



Gemini

PC/104 COM Express Type 6 Embedded Computer Board

User Manual

Revision 1.22



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Notices

Technical Support

Please use the [Technical Support Request](#) form to request assistance with a product you have already purchased.

Product and Sales Inquiry

Please use the [Sales Inquiry](#) form to request assistance with selecting a product for your application, or to obtain further information about products and service.

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Trademarks

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Important Safe Handling Information



WARNING!

ESD-Sensitive Electronic Equipment

- Observe ESD-safe handling procedures when working with this product.
- Always use this product in a properly grounded work area and wear appropriate ESD-preventive clothing and/or accessories.
- Always store this product in ESD-protective packaging when not in use.

Safe Handling Precautions

The Gemini SBC contains a high number of I/O connectors with connections to sensitive electronic components. This creates many opportunities for accidental damage during handling, installation, and connection to other equipment.

This section provides critical, best practice suggestions to avoid damage to your products. It includes descriptions of many common causes of damage – all of which can void your warranty.

Please follow these guidelines to be aware of common causes of damage and take the necessary precautions to prevent damage to your Diamond Systems' (or any vendor's) embedded computer boards.

Damage from incorrect handling or storage

- Physical and electronic damage can occur from mishandling. The following are frequent scenarios.
- An electrostatic discharge (ESD) causes a board to malfunction or stop working entirely. If ESD occurs, typically there is no visual sign of damage. While it is often difficult to identify faulty component(s), if the fault is identified there is a good chance that the board can be repaired.
- A screwdriver slips during installation, causing a gouge in the PCB surface and cutting signal traces or damaging components.
- A board is dropped, causing damage to the circuitry near the point of impact. Most of our boards are designed with at least 25 mils clearance between the board edge and any component pad, and ground / power planes are at least 20 mils from the edge. These design rules can minimize but cannot always prevent damage from impact.
- A short occurs when a metal screwdriver tip slips, or a screw drops onto a board while it is powered on. This can cause overvoltage or power supply problems described below.
- A storage rack with slots to hold boards can damage components near the board edge. Many boards have components that are close to the board edge, which are subject to damage in racks.
- Connector pins are bent by improperly dis-assembling attached boards or ribbon cables from a pin header, or from physical impact or improper storage. Typically, bent pins can be repaired one at a time with needle-nose pliers. Severely bent or frequently repaired pins may require the replacement of the connector.

Best Practices to avoid damage during handling or storage

- To prevent ESD damage, always follow proper ESD-prevention practices when handling any electronic components.
- To prevent physical damage from impact, handle all boards with care and work in a safe, spacious environment.

- To prevent short circuit damage from a metallic tool or dropped screw, perform assembly operations ONLY when the system is powered off.
- To prevent damage to fragile components and connector pins in storage, always store boards in individual ESD-safe sleeves in sturdy bins with dividers between boards. Do NOT use racks with slots, or stack boards in a pile or in close proximity.
- To prevent damage to connector pins during assembly or dis-assembly, use caution to align connectors and especially when force is needed to disassemble components and wires. Do not 'rock' connectors back and forth or pull any component at the wrong angle.

Damage due to incorrect voltage or connections

Power supply wired backwards

Diamond Systems power supplies and boards are not designed to withstand a reverse power supply connection. Reverse power will destroy nearly every IC that is connected to the power supply. Reverse power damage is rarely repairable. Check twice before applying power!

Board not installed properly in PC/104 stack

If a PC/104 board is accidentally shifted by 1 row or 1 column (of pins) it is possible for power and ground signals on the bus to contact the wrong pins. For example, this can damage components attached to the data bus because it puts the $\pm 12V$ power supply lines directly on data bus lines.

Overvoltage on analog input

If a voltage applied to an analog input exceeds the design specification of the board, the input multiplexor and/or parts behind it can be damaged. Most of our boards will withstand an erroneous connection of up to $\pm 35V$ on the analog inputs, even when the board is powered off, but not all boards, and not in all conditions.

Overvoltage on analog output

If an analog output is accidentally connected to another output signal or a power supply voltage, the output can be damaged. On most of our boards, a short circuit to ground on an analog output will not cause trouble.

Overvoltage on digital I/O line

If a digital I/O signal is connected to a voltage above the maximum specified voltage, the digital circuitry can be damaged. On most of our boards the acceptable range of voltages connected to digital I/O signals is 0-5V, and they can withstand about 0.5V beyond that (-0.5 to 5.5V) before being damaged. However, logic signals at 12V and even 24V are common, and if one of these is connected to a 5V logic chip, the chip will be damaged, and damage may extend past that chip to others in the circuit.

Best Practices to avoid damage due to incorrect voltage or connections

- Ensure all power supply connections are correct and not reversed!
- Ensure all pins are aligned properly before and after assembling boards and components!
- Ensure proper voltage is supplied to all analog inputs!
- Ensure all analog voltage outputs do not connect to another signal output or power supply output!
- Ensure all voltages for digital I/O lines are proper and with range, and that higher voltage signals (24V or 12V) are not supplied to lower voltage circuits (12V or 5V)!

IMPORTANT! Always check twice before Powering Up!

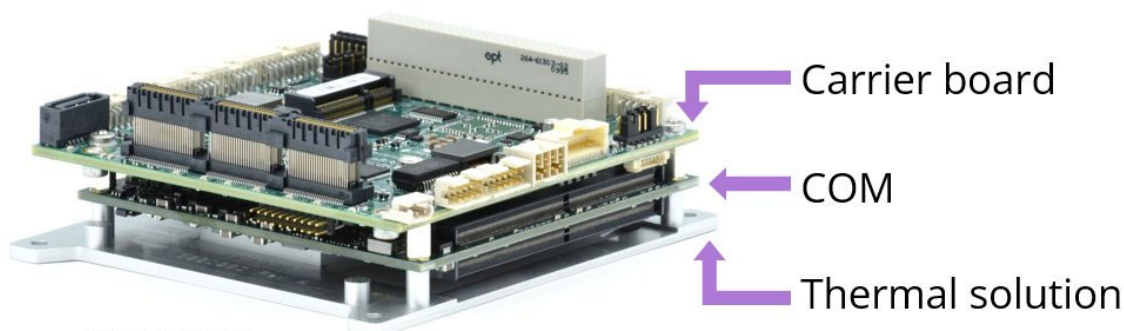
1. Introduction

1.1. Gemini SBC Overview

Gemini combines COM Express processor modules with PCIe/104 expansion to create a compact, flexible, scalable, and long-life embedded SBC platform for a wide range of industrial and rugged applications.

The PCI/104-Express (PCIe and PCI) expansion sockets are located on the top side of the board, along with a PCIe full-size minicard socket and an M.2 2242 socket for mass storage. The COM Express module, heat spreader, and mounting plate are mounted on the bottom side of the board.

Gemini contains a thicker PCB, latching I/O connectors, and -40° to +85° C operation to support reliable operation in mobile and harsh environmental applications.



GEMINI SBC

- COM Express Type 6 Compact
- 11th gen Core i7
- Up to 64GB RAM
- PCIe104 and minicard expansion

COM Express®

Gemini offers a range of COMs to support varying performance and power consumption combinations as well as to provide greater flexibility in sourcing COMs to minimize the impact of supply chain variability. This design feature makes Gemini extremely resistant to obsolescence and provides greater flexibility to system designers. Customers can also select their own COM of choice and purchase just the carrier board.

The following table summarizes key features, components, and specifications of the Gemini SBC.

<i>Feature</i>	<i>Specification</i>
CPU	Intel Core i7 11th or 13th generation, COM Express Type 6 module
Memory Type	Maximum 64 GB DDR4
Mass Storage	1x M.2 SATA Socket 2242 (22mm Wide x 42mm Long)
Ethernet Controller	ETH-1 10/100/1000Mbps Routed from COM Module ETH-2 10/100/1000Mbps Routed from Intel I210 Ethernet Controller
Display	2x HDMI 2.0a/b High Efficiency Video Coding (HEVC)); 1 x Dual Channel 24-bit LVDS Port with 3.3V and 5V Power Range @ Maximum Resolution 1920x1200
SATA Ports	2 Ports: 1 M.2 and 1 Standard SATA
Serial Ports	4 RS-232/422/485 Ports, software configurable through SP336 Transceivers
USB Ports	2x USB 2.0 to Standard Header Interface 1x USB 2.0 Muxed from Module to Mini PCI-Express (mPCIe) and USB to GPIO Interface
Utility	1x I2C, Power Button, Reset Button, 8 GPIOs, 5V @ 2A Power Supply
Audio Interface	High Definition Audio (IHDA) to Analog Audio Converter Via ALC892-CG CODEC
Digital I/O	8 Programmable Direction, 3.3V Logic Compatible
TPM (Trusted Platform Module)	TPM 2.0 via an SPI Interface
LCD Backlight Connector	LCD Backlight Power and Control Signals with 5V and 12V Power Option
PCI/104-Express Expansion Busses	PCIe/104 type 1 with up to 4 PCIe x1 links PCI-104 with support for up to 4 expansion modules Stack-up only
Minicard socket	1x Mini-PCI Express (mPCIe) Socket with PCIe and USB support
Operating System Support	Windows 11 64-bit Windows 10 64-bit Ubuntu Linux LTS 64-bit
Mechanical, Electrical, and Environmental Specifications	
Form Factor	4.0x4.0" (101.6 mm x 101.6 mm) not including mounting plate or connector overhang
Cooling Mechanism	Conduction Cooling with Heat Spreader, Bottom Side.
DC Power Input Voltage	8V-34VDC
Power Consumption	10-30W depending on installed COM and operating mode
Ambient Operating Temperature Range	-40°C to +85°C (-40°F to +185°F) dependent on COM installed.
RoHS	Compliant

1.2. COM Express Processor Options

Gemini utilizes COM Express Type 6 Compact processor modules. The following options are currently offered as of the publication date of this manual:

<i>Processor</i>	<i>Memory</i>	<i>PassMark*</i>	<i>Availability</i>
Intel Core i7-1185GRE, 11th generation	32GB soldered	7,800	Current
Intel Core i7-1365URE, 13th generation	32GB or 64GB SODIMM	10,900	Preliminary
Intel Core i7-1370PRE, 13th generation	32GB or 64GB SODIMM	20,300	Preliminary

* PassMark is a trademark of PassMark Software. The ratings shown here are obtained from PassMark and are intended to serve only as a general guideline of relative processor performance.

1.3. Baseboard Models

Gemini is available in two baseboard versions. GEM-BB01 routes eight PCIe x1 links directly from the COM module. Many COM modules do not provide eight links, so GEM-BB02 adds a PCIe switch that expands one link into several, preserving the PCIe-connected features that would otherwise be lost. As of this manual version, all models of Gemini use GEM-BB02.

<i>Model</i>	<i>Description</i>
GEM-BB01	8 PCIe x1 links routed directly from the COM module
GEM-BB02	PCIe switch expands one COM link into multiple links

1.4. Ordering Guide

The table below lists available models and options as of the publication date of this manual. Contact the Diamond website or sales department for information on newly available configurations.

1.4.1. Single Board Computers

<i>Part Number</i>	<i>Description</i>	<i>Carrier Board</i>
GEM-1185GRE-32G	Gemini SBC, i7-1185GRE CPU, 32GB RAM soldered	GEM-BB02
GEM-1365UREC-32G	Gemini SBC, i7-1365URE CPU, 32GB RAM single SODIMM	GEM-BB02
GEM-1365UREC-64G	Gemini SBC, i7-1365URE CPU, 64GB RAM dual SODIMM	GEM-BB02
GEM-1370PREC-32G	Gemini SBC, i7-1370PRE CPU, 32GB RAM single SODIMM	GEM-BB02
GEM-1370PREC-64G	Gemini SBC, i7-1370PRE CPU, 64GB RAM dual SODIMM	GEM-BB02

1.4.2. Carrier Boards

<i>Part Number</i>	<i>Description</i>
GEM-BB01	Gemini carrier board, for COMs with 8 PCIe x1 link support
GEM-BB02	Gemini Carrier Board, with PCIe switch for COMs without 8x PCIe x1 support

1.4.3. Development Kits

Development kits include the SBC, the cable kit, and a programmed flashdisk with the selected operating system installed (see next section Software Development Kits). A backup USB memory device containing the OS image is included to aid in recovery and duplication. Each Windows DK ships with a single user license. Duplication of the SDK for production use requires the purchase of additional licenses. The below table lists present and upcoming development kits. Contact Diamond Systems for current product configuration availability.

<i>Part Number</i>	<i>Description</i>
DK-GEM-1185GRE-LNX64	Development Kit, Gemini SBC, 1185GRE CPU, Linux 64-Bit OS
DK-GEM-1185GRE-WE1064	Development Kit, Gemini SBC, 1185GRE CPU, Windows 10 64-Bit OS
DK-GEM-1365UREC-LNX64	Development Kit, Gemini SBC, 1365URE CPU, Linux 64-Bit OS
DK-GEM-1365UREC-WE1164	Development Kit, Gemini SBC, 1365URE CPU, Windows 10 64-Bit OS
DK-GEM-1370PREC-LNX64	Development Kit, Gemini SBC, 1370PRE CPU, Linux 64-Bit OS
DK-GEM-1370PREC-WE1164	Development Kit, Gemini SBC, 1370PRE CPU, Windows 10 64-Bit OS

1.4.4. Software Development Kits

Software development kits provide the operating system pre-installed on a storage device, without the SBC. A backup USB memory device containing the OS image is included to aid in recovery and duplication. Each Windows SDK ships with a single user license. Duplication of the SDK for production use requires the purchase of additional licenses.

