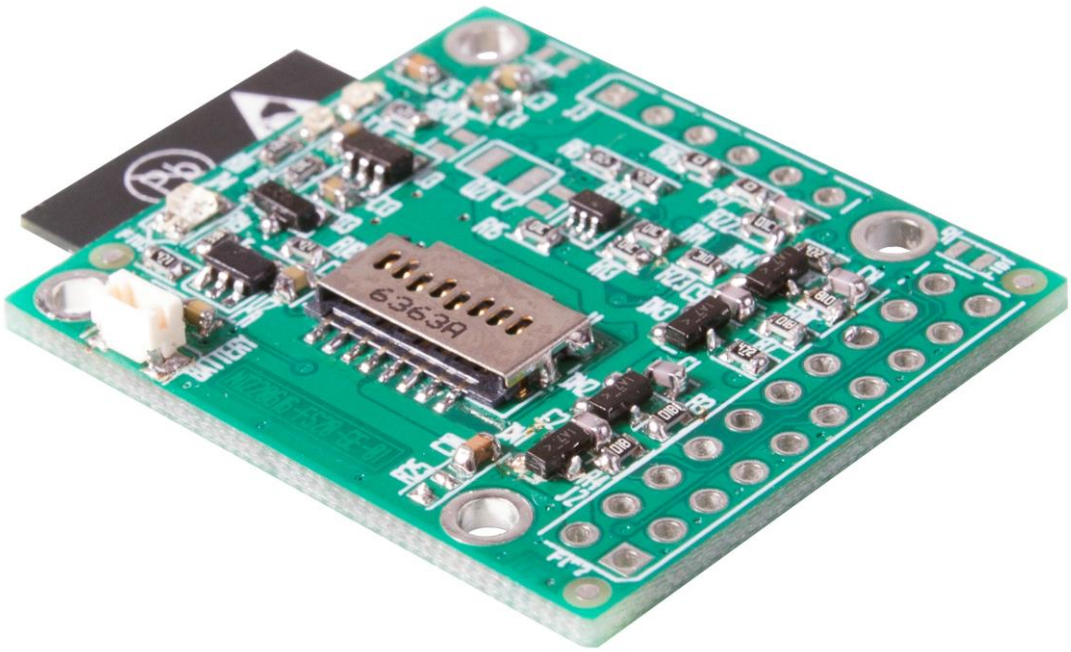
NOVAsomU1



Hardware User Manual

Index

Index of Tables

Index of Figures

1 : Welcome to the NOVAsom U1 world

Thank you for choosing this NOVAsom Industries product.
Please carefully read this user guide before using the device for the first time to ensure safe and proper use.
In particular note that :

- Contents and illustrations may differ from your device, depending on the software version, OS version or product improvements that NOVAsom Industries judges important, and are subject to change without prior notice. Always stay updated visiting www.novasomindustries.com .
- Descriptions are based on the device default settings.
- Modifying the device, the device's operating system or installing software from unofficial sources may damage the device itself and lead to data corruption or data loss, or worst, hardware damage. Such actions will violate your NOVAsom Industries license agreement and void your warranty.
- Always use genuine NOVAsom Industries accessories. The supplied items are designed only for this device and may not be compatible with other devices. To have further information on this specific item visit www.novasomindustries.com .
- Default applications on the device are subject to updates, and support for these applications may be withdrawn without prior notice. If you have any questions about an application provided with the device, please contact NOVAsom Industries at www.novasomindustries.com .
- Software, audio, wallpaper, images, and other media supplied with your device or found in the appropriate SDK are licensed for limited use. If you extract and use these materials for commercial or other purposes, you may be infringing copyright laws. As a user, you are fully responsible for the illegal use of media.

The NOVAsom U family is a product line from NOVAsom Industries, targeted toward the ultra-low power consumption and designed to compete with low power consumption boards while maintaining NOVAsom Industries high quality level.

