PRODUCT DATASHEET

Notecard Datasheet

NOTE-WBEXN

Datasheet for NOTE-WBEXN, Notecard Cellular (LTE Cat-1, EMEA): specifications, pinout, power, antenna requirements, and certifications.

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Blues Notecard® Datasheet: NOTE-WBEXN

An affordable, embeddable module for low-power cellular connectivity.

NOTE-WBEXN is part of the Notecard Cellular family of products. All Notecard Cellular modules offer secure cellular connectivity for a wide range of IoT deployments.

All Notecards SKUs use the same M.2 pinout and the same powerful JSON-based programming interface. This consistency helps developers add connectivity to IoT solutions while simplifying future migrations to different Notecard radios or SKUs.

Functional Description

Notecard is an embeddable device-to-cloud data pump designed to remove the complexity and friction inherent in traditional IoT solutions. The Notecard family includes models supporting secure cellular, WiFi, LoRa, or satellite connectivity, enabling rapid development and iteration at a predictable, low cost. With as little as two lines of code on your host MCU, and no external libraries or dependencies, any Notecard model can securely move data from device to cloud.

Specifically, the Notecard NOTE-WBEXN is:

- A drop-in embeddable data storage and transport module for cellular IoT products, pumping JSON-formatted or binary data ("Notes") bi-directionally between device and cloud:
  - JSON from/to MCU application using I2C, Serial, or USB.
  - JSON to/from your cloud app using HTTPS or MQTT.
  - JSON is auto-tagged with date/time and cell tower location. GPS location tagging is also available, but the GPS module is off by default and requires explicit activation.
- A removable and field-upgradable system-on-a-module (SOM).
- A cellular device without the monthly fees.
- A cellular device with an embedded MFF2 SIM, plus support for an optional second MFF2 SIM to provide extended coverage.

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Note

Notecard XP is a low-cost variant of NOTE-WBEXN for customers looking to scale with Blues beyond their first few thousand units. The Notecard XP is a field-upgradable, network sunset-resilient alternative to chip down cellular design that allows product builders to incorporate aspects of the Notecard hardware into their own PCB to optimize BOM costs for a volume order.

The Notecard XP requires the companion Notecarrier XP in order to function while prototyping, since this version of the Notecard **does not include a cellular radio power supply, embedded SIM, SIM-switching circuitry, or conformal coating**. Therefore, information specific in this datasheet to those components do not apply to the Notecard XP variant.

Features

- **Low-power.** Designed to operate on battery power, be "always-on", maintain time & location, while typically drawing less than ~9µA@5V when idle.
- **MCU-agnostic.** Will support any MCU or single-board computer as your app processor — even low-memory, 8-bit microcontrollers.
- **Global.** With modems tailored for use in North America, EMEA, or globally, a Notecard can connect in almost any location. See Cellular Service for details.
- **Hassle-free.** The integrated, embedded MFF2 SIM features both North American and Global coverage options. No SIM or carrier subscription is required. Includes 10 years of cellular service with 500MB of data (more data options available upon request).
- **Connected.** Provides connectivity without the hassle of dealing with SSIDs, passwords, access points, gateways, carriers, or SIMs.
- **Secure.** Integrated STSAFE Secure Element with hardware crypto, true hardware random number generator, and a factory-installed ECC P-384 certificate provisioned at chip manufacture. *Note that the certificate is no longer valid after November 16, 2047.*
- **Simple.** Uses a JSON command interface over I2C, UART, or USB. Allows you to connect your 3.3V or 1.8V MCU, while eliminating complex AT commands and state to manage.
- **Power-conscious.** Integrated GPS with LIS2DTW accelerometer, for power-optimized location/motion awareness. Not to mention a mostly-offline data sync mode for low power, and always-online mode for low latency.

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- **Encrypted.** Secures transactions without any provisioning challenges, using encrypted "off the internet" communication.
- **Efficient.** Battery-powered cellular without the complexity of managing modems, connections, queues, or storage.
- **Integrated.** Utilizes an extremely thin cloud infrastructure that directly routes your data to where it belongs: AWS, Azure, GCP, or your own cloud.
- **Built for data.** Data routing and simple "no code/low code" visual data stream analysis through Notehub (SaaS), or host and integrate Notehub functionality into your own app (OSS).

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Package Configuration

NOTE-WBEXN - Notecard, Wideband, EMEA, 500MB

- Product Name: Notecard Cellular
- Modem: Quectel EG91-EX
- Data Networks: LTE Cat-1 / WCDMA / GPRS
- General Region: EMEA (Europe, Middle East, Africa; see Cellular Service below)
- Data included: 500MB

View in Store

Modem Datasheet

To best determine the supported bands and radio access technologies (RATs), refer to the modem datasheet.