<i>Part Number</i>	<i>Description</i>
SDK-GEM-1185GRE-LNX64	Software Dev Kit, Gemini SBC, 1185GRE CPU, Linux 64-Bit OS
SDK-GEM-1185GRE-WE1064	Software Dev Kit, Gemini SBC, 1185GRE CPU, Windows 10 64-Bit OS
SDK-GEM-1365UREC-LNX64	Software Dev Kit, Gemini SBC, 1365URE CPU, Linux 64-Bit OS
SDK-GEM-1365UREC-WE1164	Software Dev Kit, Gemini SBC, 1365URE CPU, Windows 10 64-Bit OS
SDK-GEM-1370PREC-LNX64	Software Dev Kit, Gemini SBC, 1370PRE CPU, Linux 64-Bit OS
SDK-GEM-1370PREC-WE1164	Software Dev Kit, Gemini SBC, 1370PRE CPU, Windows 10 64-Bit OS

1.4.5. Cable Kit

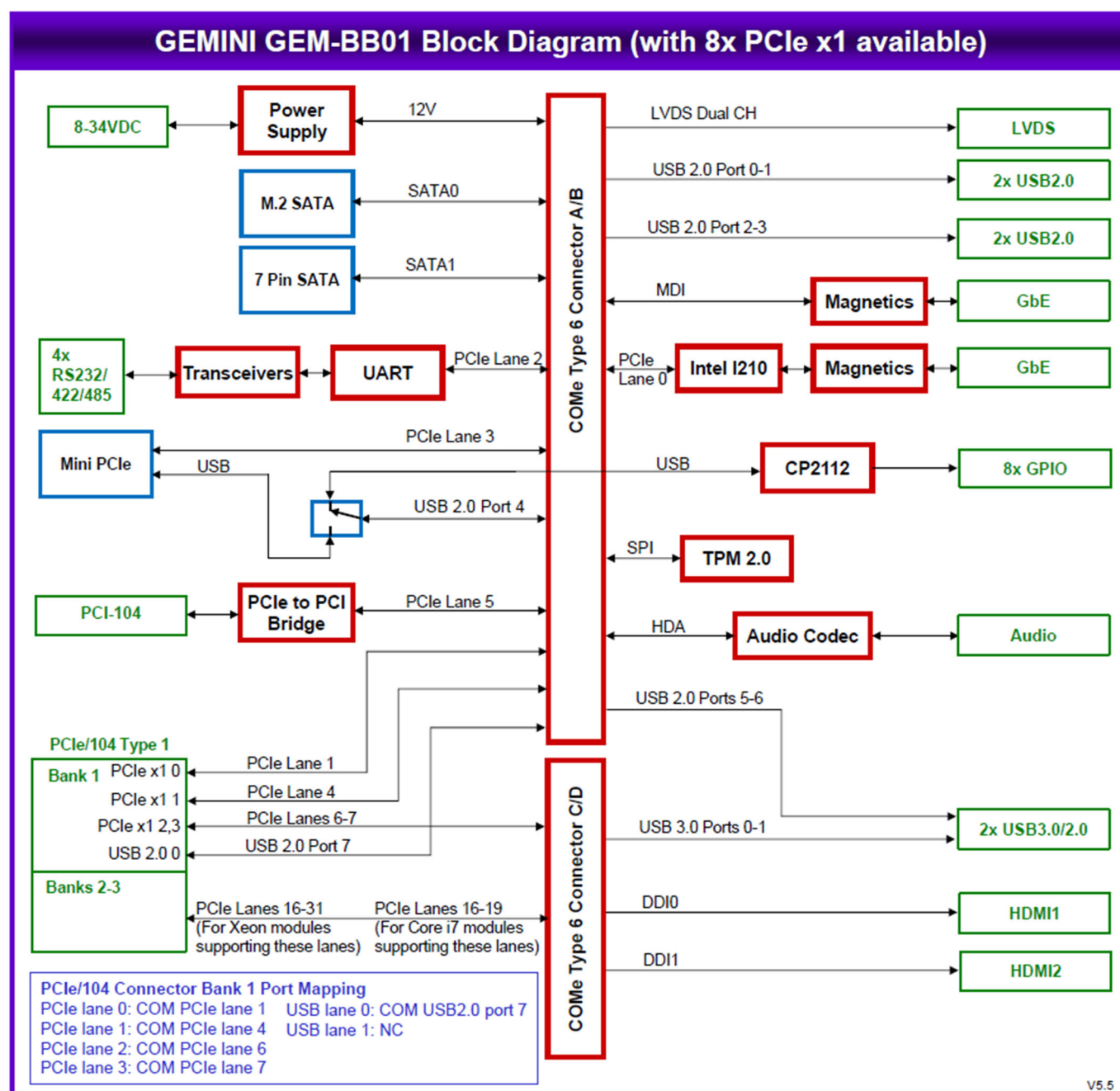
<i>Part Number</i>	<i>Description</i>
CK-GEM-01	Cable Kit, Gemini COM-Based SBC

2. Block Diagrams

Gemini is available in two carrier board configurations, which differ in how the PCIe links from the COM Express module are distributed to the expansion interfaces.

2.1. GEM-BB01 — 8 PCIe x1 Links

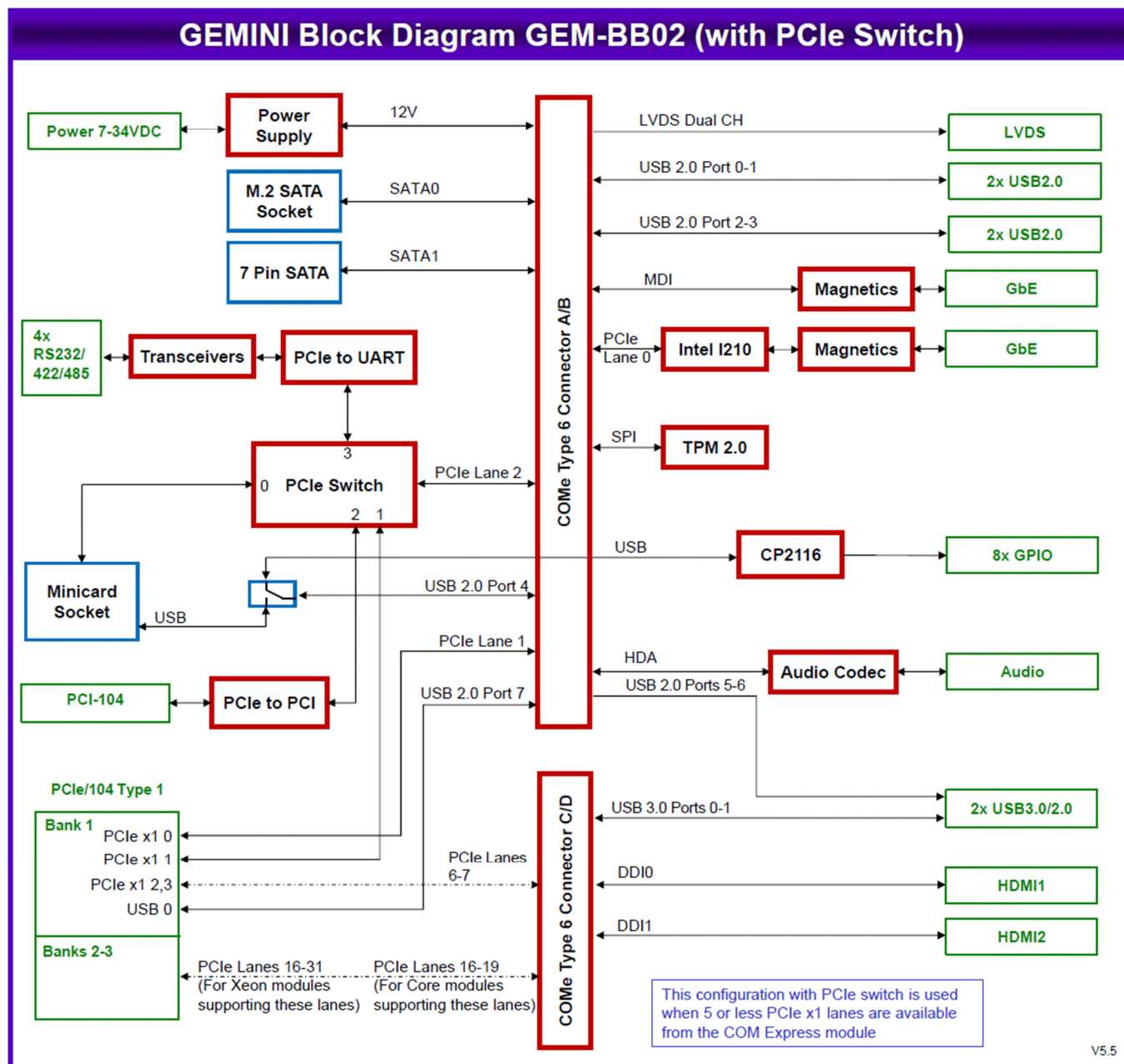
GEM-BB01 routes eight PCIe x1 links directly from the COM Express module to the expansion interfaces. This configuration requires a module that provides all eight links.



GEM-BB01 block diagram

2.2. GEM-BB02 — PCIe Switch

Many COM Express modules do not provide eight PCIe x1 links. GEM-BB02 adds a PCIe switch that expands one link from the module into several, so that the expansion interfaces which would otherwise be lost remain available. This configuration is used when only five PCIe x1 lanes are available from the COM Express module.



GEM-BB02 block diagram

3. Functional Overview

This section provides further details of the features of the Gemini SBC.

3.1.1. COM Express Module

The SBC supports a range of COM Express Type 6 Compact processor modules. The use of COM Express provides great flexibility to choose from different price / power consumption / performance levels, and it helps to “future proof” the product and the application in which it is used. By swapping out one COM for another, the product’s performance can be increased and its lifecycle extended. This feature makes Gemini an ideal platform for long-life applications.

3.1.2. Power Supply Specifications

Gemini SBC requires a power supply input voltage of +8V to 34VDC for operation. All required supply voltages for the board are derived from this single main DC input. These power supplies are capable of supporting all on-board features at the highest capacity and contain reserves to power additional peripherals and features listed in the table below.

On-board feature power supply capacity:

<i>Feature</i>	<i>12V</i>	<i>5V</i>	<i>3.3V</i>
COM Module	2A	0.5A	
PCIe MiniCard Socket			2A
M.2 SSD			0.5A
USB 2.0 Ports		2A	
USB 3.0 Ports		1.8A	
PCI-104 and PCI/104 Express	1A	2A	0.5A
Utility Connector		2A	

3.1.3. RTC Backup Battery

A 2-pin connector is provided to enable the connection of an external battery for RTC backup.

3.1.4. Ethernet Ports

The SBC is equipped with two 10/100/1000 Gigabit Ethernet ports. The first Ethernet port is routed directly from the COM module. The second is derived from the Intel WGI210IT PCIe Ethernet controller which is accessed via x1 PCIe lane routed from the Module.

Both ports include on-board magnetics and are available on the SBC standard 2x5 pin headers that are compatible with Diamond Systems standard Ethernet cables.

On-board LEDs are available to indicate the Link, Activity, and Speed status associated with each port. The LEDs are located along the lower board edge near the PCIe/104 connector.

3.1.5. Audio Interface

An Audio codec on the SBC manages PC audio functionality. The audio I/O signals include Stereo Line-In, Stereo Line-Out, and Mic-In.

3.1.6. Digital I/O (GPIO)

Eight General Purpose Input/Output (GPIO) lines are provided by a CP2112 USB peripheral. These lines are independently configurable for input or output and are individually addressable. They operate at 3.3V logic levels. Utility software is provided to configure and control these GPIO lines.

3.1.7. Display Output Controller

The SBC supports LVDS LCD and HDMI 2.0 a/b display outputs.

The SBC supports a 24-bit dual-channel LVDS display with a 2x15 right-angle latching connector. A separate backlight supply connector provides LCD backlight supply and PWM (Pulse Width Modulation) control.

The backlight supply is derived from the main power input and is selected with jumper block JP1.

The board offers two HDMI video output ports, both of which are routed from the Module and available on two separate 2x10 pin headers.

3.1.8. LED Indicators

The SBC hosts the LED Indicators. The on-board LED Indicator panel is located at the edge of the SBC or adjacent to its signal source. The LEDs are displayed on a silkscreen panel with a description of their function and status as listed in the table below.

The following table lists the LED functions and properties implemented on the Gemini SBC.

<i>Function</i>	<i>LED Color and Operation</i>	<i>PCB Label</i>
Power Input	Supplied Power Input	PWR IN
Power	Green LED indicates Power Supply is Good	PWR ON
BIOS LED	Green LED indicates Module Booted Successfully	BIOS
Ethernet	Green LED indicates Link, Activity, and Speed Status of Each Port	LNK. ACT.

3.1.9. PCIe MiniCard Socket

The SBC is equipped with a full-size MiniCard PCIe socket which is 51 mm in length. It supports full-size modules including both PCIe and USB2.0 modules. Two M2 threaded standoffs are mounted on the board for installing a full-size module.