3 different standard products (with different configurations) are available:

• NOVAsomU1A: with processor ESP32 @240MHz,384KB RAM

• NOVAsomU5A: with processor NXP® iMX6 ULL@900MHz, 512MB RAM, 2 PCM on strip

• NOVAsomU5C: with processor NXP® iMX6 ULL @900Mhz,512MB RAM , jack 3.5mm.

This list is only an example and will vary with time, more information about product status and availability can be found visiting www.novasomindustries.com .

2 : Features

NOVAsom U1 is a very small NOVAsom board, that targets a wide variety of applications, ranging from low-power sensor networks to the most demanding tasks, such as voice encoding, music streaming and moreover.
It's equipped with 2 CPU cores that can be individually controlled, and the clock frequency is adjustable from 80MHz to 240MHz. The user may also power off the CPU and make use low-power co-processor to constantly monitor the peripherals for changes or crossing of thresholds.
NOVAsom U1 integrates a 2.54 mm. dual row strips for a rich set of per external expansions, ranging from capacitive touch sensors, Hall sensors, low-noise sense amplifiers, SD card interface, high-speed SPI, UART, I2C. The integration of Bluetooth, Bluetooth LE and Wi-Fi ensures that a wide range of applications can be targeted.
The operating system chosen for NOVAsom U1 is freeRTOS; secure (encrypted) over the air (OTA) upgrade is also supported, so that developers can continually upgrade their products even after their release.

Table 1 provides the specifications of NOVAsom U1

Categories	Items	Specifications
Wi-Fi	RF certification	FCC/CE/IC/TELEC/KCC/SRRC/NCC
	Protocols	802.11 b/g/n/e/i (802.11n up to 150 Mbps)
		A-MPDU and A-MSDU aggregation and 0.4 µs guard interval support
	Frequency range	2.4 ~ 2.5 GHz
Bluetooth	Protocols	Bluetooth v4.2 BR/EDR and BLE specification
	Radio	NZIF receiver with -97 dBm sensitivity
		Class-1, class-2 and class-3 transmitter
		AFH
	Audio	CVSD and SBC
Hardware	Module interface	SD card, UART, SPI, SDIO, I2C, LED PWM, Motor PWM, I2S, IR
		GPIO, capacitive touch sensor, ADC, DAC, LNA preamplifier

	On-chip Sensors	Hall sensor, temperature sensor
	On-board Clock	40 MHz crystal
	Operating Voltage	
	Operating Current	Average:
	Minimum current delivered by power supply	
	Operating temperature range	-40°C ~ +85°C
	Ambient temperature range	Normal temperature
	Package size	
Software	Wi-Fi mode	Station/SoftAP/SoftAP+Station/P2P
	Wi-Fi Security	WPA/WPA2/WPA2-Enterprise/WPS
	Encryption	AES/RSA/ECC/SHA
	Firmware upgrade	UART Download / OTA (download and write firmware via network or host)
	Software development	Supports Cloud Server Development / SDK for custom firmware development
	Network protocols	IPv4, IPv6, SSL, TCP/UDP/HTTP/FTP/MQTT
	User configuration	AT instruction set, cloud server, Android/iOS app

Table 1 : Specifications

3 : Description

This chapter describes the modules and functions integrated in NOVAsom U1.

Visit www.novasomindustries.com , you can download 3D drawings and detailed mechanical drawing.

3.1 CPU and Internal Memory

NOVAsom U1 contains two low-power Xtensa® 32-bit LX6 microprocessors. The internal memory include:

- 448KB of ROM for booting and core functions.
- 520KB (8KB RTC FAST memory included) of on-chip SRAM for data and instruction
  - 8 KB of SRAM in RTC, which is called RTC FAST Memory and can be used for data storage; it is accessed by the main CPU during RTC Boot from the Deep-sleep mode.
- 8KB of SRAM in RTC, which is called RTC SLOW Memory and can be accessed by the co-processor during the Deep-sleep mode.
- 1 kbit of eFuse, of which 256 bits are used for the system (MAC address and chip configuration) and the remaining 768bits are reserved for customer applications, including Flash-Encryption and Chip-ID

3.2 External Flash and SRAM

NOVAsom U1 supports up to four 16-MB of external QSPI flash and SRAM with hardware encryption based on AES to protect developers' programs and data.

