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INNOVATIONS FOR EMBEDDED DESIGNS

Venice GW7300
Single Board Computer

Operating Manual

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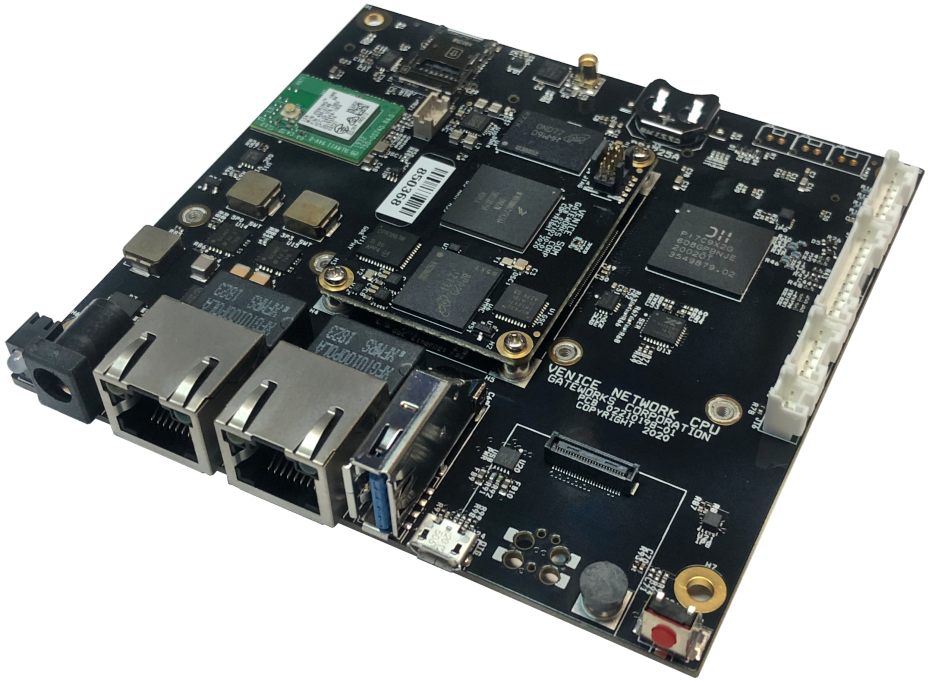

Get Started Quickly

www.gateworks.com/quickstart

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1. INTRODUCTION

1.1. Product Description

The GW7300-00 is a member of the Gateworks 7th generation Venice family of single board computers targeted for small embedded applications such as IoT Gateways, Machine Learning, Unmanned Aerial Vehicles (UAV) equipment, digital signage, and robotics. The GW7300-00 features the 64-bit NXP™ i.MX8M Mini Quad Core ARM® Cortex™-A53 SoC processor operating at 1.6GHz, 1GBytes of LPDDR4 DRAM, and 8GBytes of eMMC System Flash. Three Mini-PCIe expansion sockets can be used for 802.11ax/ac/b/g/n WiFi radios, 5G/4G/3G/CATM1 cellular modems and other PCI Express peripherals. Peripheral headers support Digital I/O, Analog Input, RS232/485 and TTL Serial, I2C and SPI. A combined MIPI-DSI/CSI header with I2S audio offers video input/output. A dual configuration connector supports both MicroSD & Nano SIM simultaneously. A 3-Axis accelerometer is standard. An optional GPS and onboard Laird Sterling 802.11b/g/n WiFi/Bluetooth module are available. The Gateworks System Controller provides embedded features such as real time clock, voltage and temperature monitor, serial EEPROM, programmable pushbutton switch, and advanced power management with programmable board shut-down and wake-up for remote sensor applications. A wide-range DC input power supply provides up to 15W of power to the Mini-PCIe sockets for supporting the latest high-power radios. Power is applied through a dedicated barrel jack or an Ethernet port in an active 802.3af/at or passive Power over Ethernet (PoE) architecture. Ubuntu Linux BSP is supported.

