

## VENUS Rugged 3.5 Inch SBC with 7th Gen Core i7 CPU and PCIe/104



 PCIe104

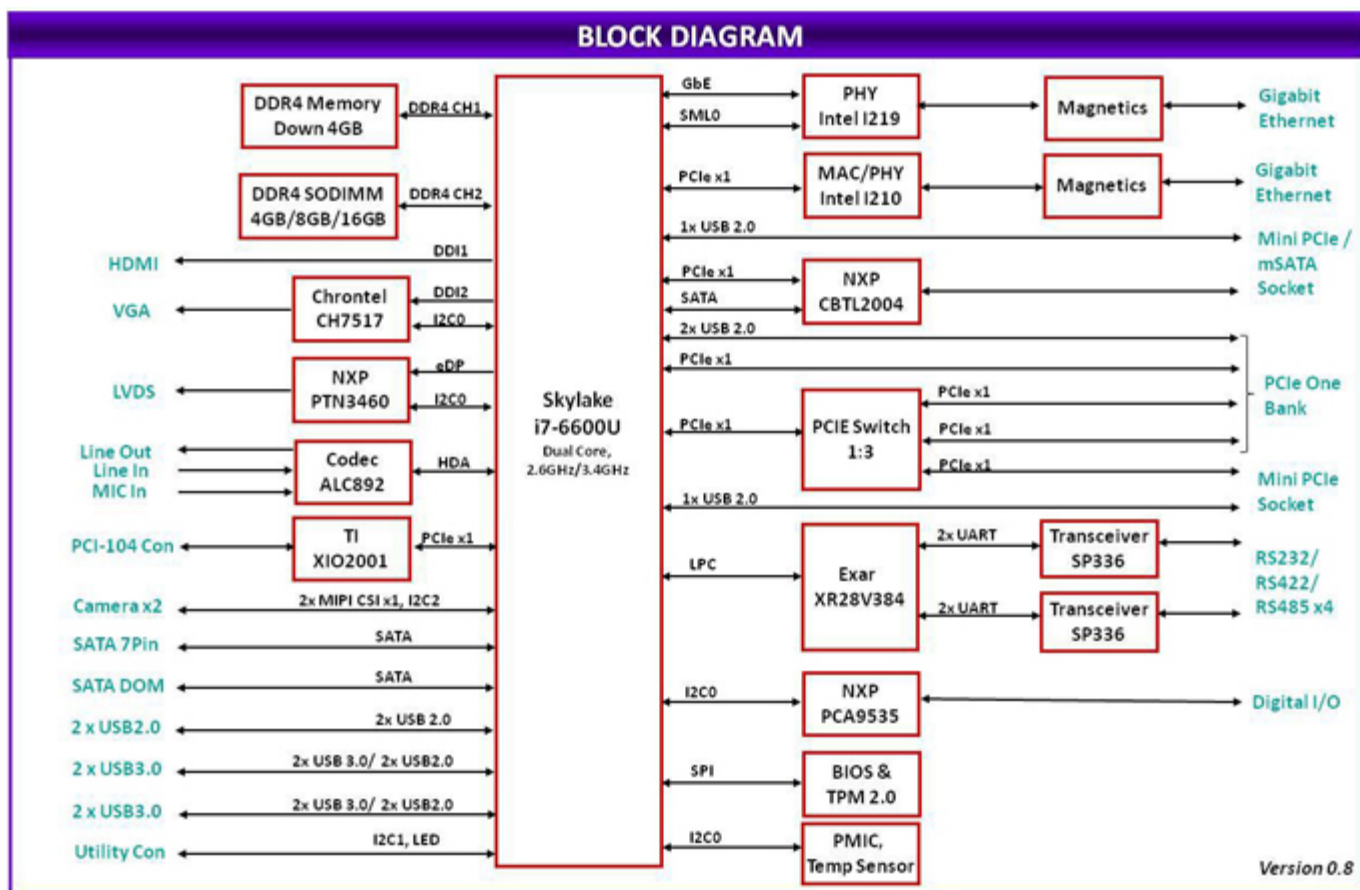


### FEATURES

- Intel "Kaby Lake" 7th Gen Core i7-7660U 2.8GHz
- 4GB DDR4 RAM soldered on board
- Expansion socket for up to 16GB additional / 20GB total RAM
- 2x Gigabit Ethernet
- 2x SATA 3.0 ports + mSATA socket
- VGA, HDMI & dual channel LVDS with 3 simultaneous independent display support
- 4x RS-232/422/485 ports
- 6x USB 2.0 ports
- 4x USB 3.0 ports
- HD audio
- 16 GPIO lines with 3.3/ 5V logic levels
- TPM module
- CSI camera serial interface
- 2x PCIe MiniCard sockets; one socket supports mSATA
- OneBank-Plus PCIe/104 + PCI-104 expansion socket
- +9-18VDC input voltage
- 14W power consumption typical
- 3.5 inch form factor: 5.75" x 4.0" (146mm x 102mm)
- 40°C to +85°C operating temperature
- Bottom-mounted heat spreader cooling

Based on the "Kaby Lake" 7th generation Core i7 processor, Venus offers high CPU performance in a small form factor rugged SBC with modest power consumption. It incorporates a full suite of rugged features such as soldered memory, latching connectors, a thicker PCB, and true -40/+85°C operating temperature, making it suitable for the most demanding vehicle applications. High I/O density, multiple expansion sockets, rugged design, modest power consumption of 14W, and wide temperature operation combine to make Venus an extremely attractive option for applications requiring high CPU performance or ruggedness.