NOVAsom U1 can access the external QSPI flash and SRAM through high-speed caches.

- Up to 16 MB of external flash are memory-mapped onto the CPU code space, supporting 8, 16 and 32-bit access. Code execution is supported.
- Up to 8 MB of external flash/SRAM are memory-mapped onto the CPU data space, supporting 8, 16 and 32-bit access. Data-read is supported on the flash and SRAM. Data-write is supported on the SRAM.

NOVAsom U1 integrates 4 MB of external SPI flash. The 4-MB SPI flash can be memory-mapped onto the CPU code space, supporting 8, 16 and 32-bit access. Code execution is supported. The integrated SPI flash is connected to GPIO6, GPIO7, GPIO8, GPIO9, GPIO10 and GPIO11. These six pins cannot be used as regular GPIO.

3.3 Crystal Oscillators

NOVAsom U1 support 40MHz crystal oscillator.

3.4 RTC and Low-Power Management

With the use of advantanced power management technologies, NOVAsom U1 can switch between different power modes

- Power modes:
  - Active mode: The chip radio is powered on. The chip can receive, transmit, or listen.
  - Modem-sleep mode: The CPU is operational and the clock is configurable. The Wi-Fi/Bluetooth base-band and radio are disabled
  - Light- sleep mode: The CPU is paused. The RTC memory and RTC peripherals, as well as the ULP co-processor are running. Any wake-up events (MAC, host, RTC timer, or external interrupts) will wake up the chip
  - Deep-Sleep mode: Only the RTC memory and RTC peripherals are powered on. Wi-fi and Bluetooth connection data are stored in the RTC memory. The ULP co-processor can work.
  - Hibernation mode: The internal 8-MHz oscillator and the ULP co-processor are disabled. The RTC recovery memory is powered down. Only one RTC timer on the slow clock and some RTC GPIOs are active. The RTC timer or the RTC GPIOs can wake up the chip from the Hibernation mode.
- Sleep Patterns
  - Association sleep pattern: The power mode switches between the Active mode, Modem- and Light- sleep mode during this sleep pattern. The CPU, Wi-Fi, Bluetooth, and radio are woken up at predetermined intervals to keep Wi-Fi/BT connections alive
  - ULP sensor-monitored pattern: The main CPU is in Deep-sleep mode. The ULP co-processor takes sensor measurements and wake up the main system, based on the data collected from sensors.

Power mode	Active	Modem-sleep	Light-sleep	Deep-sleep	Hibernation
Sleep pattern	Association sleep pattern			ULP sensor – monitored pattern	-
CPU	ON	ON	PAUSE	OFF	OFF
Wi-Fi/BT baseband and radio	ON	OFF	OFF	OFF	OFF
RTC memory and RTC peripherals	ON	ON	ON	ON	OFF
ULP co-processor	ON	ON	ON	ON/OFF	OFF

Table 2 : Sleep-mode

4 : Connectors description and Configuration

4.1 Connectors list and function

In Figure 2 you can see the NOVAsom U1 board connectors top placement, while in Figure 3 you can see the NOVAsom U1 board connectors bottom placement