1.2. Standard Features

- NXP™ 64-bit i.MX8M Mini 1.6GHz Quad Core ARM
- 1GByte LPDDR4-2133 SDRAM Memory
- 8GBytes eMMC Flash System Memory
- Three High-Power Gen 2 Mini-PCIe Sockets with USB 2.0 and Nano SIM
- MicroSD & Nano SIM slots
- Two GbE Ethernet Ports supporting 802.3at/af and Passive PoE
- Digital I/O & Analog Expansion
- RS232/RS485 and TTL Serial Expansion
- I2C & SPI Expansion
- USB 2.0 Host and OTG Ports
- MIPI-DSI and MIPI-CSI Port
- Serial Audio In/Out
- Digital 3-axis Accelerometer/Magnetometer
- Optional u-blox GPS Receiver with MMCX Antenna Connector
- Optional Laird Sterling 802.11b/g/n & BLE v4.2 BR/DR/LE
  - Single Antenna Port with WiFi/BLE Coexistence
  - Based on Broadcom BCM4343W SoC
- Real Time Clock with Battery Backup
- Voltage and Temperature Monitor
- Serial Configuration EEPROM
- Programmable Watchdog Timer

- 8 to 60VDC Input Voltage Range
- Power Through Barrel Jack Connector or 802.3af/at Active or Passive PoE
- 6W@25°C Typical Operating Power
- 15W Available for Mini-PCIe Sockets
- Reverse Voltage Protection
- -40°C to +85°C Operating Temperature
- Ubuntu Linux Board Support Package
- 1 Year Warranty

1.3. Ordering Options – Standard Configuration*

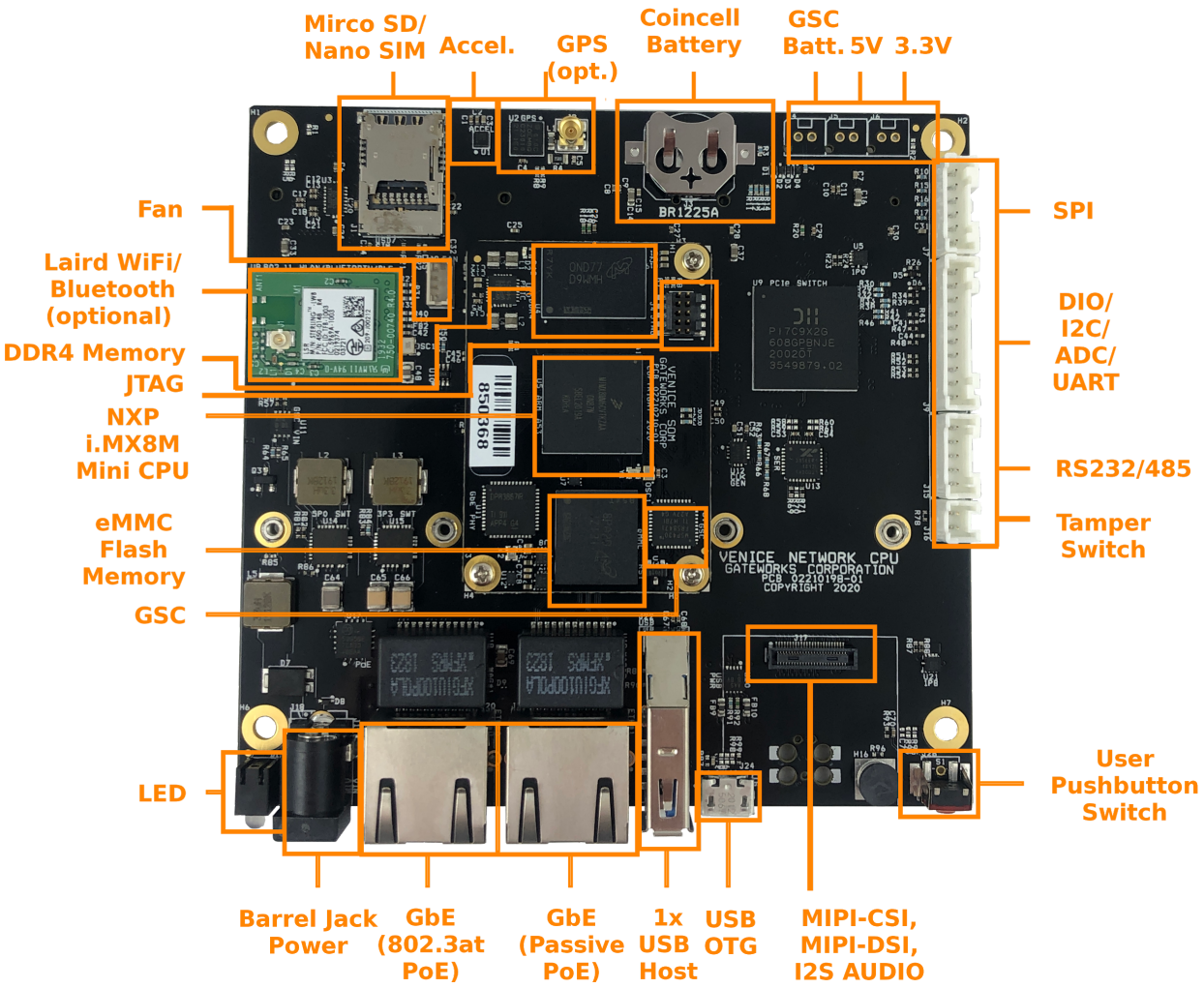
Order Code	ARMv8 processor	SDRAM	Flash	Operating Temp	Peripherals
GW7300-00	Quad Core @ 1.6GHz	1GByte	8GBytes	-40℃ to +85℃	Standard
GW7300-01	Quad Core @ 1.6GHz	4GByte	64GBytes	-40℃ to +85℃	Standard
GW7301-00	Quad Core @ 1.6GHz	1GByte	8GBytes	-40℃ to +85℃	+GPS +WiFi/BLE
GW7301-01	Quad Core @ 1.6GHz	4GByte	64GBytes	-40℃ to +85℃	+GPS +WiFi/BLE