### Block Diagram



## ◆ Display Features

Venus supports 3 simultaneous independent displays, VGA, HDMI, and dual channel LVDS LCD. The HDMI port is capable of 4K screen resolution. Mass storage options include SATA DOM, mSATA, and a connector for an external SATA drive (all ports are SATA III capable). Diamond offers a series of MLC and SLC mSATA and SATA DOM modules with wide temperature qualification for use with Venus.

## ◆ Wide Range of I/O

The 3.5 inch form factor enables Venus to include an impressive range of I/O features on a single board while retaining a small form factor profile. Connectivity includes 4 RS-232/422/485 serial ports, 6 USB ports (4 are USB 3.0 capable), dual gigabit Ethernet ports, and 16 digital I/O lines.

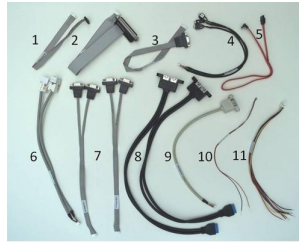
The 4 serial ports support RS-232, RS-422, and RS-485 protocols. Protocol selection as well as all other configurations are fully software programmable and may be configured in the BIOS for convenience or controlled via an application program. For RS-422 and RS-485, line termination resistors are also provided and are programmable.

## ◆ Development Support

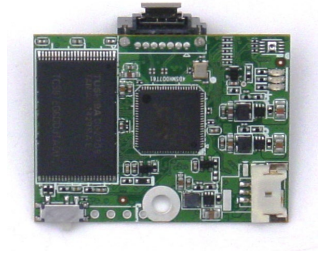
Venus is available in a complete development kit that includes a Venus SBC, a cable kit, a SATA Disk-on-Module (SATA-DOM) with your choice of operating system pre-installed, and a backup USB flashdisk. Available operating systems are Linux Ubuntu 20.04 kernel 5.x 64-bit and Windows 10 64-bit. Other OS support is available by consultation. For customers who already have a Venus SBC or who have multiple boards, the programmed SATA-DOM and backup USB flash are also available as an SDK.