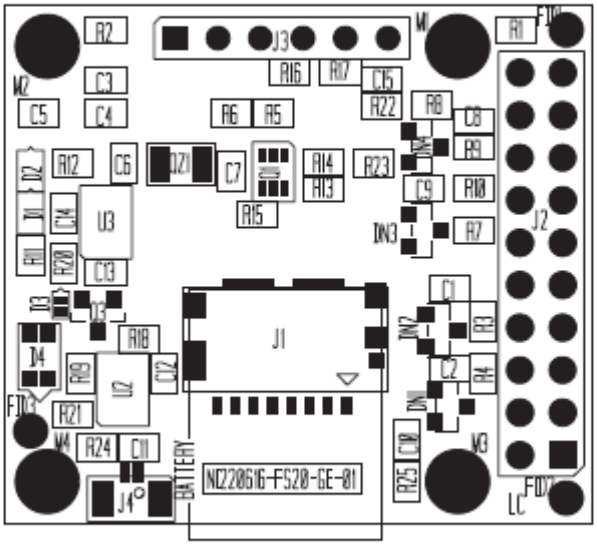


Figure 1 : NOVAsom U1 top view

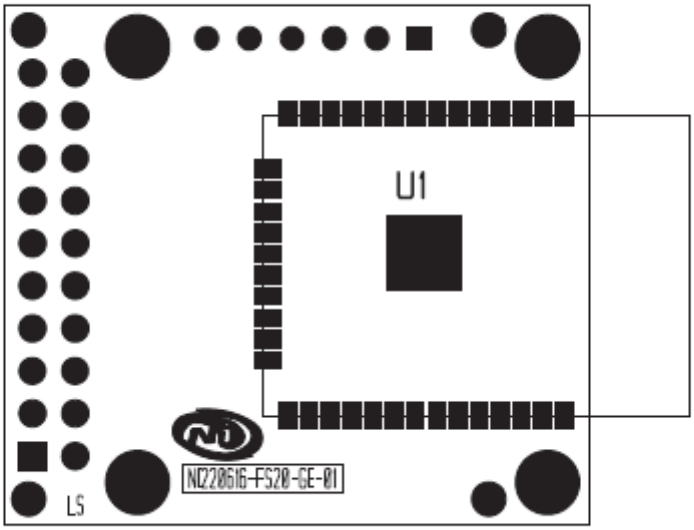


Figure 2 : NOVAsom U1 bottom view

In Table 1 you can see the the NOVAsom U1 board connectors and the mating connectors.

4.3 J2 Connector pinout

J2 is the expansion connector. The functions available are on Table 3 below.

Pin	Signal Name	Function	ESP32 pin
1	VSPIMISO	SPI MISO	37
2	VCC-3V3	Power +	
3	VSPIMOSI	SPI MOSI	31
4	VBAT	Battery +	
5	VSPICLK	SPI CLOCK	30
6	ADC0	Analog ch0	4
7	VSPICSS	SPI SLAVE SELECT	29
8	ADC1	Analog ch1	5
9	I2C_SCL	I2C CLOCK	33
10	BIT_OC0	Open drain OUT0	
11	I2C_SDA	I2C DATA	36
12	BIT_OC1	Open drain OUT1	
13	UART2TXD	UART TXD	28
14	VCC-5VIN	Input Power +	
15	UART2RXD	UART RXD	27
16	DAC1	Analog out 1	10
17	BIT_IN0	Analog/Digital input 0	7
18	DAC2	Analog out 2	11
19	BIT_IN1	Analog/Digital input 1	8
20	GND	Power -	

Table 3 : J2 Connector pinout

4.4 J3 Connector pinout

J3 is the debug connector. The functions available are on Table 3 below.

Pin	Signal Name	Function	ESP32 pin
1	VCC-3V3	Power +	
2	U0TXD	UART0 TX	35
3	U0RXD	UART0 RX	34
4	U0DTR	UART0 DTR	3
5	U0RTS	UART0 RTS	25
6	GND	Power -	

Table 4 :J3 Connector pinout

4.4 J4 Connector pinout

J4 is for an external battery. The NOVAsom U1 board can be powered from an external LiPo 1S battery, and can charge it when connected to the main power supply (VCC-5VIN , J2 pin 14). The charge current is limited to 450mA.

Pin	Signal Name	Function	ESP32 pin
1	VBAT	Battery Power +	
2	GND	Power -	

Table 5 :J5 Connector pinout

5 : Electrical characteristic

5.1 Absolute maximum ratings

Over operating free-air temperature range (unless otherwise noted)(1)(2)

VCC-5VIN	5.5V
3.3V pin input voltage (2)	3.6V
Battery Voltage Input	4.6V
3.3V pin output voltage (2)	3.6V
Input clamp current for 3.3V pin (2)	10mA
Dedicated pin : BIT_IN0 and BIT_IN1 maximum voltage	36V
Dedicated pin : Open drain OUT1 and Open drain OUT2 Voltage	36V
Dedicated pin : ADC0 and ADC1 maximum voltage	36V (Note : ADC Reference voltage is 3.3V)