- Quectel EG91

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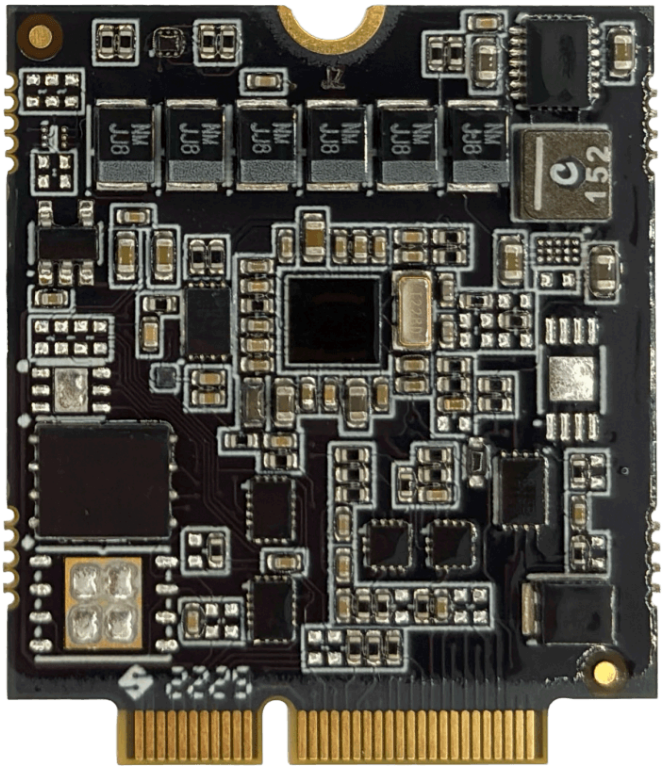
Block Diagram

The Cellular Notecard is packaged using a compact removable form factor, 30mm x 35mm.

3D models and dimensioned drawings for Notecard, along with open hardware designs for Notecarrier boards, are available in the note-hardware GitHub repository, making it a straightforward task to embed the Notecard into a broad variety of host device designs. See Design Files for the files that apply to this Notecard.

The Notecard has an embedded MFF2 SIM that enables its included cellular service coverage, with an integrated external SIM switch for applications that require such a capability.

The Notecard can interface with the host MCU at either 1.8v or 3.3v levels.

Front	Back
	

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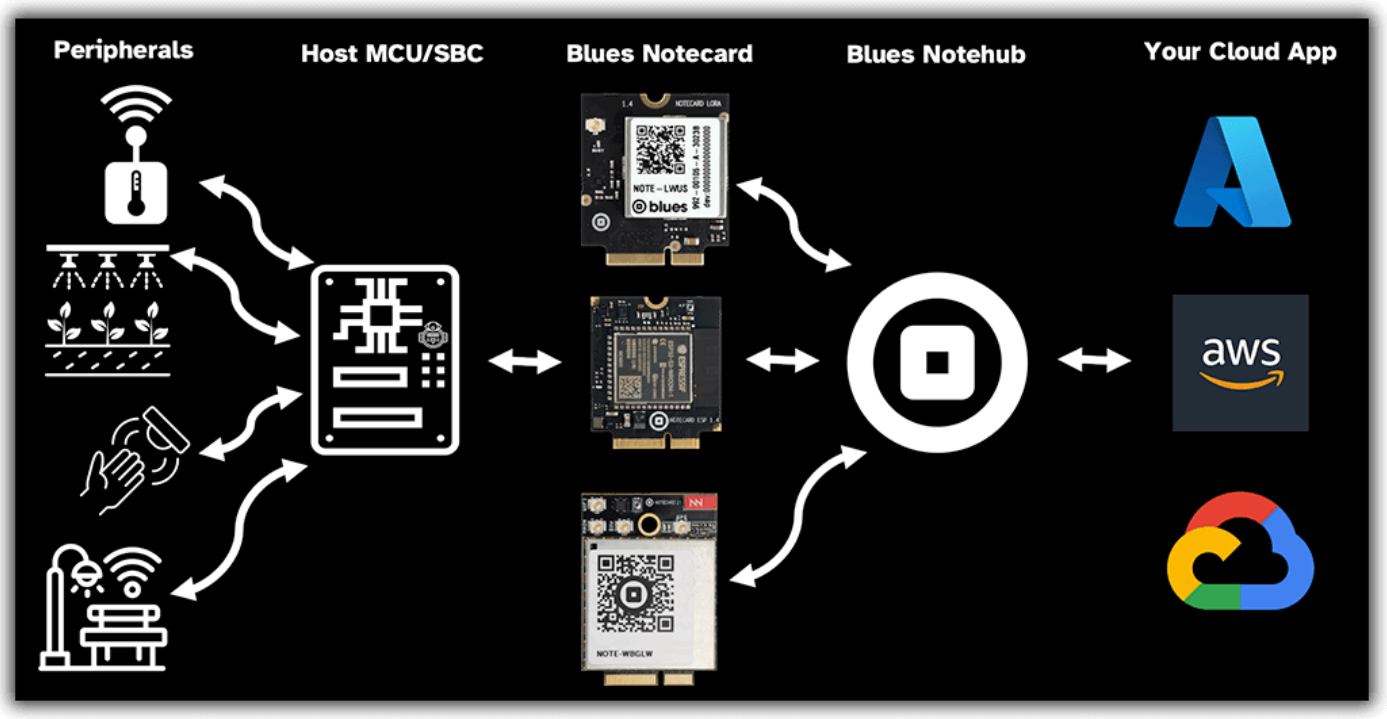
Typical Application

As shown below, Notecard is not an application processor and hosts no customer application code. It can be used as a data pump peripheral that is focused on bidirectional, asynchronous, secure data staging and transfer of JSON Notes.