Venus



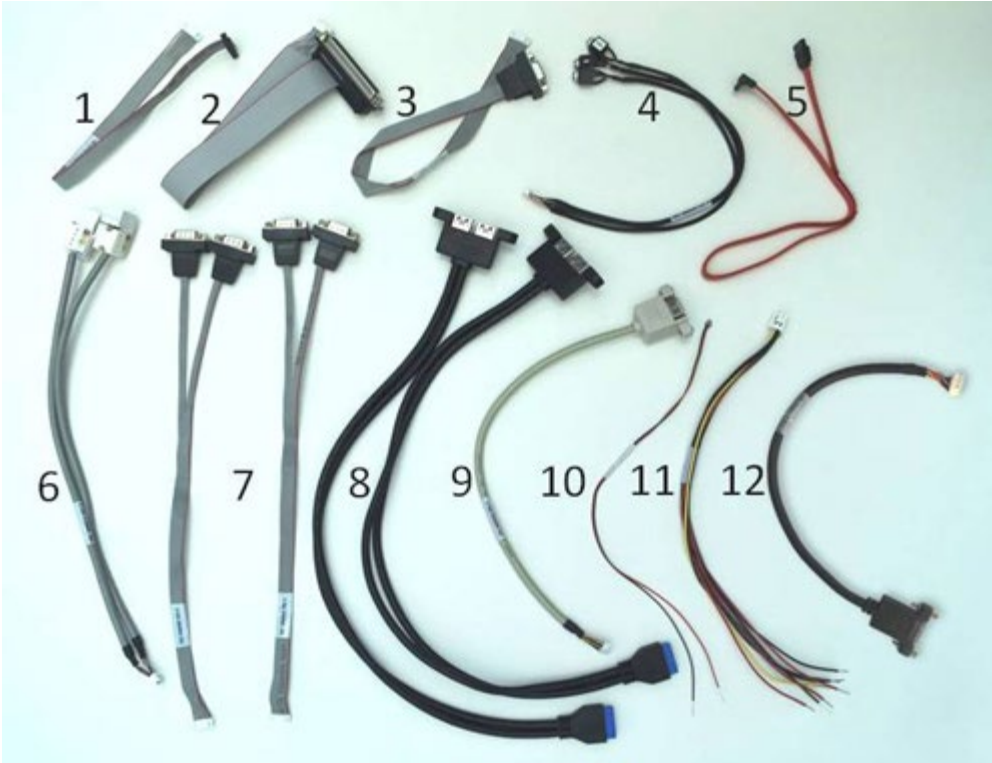
Venus Cable kit



SATA DOM

### ◆ Cable Kit

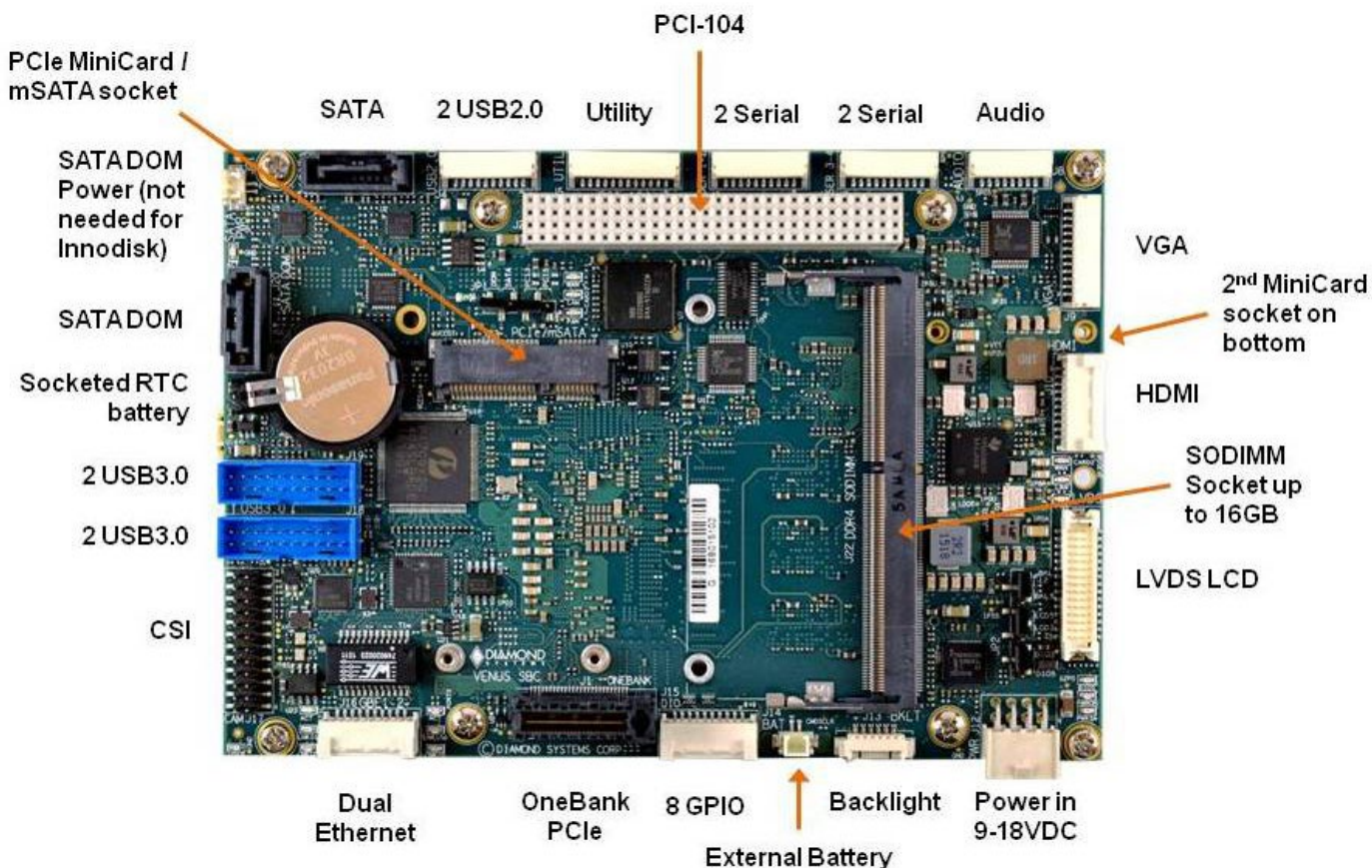
The Venus cable kit CK-VNS-05 includes cables for all I/O connectors. This version of the kit includes rugged latching cables for the USB 3.0 ports.