* Contact factory for different configurations of CPU, DRAM, Flash, and support peripherals

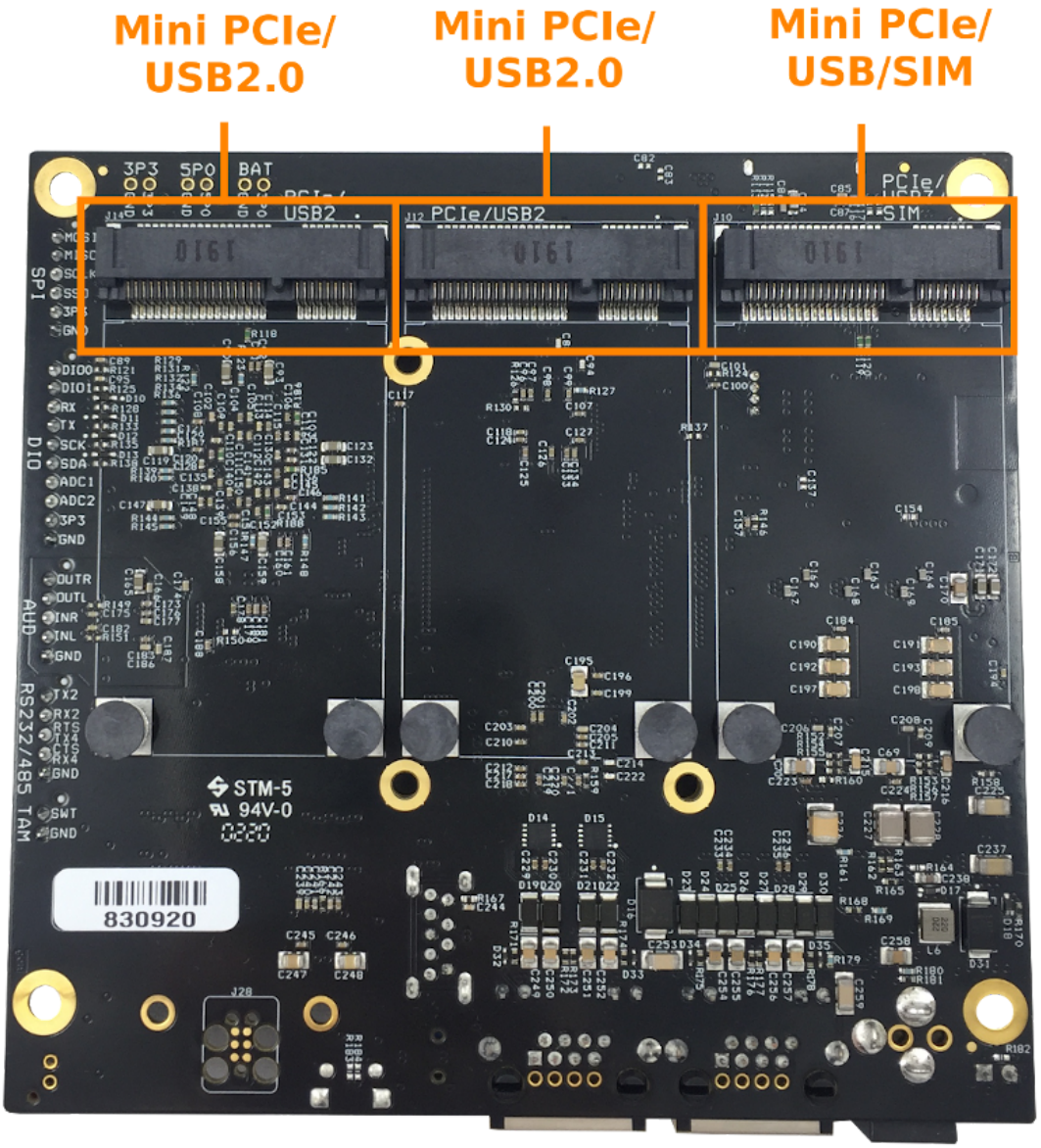
1.4. Ordering Options – Accessories

Order Code	Description
GW11033	USB JTAG Programmer 10-pin Kit (Contains GW16099)
GW10054	Gigabit PoE Injector
GW10030	24V Supply
GW11049	Development Kit, Includes GW7300 SBC