Key Features

- **Tracking**

  Notes transferred by the Notecard can be tagged with time and location. Location is obtained using a GPS receiver, and time is available from both the cellular network and GPS. To optimize energy use in devices when not in motion, the Notecard has a MEMS-based, LIS2DTW accelerometer that determines when use of the GPS is not required.

- **Security**

  Modern services require that the cloud and the device perform bidirectional authentication so that neither can be spoofed. For many applications it's important that over-the-air and over-the-wire data is encrypted. For this reason, the Notecard integrates an STSAFE Secure Element which contains symmetric keys manufactured into the chip. Neither the manufacturer

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of the Notecard nor the manufacturer of the customer's product has any need to handle or manage secure key material. The keys generated by STMicroelectronics for the Notecard use ECC with the NIST P-384 curve, and the signature algorithm is ECDSA-with-SHA384.

- **Low Power Consumption**

  The Notecard has sophisticated power control and makes heavy use of variable clock speeds. This enables the Notecard to have a typical idle current consumption of ~9µA@5V, while still supporting active UART and I2C communication.

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Power Information

The Notecard's main supply voltage (`VMODEM_P`) is used for the cellular modem and associated circuitry. The Notecard has on-board regulators designed for direct connection to a battery, so any voltage in the range of 2.5V to 5.5V may be provided.

The Notecard typically sits in an idle mode waiting for a request from the host MCU, however the Notecard current draw increases to the ~250mA range when the modem is active. Furthermore, when in a region requiring the use of GSM, it can spike to up to nearly 2A for a few milliseconds. The modem also draws tens of mA when the GPS is receiving or the CPU is performing session encryption. As such, it's recommended that `VMODEM_P` be directly connected to a battery or other supply that is capable of such brief spikes. It is also recommended that PCB traces for `VMODEM_P` and `GND` be designed to handle such current.

The Notecard's logic voltage (`VIO_P`) is provided by the Notecarrier or host system for digital communication; it will be either 1.8V or 3.3V. Although the Notecard typically draws very little current, this supply should be designed with a 150mA budget allocated to the Notecard.

Pin Name	Direction	Pin Numbers	Usage
GND	--	3,5,6,11,18,33,39,45,51,57,71,73	Ground
VIO_P	IN	2,4	1.8V or 3.3V @ 150mA
VUSB	IN	13	USB Serial proxy for "line power", with respect to dynamic line voltage detection
VMODEM_P	IN	70,72,74	2.5V to 5.5V, capable of sustained 750mA draw

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Warning

The Notecard XP variant of NOTE-WBEXN requires pairing with a Notecarrier that can provide the proper voltage to `VMODEM`.

For NOTE-WBEXN, the acceptable voltage range is 3.3V-4.8V, with a typical value of 3.8V.

Note

In order to take advantage of various Notecard features pertaining to "dynamic line voltage detection" (both now and in the future), or establish a USB Serial connection to the Notecard, you must connect the `VUSB` power pin and support the USB power design aspects of the Notecard.

Features include:

- Continuous mode behavior with the `usb` flag.
- Triangulate mode behavior with the `usb` flag.
- Monitor mode behavior.

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Reset and Loss of Power

Warning

A power-loss event occurs whenever the Notecard loses power on `VIO_P` or `VMODEM_P`, or the Notecard's `NRST` pin is pulled low.

The modems used on all cellular Notecard variants are designed by their manufacturers to use best efforts to maintain integrity when recovering from a power-loss event. That said, there is a small chance that recovery will be impossible and the modem will be rendered permanently unusable.

Upon recovering from any power-loss event, the Notecard initiates a procedure to ensure filesystem integrity. The Notecard also conducts a procedure upon first connection to Notehub after power loss to ensure consistency between Notecard's file system and Notehub's replica copy of those files. This verification procedure is done to protect and ensure the integrity of your product, and you should expect additional use of network bandwidth when these rare events occur.

It is the responsibility of every product designer to ensure that designs utilizing Notecard provide constant power to `VMODEM_P` and `VIO_P`, at the cost of as little as 8 µA, so as to ensure that power-loss events do not occur as a matter of course from the perspective of the Notecard.

If repeated power failures are expected and unavoidable in a product's use, designs must incorporate a small battery or lithium ion capacitor to provide backup power, and the Notecard firmware should be configured to enter a quiescent state when operating on its backup supply.

Frequent power-loss events will result in the voiding of the Notecard warranty. In addition, since repeated Notecard resets can be indistinguishable from "denial of service" attacks on the Notehub, Blues also reserves the right to deny access to devices that exhibit such behavior.

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Antenna Requirements

The Notecard requires a cellular antenna. The antenna should support the entire range of LTE bands in use in the region of deployment.

All versions of the Cellular Notecard require only a single LTE antenna, though Wideband Notecards can improve their receiving sensitivity through a second antenna on the `DIV` u.FL connector.