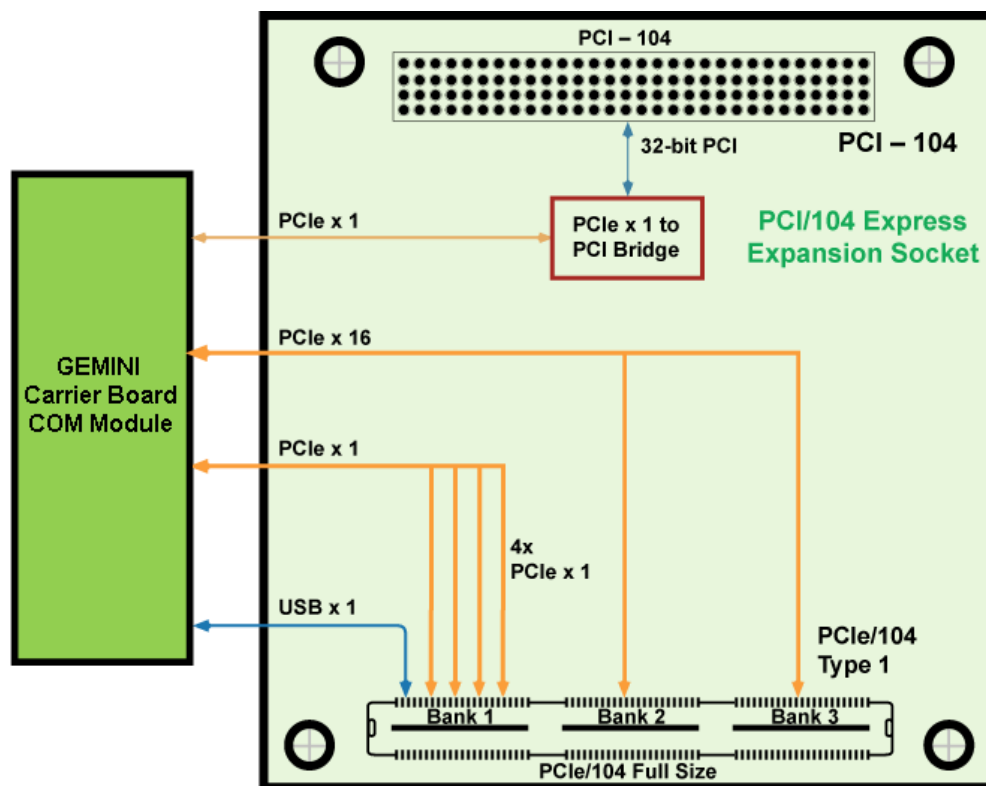
The USB 2.0 port is shared with the GPIO expander feature which provides the GPIO signals. By default, the GPIO expander connection is selected. The setting can be changed using jumper block JP3.

3.1.10. PCI-104 and PCIe/104 Expansion Interface

This illustration shows the general architecture of the PCI/104-Express interface implemented on Gemini.

The PCI interface is implemented with a PCIe to PCI bridge and supports up to 4 PCI-104 add-on modules. Both 5V and 3.3V bus logic levels are supported with jumper selection.

The PCIe/104 interface includes both x1 and x4/8/16 links. On models with GEM-BB01 carrier board, 4 PCIe x1 links are provided to support up to 4 PCIe/104 add-on modules. On models with GEM-BB02 carrier board, only 2 PCIe x1 links are provided for up to 2 PCIe/104 add-on modules. The PCIe x4/x8/x16 link depends on the architecture of the installed COM. All Core i7 COMs currently offered with Gemini support a single PCIe x4 link connected to bank 2 on the PCIe/104 connector. If a x8 or x16 link is required, check with Diamond Systems for availability of a COM supporting this feature.



Gemini carrier board with COM module and PCI/104-Express interface

3.1.11. SATA M.2 Socket

The SBC is equipped with one SATA port routed from the Module to the M.2 M-key socket in 2242) form factor. The socket supports M-keyed SATA SSDs. One threaded spacer is mounted on the board for installing M.2 SATA SSDs.

3.1.12. SATA Port Connector

One SATA port is available through the standard 7-pin SATA connector.

3.1.13. Serial Ports

Four serial ports are available on the SBC using 2 2x5 latching headers.

The serial ports are implemented using a PCIe to Quad UART controller Part Number XR17V354 that serves as a single lane PCIe bridge to 4 independent enhanced 16550 compatible UARTs. The XR17V354 ((V354) is compliant to PCIe 2.0 Gen 1 (2.5GT/s).

The ports implement RS-232, RS-422, and RS-485 protocols through the programmable SP336 serial transceivers, where 1 transceiver serves 2 ports. The protocol can be selected using GPIO pins on the UART interface and through the available Jumper options.

On-board Jumper blocks options are provided to enable 121-ohm line termination for the RS-422 and RS-485 protocols.

3.1.14. Trusted Platform Module

Gemini SBC implements a Trusted Platform Module (TPM) 2.0 Part No. SLB 9670XQ2.0 by Infineon that is accessible through an SPI (Serial Peripheral Interface).

Standardized by the International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC) and the TCG (Trusted Computing Group), TPM is a standard specification to secure hardware through integrated cryptographic keys and is implemented via the microchip TPM SPI communications protocol. It is used for device identification, authentication, remote attestation, platform integrity, cryptographic services and is time-specific.

The TPM 2.0 module standard incorporates functionalities such as algorithms, support for multiple trusted keys, and a wide range of applications. This requires TPM 2.0 to be enabled, activated, and set to UEFI (Unified Extensible Firmware Interface) -a software interface firmware -through the BIOS.

3.1.15. GPIO Support

Gemini supports eight digital I/O (GPIO) lines that operate with 3.3V logic levels based on a CP2112 USB to SMBus/GPIO bridge. During power-up or reset, all I/O lines are programmed to the input direction to avoid any conflicts with external circuitry.

Each digital I/O line can be individually configured to set the input or output direction. This enables the lines split between input and output flow. All lines can be individually read or written or read in groups by port, enabling I/O peripherals configurations to be customized to suit application requirements.

This GPIO circuit shares its host USB interface with the minicard socket. The selection is made with jumper block JP3. Either the GPIO or the minicard can be used, not both simultaneously. By default the GPIO circuit is selected.

3.1.16. PCIe Link Routing

PCIe x1 link availability and connections depend on both the baseboard and the installed COM.

Configuration 1: 8 PCIe x1 Links

In models using GEM-BB01, The installed COM offers 8 PCIe x1 ports, and they are connected to the I/O features and expansion sockets on the board as shown in the below table. These models support up to 4 PCIe x1 ports on the PCIe/104 connector.

<i>PCIe Lane from COM</i>	<i>Interface</i>
Lane 0	Gigabit Ethernet #2
Lane 1	PCIe/104 PCIe x1 port 0
Lane 2	UART for serial ports 1-4
Lane 3	mPCIe Port
Lane 4	PCIe/104 PCIe x1 port 1
Lane 5	PCIe to PCI Bridge for PCI-104
Lane 6	PCIe/104 PCIe x 1 port 2
Lane 7	PCIe/104 PCIe x1 port 3

Configuration 2: Reduced PCIe x1 Links

In models using GEM-BB02, the installed COM offers 6 or less PCIe x1 ports, and they are connected to the I/O features and expansion sockets as indicated below. In these models, PCIe lane 2 is connected to a 1:4 PCIe switch that expands the number of PCIe connections available. Note that in these models, the PCIe/104 connector supports only 2 PCIe x1 ports, since COM ports 6 and 7 are not available.

<i>PCIe Lane from COM</i>	<i>Interface</i>
Lane 0	Gigabit Ethernet #2
Lane 1	PCIe/104 PCIe x1 port 0
Lane 2	PCIe 1:4 switch upstream port
Lane 3	N/C
Lane 4	N/C
Lane 5	N/C
Lane 6	N/C
Lane 7	N/C

The PCIe switch in turn supports the following on-board peripherals and connections:

<i>PCIe switch downstream port</i>	<i>Interface</i>
Lane 0	PCIe minicard socket
Lane 1	PCIe/104 PCIe x1 port 1
Lane 2	PCIe to PCI Bridge for PCI-104
Lane 3	UART for serial ports 1-4

3.1.17. USB Port Interfaces

Gemini supports 6 USB ports on its I/O connectors:

- Four USB 2.0 ports are routed to 2x5 latching headers with 2 ports per header.
- Two USB 3.0 ports are routed to two 2x5 headers with 1 port per header. These ports provide fallback USB 2.0 capability in addition to USB 3.0 support.

An additional USB 2.0 port is used to support either the minicard socket USB connection or a GPIO expander offering GPIO on connector J33.

An additional USB 2.0 port is routed to the PCIe/104 connector to support PCIe/104 modules using a USB interface.

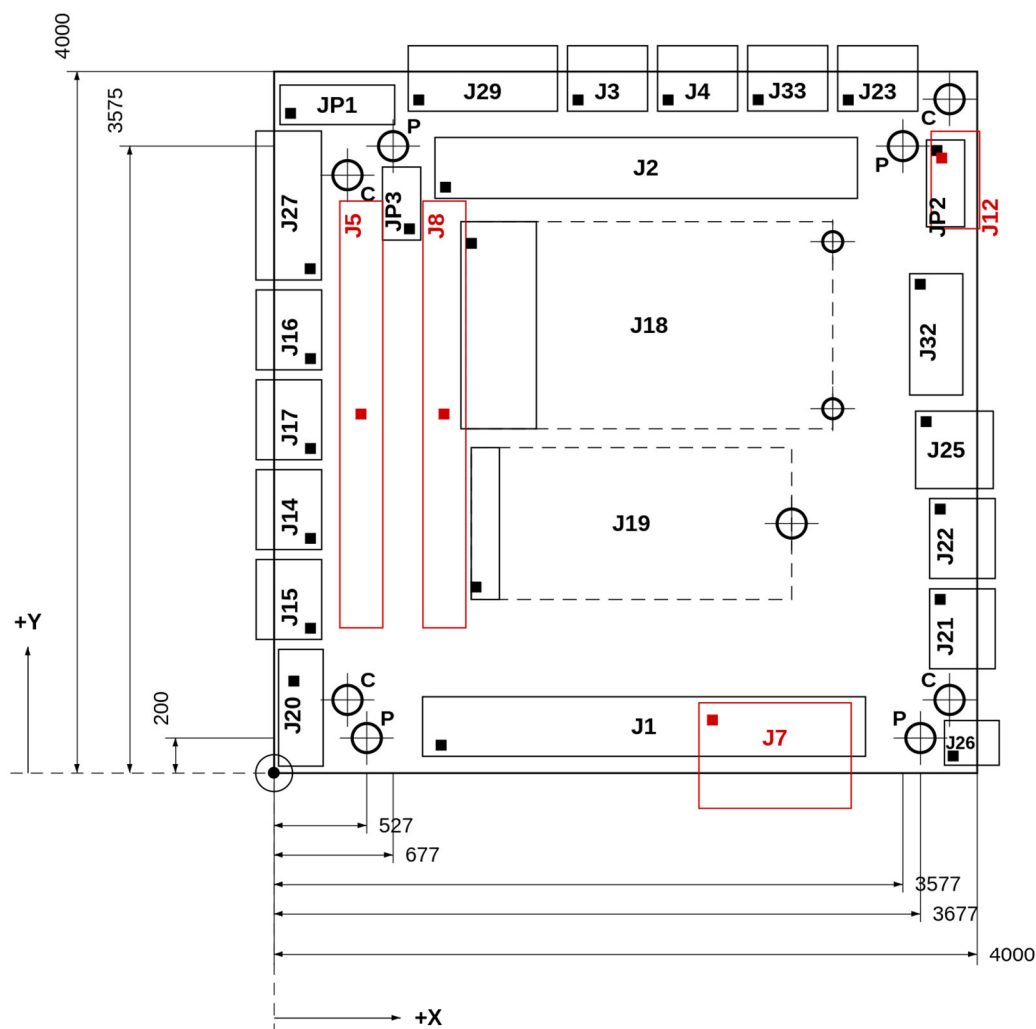
The USB 2.0 ports are mapped as shown in the table below.

<i>Port</i>	<i>Connector</i>	<i>Assignment</i>
0	J16 USB 2.0	Port 0
1	J16 USB 2.0	Port 1
2	J17 USB 2.0	Port 2
3	J17 USB 2.0	Port 3
4	Either USB to GPIO expander or minicard socket	
5	J14 USB 3.0	Fallback USB 2.0 port
6	J15 USB 3.0	Fallback USB 2.0 port
7	J1 PCIe/104	USB 2.0 port 0

4. Mechanical Drawings and Thermal Solutions

The drawing below gives the dimensions of the Gemini printed circuit board, the mounting positions, and the location of every connector and jumper block. It covers the bare board; it does not include the COM Express module or the heat spreader.

4.1. Carrier board dimensions with connector and jumper locations



Datum: X = 0, Y = 0

Bottom left corner of the board. All coordinates in mils.

Black outlines are components on the top side of the board; red outlines are on the bottom side.

■ marks pin 1 of each connector, which is pin A1 on the FCI connectors.

P 4-40 soldered nuts for PC/104 standoffs. Boards mount on the top side.