1.5. Feature Locations



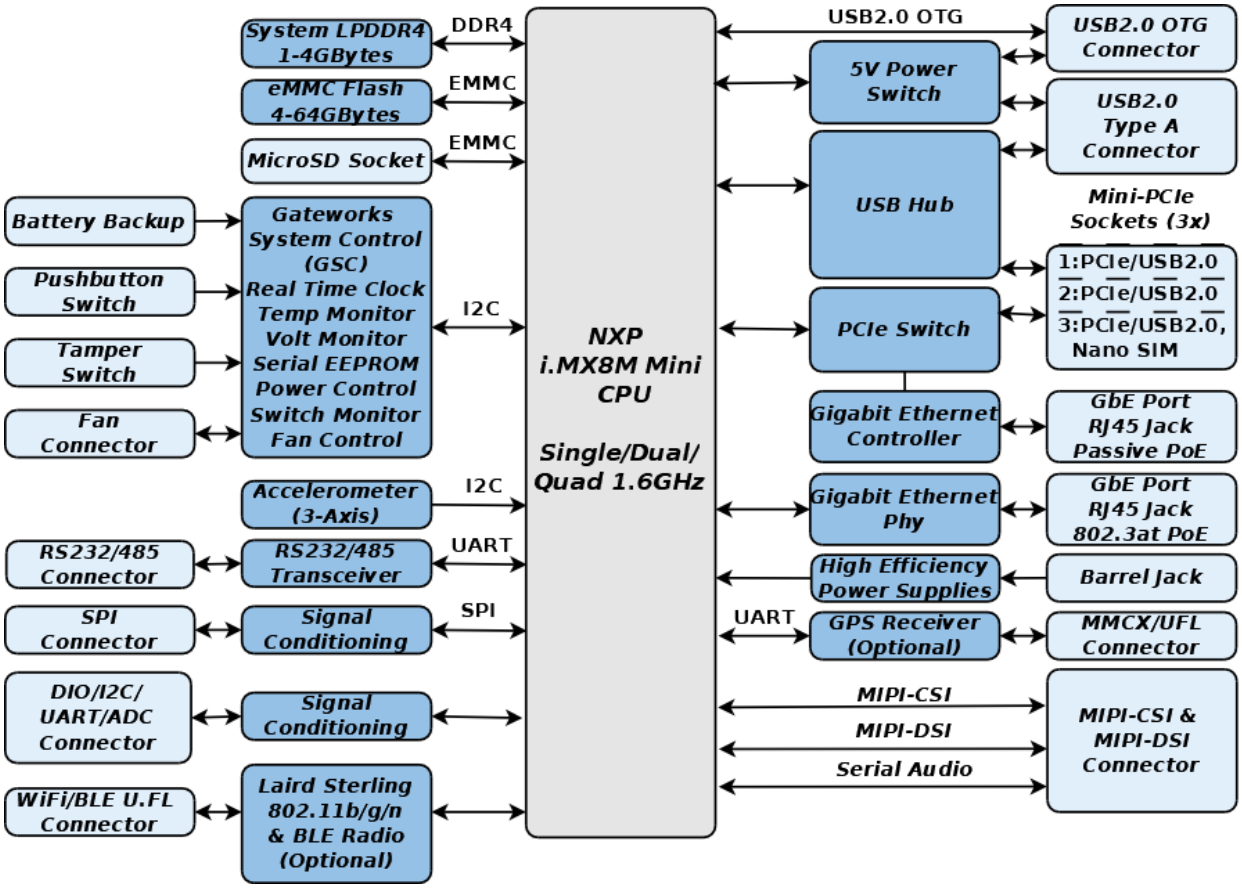
Top Side Features



Bottom Side Features

1.6. Functional Blocks

The functional block diagram is shown below followed by a detailed description of each major functional block.



Functional Block Diagram

ARMv8 Processor

The 64-bit NXP™ i.MX8M Mini Quad Core ARM® Cortex™-A53 SoC processor includes many peripherals for supporting secure network and multimedia processing and connectivity in small embedded applications.

- Quad Cortex-A53 processing cores
- Core operating frequency of 1.6GHz
- DDR4 SDRAM supports up to 2133MTps data rate
- Interfaces include Gigabit Ethernet, PCIe Gen2, and USB 2.0
- Peripheral interfaces include eMMC, SPI, I2C, UART, and GPIO
- Integrated acceleration for security
- Integrated 2D & 3D GPU (1x shader, OpenGL® ES 2.0)
- MIPI Display DSI & Camera CSI
- 1080p60 Encoder and Decoder
- IEEE1588 precision stamp protocol support

DDR4 SDRAM

The SDRAM resides in one LPDDR4 device soldered directly to the board. This architecture supports DDR4 memory capacities from 1GByte to 4GBytes. The 32-bit DDR4 interface operates at up to 1500MHz for supporting fast data transfer rates. The factory default includes 1GByte of LPDDR4.

System Flash

The System Flash supports eMMC memory capacities from 4GBytes to 64GBytes. The 8-bit data bus interface supports double data transfer rates. The default boot device is the eMMC Flash. The factory default is 8GBytes.

Mini-PCIe Sockets

Mini-PCIe is a small form factor PCI card that uses the same signal protocol, electrical specifications, and configuration definitions as conventional PCI Express. The board includes Gen 2 capable Mini-PCIe sockets with the following enhancements to the PCI Express standard.

- The 3.3V power for the socket is increased from a maximum of 3.3W to 8W for accommodating higher power radios. The 8W limit is due to the 0.5A limit of the individual socket pins.