The NOTE-WBEXN is a "wideband" version of the Notecard which optionally supports a second diversity antenna for maximum range when using LTE Cat-1.

> **Note**
>
> Actual RF performance of the Notecard depends on a variety of physical factors, including:
>
> - The choice of antenna(s).
> - The physical environment.
> - The trace layout, dimensions, and/or PCB tolerance of the carrier board (e.g. Notecarrier) used.

If an application utilizes GPS location, a GPS antenna is also required. The Notecard design allows the option of a passive or active GPS antenna, and can supply a 3.3V - 4.0V bias voltage to power an active antenna's LNA. If an active antenna requires a different voltage, the board designer can inject whatever voltage they require into the antenna's coax by feeding it to the `VACT_GPS_IN` pin.

Active GPS

If you choose to connect an Active GPS antenna to the Notecard GPS u.FL connector, you are required to provide your antenna's DC bias voltage to the center conductor of the coax antenna via `VACT_GPS_IN`. For your convenience, Notecard supplies a 3.3V - 4.0V power supply at `VACT_GPS_OUT` whenever it activates its GPS, so `VACT_GPS_OUT` can be connected directly to `VACT_GPS_IN`. `VACT_GPS_OUT` must not be used for any other purpose than powering an active antenna Low-Noise Amplifier.

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Pin Name	Direction	Pin Number	Usage
VACT_GPS_IN	IN	22	Active GPS antenna DC bias voltage
VACT_GPS_OUT	OUT	20	+3.3V - 4.0V from Notecard when GPS is operating

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Cellular Service

A 10-year data plan with 500MB of cellular data is embedded in the Notecard, with more available for applications requiring it. No other actions related to cellular activation or deactivation are required. There are no "know your customer" restrictions, so the Notecard can be embedded in a product without knowing the ultimate end-customer. Placement of a product can be permanent, although the coverage area may change from time to time because of local technical and regulatory restrictions.

Covered Countries

To approximately forecast the Notecard's compatibility with a country, you can research the networks available (for example on Wikipedia) and cross-reference with the modem datasheet.

Warning

This list of covered countries does not imply any widespread deployment or national coverage. Carrier agreements change over time. This list is for planning purposes only - we have not independently verified coverage.

If your experience differs please let us know so we can keep this list updated.

Covered Countries			
Afghanistan	Aland Islands	Albania	Anguilla
Argentina	Armenia	Aruba	Australia
Austria	Azerbaijan	Bangladesh	Belarus
Belgium	Bosnia and Herzegovina	Bulgaria	Burkina Faso
Cambodia	Cameroon	Canada	Cayman Islands

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Covered Countries			
Chad	Chile	Colombia	Congo
Costa Rica	Croatia	Cyprus	Czech Republic
Denmark	Dominican Republic	Dutch Antilles	El Salvador
Estonia	Ethiopia	Faroe Islands	Fiji
Finland	France	Gabon	Georgia
Germany	Ghana	Gibraltar	Greece
Greenland	Guernsey	Haiti	Hong Kong
Hungary	Iceland	Indonesia	Ireland
Isle Of Man	Israel	Italy	Japan
Jersey	Jordan	Kazakhstan	Kenya
Kyrgyzstan	Lao	Latvia	Lesotho
Liechtenstein	Lithuania	Luxembourg	Macao
Macedonia	Malawi	Malaysia	Mali
Malta	Martinique	Mayotte	Mexico
Moldova	Mongolia	Montenegro	Morocco
Mozambique	Nepal	Netherlands	New Zealand
Norway	Panama	Peru	Poland

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Covered Countries			
Portugal	Romania	Rwanda	Saint Barthelemy
Saint Kitts and Nevis	Saint Lucia	Saint Martin	Seychelles
Singapore	Slovakia	Slovenia	South Africa
Spain	Sri Lanka	Suriname	Sweden
Switzerland	Taiwan	Tajikistan	Tanzania
Thailand	Trinidad and Tobago	Ukraine	United Kingdom
Uruguay	Uzbekistan	Virgin Islands (British)	Zambia
Zimbabwe			

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Pin Information

Pin Definitions

Pin Name	Pin Description
ALT_DFU_BOOT	Used by Notecard to control the BOOT pin of the host MCU during Outboard DFU and host restart. Tri-state otherwise.
ALT_DFU_RESET	Used by Notecard to pulse the RESET pin of the host MCU low during Outboard DFU and host restart. Tri-state otherwise.
ALT_DFU_ACTIVE	Driven low by Notecard to indicate to the host that an Outboard DFU or host restart is in progress.
ALT_DFU_RX	Input on which Notecard receives data from the host during Outboard DFU. Tri-stated when Outboard DFU is not in progress.
ALT_DFU_TX	Output on which Notecard sends data to the host during Outboard DFU. Tri-stated when Outboard DFU is not in progress.
ATTN_P	Attention pin (requires protection)
AUX_EN_P	Auxiliary serial port enable (requires protection)
AUX_RX_P	Auxiliary UART receive (requires protection)
AUX_TX_P	Auxiliary UART transmit (requires protection)
AUX1	Auxiliary GPIO pin 1
AUX2	Auxiliary GPIO pin 2
AUX3	Auxiliary GPIO pin 3