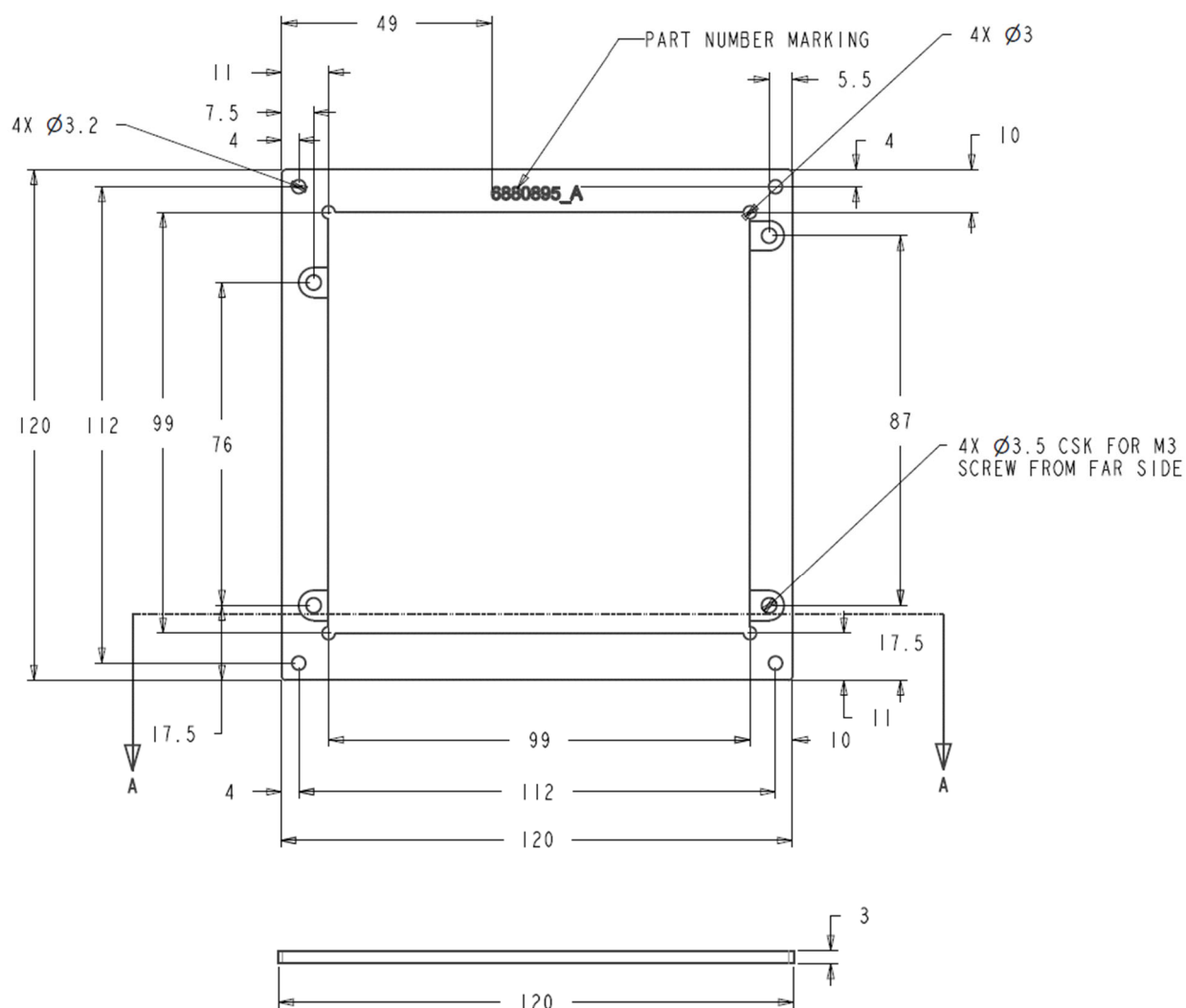
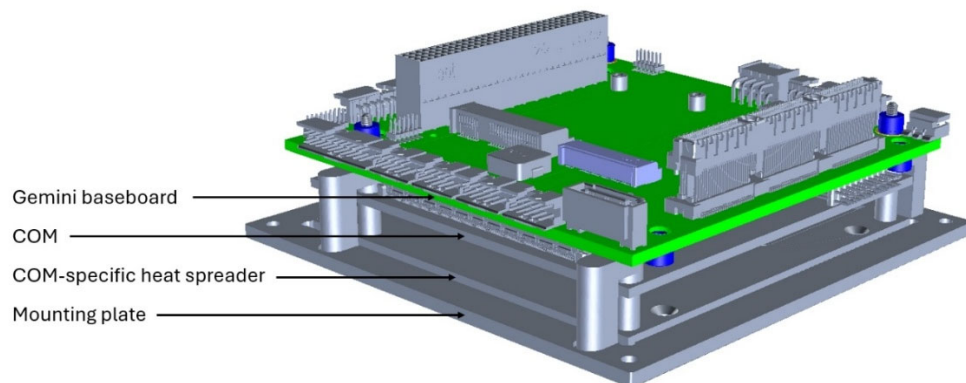
C M2.5 soldered nuts for the COM Express module, which mounts on the bottom side.

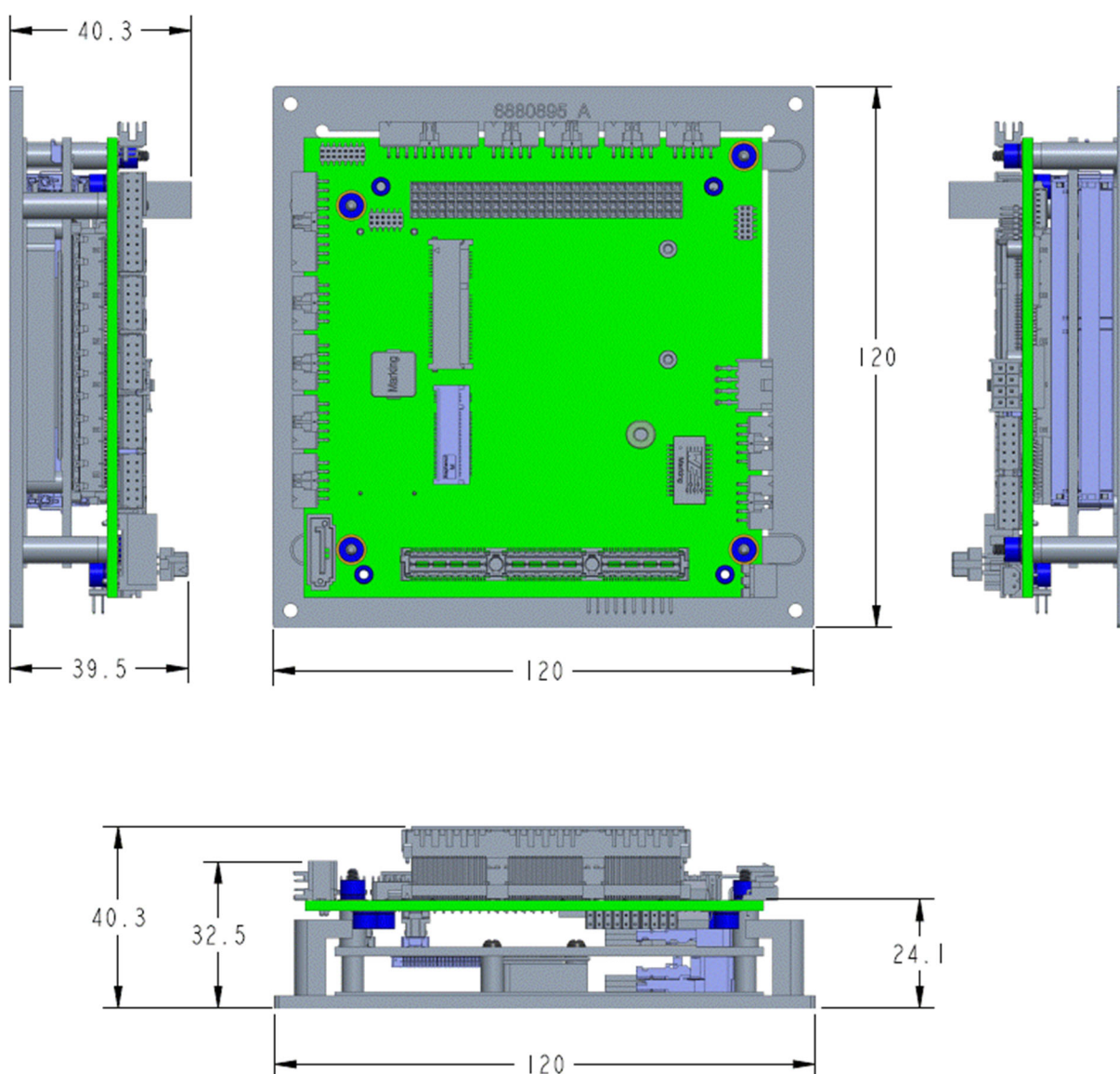
One nut position serves the M.2 module and two serve the PCIe MiniCard. Dashed outlines show the installed module envelopes.

Gemini printed circuit board dimensions

4.2. Models with Universal Mounting Plate

The universal mounting plate is designed to accommodate any Type 6 COM Express module along with the COM vendor's product-specific heat spreader. The heat spreader is recessed slightly to allow for the installation of a 1mm thick thermal pad with 20% nominal compression. This ensures that Gemini can achieve the temperature performance specified by the COM vendor. This design is featured on all models of Gemini except for the 1185GRE.

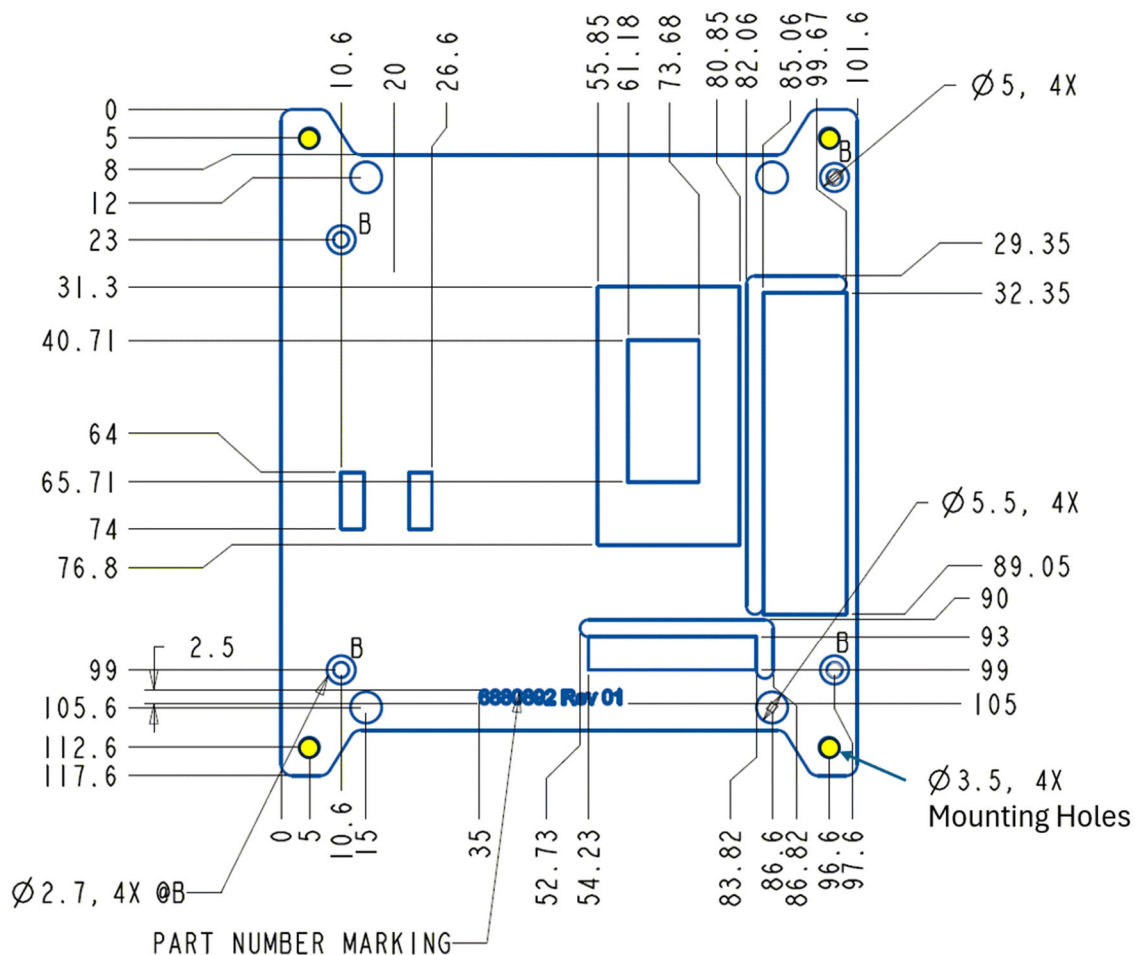




Gemini dimensions with the universal mounting plate installed

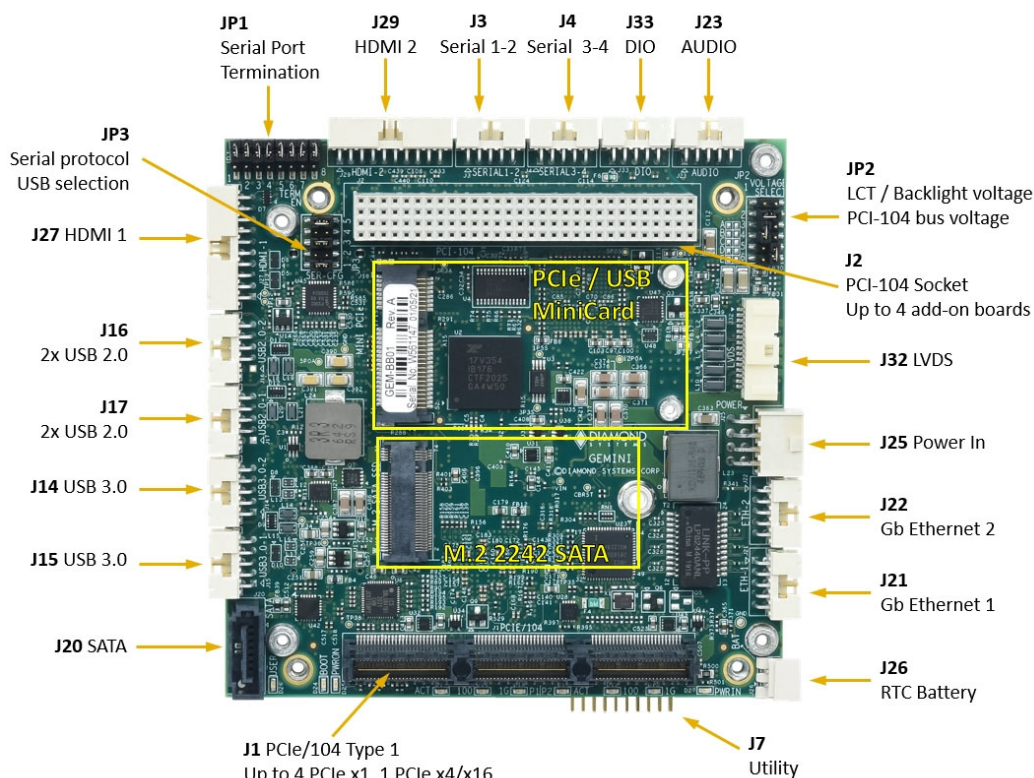
4.3. Models with Integrated Mounting Plate + Heat Spreader

The 1185GRE model of Gemini uses an integrated heat spreader + mounting plate for a more compact total solution. This integrated design is achievable due to the lower total heat dissipation of the 1185GRE processor which enables the use of a simple aluminum heat spreader design without heat pipes.