- The PCIe reset for the socket is unique and under software control.
- Certain sockets support both PCIe and USB 2.0 signaling

USB Support

- Slot J10 Supports PCIe, USB 2.0, SIM
- Slot J12 can support PCIe and USB 2.0.
- Slot J14 can support PCIe and USB 2.0.

PCIe Socket Reset & WiFi Disable

The Mini-PCIe sockets support individual software programmable resets and shared WiFi disable signals. The reset signal is controlled through the processor PCIe interface and the WiFi disable signal is controlled through the Gateworks System Controller.

Micro-SD and Nano SIM Expansion

A combined Micro-SD and Nano SIM socket extends the functionality of the SBC.

The Micro-SD extends the local Flash storage capacity. The socket accepts small 11mm by 15mm removable cards with storage capacities from 64Mbytes to 32Gbytes. The 4-bit data interface supports transfer rates up to 25Mbytes per second. This readily available storage device is commonly used in cellular phones, GPS devices, portable media players, and digital cameras.

The Micro-SD socket communicates with the processor using the SD[2] Secure Digital interface and supports a card detect signal SD2_CD signal. Software drivers are available for SD format cards.

The Nano SIM (4FF) socket accepts 12.3 mm by 8.8 mm cellular SIM cards. The SIM signals are routed to a single Mini-PCIe socket, J10, for cellular modem usage.

GbE Ethernet

The SBC supports a single Gigabit Ethernet port. The Ethernet port operates in a 10BASE-T, 100BASE-TX or 1000BASE-T configuration and includes auto MDI/MDIX for automatically switching data receive and data transmit pairs. Additional features include full-duplex operation as well as support for auto- negotiation. The data interfaces include direct-touch ESD protection that exceeds IEC61000-4-2-ESD. The Ethernet MAC addresses are programmed into the Gateworks System Controller Configuration EEPROM during automated factory testing.

