

# Reference Manual

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## **VL-MPEu-G2**

Mini PCIe GPS Receiver Module



**VERSA**LOGIC  
CORPORATION



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VersaLogic reserves the right to revise this product and associated documentation at any time without obligation to notify anyone of such changes.

## Product Revision Notes

*Revision 1.00* – Commercial release.

## Support

The VL-MPEu-G2 support page, at <http://www.versalogic.com/private/mpeug2support.asp>, contains additional information and resources for this product including:

- Reference Manual (PDF format)
- Device drivers
- Data sheets and manufacturers' links for chips used in this product
- Photograph of the circuit board

This is a private page for VL-MPEu-G2 users that can be accessed only by entering this address directly. It cannot be reached from the VersaLogic homepage.

The VersaTech KnowledgeBase is an invaluable resource for resolving technical issues with your VersaLogic product.

[VersaTech KnowledgeBase](#)

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## Description

### FEATURES AND CONSTRUCTION

The VL-MPEu-G2 is an extremely small and rugged GPS module based on the industry-standard Mini PCIe module format. It provides global positioning and time-stamp information for embedded systems. The board incorporates the u-blox NEO-7 GPS/GNSS module. Its features include:

- Support for GPS, GLONASS, Galileo, and QZSS
- NMEA, UBX, and RTCM protocols
- Industrial temperature range operation
- RoHS-compliant

The VL-MPEu-G2 features high reliability design and construction, including voltage sensing reset circuits and self-resetting fuses on the power supplies to the user I/O connectors.

VL-MPEu-G2 boards are subjected to 100% functional testing and are backed by a limited two-year warranty. Careful parts sourcing and US-based technical support ensure the highest possible quality, reliability, service, and product longevity for this exceptional board.

## Technical Specifications

Specifications are subject to change without notification.

### General Specifications

**Board Size:**

30.00 mm x 50.95 mm (Mini PCIe standard)

**Storage Temperature:**

-40° to +85°C

**Operating Temperature:**

-40° to +85°C

**Power Requirements:**

3.3V @ 0.22W

(supplied from the Mini PCIe socket)

**Mini PCIe Signal Type:**

USB 2.0

**Software:**

Compatible with most x86 operating systems including Windows, Windows Embedded, and Linux (Wheezy)

**Weight:**

VL-MPEu-G2E: 0.018 lbs (0.008 kg)

### GPS Specifications

**Accuracy:**

Autonomous Position: 2.5m

SBAS Position: 2.0m

Velocity: 0.1 m/s

**Startup Time:** *(at satellite signal levels greater than 130 Bm)*

Aided Start: 5 sec.

Hot Start: 1 sec.

Warm Start: 28 sec.

Cold Start: 29 sec.

**Timing Output:**

The TIMEPULSE output generates pulse trains synchronized with the GPS time grid. The time pulse signal is 1 pulse per second.

Frequency: 0.25 to 10 MHz (configurable)

Interface: 3.3 TTL on a connector

**Sensitivity:**

Tracking: -162 dBm

Reacquisition: -160 dBm

**Antenna:**

U.FL antenna connector. Compatible with active antennas only.