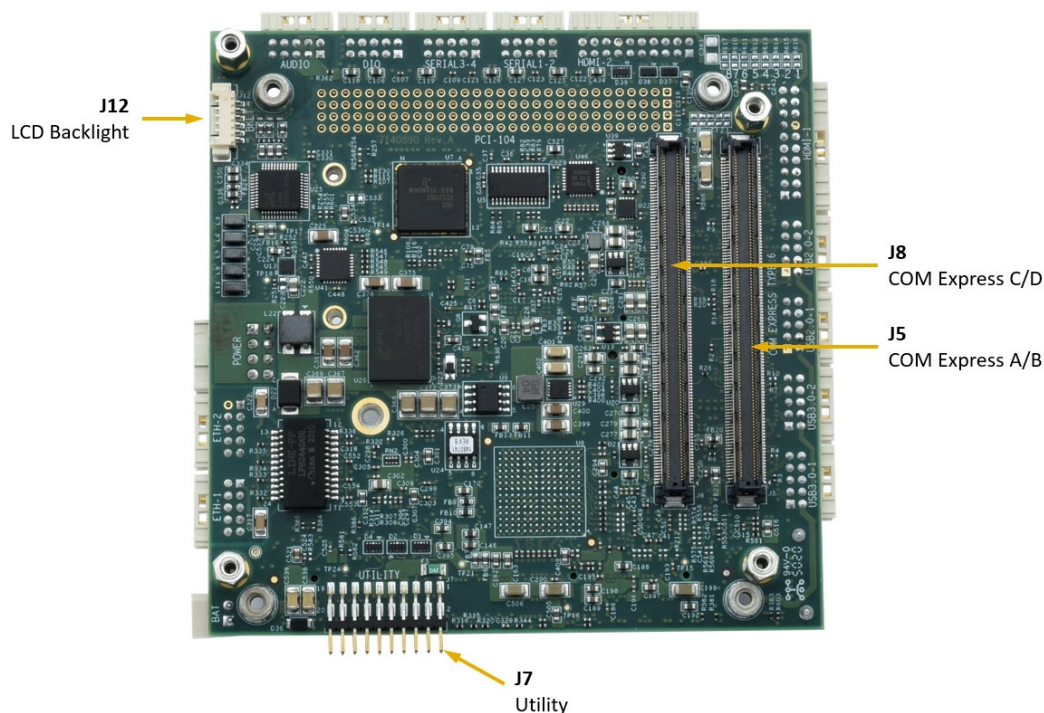


Integrated mounting plate and heat spreader

5. Connector and Jumper Locations



Connector and jumper locations, top view



Connector locations, bottom view

6. I/O Connector Pinouts

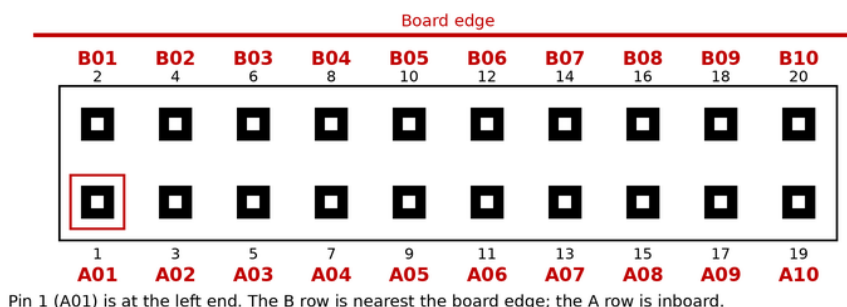
6.1. Connector Quick Reference

<i>Connector</i>	<i>Function</i>
J1	PCI/104 Express
J14, J15	USB3.0
J16, J17	USB 2.0
J18	PCIe MiniCard
J19	M.2 M-Key SATA
J20	SATA 7 Pin
J21, J22	Ethernet
J23	Audio
J25	Power
J26	Battery
J27, J29	HDMI
J32	LVDS
J33	GPIO
J5, J8 (Bottom Side)	COM Express Connector
J7 (Bottom Side)	Utility
J12 (Bottom Side)	LVDS Backlight

6.2. Connector Pin Numbering

Most of the I/O connectors on Gemini are FCI dual row right-angle through-hole headers. The pinouts in this section use sequential pin numbers, with odd numbers in one row and even numbers in the other. The manufacturer datasheet however labels the rows A and B.

The two schemes correspond as follows: the A row carries the odd pin numbers and the B row carries the even pin numbers. Pin 1 in the pinout tables corresponds to pin A01 in the manufacturer datasheet. Pin 1 is identified with a small indicator in the PCB silkscreen. The B row is the row nearest the edge of the PCB, and the A row is inboard.



FCI connector pin numbering, 20-pin connector

6.2.1. Power IN Connector: J25

The Power-IN connector supplies power using an input voltage range from +8V to 34VDC. A 2x4 Samtec IPL1 latching pin header is used for power input.

The carrier board generates all voltages required for the COM module and carrier board peripherals from this primary voltage supply.

GND	1	5	VIN
GND	2	6	VIN
GND	3	7	VIN
GND	4	8	VIN

Connector Type: 2x4 Custom Version of Samtec IPL1 Series with Longer PCB Pins for .093" Thick PCB

Mating Cable Part Number: DSC No.6980512

6.2.2. External Battery Connector: J26

The SBC provides an external battery connected via a two-pin connector to support real-time clock and BIOS custom settings.

VBAT = +3.3V +/-10%

The pinout signals and pin numbers for the connector are specified below.

1	Battery V+
2	Ground

Connector: Molex Mini-SPOX 22057025 2-Pin RA TH Shrouded Pin Header

Mating Cable Part Number: DSC No. 6980524

6.2.3. Ethernet Connectors: J21, J22

The SBC hosts two identical on-board connectors for the 10/100/1000 BASE T Ethernet. The Ethernet PHY, magnetics, and RJ45 connectors are implemented on the SBC.

The pinouts for the GbE connector specified below.

NOTE: The Key positions corresponding to the key positions in the cable are cut away.

Chassis Gnd	1	2	Key
DA+	3	4	DA-
DB+	5	6	DB-
DC+	7	8	DC-
DD+	9	10	DD-

Connector: FCI 98464-F06-10ULF Latching 2x5 2mm Pitch Right Angle Shrouded Pin Header

Mating Cable Part Number: DSC No.6980604

6.2.4. Audio Connector: J23

The audio signal interface implements the physical layer, data link layer, and the application layers, between shared protocols generated on the Digital I/O circuits on the SBC. Implementation includes a flexible audio-port switching functionality with digital microphone & speaker outputs.

Audio signals from the HD Codec are routed at the 2x5 header on the following pinouts.

Line Out L	1	2	Line Out R
GND_Audio	3	4	GND_Audio
Line In L	5	6	Line In R
GND_Audio	7	8	GND_Audio
NC	9	10	Mic In

Connector: FCI 98464-F06-10ULF Latching 2x5 2mm Pitch Right Angle Shrouded Pin Header

Mating Cable Part Number: DSC No.6980608

6.2.5. Digital I/O: J33

The microcontroller on the SBC integrates eight General Purpose Input/output (GPIO) lines that operate and maintain compatibility at 3.3V logic level supplies.

The GPIO pins can be used as either digital inputs or outputs.

The pinout signals and pin numbers for the connector are specified below.

Ground	1	2	+3.3V, 100mA fuse
DIO0	3	4	DIO4
DIO1	5	6	DIO5
DIO2	7	8	DIO6
DIO3	9	10	DIO7

Connector: FCI 98464-F06-10ULF Latching 2x5 2mm Pitch Right Angle Shrouded Pin Header

6.2.6. HDMI Connectors: J27, J29

Two HDMI connector interfaces are available for HDMI video outputs through separate 2x10 pin headers.

The HDMI signals are processed through a level translator IC from the COM module over DDI (Digital Display Interface) lanes.

Data 2+	1	2	Ground
Data 2-	3	4	Data 1+
Ground	5	6	Data 1-
Data 0+	7	8	Ground
Data 0-	9	10	Clock+
Ground	11	12	Clock-
CEC	13	14	Reserved
DDC Clock	15	16	DDC Data
Ground	17	18	+5V
Hot Plug Detect	19	20	Chassis Ground

Connector: FCI 98464-F06-20ULF Latching 2x10 2mm Pitch Right Angle Shrouded Pin Header

Mating Cable Part Number: DSC No.6980605

6.2.7. LVDS LCD Connector: J32

The Low-voltage Differential Signaling (LVDS) LCD connector interface provides configurable voltage levels for powering the display panels.

The LCD panel power voltage operates with an I/O voltage range of 3.3V and 5V supply which is configured using a Jumper. The default setting is 3.3V.

The pinout signals and pin numbers are specified below.

VDD 5V/3.3V	1	2	VDD 5V/3.3V
VDD 5V/3.3V	3	4	VDD 5V/3.3V
CLK+ Odd	5	6	CLK+ Even
CLK- Odd	7	8	CLK-Even
Ground	9	10	Ground
D0+ Odd	11	12	D0+ Even
D0- Odd	13	14	D0- Even
D1+ Odd	15	16	D1+ Even
D1- Odd	17	18	D1- Even
D2+ Odd	19	20	D2+ Even
D2- Odd	21	22	D2- Even
D3+ Odd	23	24	D3+ Even
D3- Odd	25	26	D3- Even
Ground	27	28	Ground
DDC CLK	29	30	DDC DATA

Connector Type/Number: Molex 5015713007 1mm Pitch Right Angle Shrouded Pin Header

Mating Cable Part Number: Specific to the target display

6.2.8. LCD Backlight Connector: J12

The brightness control for the LCD backlight has a weak pull-down resistor to ensure maximum brightness when the LCD is not connected externally.

This signal is controlled by a PWM pin on the COM module. A Jumper enables selecting the source of the brightness signal to the PWM pin.

The pinout signals and pin numbers for the connector are specified below.

1	Power +5V/+12V, Jumper Selectable
2	Power +5V/+12V, Jumper Selectable
3	Ground
4	Ground
5	Enable (GPIO Output), 0 = Off, Open Circuit = on
6	Brightness, 0-5VDC Variable; 0V = Max, 5V = Min

Connector Type: Molex 053261-0671, 1x6, 1.25 mm pitch, surface mount right angle header. The backlight supply voltage on pins 1 and 2 is selected with JP2.

Connector: Molex 053261-0671 Right Angle Type Friction Lock Pin Header

6.2.9. SATA Connector: J20

The SATA connector is an industry-standard vertical connector that does not support the Pin 7 VCC (Voltage Common Collector) option for an installed SATADOM, which is a Disk on Module (DOM) with flash drive and a SATA Interface.

The pinout signals and pin numbers for the connector are specified below.

1	Ground
2	Transmit+
3	Transmit-
4	Ground
5	Receive -
6	Receive +
7	Ground

6.2.10. Serial Port Connectors: JP3

The SBC supports four serial ports available at 2 headers. Each connector supports two serial ports.

The pinouts specific to the transceiver interfaces RS232/ RS422/ RS485 are as follows.

6.2.11. RS-232 Interface

TX1	1	2	RTS1
RX1	3	4	CTS1
GND	5	6	GND
TX2	7	8	RTS2
RX2	9	10	CTS2

6.2.12. RS-422 (SP336) Interface

TX1+	1	2	TX1-
RX1 +	3	4	RX1-
GND	5	6	GND
TX2+	7	8	TX2-
RX2+	9	10	RX2-

6.2.13. RS-485 (SP336) Interface

TX1/RX1+	1	2	TX1/RX1-
NC	3	4	NC
GND	5	6	GND
TX2/RX2+	7	8	TX2/RX2-
NC	9	10	NC

Connector: FCI 98464-F06-10ULF Latching 2x5 2mm Pitch Right Angle Shrouded Pin Header

Mating Cable Part Number: DSC No. 6980601

6.2.14. USB 2.0 Ports: J16, J17

The SBC hosts two USB 2.0 connectors with identical pinouts. Each connector provides access to two USB 2.0 ports. The shield pin is tied to the system Ground. The pinout signals and pin numbers are specified below. J16 contains ports 0 and 1, while J17 contains ports 2 and 3 (using 0-based numbering).