Table 6 : Absolute maximum ratings

(1) Stresses beyond those listed under “Absolute maximum ratings” may cause permanent damage to the board. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “Recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect board reliability.
(2) The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

5.2 Recommended operating conditions

VCC-5VIN	5V ± 5%
3.3V pin input voltage (2)	3.3V ± 5%
Battery Voltage Input	4.3V
3.3V pin output voltage (2)	3.3V ± 5%
Input clamp current for 3.3V pin (2)	1mA
Dedicated pin : BIT_IN0 and BIT_IN1 maximum voltage	30V
Dedicated pin : Open drain OUT1 and Open drain OUT2 Voltage	30V
Dedicated pin : ADC0 and ADC1 maximum voltage	30V (Note : ADC Reference voltage is 3.3V)

Table 73 : Recommended operating conditions

5.3 Power consumption and power dissipation

For the details of the low power modes consult the ESP-WROOM-32 Processor Reference Manual

6 : Operational characteristics

6.1: NOVAsom U1 programmer debugger

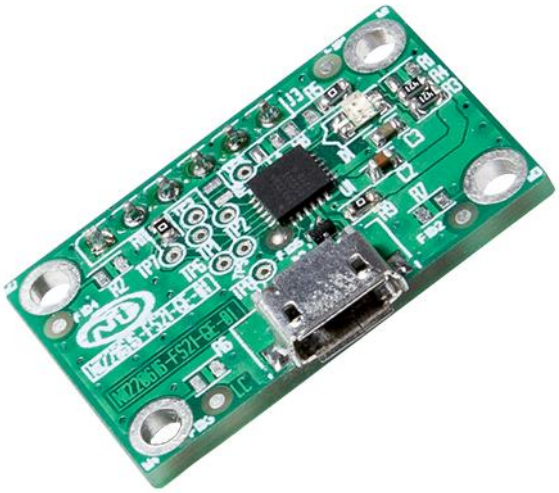


Figure 3 : NOVAsom U1 programmer debugger

NOVAsom U1 programmer debugger is a simply, low-cost module that supports in-system programming and debugging of applications written for NOVAsom U1 board.
NOVAsom U1 programmer debugger can provide power supply to your NOVAsom U1 boards. Connect the board with Micro-USB to the workstation, then connect NOVAsom U1 programmer debugger to NOVAsom U1 board through J3 connector. This is the only way to read NOVAsom U1 console.

NB: Make sure to connect NOVAsomU1 programmer debugger to NOVAsomU1 board as shown in the picture below. If you connect the programmer in the wrong way, you may damage the board.