CK-VNS-05 includes the following cables:

| No. | Qty | Cable   | Description  | Drawing              |
|-----|-----|---------|--|----------------------|
| 1   | 1   | 6980514 | Cable, Utility, 2x6 2mm IDC Socket                               | <a href="#">Show</a> |
| 2   | 1   | 6980517 | Digital I/O cable, DB37F connector                               | <a href="#">Show</a> |
| 3   | 1   | 6980507 | Cable, VGA, 1.25mm Con DE15 Female                               | <a href="#">Show</a> |
| 4   | 1   | 6980508 | Cable, Audio, 1.25mm 2X 3.5mm                                    | <a href="#">Show</a> |
| 5   | 1   | 6989101 | SATA Cable, 7-Pin Data, Straight to Right Angle, 500mm           | <a href="#">Show</a> |
| 6   | 1   | 6980513 | Cable, Dual Ethernet, 2x10 1.25mm                                | <a href="#">Show</a> |
| 7   | 2   | 6980500 | Cable 1.25mm to 2x DB9M Serial                                   | <a href="#">Show</a> |
| 8   | 2   | 6980610 | Dual USB 3.1 type A cable with latching 2x10 2mm board connector | <a href="#">Show</a> |
| 9   | 1   | 6980503 | Cable, 2xUSB 2.0, 1.25 Con                                       | <a href="#">Show</a> |
| 10  | 1   | 6980524 | External battery cable, discrete wires                           | <a href="#">Show</a> |
| 11  | 1   | 6980512 | Power input cable, discrete wires                                | <a href="#">Show</a> |

## I/O Features



Venus has a SATA DOM socket and a second SATA connector. All ports are SATA III compliant.

A multi-use MiniCard socket auto-selects for either a PCIe MiniCard or mSATA flashdisk. This dual function socket can be used to add compact additional I/O or mass storage to your system. The dedicated SATA connector can be used with off-board SATA devices and also supports use of a board-mounted miniature SATA disk-on-module for a smaller overall system envelope with less cables. Most I/O on Venus utilizes latching I/O connectors for enhanced ruggedness and reliability. Venus has a SATA DOM socket and a second SATA connector. All ports are SATA III compliant.

Venus provides 4 RS-232/422/485 ports using multiprotocol transceivers, one per port. All configuration features are fully programmable as well as configurable in the BIOS screens, including protocol and line termination for RS-422/485. In RS-458 mode, both echo and no-echo modes are supported. The expansion connectors use 22mm stacking height to provide more clearance for installed minicards.

Venus supports two 10/100/1000 high speed Gigabit Ethernet ports derived from Intel I210IT PCIe Gigabit Ethernet controllers. A latching connector is used to bring these ports off board instead of RJ-45 jacks, optimizing space on the board and increasing ruggedness. Activity status of the Ethernet ports can be read from LEDs.

## Expansion Capability

In addition to the already high level of onboard I/O, Venus also provides great expansion flexibility, including both a OneBank Plus (PCIe/104 + PCI-104) socket and 2 full-size MiniCard sockets.