J16			
Key	1	2	Shield
USB 0 Power-	3	4	USB 1 Power-
USB 0 Data+	5	6	USB 1 Data+
USB 0 Data-	7	8	USB 1 Data-
USB 0 Power+	9	10	USB 1 Power+

J17			
Key	1	2	Shield
USB 2 Power-	3	4	USB 3 Power-
USB 2 Data+	5	6	USB 3 Data+
USB 2 Data-	7	8	USB 3 Data-
USB 2 Power+	9	10	USB 3 Power+

Connector: FCI 98464-F06-10ULF Latching 2x 5 2mm Pitch Right Angle Shrouded Pin Header

Mating Cable Part Number: DSC No. 6980602

6.2.15. USB 3.0 Ports: J14, J15

The SBC provides two USB 3.0 ports. Both are routed from the COM to a dedicated 2x5 latching connector. Both ports include USB 2.0 fallback ports. The shield pin is tied to system Ground.

USB_SS RX0-	1	2	Shield
USB_SS RX0+	3	4	Ground
Ground	5	6	USB 2.0 D+
USB_SS TX0-	7	8	USB 2.0 D-
USB_SS TX0+	9	10	USB Power

Connector: FCI 98464-F06-10ULF Latching 2x 5 2mm Pitch Right Angle Shrouded Pin Header

Mating Cable Part Number: DSC No.6980530

6.2.16. Utility Connector: J7

The utility connector provides access to the power button, reset signal, I2C port, and GPIO pins from the UART. The utility power signals are protected with polyswitch resettable current-limiting devices.

Power Button	1	2	I2C Data
Reset-	3	4	I2C Clock
UART GPIO 8	5	6	UART GPIO 12
Ground	7	8	Ground-I2C
5V Fused 500mA	9	10	3.3V Fused 500mA
5V Utility	11	12	Ground
5V Utility	13	14	Ground
UART GPIO 9	15	16	UART GPIO 13
UART GPIO 10	17	18	UART GPIO 14
UART GPIO 11	19	20	UART GPIO 15

Connector Type: 2mm Pitch 2x10 Right Angle SMT Pin Header

Mating Cable: Standard 20 Position Ribbon Cable with 2mm Pitch IDC Connector

6.2.17. PCIe MiniCard Socket: J18

All TX/RX designations are with respect to the host processor (COM). The TX signals on the socket drive the RX signals on the installed minicard, and the TX signals on the minicard drive the RX signals on the socket.

Two M2 standoffs with screws are located at the far end of the module installation site for fixing the minicard to the carrier board.

WAKE#	1	2	+3.3V
RSVD	3	4	Gnd
RSVD	5	6	+1.5V
Clkreq-	7	8	UIM PWR
Gnd	9	10	UIM DATA
PCIe 1 Clk-	11	12	UIM CLK
PCIe 1 Clk+	13	14	UIM RESET
Gnd	15	16	UIM VPP
KEY			
RSVD	17	18	Gnd
RSVD	19	20	Disable-
Gnd	21	22	PCIe Reset-
PCIe 1 RX-	23	24	+3.3V
PCIe 1 RX+	25	26	Gnd
Gnd	27	28	+1.5V
Gnd	29	30	SMB Clk
PCIe 1 TX-	31	32	SMB Data
PCIe 1 TX+	33	34	Gnd
Gnd	35	36	USB D-
Gnd	37	38	USB D+
+3.3V	39	40	Gnd
+3.3V	41	42	WWAN LED-
Ground	43	44	WLAN LED-
	45	46	WPAN LED-
	47	48	+1.5V
Pull-up to +3.3V	49	50	Gnd
	51	52	+3.3V

Socket Part Number: JAE MM60-52B1-E1-R650 or equivalent

6.2.18. M.2 M-KEY Flashdisk Socket: J19

J19 is N M.2 M key socket intended for use with a SATA flashdisk (NVMe / PCIe flashdisks are not supported on this socket). All TX/RX designations are with respect to the host processor (COM). TX signals on the socket drive the RX signal on the Module, and the RX signal on the socket is driven by the TX signal on the installed module. An M3 mounting standoff and screw are provided at the far end of the module installation site.

The 4 Config pins are tied to ground on the carrier board to indicate the socket is configured for SATA operation.

Config 3 (Gnd)	1	2	+3.3V
Gnd	3	4	+3.3V
	5	6	
	7	8	
	9	10	DAS/DSS#
	11	12	
	13	14	
	15	16	
	17	18	
	19	20	
Config 0 (Gnd)	21	22	
	23	24	
	25	26	
Gnd	27	28	
	29	30	
	31	32	
Gnd	33	34	
	35	36	
	37	38	DEVSLP
Gnd	39	40	
SATA_RX+	41	42	
SATA_RX-	43	44	
Gnd	45	46	
SATA_TX-	47	48	
SATA_TX+	49	50	
Gnd	51	52	
	53	54	
	55	56	
Gnd	57	58	
KEY			
	67	68	
Config 1 (GND)	69	70	+3.3V
GND	71	72	+3.3V
GND	73	74	+3.3V
Config 2 (GND)	75		

Socket Part Number: Amphenol MDT320M03001 or equivalent

6.2.19. PCIe/104 Express Connector: J1

This connector is divided into 3 banks. The first bank is commonly referred to as OneBank. It supports up to 4 PCIe x 1 links and one USB 2.0 link. The remaining 2 banks support PCIe x4 / x8 / x16 links, depending on the features available on the installed COM.

The center tab on banks 1 and 2 provide 5V power, while the center tab on bank 3 provides 12V power. These power rails are provided by the Gemini on-board power supply. In most cases no external power source is needed for installed PCIe-104 modules. In cases where the module may have higher-than-normal power requirements, any such special requirements will be indicated in the expansion module's user manual.

Bank 1 ("OneBank" connector)

USB-OC#	1	+5 V TAB	2	PCIe Reset#
+3.3V	3		4	+3.3V
USB_1+	5		6	USB_0+
USB_1-	7		8	USB_0-
Ground	9		10	Ground
PCIe1 Tx+	11		12	PCIe0 Tx+
PCIe1 Tx-	13		14	PCIe0 Tx-
Ground	15		16	Ground
PCIe2 Tx+	17		18	PCIe3 Tx+
PCIe2 Tx-	19		20	PCIe3 Tx-
Ground	21		22	Ground
PCIe1 Rx+	23		24	PCIe0 Rx+
PCIe1 Rx-	25		26	PCIe0 Rx-
Ground	27		28	Ground
PCIe2 Rx+	29		30	PCIe3 Rx+
PCIe2 Rx-	31		32	PCIe3 Rx-
Ground	33		34	Ground
PCIe1 Clk+	35		36	PCIe0 Clk+
PCIe1 Clk-	37		38	PCIe0 Clk-
+5VSB	39		40	+5VSB
PCIe2 Clk+	41		42	PCIe3 Clk+
PCIe2 Clk-	43		44	PCIe3 Clk-
Ground(Dir)	45		46	PWRGOOD
SMB Data	47		48	PEX_CLK+
SMB Clk	49		50	PEX_CLK-
SMB Alert#	51		52	PSON#

Bank 2

STK0 / WAKE#	53	+5 V TAB	54	STK1 / PEG_ENA#
Ground	55		56	Ground
PEx16 Tx8+	57		58	PEx16 Tx0+
PEx16 Tx8-	59		60	PEx16 Tx0-
Ground	61		62	Ground
PEx16 Tx9+	63		64	PEx16 Tx1+
PEx16 Tx9-	65		66	PEx16 Tx1-
Ground	67		68	Ground
PEx16 Tx10+	69		70	PEx16 Tx2+
PEx16 Tx10-	71		72	PEx16 Tx2-
Ground	73		74	Ground
PEx16 Tx11+	75		76	PEx16 Tx3+
PEx16 Tx11-	77		78	PEx16 Tx3-
Ground	79		80	Ground
PEx16 Tx12+	81		82	PEx16 Tx4+
PEx16 Tx12-	83		84	PEx16 Tx4-
Ground	85		86	Ground
PEx16 Tx13+	87		88	PEx16 Tx5+
PEx16 Tx13-	89		90	PEx16 Tx5-
Ground	91		92	Ground
PEx16 Tx14+	93		94	PEx16 Tx6+
PEx16 Tx14-	95		96	PEx16 Tx6-
Ground	97		98	Ground
PEx16 Tx15+	99		100	PEx16 Tx7+
PEx16 Tx15-	101		102	PEx16 Tx7-
Ground	103		104	Ground

Bank 3

STK2 / SDVO_DAT	105	+12 V TAB	106	SDVO_CLK
Ground	107		108	Ground
PEx16 Rx8+	109		110	PEx16 Rx0+
PEx16 Rx8-	111		112	PEx16 Rx0-
Ground	113		114	Ground
PEx16 Rx9+	115		116	PEx16 Rx1+
PEx16 Rx9-	117		118	PEx16 Rx1-
Ground	119		120	Ground
PEx16 Rx10+	121		122	PEx16 Rx2+
PEx16 Rx10-	123		124	PEx16 Rx2-
Ground	125		126	Ground
PEx16 Rx11+	127		128	PEx16 Rx3+
PEx16 Rx11-	129		130	PEx16 Rx3-
Ground	131		132	Ground
PEx16 Rx12+	133		134	PEx16 Rx4+
PEx16 Rx12-	135		136	PEx16 Rx4-
Ground	137		138	Ground
PEx16 Rx13+	139		140	PEx16 Rx5+
PEx16 Rx13-	141		142	PEx16 Rx5-
Ground	143		144	Ground
PEx16 Rx14+	145		146	PEx16 Rx6+
PEx16 Rx14-	147		148	PEx16 Rx6-
Ground	149		150	Ground
PEx16 Rx15+	151		152	PEx16 Rx7+
PEx16 Rx15-	153		154	PEx16 Rx7-
Ground	155		156	Ground

6.2.20. COM Module Connector Pinouts

COM Express connector J5, rows A and B:

GND	A1	B1	GND	PCIE_TX4-	A56	B56	PCIE_RX4-
GBE0_MDI3-	A2	B2	GBE0_ACT#	GND	A57	B57	SD_WP
GBE0_MDI3+	A3	B3	LPC_FRAME#	PCIE_TX3+	A58	B58	PCIE_RX3+
GBE0_LINK100#	A4	B4	LPC_AD0	PCIE_TX3-	A59	B59	PCIE_RX3-
GBE0_LINK1000#	A5	B5	LPC_AD1	GND	A60	B60	GND
GBE0_MDI2-	A6	B6	LPC_AD2	PCIE_TX2+	A61	B61	PCIE_RX2+
GBE0_MDI2+	A7	B7	LPC_AD3	PCIE_TX2-	A62	B62	PCIE_RX2-
GBE0_LINK#	A8	B8	LPC_DRQ0#	GPI1	A63	B63	SD_CD#
GBE0_MDI1-	A9	B9	LPC_DRQ1#	PCIE_TX1+	A64	B64	PCIE_RX1+
GBE0_MDI1+	A10	B10	LPC_CLK	PCIE_TX1-	A65	B65	PCIE_RX1-
GND	A11	B11	GND	GND	A66	B66	WAKE0#
GBE0_MDI0-	A12	B12	PWRBTN#	GPI2	A67	B67	WAKE1#
GBE0_MDI0+	A13	B13	SMB_CK	PCIE_TX0+	A68	B68	PCIE_RX0+
GBE0_CTREF	A14	B14	SMB_DAT	PCIE_TX0-	A69	B69	PCIE_RX0-
SUS_S3#	A15	B15	SMB_ALRERT#	GND	A70	B70	GND
SATA0_TX+	A16	B16	SATA1_TX+	LVDS_A0+	A71	B71	LVDS_B0+
SATA0_TX-	A17	B17	SATA1_TX-	LVDS_A0-	A72	B72	LVDS_B0-
SUS_S4#	A18	B18	SUS_STAT#	LVDS_A1+	A73	B73	LVDS_B1+
SATA0_RX+	A19	B19	SATA1_RX+	LVDS_A1-	A74	B74	LVDS_B1-
SATA0_RX-	A20	B20	SATA1_RX-	LVDS_A2+	A75	B75	LVDS_B2+
GND	A21	B21	GND	LVDS_A2-	A76	B76	LVDS_B2-
SATA2_TX+	A22	B22	SATA3_TX+	LVDS_VDD_EN	A77	B77	LVDS_B3+
SATA2_TX-	A23	B23	SATA3_TX-	LVDS_A3+	A78	B78	LVDS_B3-
SUS_S5#	A24	B24	PWR_OK	LVDS_A3-	A79	B79	LVDS_BKLT_EN
SATA2_RX+	A25	B25	SATA3_RX+	GND	A80	B80	GND
SATA2_RX-	A26	B26	SATA3_RX-	LVDS_A_CLK+	A81	B81	LVDS_B_CLK+
BATLOW#	A27	B27	WDT	LVDS_A_CLK-	A82	B82	LVDS_B_CLK-
ATA_ACT#	A28	B28	AC_SDIN2	LVDS_I2C_CK	A83	B83	LVDS_BKLT_CTRL
AC_SYNC	A29	B29	AC_SDIN1	LVDS_I2C_DAT	A84	B84	VCC_5V_SBY
AC_RST#	A30	B30	AC_SDIN0	GPI3	A85	B85	VCC_5V_SBY
GND	A31	B31	GND	RSVD (N/C)	A86	B86	VCC_5V_SBY
AC_BITCLK	A32	B32	SPKR	eDP_HPD	A87	B87	VCC_5V_SBY
AC_SDOUT	A33	B33	I2C_CK	PCIE0_CK_REF+	A88	B88	BIOS_DIS1#
BIOS_DIS0#	A34	B34	I2C_DAT	PCIE0_CK_REF-	A89	B89	VGA_RED
THRMTRIP#	A35	B35	THRM#	GND	A90	B90	GND
USB6-	A36	B36	USB7-	SPI_POWER	A91	B91	VGA_GRN
USB6+	A37	B37	USB7+	SPI_MSIO	A92	B92	VGA_BLU
USB_6_7_OC#	A38	B38	USB_4_5_OC#	SD_CLK	A93	B93	VGA_HSYNC
USB4-	A39	B39	USB5-	SPI_CKL	A94	B94	VGA_VSYNC
USB4+	A40	B40	USB5+	SPI_MOSI	A95	B95	VGA_I2C_CK
GND	A41	B41	GND	TPM_PP (N/C)	A96	B96	VGA_I2C_DAT
USB2-	A42	B42	USB3-	TYPE10#	A97	B97	SPI_CS#
USB2+	A43	B43	USB3+	SER0_TX	A98	B98	RSVD
USB_2_3_OC#	A44	B44	USB_0_1_OC#	SER0_RX	A99	B99	RSVD
USB0-	A45	B45	USB1-	GND	A100	B100	GND
USB0+	A46	B46	USB1+	SER1_TX	A101	B101	FAN_PWMOUT
VCC_RTC	A47	B47	EXCD1_PERST#	SER1_RX	A102	B102	FAN_TACHIN
EXCD0_PERST#	A48	B48	EXCD1_CPPE#	LID#	A103	B103	SLEEP#
EXCD0_CPPE#	A49	B49	SYS_RESET#	VCC_12V	A104	B104	VCC_12V
LPC_SERIRQ	A50	B50	CB_RESET#	VCC_12V	A105	B105	VCC_12V
GND	A51	B51	GND	VCC_12V	A106	B106	VCC_12V
PCIE_TX5+	A52	B52	PCIE_RX5+	VCC_12V	A107	B107	VCC_12V
PCIE_TX5-	A53	B53	PCIE_RX5-	VCC_12V	A108	B108	VCC_12V
GPI0	A54	B54	SD_CMD	VCC_12V	A109	B109	VCC_12V
PCIE_TX4+	A55	B55	PCIE_RX4+	GND	A110	B110	GND