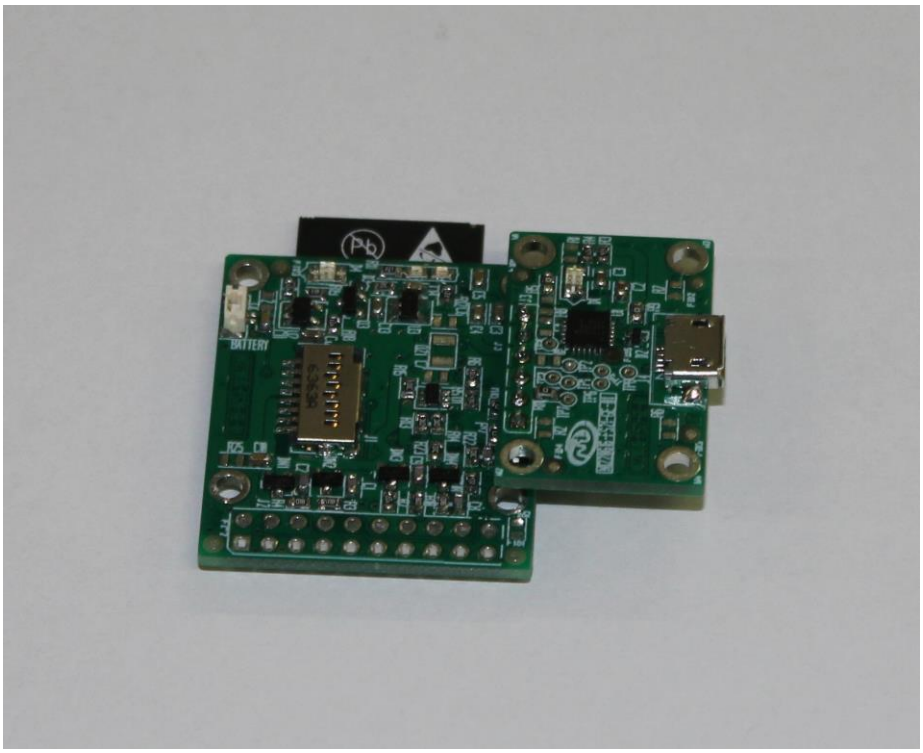


Figure 4 : NOVAsom U1 programmer debugger with NOVAsom U1 board

Check others details on our website www.novasomindustries.com

6.2 : Development system requirements

From the NOVAsom Industries web site www.novasomindustries.com the user can download the NOVAsom SDK to ease the development process for all the NOVAsom Industries boards.
The NOVAsom SDK is a virtual machine tool, running on a Lubuntu core and based on VirtualBox.
The Virtual Machine is thus compatible with hosts based on Windows™ , MacOS™ or Linux machines.
More detailed information about the installation process of the NOVAsom SDK can be found visiting the NOVAsom Industries web site at www.novasomindustries.com .
Normally, for a relatively relaxed development, an I5 host with 15 GBytes of free hard disk space and 4GBytes of RAM is enough.
For very heavy developments "the bigger is better", so more RAM you can dedicate to the Virtual Machine the faster the Virtual Machine will run.
A more than good situation is an I7 host with 16GB of RAM and 128GB of free disk space.
For connecting to the NOVAsom U console you need a NOVAsom U Programmer Debugging.

6.3 : The NOVAsom U1 console

In order to use the serial console available on the NOVAsom U board you need a serial terminal and a NOVAsom U programmer debugger.
GtkTerm is a good choice for Linux users, Teraterm is a nice choice for Windows™ users, it's up to MacOS™ users to understand which kind of terminal application they need.
The NOVAsom U port is a standard RS232 serial port with a bit rate of 115200 with no flow control and 1 stop bit..
Just plug the power supply ,programmer debugger and the serial port and you will see the boot process of your new NOVAsom U1 board.

6.4 : The first boot

The steps in order to boot your NOVAsom U1 board are :

- Connect NOVAsom U1 to the workstation with NOVAsom U1 programmer debugger.
- Open a serial terminal SW
- Disable DTR / RTS signal

After just some half a second you should see on your terminal application something similar to what you see in Figure 2 below, and this means you have your NOVAsom U1 powered up and running.