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Pin Name	Pin Description
AUX4	Auxiliary GPIO pin 4
AUX_CHARGING	Charge detection
BOOT	Test/debug pin used to force Notecard into its bootloader
GND	Ground
NC	No connection (must be left open)
NRST	Active-low (not) reset*
RSVD	Reserved for internal use (electrically connected and must be left open)
RX_P	UART receive (requires protection)
SCL_P	I2C clock (requires protection - Notecard has onboard 10K pull-up resistors)
SDA_P	I2C data (requires protection - Notecard has onboard 10K pull-up resistors)
SIM_CLK	External SIM clock
SIM_IO	External SIM input/output
SIM_NPRESENT	External SIM active-low (not) present
SIM_RST	External SIM reset
SIM_VCC	External SIM positive (common collector) voltage
TX_P	UART transmit (requires protection)

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Pin Name	Pin Description
USB_DN	USB data negative
USB_DP	USB data positive
VACT_GPS_IN	Active antenna GPS bias voltage
VACT_GPS_OUT	Active antenna GPS bias voltage, nominal 3.8V from Notecard
VIO_P	I/O Voltage (requires protection)*
VMODEM_P	Voltage modem (requires protection)*
VUSB	USB Active indicator from 3V3 to 5V

* See the power information section for important product design considerations related to reset and loss of power conditions.

Pin Description

Notecard M.2 Key E, Edge Connector Pinout

Pin #	Pin Name	Func. Interface	Func. Interface	Pin Name	Pin #
1	RSVD		Power	VIO_P	2
3	GND	Power	Power	VIO_P	4
5	GND	Power	Power	GND	6
7	USB_DP	USB Serial	External SIM	SIM_VCC	8
9	USB_DN	USB Serial	External SIM	SIM_RST	10

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Pin #	Pin Name	Func. Interface	Func. Interface	Pin Name	Pin #
11	GND	Power	External SIM	SIM_IO	12
13	VUSB	USB Serial	External SIM	SIM_CLK	14
15	RSVD		External SIM	SIM_NPRESENT	16
17	RSVD		Power	GND	18
19	RSVD		Active GPS	VACT_GPS_OUT	20
21	NC		Active GPS	VACT_GPS_IN	22
23	RSVD			NC	24
25	NC			NC	26
27	NC			NC	28
29	NC			NC	30
31	NC		Outboard DFU	ALT_DFU_BOOT	32
33	GND	Power	Outboard DFU	ALT_DFU_RESET	34
35	RSVD		Outboard DFU	ALT_DFU_ACTIVE	36
37	RSVD		Auxiliary Ports	AUX_CHARGING	38
39	GND	Power	I2C Serial	SCL_P	40
41	ALT_DFU_RX	Outboard DFU	I2C Serial	SDA_P	42
43	ALT_DFU_TX	Outboard DFU		RSVD	44

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Pin #	Pin Name	Func. Interface	Func. Interface	Pin Name	Pin #
45	GND	Power	Auxiliary Ports	AUX1	46
47	NC		Auxiliary Ports	AUX2	48
49	NC		Auxiliary Ports	AUX3	50
51	GND	Power	Auxiliary Ports	AUX4	52
53	RSVD		Attention	ATTN_P	54
55	RSVD		Auxiliary Ports	AUX_EN_P	56
57	GND	Power	Auxiliary Ports	AUX_RX_P	58
59	RSVD		Auxiliary Ports	AUX_TX_P	60
61	RSVD		UART Serial	RX_P	62
63	RSVD		UART Serial	TX_P	64
65	BOOT	Bootloader		RSVD	66
67	NRST	Reset		RSVD	68
69	NC		Power	VMODEM_P	70
71	GND	Power	Power	VMODEM_P	72
73	GND	Power	Power	VMODEM_P	74
75	RSVD				

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> *Link: Digi-Key part number of the connector - Both Digi-Key and Mouser have pictures for this part number that show a component with a different key, but both have links to datasheet/drawing/CAD models.*

Note

All pins whose **Functional Interface** is marked "Power" must be connected.

All pins named `NC` have no connection on the Notecard and must be left open.

All pins named `RSVD` are reserved for internal use. These pins are electrically connected on the Notecard and MUST be left open. Furthermore, any pin not used in a design MUST also be left open.

`BOOT` (pin 65) is a test/debug pin, not a functional interface. It is not required for normal operation and should be left open, but routing it to a test point on your carrier board makes it possible to recover a Notecard whose firmware update was interrupted. See Bootloader for details.

Those pins ending with `_P` may be optionally protected from anomalous external conditions on some Notecarrier designs, depending upon use-case specific requirements.

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Technical Details

Host Microcontroller API

Notecard supports a rich, simple API whose syntax is standard JSON. The developer can communicate requests to Notecard, generally by using little more than `printf` functions available in most programming languages.