COM Express connector J8, rows C and D:

GND	C1	D1	GND
GND	C2	D2	GND
USB_SSRX0-	C3	D3	USB_SSTX0-
USB_SSRX0+	C4	D4	USB_SSTX0+
GND	C5	D5	GND
USB_SSRX1-	C6	D6	USB_SSTX1-
USB_SSRX1+	C7	D7	USB_SSTX1+
GND	C8	D8	GND
USB_SSRX2-	C9	D9	USB_SSTX2-
USB_SSRX2+	C10	D10	USB_SSTX2+
GND	C11	D11	GND
USB_SSRX3-	C12	D12	USB_SSTX3-
USB_SSRX3+	C13	D13	USB_SSTX3+
GND	C14	D14	GND
DDI1_PAIR6+	C15	D15	DDI1_CTRLCLK_AUX+
DDI1_PAIR6-	C16	D16	DDI1_CTRLDATA_AUX-
RSVD	C17	D17	RSVD
RSVD	C18	D18	RSVD
PCIE_RX6+	C19	D19	PCIE_TX6+
PCIE_RX6-	C20	D20	PCIE_TX6-
GND	C21	D21	GND
PCIE_RX7+	C22	D22	PCIE_TX7+
PCIE_RX7-	C23	D23	PCIE_TX7-
DDI1_HPD	C24	D24	RSVD
DDI1_PAIR4+	C25	D25	RSVD
DDI1_PAIR4-	C26	D26	DDI1_PAIR0+
RSVD	C27	D27	DDI1_PAIR0-
RSVD	C28	D28	RSVD
DDI1_PAIR5+	C29	D29	DDI1_PAIR1+
DDI1_PAIR5-	C30	D30	DDI1_PAIR1-
GND	C31	D31	GND
DDI2_CTRLCLK_AUX+	C32	D32	DDI1_PAIR2+
DDI2_CTRLDATA_AUX-	C33	D33	DDI1_PAIR2-
DDI2_DDC_AUX_SEL	C34	D34	DDI1_DDC_AUX_SEL
RSVD	C35	D35	RSVD
DDI3_CTRLCLK_AUX+	C36	D36	DDI1_PAIR3+
DDI3_CTRLDATA_AUX-	C37	D37	DDI1_PAIR3-
DDI3_DDC_AUX_SEL	C38	D38	RSVD
DDI3_PAIR0+	C39	D39	DDI2_PAIR0+
DDI3_PAIR0-	C40	D40	DDI2_PAIR0-
GND	C41	D41	GND
DDI3_PAIR1+	C42	D42	DDI2_PAIR1+
DDI3_PAIR1-	C43	D43	DDI2_PAIR1-
DDI3_HPD	C44	D44	DDI2_HPD
RSVD	C45	D45	RSVD
DDI3_PAIR2+	C46	D46	DDI2_PAIR2+
DDI3_PAIR2-	C47	D47	DDI2_PAIR2-
RSVD	C48	D48	RSVD
DDI3_PAIR3+	C49	D49	DDI2_PAIR3+
DDI3_PAIR3-	C50	D50	DDI2_PAIR3-
GND	C51	D51	GND
PEG_RX0+	C52	D52	PEG_TX0+
PEG_RX0-	C53	D53	PEG_TX0-
TYPE0#	C54	D54	PEG_LANE_RV#
PEG_RX1+	C55	D55	PEG_TX1+

PEG_RX1-	C56	D56	PEG_TX1-
TYPE0#	C57	D57	TYPE2#
PEG_RX2+	C58	D58	PEG_TX2+
PEG_RX2-	C59	D59	PEG_TX2-
GND	C60	D60	GND
PEG_RX3+	C61	D61	PEG_TX3+
PEG_RX3-	C62	D62	PEG_TX3-
RSVD	C63	D63	RSVD
RSVD	C64	D64	RSVD
PEG_RX4+	C65	D65	PEG_TX4+
PEG_RX4-	C66	D66	PEG_TX4-
RSVD	C67	D67	GND
PEG_RX5+	C68	D68	PEG_TX5+
PEG_RX5-	C69	D69	PEG_TX5-
GND	C70	D70	GND
PEG_RX6+	C71	D71	PEG_TX6+
PEG_RX6-	C72	D72	PEG_TX6-
GND	C73	D73	GND
PEG_RX7+	C74	D74	PEG_TX7+
PEG_RX7-	C75	D75	PEG_TX7-
GND	C76	D76	GND
RSVD	C77	D77	RSVD
PEG_RX8+	C78	D78	PEG_TX8+
PEG_RX8-	C79	D79	PEG_TX8-
GND	C80	D80	GND
PEG_RX9+	C81	D81	PEG_TX9+
PEG_RX9-	C82	D82	PEG_TX9-
RSVD	C83	D83	RSVD
GND	C84	D84	GND
PEG_RX10+	C85	D85	PEG_TX10+
PEG_RX10-	C86	D86	PEG_TX10-
GND	C87	D87	GND
PEG_RX11+	C88	D88	PEG_TX11+
PEG_RX11-	C89	D89	PEG_TX11-
GND	C90	D90	GND
PEG_RX12+	C91	D91	PEG_TX12+
PEG_RX12-	C92	D92	PEG_TX12-
GND	C93	D93	GND
PEG_RX13+	C94	D94	PEG_TX13+
PEG_RX13-	C95	D95	PEG_TX13-
GND	C96	D96	GND
RSVD	C97	D97	RSVD
PEG_RX14+	C98	D98	PEG_TX14+
PEG_RX14-	C99	D99	PEG_TX14-
GND	C100	D100	GND
PEG_RX15+	C101	D101	PEG_TX15+
PEG_RX15-	C102	D102	PEG_TX15-
GND	C103	D103	GND
VCC_12V	C104	D104	VCC_12V
VCC_12V	C105	D105	VCC_12V
VCC_12V	C106	D106	VCC_12V
VCC_12V	C107	D107	VCC_12V
VCC_12V	C108	D108	VCC_12V
VCC_12V	C109	D109	VCC_12V
GND	C110	D110	GND

6.2.21. PCI-104 Connector: J3

The SBC contains a non-stack-through/short pin PCI-104 connector located on the top side of the board in the standard position, as specified in the latest revision of the PC/104-Plus Specifications.

The hole diameter of the PCB footprint accommodates the installation of the EPT PCI-104 press-fit connector as well as standard solder-tail connectors.

The board supports 5V and 3.3V PCI-104 add-in-modules. The 3.3V add-in-modules operate in +3.3V VI/O settings and the 5V add-in modules operate in +5V settings in the host module. The settings can be configured using the PCI VIO Jumper option.

The pinout signals and pin numbers for the connector are specified below.

Pin	A	B	C	D
1	GND/5.0V KEY ²	Reserved	+5	AD00
2	VI/O	AD02	AD01	+5V
3	AD05	GND	AD04	AD03
4	C/BE0#	AD07	GND	AD06
5	GND	AD09	AD08	GND
6	AD11	VI/O	AD10	M66EN
7	AD14	AD13	GND	AD12
8	+3.3V	C/BE1#	AD15	+3.3V
9	SERR#	GND	SB0#	PAR
10	GND	PERR#	+3.3V	SDONE
11	STOP#	+3.3V	LOCK#	GND
12	+3.3V	TRDY#	GND	DEVSEL#
13	FRAME#	GND	IRDY#	+3.3V
14	GND	AD16	+3.3V	C/BE2#
15	AD18	+3.3V	AD17	GND
16	AD21	AD20	GND	AD19
17	+3.3V	AD23	AD22	+3.3V
18	IDSEL0	GND	IDSEL1	IDSEL2
19	AD24	C/BE3#	VI/O	IDSEL3
20	GND	AD26	AD25	GND
21	AD29	+5V	AD28	AD27
22	+5V	AD30	GND	AD31
23	REQ0#	GND	REQ1#	VI/O
24	GND	REQ2#	+5V	GNT0#
25	GNT1#	VI/O	GNT2#	GND
26	+5V	CLK0	GND	CLK1
27	CLK2	+5V	CLK3	GND
28	GND	INTD#	+5V	RST#
29	+12V	INTA#	INTB#	INTC#
30	-12V	Reserved	Reserved	GND/3.3V KEY

7. I/O Connector List and Mating Cables

7.1. I/O Connector Details

The following table provides a summary of the I/O connectors on the Gemini SBC.

<i>Function</i>	<i>Ref Des</i>	<i>Manufacturer</i>	<i>Part No.</i>	<i>Description</i>	<i>DSC Mating Cable</i>
PCIe/104 Express	J1	Samtec	ASP-142781-03	156 Position. Top Mount	N/A
PCI-104	J2	EPT	264-61303-02	30 x 4 pin 2mm Pitch with Solder Tails	NA
Serial Ports (x2)	J3, J4	Amphenol FCI	98464-G61-10ULF	2x5 2mm Pitch Latching RA TH Header	6980601
Module COM Express Connector	J5, J8	Foxconn	QT002206-4131-3H	220 Position Connector Plug, SMT, Outer Shroud. Contacts Surface Mount Gold	N/A
Utility	J7	Amphenol	10112690-G03-10ULF	2x10 right angle SMT pin header	6981164
LCD Backlight	J12	Molex	053261-0671	1x6 1.25 mm Pitch, SMD RA Header	Custom
USB 3.0 (x2)	J14, J15	Amphenol FCI	98464-G61-10ULF	2x5 2mm Pitch Latching RA TH Header	6980603
USB 2.0 (x2)	J16, J17	Amphenol FCI	98464-G61-10ULF	2x5 2mm Pitch Latching RA TH Header	6980602
PCIe MiniCard	J18	JAE	MM60-52B1-E1-R650	52-Pin MiniCard Full Size with PCB Mount Threaded Spacers	N/A
SATA M.2 SSD Socket	J19	Amphenol	MDT320M03001	Connector Female. 67 Position. 0.020 Gold Plated	N/A
SATA Connector	J20	Molex	0678008025	Connector Header 7 Position. Vertical T/H	6989101
GbE Ethernet (x2)	J21, J22	Amphenol FCI	98464-G61-10ULF	2x5 2mm Pitch Latching RA TH Header	6980604
Audio Connector	J23	Amphenol FCI	98464-G61-10ULF	2x5 2mm Pitch Latching RA TH Header	6980608
Power IN	J25	Samtec	ASP-194529-01	2x4 Latching Box Header T/H Right Angle 1" Pitch Long PCB Pins	6980512
External Battery	J26	Molex	22057025	2 Pos. 2.5 mm Pitch RA TH Header	6980524
HDMI	J27, J29	Amphenol FCI	98464-G61-20ULF	2x10 2mm Pitch Latching RA TH Header	6980605
LVDS	J32	Molex	5015713007	2x15 1mm RA SMT Shrouded Header	Custom
GPIO	J33	Amphenol FCI	98464-G61-10ULF	2x5 2mm Pitch Latching RA TH Header	6980609

7.2. Cable Kit CK-GEM-01

Cable kit **CK-GEM-01** contains the cables listed below. Drawings for these cables are published on the Diamond Systems website for customers seeking to manufacture their own cables in production quantities.