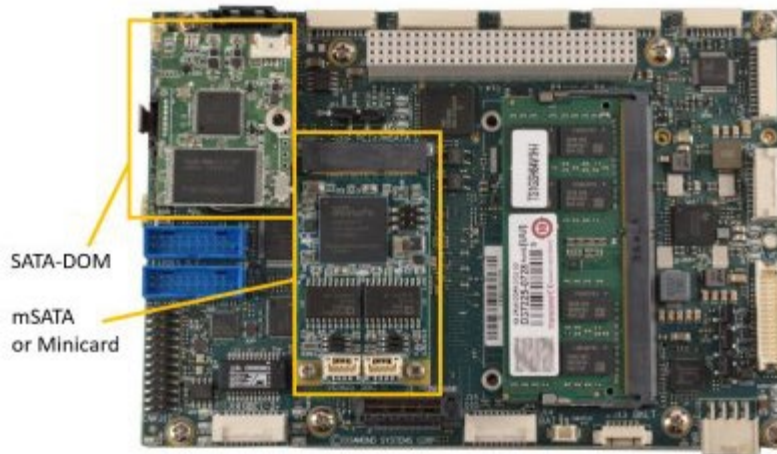
The compact OneBank expansion connector provides high performance PCIe expandability in a stacking format. The expansion connectors use 22mm stacking height to provide more clearance for installed minicards. It supports up to 3 PCIe/104 Type 1 and Type 2 add-on modules along with PCIe/104 OneBank I/O modules with PCIe x1 host interface, while conserving board space and reducing total system cost.

### **Learn more about the OneBank expansion connector.**

The companion PCI-104 connector supports PCI-104 modules for compatibility with an even greater array of I/O modules. Use of PC/104-Plus modules will require removing the PC/104 ISA connector to avoid interference with the OneBank connector.

The top side MiniCard socket supports full-size PCIe and USB MiniCards as well as mSATA Disk-on-Modules. The bottom side socket supports full-size and half-size PCIe MiniCards.

**Mass storage options** include the top side mSATA socket as well as a SATA-DOM socket. Flashdisk modules up to 256GB in wide temperature range are available for both sockets.



**SATA-DOM and mSATA/minicard sockets on top side**

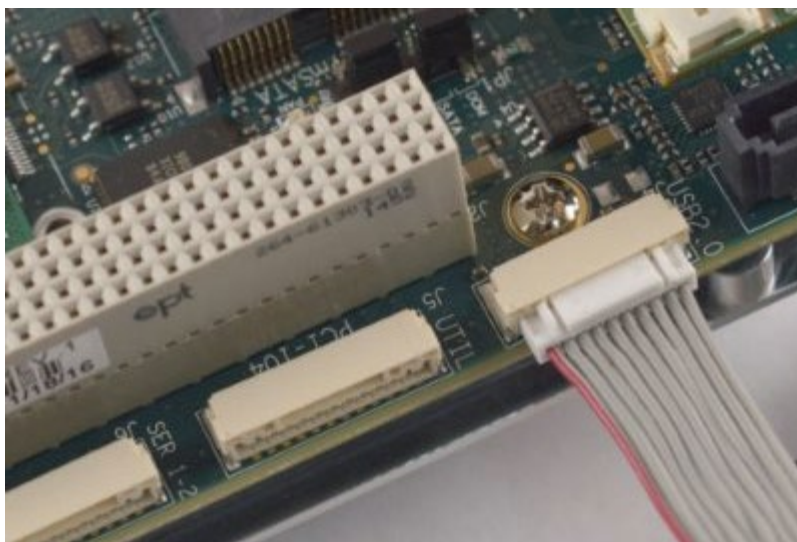


**Second half/full-size MiniCard socket available on bottom side**

### **◆ Rugged Features**

Venus incorporates a full suite of rugged features such as latching connectors, a thicker PCB, and soldered memory, making it suitable for the most demanding vehicle applications.

Most I/O connectors use a true locking design to ensure reliable operation in high vibration environments. The 50% thicker PCB along with 8 mounting points provides greater rigidity to minimize the possibility of solder joint failure from vibration.