Serial Communication

JSON requests and responses (the Notecard's Application Programming Interface "API") may be sent over any of the following interfaces:

- USB Serial Interface
- UART Serial Interface
- I2C Interface

> **Note**
>
> If NOT using a Notecard firmware library, you may unintentionally send requests to the Notecard so fast that you overflow the fixed-size buffer it uses to receive data (whether it be I2C, Serial, or UART). The solution is to pause 250 ms after every 250 bytes sent and ensure the total size of each NDJSON object sent is no more than 8KB.

API Reference

For API usage, names, and parameters, please refer to the Notecard API Reference.

USB Serial Interface

The USB Serial Interface appears to the host as a USB 2.0 Full Speed CDC device. You can access it from Linux, Windows, or macOS without a device driver using terminal emulation software. Newline-delimited JSON requests may be sent directly as UTF-8 text over this port, or you may use the open-source Blues libraries for C, Python, Go, and Arduino.

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Pin Name	Direction	Pin Number	Usage
USB_DN	I/O	9	USB D- data signal
USB_DP	I/O	7	USB D+ data signal
VUSB	IN	13	+5V from USB
GND	I/O	11	Ground from USB

UART Serial Interface

The UART Serial Interface operates at `VIO_P` at a fixed baud rate of 9600 using eight data bits, no parity bit, and one stop bit. Newline-delimited JSON requests may be sent directly as UTF-8 text over this port, or you may use the open-source Blues libraries for C, Python, Go, and Arduino.

Pin Name	Direction	Pin Number	Usage
RX_P	IN	62	Receive data signal
TX_P	OUT	64	Transmit data signal

I2C Interface

The Notecard acts as an I2C secondary device operating at `VIO_P`, and it implements a simple Serial-over-I2C protocol. You can access it from an embedded host using open-source Blues libraries for C, Python, Go, and Arduino.

Pin Name	Direction	Pin Number	Usage
SCL_P	IN	40	I2C clock
SDA_P	I/O	42	I2C data

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Host Microcontroller Hardware Interface

Attention Interrupt

Using software, you can optionally configure Notecard to use the `ATTN` output pin to:

- Inform the host MCU of certain asynchronous events (such as incoming data availability, or Notecard motion) in an interrupt-driven manner rather than just polling.
- Place the host MCU into a power-off sleep state and wake it back up again.

Pin Name	Direction	Pin Number	Usage
ATTN_P	OUT	54	Attention pin

Note

This pin operates at `VIO_P`. If it is unused it can be left disconnected.

Auxiliary Ports

An optional Auxiliary UART Serial Interface is available on the `AUX_RX_P` and `AUX_TX_P` pins. This interface is inactive unless enabled by raising the `AUX_EN_P` pin since this UART consumes extra power when in use. It operates at `VIO_P` using eight data bits, no parity bit, and one stop bit. The default baud rate is 115200, except in `gps` mode, where it is 9600; either can be overridden with the `rate` argument to `card.aux.serial`. If this interface is unused, the three pins can be left disconnected.

The AUX1-4 pins operate at `VIO_P` and can be configured in software to operate in several optional modes, such as GPIO mode, monitor mode, and LED/NeoPixel mode. See `card.aux` for the full list of modes and which Notecards support them, and Working with the Notecard AUX Pins for usage examples. If these pins are unused, they can be left disconnected.

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Pin Name	Direction	Pin Number	Usage
AUX_EN_P	IN	56	Enables serial port on `AUX_RX_P` and `AUX_TX_P`
AUX_RX_P	IN	58	RX data for serial port enabled by `AUX_EN_P`
AUX_TX_P	OUT	60	TX data for serial port enabled by `AUX_EN_P`
AUX1	I/O	46	General Purpose IO
AUX2	I/O	48	General Purpose IO
AUX3	I/O	50	General Purpose IO
AUX4	I/O	52	General Purpose IO
AUX_CHARGING	I/O	38	Alt. attention pin or charge detection

Note

The auxiliary serial port is normally disabled because it consumes up to 100µA of power when enabled.

Outboard DFU Interface

As an alternative to using the Auxiliary Ports for Outboard DFU, there are also dedicated pins on certain Notecards. For more information on using this interface, check the detailed documentation.

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Pin Name	Direction	Pin Number	Usage
ALT_DFU_BOOT	OUT	32	Used by Notecard to control the BOOT pin of the host MCU during Outboard DFU and host restart. Tri-state otherwise.
ALT_DFU_RESET	OUT	34	Used by Notecard to pulse the RESET pin of the host MCU low during Outboard DFU and host restart. Tri-state otherwise.
ALT_DFU_ACTIVE	OUT	36	Driven low by Notecard to indicate to the host that an Outboard DFU or host restart is in progress.
ALT_DFU_RX	IN	41	Input on which Notecard receives data from the host during Outboard DFU. Tri-stated when Outboard DFU is not in progress.
ALT_DFU_TX	OUT	43	Output on which Notecard sends data to the host during Outboard DFU. Tri-stated when Outboard DFU is not in progress.

External SIM

Notecard contains an integrated, embedded MFF2 SIM but may also be configured to use an external 1.8V Micro-SIM via this interface. This interface is powered by the Notecard. Note that use of an external SIM card also requires that the Notecard be re-configured in software with the APN, access technology, and bands appropriate for the SIM's carrier.

