Reference Manual

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VL-MPEu-G3

Mini PCIe GPS Receiver Module

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CORPORATION

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Notice:

Product Revision Notes

Revision 1.0 – Initial draft

Support

The VL-MPEu-G3 support page 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

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

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Description

FEATURES AND CONSTRUCTION

The VL-MPEu-G3 is an extremely small and rugged GPS module based on the industry-standard Mini PCIe module format. Mini PCIe allows the addition of I/O functions to a system with almost no increase in overall system/package size. Mini PCIe modules provide a simple, economical, and standardized way to add I/O functions to embedded computer products.

In a very small package, this GPS receiver board provides global positioning and time-stamp information in embedded systems.

This GPS receiver module delivers complete position, velocity, and time (PVT) data for use in host applications. The GPS receiver provides simultaneous 72-channel operation for stable satellite tracking and aided GPS startup for fast initial signal acquisition. Support for GPS (United States), GLONASS (Russian), Galileo (European Union), and BeiDou (China), systems provide complementary coverage to enable reliable tracking in difficult environments such as cityscape / building canyons. Additional internal augmentation systems include Satellite-Based Augmentation System (SBAS), QZSS, IMES, and Differential GPS (D-GPS). GPS data is available in NMEA, UBX, and RTCM protocols. The GPS data is accessed via USB.

In addition to positioning and navigation applications, GPS/GNSS signals are widely used as accurate and low-cost precision time or frequency references used by remote or distributed wireless communication, industrial, financial, and power-distribution equipment. The TIMEPULSE output generates a precision time reference via a pulse train synchronized with the GPS or UTC time grid. Linked to the satellites' atomic clocks, this output produces intervals configurable from 0.25 Hz to 10 MHz. The high precision time reference may be used as a low frequency time synchronization pulse or as a high frequency reference signal. By default, the time pulse signal is configured to one pulse per second.

The standard model includes an on-board battery to retain satellite position data and supports fast restart of the GPS chip. Connection to an external 3.0V battery is also available at reference designator J2.

The VL-MPEu-G3 supports OEM applications where high reliability and long-term availability are required. From application design-in support, to a 5+ year production life guarantee, the VL-MPEu-G3 provides a durable expansion option with an excellent cost of ownership.

This rugged product is designed and tested for full industrial temperature operation (-40º to +85ºC). It also meets MIL-STD-202G specifications for shock and vibration.

The module supports IPC-A-610 Class 2 standards. Class 3 versions are available for extremely high reliability applications.

TECHNICAL SPECIFICATIONS

Specifications are subject to change without notification.

General Specifications

Board Size: 30 mm x 50.95 mm x 6.32 mm

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

GPS Specifications

Accuracy: Autonomous Position - 2.5m
Velocity - 0.05 meters/second
Heading - 0.3 degrees

Startup Time: Aided Start - 5 seconds
Hot Start -1 second
Cold Start - 29 seconds

Timing Output: Provides a high precision output pulse train synchronized with the GPS time grid. The default time pulse signal is 1 pulse per second.

Sensitivity: Tracking -167 dBm
Reacquisition -153 to -160 dBm

**Antenna:** External Compatible with active antennas only.

Host Communication: Interface Mini PCIe – USB signaling
Protocol NMEA, UBX, RTCM

Battery: GPS receiver – On-board (VL-MPEu-G3E)
GPS receiver – no battery (VL-MPEu-G3E-Z)

Note: Customers using this product at high temperature and turning the system off and on regularly should use VL-MPEu-G3E-Z and purchase an external battery.