### **Positive latching connector system enhances ruggedness and reliability**

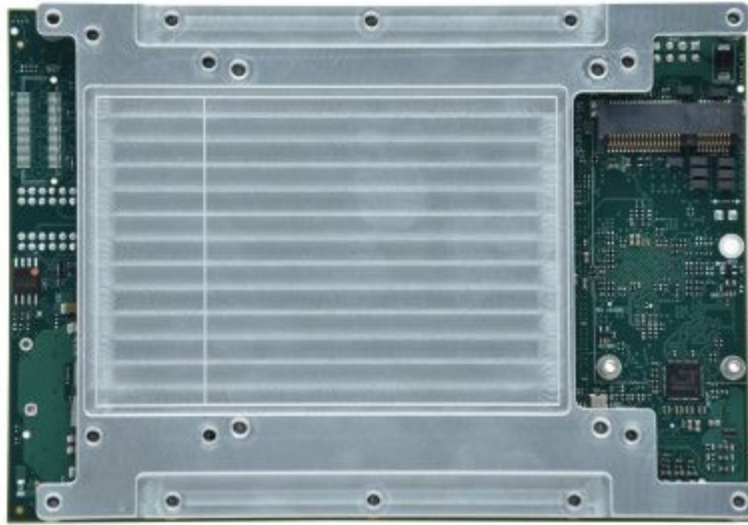


### **Thicker PCB inhibits flexing from high vibration**

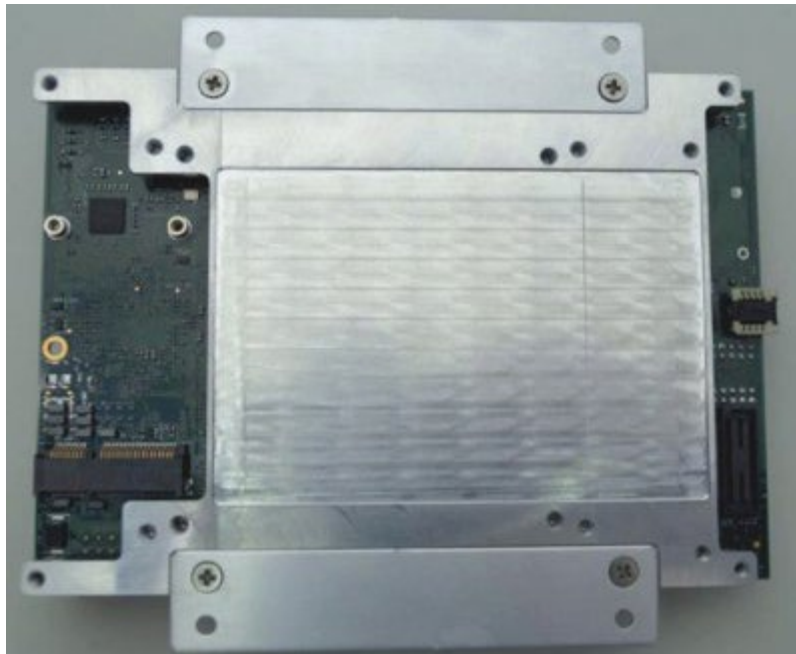
#### **◆ Innovative Conduction Cooling**

The bottom side heat spreader on Venus provides the most efficient cooling solution in a weight-optimized design, enabling Venus to run reliably at up to 85°C. The heat spreader conducts heat directly to the system chassis for maximum heat dispersion to the ambient environment and minimum radiation into the enclosure interior. By reducing the interior temperature, Venus helps to improve overall system reliability. In addition the bottom side heat spreader leaves the entire top side of the board free for expansion and memory modules, simplifying system configuration and maintenance.

The Venus heat spreader includes a number of innovations to provide system designers with flexibility and confidence. The bottom side contains a depression for an included thermal pad for optimum thermal contact with the enclosure surface. A series of English and Metric mounting holes are available for installation. A mounting tab accessory kit enables convenient installation from the inside of the enclosure to eliminate concerns of violating the enclosure's environmental integrity.