The IEEE802.3 compliant Ethernet MAC Media Access Controllers are located in the processor. The Gigabit Ethernet Port MAC communicates to an external PHY physical layer device through an RGMII interface. The external PHY is reset under software control using a processor digital I/O signal.

The RJ45 connector for the Gigabit Ethernet Port includes integrated status lights. The green light is on for link and blinking for activity. The yellow status light indicates speed. The yellow light is off for both 10Mbps and 100Mbps, and on for 1000Mbps.

The SBC input power can be provided through the Gigabit Ethernet Port jack in a Passive Power over Ethernet architecture. This is discussed in greater detail at the end of this section. The RJ45 connectors can be replaced with an 8-pin dual-row 2mm header such as the JST B08B-PUDSS as an ordering option.

USB Ports

The processor includes two USB ports. The default processor supports USB 2.0. Future SOMs may support USB 3.0. One port is connected to a OTG Type-B connector and the other to a USB Hub, which is routed to a Type-A connector. Mini-PCIe sockets also receive USB signalling. Both USB ports support low-speed 1.5Mbps transfers, full-speed 12Mbps transfers, and high- speed 480Mbps transfers. The SBC is configured as a Downstream Facing Port capable of sourcing 5V at 1.5A. The output power is enabled through a CPU GPIO signal (GPIO[1]:DIO[12]) and the current fault monitoring is monitored through another CPU GPIO signal (GPIO[1]:DIO[13]).

Peripheral Expansion

The SBC includes a peripheral expansion connector that supports digital I/O, serial I/O, analog input, system reset, I2C and power.

Digital I/O

There are several general purpose digital I/O signals supported with CPU GPIO digital I/O signals. The 3.3V digital I/O signals support 10mA drive current, 10mA sink current, and signal conditioning in the form of a series 332 ohm resistor.

Serial I/O

The serial interface is available through several UARTs as defined in the connector section in this document. Several UARTs are routed through a programmable transceiver supporting RS232 and RS485 (half duplex and full duplex). Another UART is routed to the optional GPS and a header for TTL levels. The last UART is used for the Bluetooth on the optional BLE/WiFi module.

Analog Input

There are two analog inputs that are available through the Gateworks System Controller. The 0 to 5V analog input is divided by two.

System Reset

The system reset signal is connected to the Gateworks System Controller pushbutton input and supports all of the associated features. This includes generating an interrupt, system reset, and powering the SBC on and off.

I2C Two Wire Interface

An I2C interface is offered.The 3.3V two wire interface supports standard SCL/SDA protocols up to400KHz with 7-bit and 10-bit addressing in both master and slave operation. The two wire interface is supported with the processor port and includes pull up resistors on both signals.
More information can be found at the following links:

- http://trac.gateworks.com/wiki/I2C

SPI Serial Peripheral Interface

An SPI serial peripheral interface is available through a connector. The interface includes 121 ohm series resistors for short circuit protection, operates up to 50MHz, and supports both interrupt and polled transactions.
More information can be found at the following links:

- http://trac.gateworks.com/wiki/SPI

Gateworks System Controller

The GSC Gateworks System Controller is a custom battery-backed micro-controller designed by Gateworks to implement many of the embedded features found on the board. This includes features such as real time clock with battery backup, system temperature and voltage monitor, configuration EEPROM, and digital I/O. Software information can be found at http://trac.gateworks.com/wiki/gsc

Real Time Clock with Battery Backup

The real time clock is provided by the Gateworks System Controller. The Gateworks System Controller emulates an industry standard Dallas Semiconductor DS1672 to support the real time clock. This includes a 32-bit counter that counts seconds for determining time of day, week, month, and year. The I2C address for the real time clock is 0x68h. The real time clock is battery backed to retain time information when power is removed from the board. The battery is a 12.5mm BR1225 coin cell installed in a surface mount socket.

