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PRODUCT DATASHEET

# Notecard Datasheet

## NOTE-WBEXN

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

# 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.

## 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  $\sim 9\mu\text{A}@5\text{V}$  when idle.
- **MCU-agnostic.** Will support any MCU or single-board computer as your app processor - even low-memory, 8-bit microcontrollers.
- **Global.** With both narrowband and wideband modems tailored for use in North America 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 global 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.
- **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.io (SaaS), or host and integrate Notehub functionality into your own app (OSS).

# 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

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## Modem Datasheet

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

- [Quectel EG91](#) 

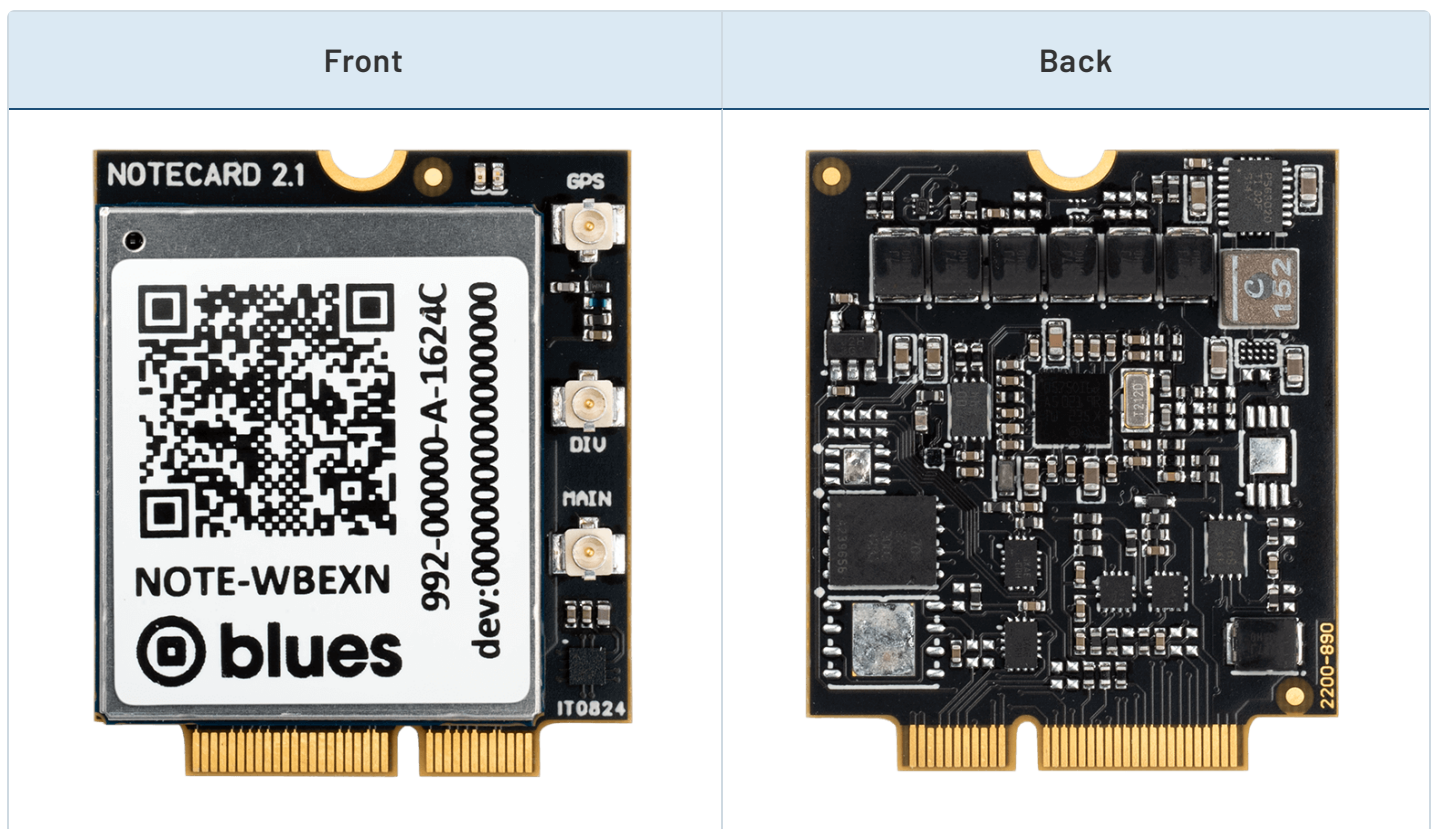
## Block Diagram

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

Open hardware schematics for both the Notecard and Notecarrier boards [are available on GitHub](#)<sup>🔗</sup>, making it a straightforward task to embed the Notecard into a broad variety of host device designs.