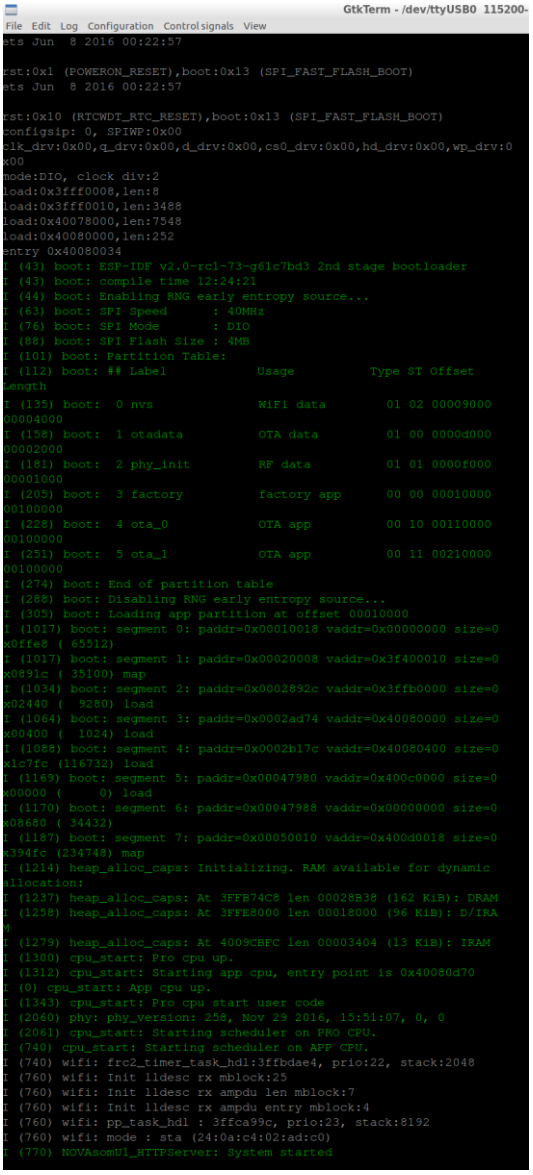


Figure 5 : First boot console output

6.5 : Connecting an external battery to the NOVAsom U1 board

NOVAsom U1 board can operate on an external supply.
The NOVAsom U1 board has a recommended power supply of 3.7V LiPo battery. External battery can be attach on J4 connector, with 02 SUR-32S JST Connector RCPT SUR 2POS .8MM TIN male connector on battery side.
There are many sizes of Lithium Polymer batteries, ranging from ~150mAh all the way up the 10.000+mAh. Choose the best size for your needs.
Moreover NOVAsom U1 board has available an internal battery charger. For charging battery, just plug battery on J4 connector, then plug NOVAsom U1 programmer debugger to the board, finally connect programmer to the workstation or a wall charger.
visiting the www.novasomindustries.com for more info.

7 : Board outline and mechanical dimensions

Detailed drawings, 3D drawings, full mechanical specifications and additional information can be found visiting the www.novasomindustries.com page in the NOVAsom U1 dedicated section or contacting the appropriate sales person or distributors.

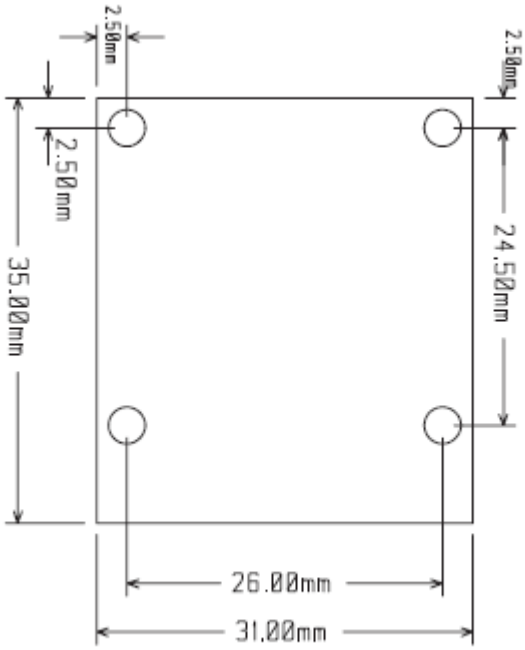


Figure 6 :The NOVAsom U1 dimension

8 : Contacts

Novasom Industries Italy
Headquarter:
Via Orbassano 2/a 10048 Vinovo (TO)
Phone (+39) 011/9004003
Fax (+39) 011/9653274
mail info@novasomindustries.com

Web page : www.novasomindustries.com .

9 : Document revisions, references and notes

9.1 Document revisions

9.2 External references

For the NOVAsom Industries products and NOVAsom U1 in detail :

www.novasomindustries.com

9.2 Notes

Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates.
It is your responsibility to ensure that your application meets with your specifications.
NOVAsom Industries MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION, INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. NOVAsom Industries disclaims all liability arising from this information and its use.
Use of NOVAsom Industries devices and software in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless NOVAsom Industries from any and all damages, claims, suits, or expenses resulting from such use.
No licenses are conveyed, implicitly or otherwise, under any NOVAsom Industries intellectual property rights.