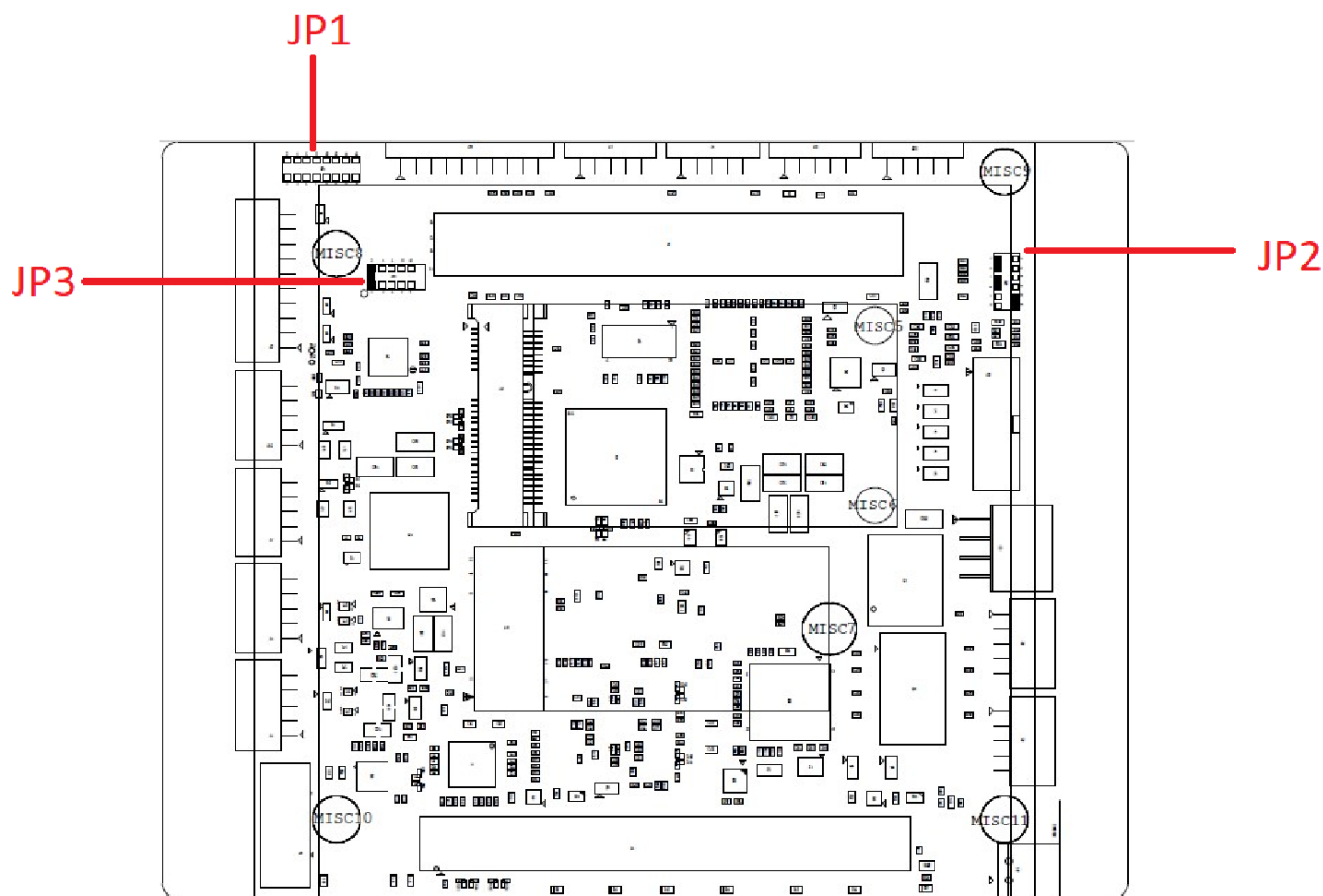


CK-GEM-01 cable kit

No.	Part Number	Description	Qty	Mating Connector
1	6980512	Cable, Power, 2x4 0.1" latching to discrete wires, 12"	1	J25 Power In
2	6980524	Cable, External Battery, Molex Spox 2-position to tinned leads, 12"	1	J26 Battery In
3	6980601	Cable, Dual Serial Port, FCI 98464 to 2x DB9M, 12" ribbon	2	J3, J4 Serial Ports
4	6980602	Cable, Dual USB 2.0, FCI 98464 to dual Type A panel mount receptacle, 12"	2	J16, J17 USB 2.0
5	6980603	Cable, USB 3.0, latching 2x5 2mm to Type A socket panel mount, 12"	2	J14, J15 USB 3.0
6	6980604	Cable, Ethernet, latching 2x5 2mm to RJ-45 socket panel mount, 12"	2	J21, J22 Gigabit Ethernet
7	6980605	Cable, HDMI, latching 2x10 2mm to HDMI panel mount, 12"	2	J27, J29 HDMI
8	6980608	Cable, Audio, latching 2x10 2mm to 3x 3.5mm stereo jacks, 12"	1	J23 Audio
9	6980609	Cable, FCI latching 2x5 2mm to IDC 2x5 2mm, 12"	1	J33 Digital I/O
10	6989101	Cable, SATA 7-pin, straight to right angle, notch out, red, 0.5m	1	J20 SATA
11	6981164	Cable, IDC 2x10F 2mm to IDC 2x10F 2mm, 12" ribbon	1	J7 Utility

8. Jumper Configuration

The following figure represents the connector and Jumper blocks located on the top layout of the Gemini SBC. The default Jumper positions are highlighted in black color.



Gemini SBC Default Jumper Locations Top View

The Jumper blocks on the Gemini SBC can be configured to enable/disable or alter the default signal routing settings on the circuit, using Jumper shunts.

The following table describes the Jumper Blocks on the SBC. Refer to Figure 8-1 above for Jumper Locations.

<i>Jumper</i>	<i>Description</i>
JP1	Serial Termination
JP2	Voltage Selection
JP3	Serial Protocol and USB Mux Selection

8.1. JP1 — Serial Port Termination

Jumper block JP1 is used to configure the serial port termination for RS-422 and RS-485 protocols. Termination is not available for RS-232.

The following table lists Jumper Block JP1 pin numbers, their associated functions, and descriptions. A jumper IN selects the indicated termination, and OUT deselects it. When termination is enabled, a 120-ohm resistor is connected across the differential pair of the named port's TX or RX lines.

<i>Label</i>	<i>Jumper Pins</i>	<i>Function</i>
1	1-2	Port 1 TX Termination
2	3-4	Port 2 TX Termination
3	5-6	Port 1 RX Termination
4	7-8	Port 2 RX Termination
5	9-10	Port 3 TX Termination
6	11-12	Port 4 TX Termination
7	13-14	Port 3 RX Termination
8	15-16	Port 4 RX Termination

8.2. JP2 — Peripheral Voltage Selection

Jumper block JP2 provides selection options for the PCI-104 connector signal voltage, LVDS LCD supply voltage, and the LCD backlight supply voltage. The jumper block pinout is designed to prevent the possibility of shorting two power supplies with an incorrect jumper position.

To select the desired supply voltage for each circuit, shunt a Jumper to short the supply voltage of a pin to the desired power pin. For example, to select 5V PCI bus voltage, shunt the Jumper over pins 1 and 3. Note that jumpers may be installed in both orientations, across rows or in line with rows, depending on the desired configuration.

<i>Label</i>	<i>Signal</i>	<i>Pin</i>	<i>Pin</i>	<i>Signal</i>
1	5V	1	2	NC
2	V-PCI	3	4	3.3V
3	V-LVDS	5	6	3.3V
4	5V	7	8	NC
5	NC	9	10	12V
6	5V	11	12	V-Backlight

The following table lists the Jumper positions and associated voltage specifications. The text in bold and italics indicates the default settings.

<i>Jumper Position</i>	<i>Voltage Selection</i>
<i>1-3</i>	<i>V-PCI = 5V</i>
3-4	V-PCI = 3.3V
<i>5-6</i>	<i>V-LVDS = 3.3V</i>
5-7	V-LVDS = 5V
<i>10-12</i>	<i>V-Backlight = 12V</i>
11-12	V-Backlight = 5V

8.3. JP3 — Serial Port Protocol and USB Selection

Jumper block JP3 is used to configure the serial protocols for the four serial ports, 1, 2, 3, and 4 and to select whether the GPIO expander or the minicard socket is connected to the free USB 2.0 port..

The serial port protocol selection is performed in a pair-wise format where each pair, Ports 1-2 and Ports 3-4, are assigned the same protocol. The two related jumpers work together to select the protocol for the pair of ports. Jumpers 2 and 4 must be used together for Ports 1 and 2, and jumpers 3 and 5 must be used together for Ports 3 and 4.

The functions of the jumper positions are specified in the table below.

<i>Label</i>	<i>Function</i>
1	USB 2.0 Assignment
2	Serial Port 1,2 Mode 2 control bit
3	Serial Port 3,4 Mode 2 control bit
4	Serial Port 1,2 Mode 0 control bit
5	Serial Port 3,4 Mode 0 control bit
6	Not used

8.3.1. Serial Port Configuration

Serial port jumper configuration options are shown in the tables below. The default label configuration is marked in bolded text.

<i>Position 2</i>	<i>Position 4</i>	<i>Ports 1 & 2 Protocol</i>
OUT	OUT	RS232
IN	OUT	Loopback
OUT	IN	RS422
IN	IN	RS485

<i>Position 3</i>	<i>Position 5</i>	<i>Ports 3 & 4 Protocol</i>
OUT	OUT	RS232
IN	OUT	Loopback
OUT	IN	RS422
IN	IN	RS485

8.3.2. USB Multiplexer Selection

USB 2.0 port configuration is shown in the table below. The default label setting is marked in bold text.

<i>Jumper position 1</i>	<i>Function</i>
IN	GPIO Expander
OUT	PCIe MiniCard

9. LED Functions

Along the lower edge of the Gemini carrier board is a series of LEDs providing useful information on the board's status and operation. The LEDs are described in order from left to right.



LED	Function
USER	Controlled by digital IO MPIO7 on the XR17V34 UART; utility program provided to control this LED; useful for verifying the board is active (not hung)
BOOT	Controlled by digital IO MPIO6 on the XR17V34 UART; BIOS will turn on this LED after completing startup operations
PWRON	Controlled by power supply startup logic; LED will illuminate after all power supplies have turned on and are operating normally
ACT (P1)	Ethernet port 1 activity indicator; will flash when Ethernet port 1 has traffic
100 (P1)	Ethernet port 1 speed indicator; will illuminate solid if port 1 is connected at 100Mbps
1G (P1)	Ethernet port 1 speed indicator; will illuminate solid if port 1 is connected at 1Gbps
ACT (P2)	Ethernet port 2 activity indicator; will flash when Ethernet port 2 has traffic
100 (P2)	Ethernet port 2 speed indicator; will illuminate solid if port 2 is connected at 100Mbps
1G (P2)	Ethernet port 12 speed indicator; will illuminate solid if port 2 is connected at 1Gbps
PWR IN	Power In indicator. The LED will illuminate solid if a valid input voltage is applied to the power input connector J25.

10. Specifications

The Gemini SBC specifications are summarized in the following table.

<i>Feature</i>	<i>Description</i>
CPU	Intel Core i7 11th or 13th generation, COM Express Type 6 module
Cooling Accessory	Heat Spreader/Heat-Spreader Assembly
Memory	64 GB DDR4s
Display	2x HDMI 2.0a/b, HEVC, 1 x Dual Channel 24-bit LVDS Port at 3V and 5V Power Range @ Maximum Resolution 1920x1200, LCD Backlight
USB Ports	4x USB 2.0, 2x USB 3.0
Serial Ports	4 RS-232/422/485 Ports.
Ethernet Controller	ETH-1 10/100/1000Mbps Routed from COM Module ETH-2 10/100/1000Mbps Routed from Intel I210 Ethernet Controller
Mass Storage	1x Mini-PCI Express (mPCIe) Socket with Optional USB Support 1x M.2 SATA Socket 2242 (22mm Wide x 42mm Long)
Expansion Busses	4 x1 PCIe Gen 2 ports, x16 PEG (PCI Express Graphics Adapter Ports) and 1x USB 2.0 Port via the PCIe/104 Connector 3.3V and 5V compatible PCI bus via PCI-104 Connector.
Utility	1x I2C, Power Button, Reset Button, 8 GPIOs, 5V @ 2A Power Supply
Digital/Analog Specifications	
Number of Lines	8 Programmable Direction, 3.3V Logic Compatible
Direction	Bidirectional
Input voltage	
Logic 0:	Low: 0V
Logic 1	High: 3.3V
Output Voltage	
Logic 0:	Low: 0V
Logic 1	High: 3.3V
Mechanical and Environmental Properties	
Dimensions	H 4" x W 4" (101.6 mm x 101.6 mm)
Weight	TBU With/Without Heat Spreader
DC Power Input Voltage	8V-34VDC. Wide Input Supply Range
Power Consumption	36 W
Operating Temperature	-40°C to +85°C (-40°F to +185°F)
Shock	MIL-STD-202G Compatible
Vibration	MIL-STD-202G Compatible
RoHS	Compliant