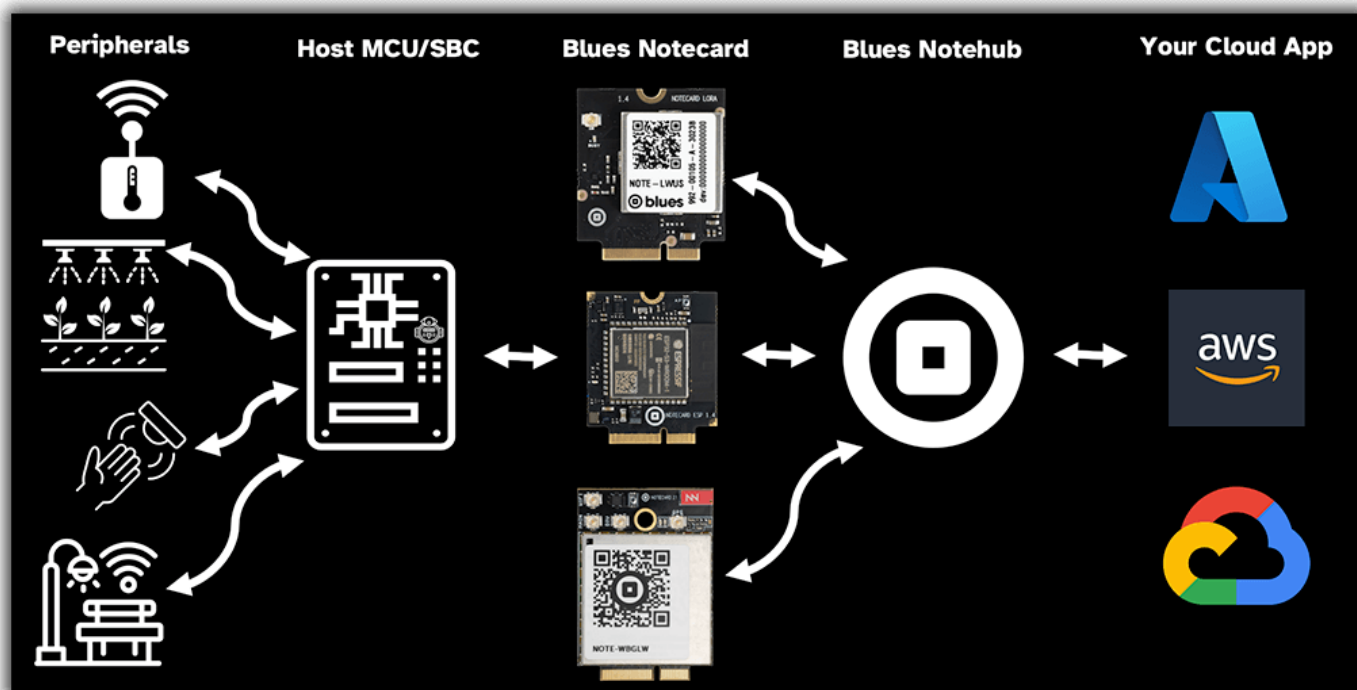
The Notecard has an embedded MFF2 SIM that enables its included cellular service coverage, with an integrated external SIM switch for applications that require such a capability.

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



## 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 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  $\sim 9\mu\text{A}@5\text{V}$ , while still supporting active UART and I2C communication.

## 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 10's 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                               | <a href="#">USB Serial</a> 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                                                     |

## 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.

## 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  $\mu$ A, 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.

# 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 and the 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.

| 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 |

# 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 |
| Chad              | Chile                  | Colombia   | Congo          |

| Covered Countries |                    |                |                  |
|-------------------|--------------------|----------------|------------------|
| 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           |
| Portugal          | Romania            | Rwanda         | Saint Barthelemy |

| Covered Countries     |                     |                          |                |
|-----------------------|---------------------|--------------------------|----------------|
| 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              |                     |                          |                |