Pin Name	Direction	Pin Number	Usage
SIM_CLK	OUT	14	Clock

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Pin Name	Direction	Pin Number	Usage
SIM_IO	I/O	12	Data
SIM_NPRESENT	IN	16	Active-low input indicating presence of SIM card, else must be `NC`. Required if an external SIM is used, and is supported by the mechanical switch in SIM card slot hardware.
SIM_RST	OUT	10	Reset
SIM_VCC	OUT	8	+1.8V supply for external Micro-SIM

Onboard LEDs

Most Notecards have two small LEDs on the top of the module, each driven by a different source.

The red LED is controlled by Notecard firmware. It blinks at boot, lights while the Notecard is processing a request or writing to flash, and stays on continuously while the Notecard is in SoftAP mode. Its behavior can be adjusted with the `mode` argument to `card.io`.

On Notecards with a cellular modem, the green LED is driven by the modem's network status output. It reflects the modem's own state, so it is dark while the modem is powered down, and its blink pattern is defined by the modem manufacturer.

Reset

Use of this pin is optional. If the host system has a global reset line, caution should be used when connecting this pin to the host system's reset because the Notecard may independently pull the line low in software. Restrictions on this pin are:

- If this pin is not used, it must remain not connected (`NC`).
- The pin is active-low. It must be held low for at least 350 ns for a clean reset.
- This pin must never be pulled-up. A pull-up would interfere with the Notecard's own internal watchdog timer and thus will prevent reliable operations.
- Some Notecarriers may invert this signal to be active-high.

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Pin Name	Direction	Pin Number	Usage
NRST	I/O	67	Active-low reset

Bootloader

`BOOT` (pin 65) is a test/debug pin that forces Notecard into its bootloader instead of running its firmware. Its primary use is recovering a Notecard whose firmware update was interrupted, leaving it unable to boot normally. This pin plays no part in normal operation and use of it is optional.

To enter the bootloader, hold `BOOT` at `VIO_P` while resetting the Notecard, then release `NRST` (pin 67) before releasing `BOOT`. Notecard will stay in its bootloader, ready to accept firmware over the USB serial interface.

Restrictions on this pin are:

- If this pin is not used, it must remain not connected (`NC`).
- Never apply a voltage above `VIO_P` to this pin.
- Never hold this pin `HIGH` in normal operation, or Notecard will enter its bootloader on every reset rather than running its firmware.

Pin Name	Direction	Pin Number	Usage
BOOT	IN	65	Force Notecard into its bootloader on reset

Tip

For the step-by-step procedure on using a Notecarrier to recover a Notecard, see Recovering a Bricked Notecard.

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Network Communication Behavior

The Notecard includes a built-in connection to Notehub (specifically `a.notefile.net:8086`) and communicates over SSL. Outbound connections speak directly with the Notehub session load balancer (or "Discovery Service") for provisioning and device authentication. By default, the TLS connection is unidirectional, but can operate bi-directionally, if needed. The keys and certificates for each device are provisioned by STMicroelectronics inside the STSAFE secure element present on every Notecard. Once the Discovery Service has provisioned or authenticated a device, it issues a "ticket" and a Handler IP address that the Notecard can use to make subsequent requests.

The Notecard can also connect to the Handler to do a constrained set of remote procedure calls related to synchronization. If the Notecard determines that the data queued for transmission to or from the Handler should be encrypted, it opens a session to the Handler on port `8086`. Otherwise, an unencrypted socket is opened on port `8081`.

The over-the-wire data transmitted on both sockets is highly byte-optimized, which is why raw SSL and TCP sockets are used, and not unoptimized HTTP/HTTPS transactions.

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Specifications

General Characteristics

Description	Value
Dimensions	30mm x 35mm
Weight	6 grams

GPS/GNSS Characteristics

Description	Value
Manufacturer-reported typical GNSS position accuracy	<2.5m

Note

GPS/GNSS accuracy information is reported by the modem manufacturer. Blues does not independently measure or guarantee this figure. Accuracy in a deployment depends on the choice of GPS antenna, the view of the sky, and the surrounding environment.

Electrical Characteristics

Absolute Maximum Ratings

Description	Minimum	Maximum	Unit
Storage temperature	-40	90	°C

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Description	Minimum	Maximum	Unit
Ambient operating temperature	-35	75	°C

DC Characteristics

Description	Minimum	Typical	Maximum	Unit
VIO Supply Voltage	1.8		3.3	V
VMODEM Supply Voltage	2.5		5.5	V
VIO Operating Current			150	mA
VMODEM Operating Current		250	2000	mA

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Ordering Information

Blues Shop

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Design Files

3D models and dimensioned drawings for every Notecard are maintained in the note-hardware GitHub repository. Use them to check how a Notecard fits on your host board and inside your enclosure.

Here are the design files available for the **NOTE-WBEXN**:

- 3D model (`.step`) — a STEP 3D model. Import it into mechanical CAD to check fit on your host board and inside your enclosure.
- 3D view (`.pdf`) — an interactive 3D view you can rotate and inspect in Adobe Acrobat, no CAD software required.
- Dimensioned drawing (`.pdf`) — a dimensioned drawing with the board outline and overall dimensions for host-board and enclosure design.