**Host Communication:**

Interface: Mini PCIe – USB signaling

Supported Protocols: NMEA, UBX, RTCM

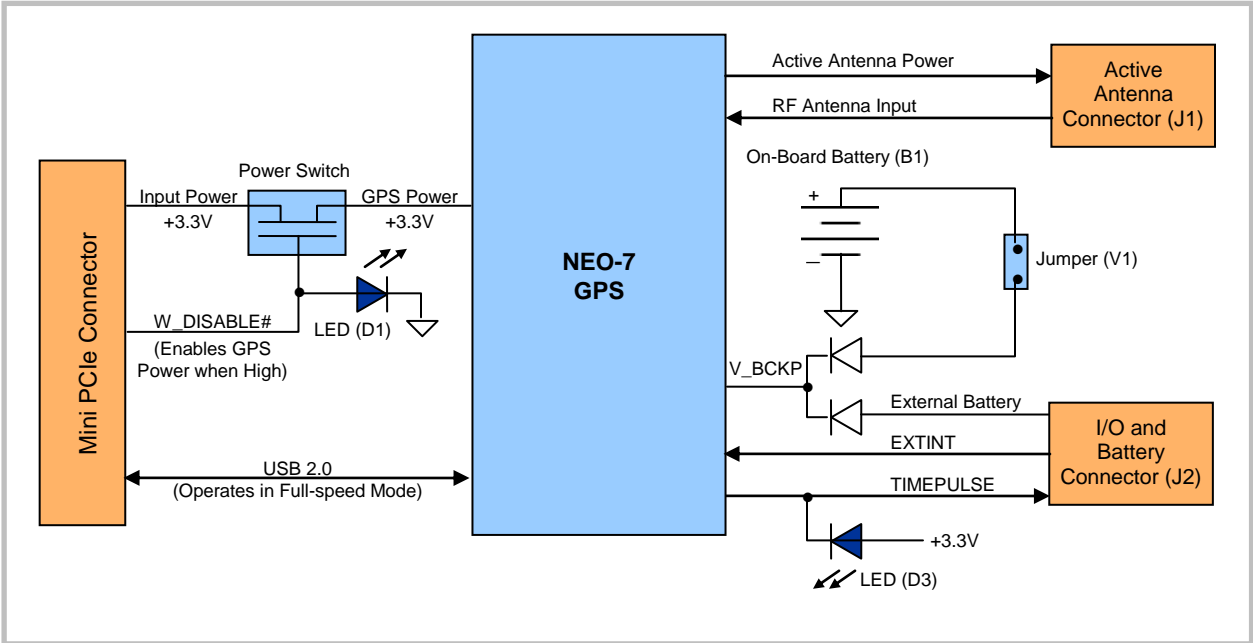
**Battery—On-board:**

On-board battery facilitates faster startup times

**Battery—External:**

Supports external 3.0V battery

# Block Diagram



## RoHS Compliance

The VL-MPEu-G2 is RoHS-compliant.

### ABOUT ROHS

In 2003, the European Union issued Directive 2002/95/EC regarding the Restriction of the use of certain Hazardous Substances (RoHS) in electrical and electronic equipment.

The RoHS directive requires producers of electrical and electronic equipment to reduce to acceptable levels the presence of six environmentally sensitive substances: lead, mercury, cadmium, hexavalent chromium, and the presence of polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE) flame retardants, in certain electrical and electronic products sold in the European Union (EU) beginning July 1, 2006.

VersaLogic Corp. is committed to supporting customers with high-quality products and services meeting the European Union's RoHS directive.

## Warnings

### ELECTROSTATIC DISCHARGE

**Warning!** Electrostatic discharge (ESD) can damage circuit boards, disk drives, and other components. The circuit board must only be handled at an ESD workstation. If an approved station is not available, some measure of protection can be provided by wearing a grounded antistatic wrist strap. Keep all plastic away from the board, and do not slide the board over any surface.

After removing the board from its protective wrapper, place the board on a grounded, static-free surface, component side up. Use an antistatic foam pad if available.

The board should also be protected inside a closed metallic antistatic envelope during shipment or storage.

**Note:** The exterior coating on some metallic antistatic bags is sufficiently conductive to cause excessive battery drain if the bag comes in contact with the bottom side of the board.

### HANDLING CARE

**Warning!** Care must be taken when handling the board not to touch the exposed circuitry with your fingers.



## Technical Support

If you are unable to solve a problem after reading this manual, please visit the VL-MPEu-G2 product support page below. This page provides links to component datasheets and device drivers.

[VL-MPEu-G2 Support Page](#)

The VersaTech KnowledgeBase contains a wealth of technical information about VersaLogic products, along with product advisories. Click the link below to see all KnowledgeBase articles related to the VL-MPEu-G2.

[VersaTech KnowledgeBase](#)

If you have further questions, contact VersaLogic Technical Support at (503) 747-2261. VersaLogic support engineers are also available via e-mail at [Support@VersaLogic.com](mailto:Support@VersaLogic.com).

### REPAIR SERVICE

If your product requires service, you must obtain a Returned Material Authorization (RMA) number by calling (503) 747-2261. Please provide the following information:

- Your name, the name of your company, your phone number, and e-mail address
- The name of a technician or engineer that can be contacted if any questions arise
- Quantity of items being returned
- The model and serial number (barcode) of each item
- A detailed description of the problem
- Steps you have taken to resolve or recreate the problem
- The return shipping address

**Warranty Repair** All parts and labor charges are covered, including return shipping charges for UPS Ground delivery to United States addresses.

**Non-warranty Repair** All approved non-warranty repairs are subject to diagnosis and labor charges, parts charges, and return shipping fees. Please specify the shipping method you prefer and provide a purchase order number for invoicing the repair.