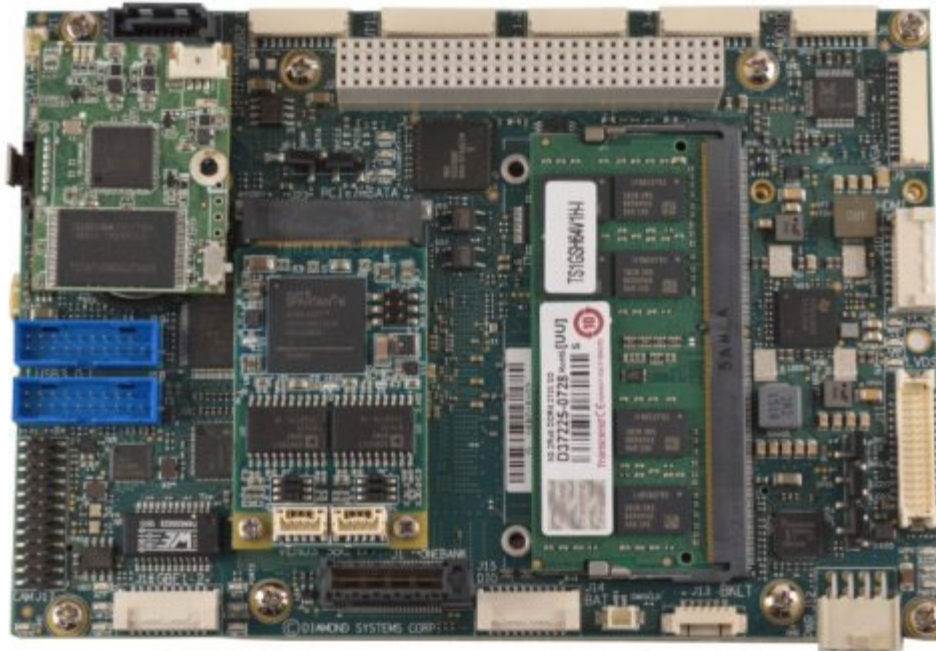
**Heat spreader on bottom side**



**Heat spreader with optional mounting tabs installed for interior mounting operation**

### ◆ Rugged Memory

Venus includes 4GB of DDR4-2133MHz memory soldered on board for enhanced ruggedness. The memory size may be upgraded to as high as 20GB using readily available DDR4 SODIMM modules in 4GB, 8GB, and 16GB capacity. For rugged applications we offer our unique RSODIMM rugged memory modules, which are designed to withstand MIL-STD-202G shock and vibration specifications. RSODIMM modules are exactly like standard SODIMM modules except they have a small PCB extension that provides two mounting holes to fix the module to the SBC more reliably.