# 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. Tri-state when Outboard DFU is not in progress.  |
| ALT_DFU_RESET  | Used by Notecard to control the RESET pin of the host MCU during Outboard DFU. Tri-state when Outboard DFU is not in progress. |
| ALT_DFU_ACTIVE | Driven low by Notecard to indicate to the host that an Outboard DFU 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                                                                                                           |

| Pin Name     | Pin Description                                                                 |
|--------------|---------------------------------------------------------------------------------|
| AUX4         | Auxiliary GPIO pin 4                                                            |
| AUX_CHARGING | Charge detection                                                                |
| 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 - Notecard has onboard 10K pull-up resistors) |
| 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)                                             |
| USB_DN       | USB data negative                                                               |
| USB_DP       | USB data positive                                                               |

| Pin Name     | Pin Description                       |
|--------------|---------------------------------------|
| VACT_GPS_IN  | Active antenna GPS bias voltage       |
| VACT_GPS_OUT | Active antenna GPS 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    |
| 11    | GND      | Power           | External SIM    | SIM_IO   | 12    |
| 13    | VUSB     | USB Serial      | External SIM    | SIM_CLK  | 14    |

| Pin # | Pin Name   | Func. Interface | Func. Interface | Pin Name       | Pin # |
|-------|------------|-----------------|-----------------|----------------|-------|
| 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    |
| 45    | GND        | Power           | Auxiliary Ports | AUX1           | 46    |
| 47    | NC         |                 | Auxiliary Ports | AUX2           | 48    |

| Pin # | Pin Name | Func. Interface | Func. Interface | Pin Name | Pin # |
|-------|----------|-----------------|-----------------|----------|-------|
| 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     |                 |                 | 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     |                 |                 |          |       |

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.

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

# 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 1500 byte buffer used 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.

| 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  |

# 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` at a fixed baud rate of 115200 using eight data bits, no parity bit, and one stop bit. 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 GPS Tracking Mode, GPIO Mode, and Internet Button Mode. If these pins are unused, they can be left disconnected.

| Pin Name     | Direction | Pin Number | Usage                                                                  |
|--------------|-----------|------------|------------------------------------------------------------------------|
| AUX_EN_P     | IN        | 56         | Enables serial port on <code>AUX_RX_P</code> and <code>AUX_TX_P</code> |
| AUX_RX_P     | IN        | 58         | RX data for serial port enabled by <code>AUX_EN_P</code>               |
| AUX_TX_P     | OUT       | 60         | TX data for serial port enabled by <code>AUX_EN_P</code>               |
| AUX1         | I/O       | 46         | General Purpose I/O                                                    |
| AUX2         | I/O       | 48         | General Purpose I/O                                                    |
| AUX3         | I/O       | 50         | General Purpose I/O                                                    |
| AUX4         | I/O       | 52         | General Purpose I/O                                                    |
| 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](#)

| 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. Tri-state when Outboard DFU is not in progress. |

| Pin Name       | Direction | Pin Number | Usage                                                                                                                          |
|----------------|-----------|------------|--------------------------------------------------------------------------------------------------------------------------------|
| ALT_DFU_RESET  | OUT       | 34         | Used by Notecard to control the RESET pin of the host MCU during Outboard DFU. Tri-state when Outboard DFU is not in progress. |
| ALT_DFU_ACTIVE | OUT       | 36         | Driven low by Notecard to indicate to the host that an Outboard DFU 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 |
| SIM_IO   | I/O       | 12         | Data  |

| Pin Name     | Direction | Pin Number | Usage                                                                                                                                                                         |
|--------------|-----------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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                                                                                                                                           |

## 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 350nS 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.

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

## Network Communication Behavior

The Notecard includes a built-in connection to Notehub.io (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 STMicrosystems 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.

# Specifications

## General Characteristics

| Description | Value       |
|-------------|-------------|
| Dimensions  | 30mm x 35mm |
| Weight      | 6 grams     |

## Electrical Characteristics

### Absolute Maximum Ratings

| Description                   | Minimum | Maximum | Unit |
|-------------------------------|---------|---------|------|
| Storage temperature           | -40     | 80      | °C   |
| 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   |

| Description              | Minimum | Typical | Maximum | Unit |
|--------------------------|---------|---------|---------|------|
| VMODEM Operating Current |         | 250     | 2000    | mA   |

# Ordering Information

[Blues Shop](#)

# 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      |
|--------------------------------------|-----------|
| <a href="#">IEC 62368-1:2018</a>     | July 2025 |
| <a href="#">EN 303 446-1 V1.2.1</a>  | July 2025 |
| <a href="#">EN 301 489-52 V1.2.1</a> | July 2025 |

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

## 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.

# Terms and Conditions

Visit [Blues Hardware Terms & Conditions](#) 

# 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.

# 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               |
| Rob Lauer         | 27 OCT 2022 | Update country coverage information            |

| Author          | Date        | Summary                                                                                |
|-----------------|-------------|----------------------------------------------------------------------------------------|
| 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                                     |
| Rob Lauer       | 06 NOV 2024 | Added errata for Notecard Cell+WiFi                                                    |
| Brandon Satrom  | 06 DEC 2024 | Expanded reset and loss of power guidance                                              |

| Author     | Date        | Summary                                            |
|------------|-------------|----------------------------------------------------|
| 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          |

# Contact Information

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