**Note:** Please mark the RMA number clearly on the outside of the box before returning.

## Board Layout and Mounting

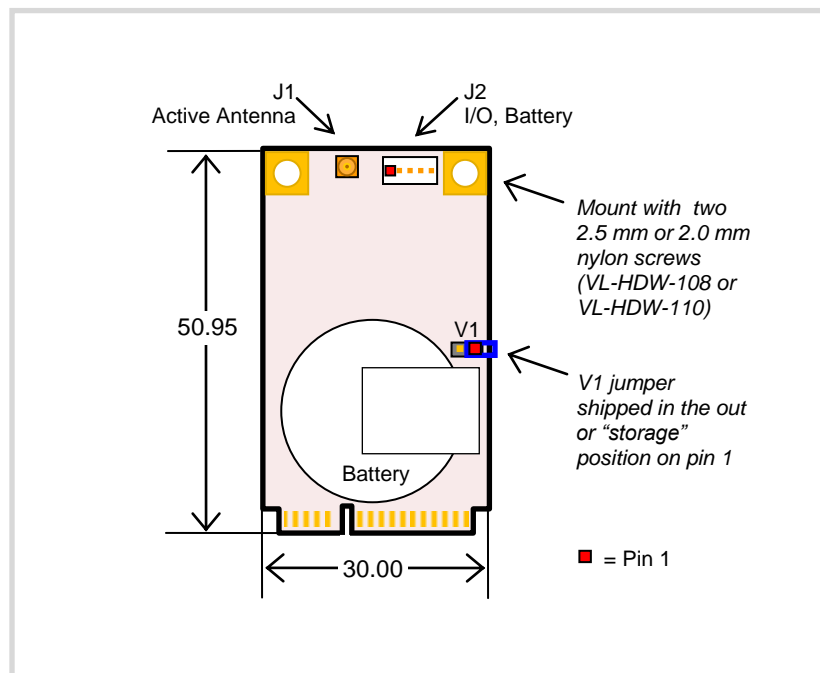
### VL-MPEU-G2 MOUNTING

The VL-MPEu-G2 is a full size Mini PCIe card and needs to be mounted into a full size Mini PCIe site. On VersaLogic CPU boards, the module is secured using two nylon screws. VersaLogic supplies 2 mm nylon screws (VL-HDW-110) and 2.5 mm nylon screws (VL-HDW-108). On non-VersaLogic CPU boards, mounting might be accomplished using a latching system.

**Note:** Be careful not to over tighten the nylon mounting screws. Optimum tightness is 1 lbf•in (0.1 N•m).

### VL-MPEU-G2 DIMENSIONS AND CONNECTORS

The VL-MPEu-G2 complies with Mini PCIe module (full size) dimensional standards. Dimensions are given below to help with pre-production planning and layout.



**Figure 1. VL-MPEu-G2 Dimensions and Connectors**

*(Not to scale. All dimensions in millimeters.)*

Table 1 provides information about the function, mating connectors, and transition cables for VL-MPEu-G2 connectors. Page numbers indicate where a detailed pinout or further information is available.

**Table 1: Connector Functions and Interface Cables**

Connector	Function	Mating Connector	Transition Cable	Cable Description	Page
J1	Active Antenna	U.FL SMT antenna jack	VL-CBR-0202	12" U.FL to RP-SMA female bulkhead – antenna cable <sup>1</sup>	12
J2	Auxiliary connector: I/O, External Battery	Molex 501330-0500 vertical 1x5 1mm Pico-Clasp	VL-CBR-0502	12" 5-wire timing and battery cable	12

1. Connects to VL-CBR-ANT02 GPS antenna with SMA connector (supports GPS signals) or VL-CBR-ANT03 active antenna with SMA connector (supports GPS and GLONASS signals).

**JUMPER SUMMARY**

Jumper Block	Description	As Shipped	Page
V1	<p><b>Battery disconnect.</b></p> <p>In – Battery connected.</p> <p>Out – Battery disconnected for storage or when an external battery is used via connector J2.</p> <p><i>Note: The jumper is shipped in the out or "storage" position on pin 1.</i></p>	Out	12

## GPS

The VL-MPEu-G2 incorporates the u-blox NEO-7 GPS/GNSS receiver using the Mini PCIe USB 2.0 interface. The NEO-7 is a low power, high sensitivity receiver suitable for a variety of embedded applications. See the following u-blox documents for complete information on the NEO-7:

- [NEO-7 Data Sheet](#)
- [NEO-7 Receiver Description: Including Protocol Specification V14](#)
- [NEO-7 Product Summary](#)
- [NEO-7 Hardware Integration Manual](#)

It is recommended that you consult the [u-blox NEO-7 Series product page](#) for periodic updates to these documents.

The latest drivers can be found on the [VL-MPEu-G2 Support Page](#).

## Antenna Connector (J1)

A single U-FL antenna jack accommodates active antenna types only. Antenna power from the GPS module is routed through this connector. Output short circuit protection is also provided. Custom models of the MPEu-G2 can support an optional LNA amplifier supported for passive antennas. Two antenna models are available from VersaLogic:

- VL-CBR-ANT02 – GPS antenna with SMA connector (supports GPS signals) or
- VL-CBR-ANT03 – active antenna with SMA connector (supports GPS and GLONASS signals)

Contact [VersaLogic Sales](#) for information.