Block Diagram
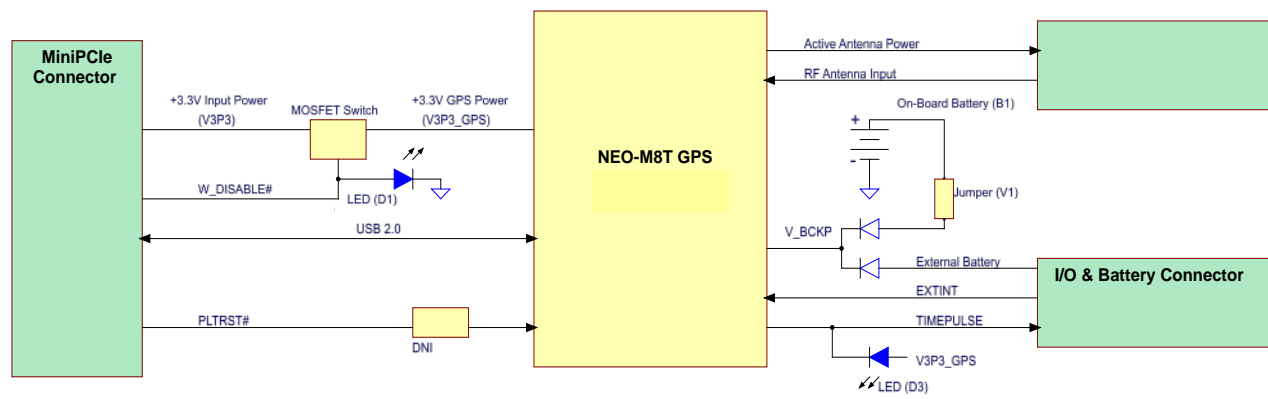
RoHS Compliance

The VL-MPEu-G3E/VL-MPEu-G3E-Z are 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-G3 product support page. This page provides links to component datasheets and device drivers.

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-G3.

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.

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-G3 Mounting

The VL-MPEu-G3 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-G3 Dimensions and Connectors

Figure 1. VL-MPEu-G3 Dimensions and Connectors
(Not to scale. All dimensions in millimeters.)
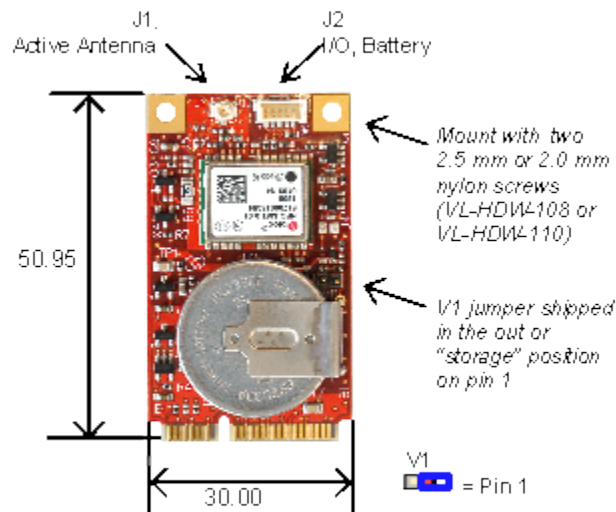
The table below provides information about the function, mating connectors, and transition cables for VL-MPEu-G3 connectors.

Table 1: Connector Functions and Interface Cables

Connector	Function	Cable/Hardware	Description
J1	Antenna jack	VL-CBR-ANT02	GPS antenna with SMA connector
		VL-CBR-ANT03	Active antenna with SMA connector
J2	External battery and I/O	Molex 501330-1100	

JUMPER SUMMARY

Jumper Block	Description	As Shipped
V1	Battery disconnect.	Out

Interfaces and Connectors   3

GPS

The VL-MPEu-G3 incorporates the u-blox NEO-M8T GPS/GNSS receiver using the Mini PCIe USB 2.0 interface. The NEO- M8T is a low power, high sensitivity receiver suitable for a variety of embedded applications. See the following u-blox documents at the VL-MPEu-G3 Support Page for complete information on the NEO-M8T:

It is recommended that you consult the u-blox NEO-M8T Series product page for periodic updates to these documents.

The latest drivers can be found on the VL-MPEu-G3 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. 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-G3 features a soldered-in 3.0V 255 mAh lithium battery. The battery (or an optional external battery) provides memory retention for the GPS almanac, ephemeris, and last position.

Note: VL-MPEu-G3E-Z is shipped without a battery

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 µA typical battery current at 25°C). At higher temperatures, the battery current linearly increases to 24 µA typical at 85°C so battery life is derated above 25°C based on an average temperature over the lifetime of the product:

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

Where, T_{avg} is the average temperature over the battery lifetime and $25°C \leq T_{avg} \leq 85°C$. Derating for $T_{avg} < 25°C$ 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 Pinout (J2)

The auxiliary connector at location J2 provides signals used by the NEO-M8T. The table below shows the J2 connector pinout.

Table 2: J2 Connector Pinout

Pin	Signal Name	Description
1	EXTINT	Interrupt input
2	TIMEPULSE	External monitoring output
3	GND	Ground
4	V_BATT_IN	External battery input
5	GND	Ground

LEDs

There are two blue LED (D1 & D3) that indicate the status of the module power (D1 is on when enabled and power is on) and the TIMEPULSE output (D3).