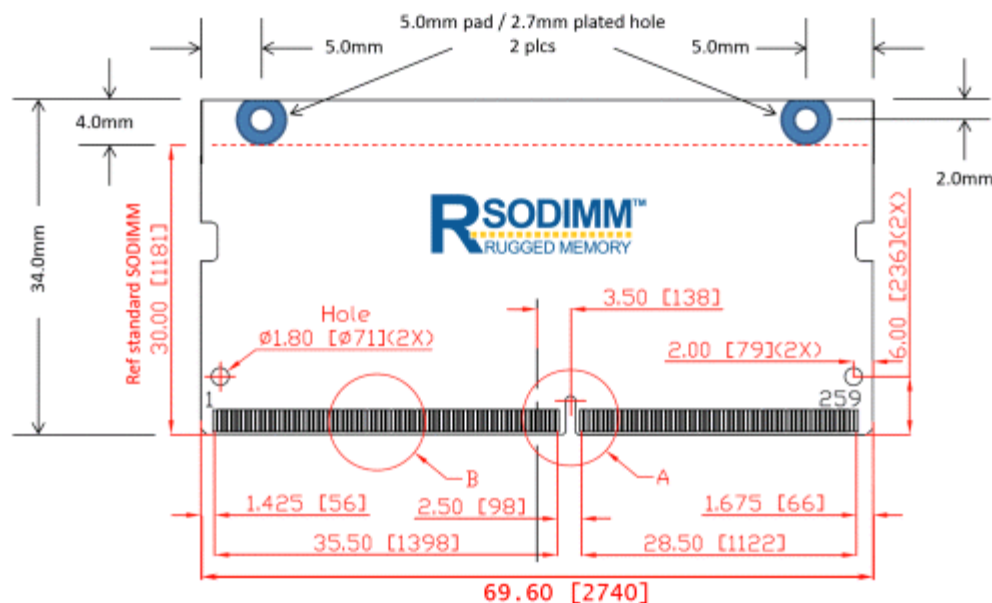


**Standard SODIMM installed for memory expansion**



**Diamond's unique rugged RSODIMM memory module installed on Venus**





**RSODIMM mechanical drawing**

## Specifications

| Features          |   |
|-------------------|---|
| Processor         | "Kaby Lake" 7th Gen Core i7-7660U 2.8GHz, 2 cores 4 threads   |
| Chipset           | Integrated onto processor package   |
| Memory            | Up to 20GB: 4GB memory down + socket for 4/8/16GB DDR4-2133 SODIMM / RSODIMM  |
| Graphics          | 3 independent displays: HDMI, VGA, and LVDS, max resolution 4096 x 2304   |
| Ethernet          | 2 Gigabit ports: 1 from chipset with i219 PHY, 1 from i210 on PCIe x1 lane, on-board LEDs for status  |
| USB               | 4x USB 3.0/2.0 ports on Intel standard USB 2.0 connectors + 2x USB 2.0 on separate connector<br>2x USB 2.0 via PCIe/104 OneBank expansion connector<br>2x USB 2.0 via PCIe MiniCard sockets   |
| Serial            | 4x multiprotocol RS-232/422/485, all features programmable including termination  |
| Audio             | HDA audio with Line in, Line out, and Mic in, ALC892 CODEC  |
| Digital I/O       | 16 lines with bitwise programmable direction, configurable 3.3V/5V logic levels, and configurable pull-up/down resistors  |
| Mass storage      | 3 SATA interfaces: SATA DOM, Standard SATA, mSATA support in one MiniCard socket  |
| Security          | TPM module Infineon SLB 9670XQ2.0   |
| Expansion         | MiniCard sockets:<br>1 socket supports full size PCIe/USB MiniCard and mSATA modules<br>1 socket supports full / half size PCIe/USB MiniCard<br>OneBank Plus (PCIe/104 + PCI-104) socket with 22mm stacking height:<br>Supports up to 3 PCIe x1 Type 1 / Type 2 / OneBank I/O modules + up to 2 USB interface modules<br>Supports up to 4 PCI-104 expansion modules |
| Connectors        | Latching, JST GH / GHD series   |
| Form factor       | "3.5 inch" form factor: 5.75" x 4.0" / 146 x 102mm  |
| Weight            | 281g/ 9.9oz   |
| Cooling           | Conduction cooling heat spreader on bottom  |
| Input voltage     | 9-18VDC   |
| Power consumption | 14W under typical operating conditions  |
| Operating Temp    | -40° to +85°C   |

## Models and Accessories

| Venus              |   |           |
|--------------------|---|-----------|
| available models:  |   |           |
| VNS776KL-4GD       | Venus SBC, i7-7660U 2.8GHz CPU, 4GB RAM soldered on board RSODIMM rugged memory expansion               | Available |
| DK-VNS776KL-WE1064 | Venus SBC development kit, includes VNS776KL-4GD SBC, Windows 10 64-bit OS on SATA DOM, and cable kit   | Available |
| DK-VNS776KL-LNX64  | Venus SBC development kit, includes VNS776KL-4GD SBC, Ubuntu Linux 64-bit OS on SATA DOM, and cable kit | Available |
| SDK-VNS766-WE10    | Venus SBC software development kit, includes Windows 10 OS on SATA DOM                                  | Available |
| SDK-VNS766-LNX     | Venus SBC software development kit, includes Linux OS on SATA DOM                                       | Available |

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| Cables and accessories |  |
|------------------------|--|
| available models:      |  |
| <b>CK-VNS-05</b>       | Venus SBC Cable Kit, With HDMI Cable                             |
| <b>6980514</b>         | Cable, Utility, 2x6 2mm IDC Socket                               |
| <b>6980517</b>         | Digital I/O cable, DB37F connector                               |
| <b>6980507</b>         | Cable, VGA, 1.25mm Con DE15 Female                               |
| <b>6980508</b>         | Cable, Audio, 1.25mm 2X 3.5mm                                    |
| <b>6989101</b>         | SATA Cable, 7-Pin Data, Straight to Right Angle, 500mm           |
| <b>6980513</b>         | Cable, Dual Ethernet, 2x10 1.25mm                                |
| <b>6980500</b>         | Cable 1.25mm to 2x DB9M Serial                                   |
| <b>6980610</b>         | Dual USB 3.1 type A cable with latching 2x10 2mm board connector |
| <b>6980503</b>         | Cable, 2xUSB 2.0, 1.25 Con                                       |
| <b>6980524</b>         | External battery cable, discrete wires                           |
| <b>6980512</b>         | Power input cable, discrete wires                                |
| <b>6980519</b>         | Cable, HDMI to 2x10 1.25mm                                       |

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