## Battery Back-up

The VL-MPEu-G2 features a soldered-in 3.0V 255 mAh lithium battery, VersaLogic part number HB3/0-1 (Digi-Key part number P224-ND). The battery (or an optional external battery) provides memory retention for the GPS almanac, ephemeris, and last position.

**Warning!** To prevent shorting, premature failure, or damage to the lithium battery, do not place the board on a conductive surface such as metal, black conductive foam, or the outside surface of a metalized ESD protective pouch. The lithium battery may explode if mistreated. Do not recharge, disassemble or dispose of in fire. Dispose of used batteries promptly.

When using battery power, the time to first-fix in a hot start scenario is reduced to 1-2 seconds (typical) if the unit has been powered off for less than 2 minutes. Without the battery (or if the unit has been off for more than 2 minutes), the time to first-fix is approximately 29 seconds (typical). These first-fix times are based on  $-130$  dBm (approximately 42 db-Hz) or higher satellite signal levels and will increase as the satellite signal levels drop. In low-signal scenarios, the first-fix times with a battery can typically range from 2-15 seconds, and without a battery can typically range from 30-180 seconds.

The on-board battery disconnect jumper (V1) is not installed by default. The battery jumper should not be installed until the module is put into service so the battery does not discharge while on the shelf. When V1 is not installed, the battery life will be at least 10 years.

Estimated average power-off battery life when the jumper V1 is installed is 2 years (based on a 15 uA typical battery current at 25°C). At higher temperatures the battery current linearly increases to 24 uA typical at 85°C so battery life is derated above 25°C based on an average temperature over the lifetime of the product:

$$\text{Battery Life (yrs)} = 30 / [15 + (T_{\text{avg}} - 25) \times 0.15]$$

Where,  $T_{\text{avg}}$  is the average temperature over the battery lifetime and  $25^{\circ}\text{C} \leq T_{\text{avg}} \leq 85^{\circ}\text{C}$ .

Derating for  $T_{\text{avg}} < 25^{\circ}\text{C}$  is not required.

The nominal battery voltage is +3.0V. If the voltage drops below +2.0V, contact VersaLogic for a replacement (part number HB3/0-1) or obtain a replacement battery from Digi-Key (part number P224-ND).

An external 3.0V battery back-up input is also provided via connector J2. If this external battery is used, then the jumper V1 should be removed if the on-board battery is installed. (However, the jumper is not required to be removed, because both the on board and external battery are diode-isolated). See the “V\_BATT” section for more information.

## Auxiliary Connector (J2)

The auxiliary connector at location J2 provides signals used by the NEO-7 and an optional external battery input. The table below shows the J2 connector pinout.

**Table 2: Auxiliary Connector J2 Pinout**

J2 Pin	Signal Name	Description
1	EXTINT	Interrupt input
2	TIME_PULSE	External monitoring output
3	GND	Ground
4	V_BATT	External battery input
5	GND	Ground

### EXTINT

EXTINT is a 3.3V logic input to the EXTINT input on the NEO-7. This can be used to generate interrupts. See the [NEO-7 Receiver Description: Including Protocol Specification V14](#) for information on interrupts. The EXTINT signal is ESD protected.

### TIME\_PULSE

TIME\_PULSE is a buffered output of the TIMEPULSE signal from the u-blox NEO-7 for external monitoring. It provides the same information as the on-board TIMEPULSE LED at location D3. It is a 3.3V CMOS output (16 mA max. High or Low). By default this signal is high when satellites are not fixed. When satellites are fixed, the signal pulses at a 1 Hz rate with a 200 ms High and 800 ms Low duty-cycle. This signal is ESD protected.

### V\_BATT

V\_BATT is an optional external battery input. The voltage should be greater than 2.0V and less than 3.6V. An on-board diode is in series with the external battery voltage, but there is no current-limiting resistor (as required by UL). Custom models of the VL-MPEu-G2 can be configured with a current-limiting resistor and to bypass the on-board diode if external diode protection is implemented. This signal is ESD protected.

## W\_DISABLE#

The W\_DISABLE# signal on pin 20 of the Mini PCIe connector can be used to turn module power off. When the signal is high (default), power is on. When the signal is low, the board is powered off. This is useful for very low power applications. How this signal is controlled depends on the board on which the module is installed. The intended use for this signal is to turn off transmitters on wireless modules, so the use on this module is not normally supported by standard drivers.

## LEDs

Two blue LEDs (D1 and D3) indicate the status of the W\_DISABLE# input from the Mini PCIe connector. D1 is on when the W\_DISABLE# signal is High, indicating that the GPS module is powered. D3 indicates TIMEPULSE output.