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Certifications

CE

CE certification indicates that a product complies with the essential requirements of relevant European health, safety, and environmental protection legislation. It is a mandatory conformity mark for products sold within the European Economic Area (EEA).

European Union (CE RED)

This Notecard is CE-marked for the EU/EEA in accordance with the Radio Equipment Directive (RED) 2014/53/EU, as documented in an EU Declaration of Conformity (DoC). Compliance with RED is demonstrated through conformance to applicable harmonized standards covering radio performance, EMC, safety, and cybersecurity.

Warning

EN 18031-1:2024 is the harmonized standard defining cybersecurity requirements for network protection. The conformity assessment was performed via manufacturer self-declaration supported by third-party testing.

This compliance assumes Notecard data is routed off-internet via the Blues-provided secure network path using the embedded SIM and Blues Notehub. Customers must not enable configurations that bypass that path. Specifically: do not use a secondary SIM for alternate cellular connectivity and do not enable WiFi transport for data traffic (WiFi may be used for WiFi Triangulation only).

Certification	Date
IEC 62368-1:2018	July 2025
EN 303 446-1 V1.2.1	July 2025
EN 301 489-52 V1.2.1	July 2025

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Certification	Date
EU Declaration of Conformity for EN 18031-1:2024	January 2026

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Board Errata

- On units shipped where all large black capacitors indicate `JJ8`, the idle current of the Notecard may measure slightly higher than the expected current draw indicated above.

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Terms and Conditions

Visit Blues Hardware Terms & Conditions

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Security and Vulnerability Scanning

As a part of our regular audit and scanning process, Blues Inc. performs full vulnerability scanning every six months. Any identified vulnerabilities will be analyzed, reported, and patched in a timely fashion, where appropriate.

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Revision History

Author	Date	Summary
Ray Ozzie	2019-2020	Document drafted
John Wiedey	2020	Various improvements
Sean Taylor	2020	Various improvements
Zachary J. Fields	11 SEP 2020	Updated information and translated to markdown
Brandon Satrom	13 APR 2021	Updated Country list based on carrier audit
Carlton Henderson	12 JUL 2021	Update coverage information
Carlton Henderson	12 JUL 2021	Fix block diagram photo
Brandon Satrom	11 NOV 2021	Added Certification Dates
Brandon Satrom	07 JAN 2022	Added RoHS Certification Dates
Brandon Satrom	15 FEB 2022	Add WiFi Notecard Datasheet
Rob Lauer	25 AUG 2022	Added updated certification data

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Author	Date	Summary
Rob Lauer	27 OCT 2022	Update country coverage information
Rob Lauer	13 JAN 2023	Added RF performance information
Rob Lauer	2 FEB 2023	Warning re: STM32 light sensitivity
Kimball Johnson	21 SEP 2023	Updated for new Cell+WiFi, LoRa, and WiFi Notecards
Rob Lauer	23 OCT 2023	Update and clarify power consumption values
Rob Lauer	31 JAN 2024	Update Notecard for LoRa datasheet details
Rob Lauer	16 APR 2024	Updated for new Cellular (black PCB) Notecards, MB Cellular Notecards, and Notecard XP
Rob Lauer	6 JUN 2024	Added cell band support for Cellular Notecards
Rob Lauer	23 JUL 2024	Update pin definitions
TJ VanToll	24 SEP 2024	Adding Notecard for LoRa v2.1 information
Rob Lauer	01 NOV 2024	Adding Notecard for LoRa v2.1 castellated pin info

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Author	Date	Summary
Rob Lauer	06 NOV 2024	Added errata for Notecard Cell+WiFi
Brandon Satrom	06 DEC 2024	Expanded reset and loss of power guidance
Rob Lauer	20 DEC 2024	Added PTCRB certifications for WBNAN, NBNAN, NBGLN
Rob Lauer	5 MAR 2025	Update AUX5 to AUX_CHARGING
Rob Lauer	22 MAY 2025	Fix labelling of NC pins
Rob Lauer	13 JUN 2025	Update certifications
Rob Lauer	21 JUL 2025	Update certifications for WBNAN, NBNAN, NBGLN
Rob Lauer	28 JUL 2025	Update certifications for all Notecard SKUs
Rob Lauer	17 NOV 2025	Add FCC and IC IDs for all Notecard Cellular SKUs
TJ VanToll	21 JAN 2026	Added Notecard for Skylo
Rob Lauer	23 JUL 2026	Accuracy review vs. hardware design files

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Author	Date	Summary
Rob Lauer	03 AUG 2026	Document the `BOOT` pin (65) on all Notecard SKUs
TJ VanToll	14 AUG 2026	Adding new Telit SKUs WBEXWT & WBNAWT
Rob Lauer	18 AUG 2026	Expand countries not included
Rob Lauer	18 AUG 2026	Added manufacturer-reported GNSS accuracy figures
Rob Lauer	22 SEP 2026	Added Design Files section linking 3D models and drawings
Rob Lauer	20 OCT 2026	Added FCC, ISED, and PTCRB certifications for WBNAWT

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