System Temperature and Voltage Monitor

The system temperature and voltage monitor is provided by the Gateworks System Controller. The Gateworks System Controller does not emulate a specific device to support the temperature and voltage monitoring functions. The I2C address for the temperature and voltage monitor is 0x29h. The temperature and voltage parameters monitored by the Gateworks System Controller are listed in the table below. The GSC mapping includes the value referenced by the software driver written for the Gateworks System Controller. Software information is available on the following Gateworks Wiki page:
http://trac.gateworks.com/wiki/gsc

Analog Input	Input Divider R1/(R1+R2)	Description
0	10K/20K	Board Level Operating Temperature
1	22.1K/23.1K	Board Level Input Operating Voltage
2	10K/32.1K	ADC1
3	10K/20K	ADC2
4	None	1.1V MX8M Mini DRAM
6	None	1.2V Core Mipi
7	None	1.0V RGMII Phy
8	10K/20K	2.5V RGMII Phy
9	10K/20K	3.3V Primary Supply
12	None	0.95V CPU
13	None	1.8V LPDDR4
14	None	Reserved
15	None	Reserved

Gateworks System Controller Monitored Temperature and Voltages

Configuration EEPROM

The configuration EEPROM is provided by the Gateworks System Controller. The Gateworks System Controller emulates an Atmel 24C04. The EEPROM is divided into a general purpose section available to the application and a section reserved by Gateworks for storing various system configuration parameters. The I2C address for the configuration EEPROM is 0x50h.

Fan Speed Control

The fan speed function controls the rotational speed of a fan though the J8 connector. Fan speed control increases fan service life and decreases system acoustic airflow noise. The Gateworks System Controller supports up to six temperature set points. The fan speed is set to off until operating temperature reaches the first set point. When the operating temperature reaches the first set point, the fan speed is set to 50%. The fan speed then increases 10% as the operating temperature climbs through each additional set point. The fan connector also supports a tachometer feedback signal through the Gateworks System Controller to ensure the rotational integrity of the fan.

Additional System Level Functions

The Gateworks System Controller also supports encryption key and software programmable hardware shut-down and wake-up for the highest possible power conservation.

Battery Backup

The Gateworks System Controller must be powered at all times if support features such as continuous real time clock, and programmable hardware sleep and wake-up are required. This power is supplied by a coin cell battery when the SBC is powered down. The Gateworks System Controller seamlessly switches from the coin cell battery to input power when the SBC is powered on to extend coin cell battery life. The coin cell socket includes both a reverse charge protection resistor and a current blocking diode to provide two levels of protection required for some agency approvals.

3-Axis Accelerometer/Magnetometer

The 3-Axis sensor device combines a 8-bit linear accelerometer. The device includes a +/-2g, +/-4g, +/-8g and +/-16g dynamically selectable acceleration full scale range. Acceleration event functions include free fall and motion detection. The accelerometer communicates to the CPU on the I2C[2] bus at address 0x19. The accelerometer is a STMicroelectronics LIS2DE12TR.

More information can be found at the following links:

- https://www.st.com/en/mems-and-sensors/lis2de12.html
- http://trac.gateworks.com/wiki/accelerometer

Optional Laird Sterling 802.11b/g/n WiFi & Bluetooth Radio

An optional Laird Sterling LWB 2.4GHz WiFi & Bluetooth Radio is soldered onto the board. It is based on Broadcom BCM4343W SoC. The WiFi radio is a 1x1 MIMO and supports 802.11b/g/n. The Bluetooth radio supports Bluetooth v4.2 BR /DR/LE. A single u.FL antenna port is utilized for WiFi/BLE coexistence. The radio itself carries FCC USA certification.

More information can be found at the following links:

- Wireless: http://trac.gateworks.com/wiki/wireless/wifi
- Bluetooth: http://trac.gateworks.com/wiki/wireless/bluetooth
- Laird Manufacturer Page: Sterling LWB

Optional GPS Receiver

The optional u-blox ZOE-M8 GPS Receiver is a 72 channel Global Navigation Satellite System (GNSS) device for delivering position, velocity, and time information. The GPS Receiver includes a dual frequency RF front end for concurrent reception of up to three GNSS systems. This includes GPS/ZQSS, GLONASS, Galileo, and BeiDou.

The device is typically configured for 9600 NMEA protocol depending on the GPS firmware revision. Communication to the CPU is through the UART1 serial port interface. A pulse-per-second signal is also supported through the CPU GPIO[1]:DIO[15] digital I/O signal. The PPS signal can be factory optionally routed to a Mini-PCIe socket. A MMCX or a U.FL connector connects to an externally mounted active antenna. The antenna includes a series current limit resistor to protect against a shorted antenna.

More information can be found at the following links:

- https://www.u-blox.com/en/product/zoe-m8-series
- http://trac.gateworks.com/wiki/gps

Key Parameter	Specification
PPS Time Accuracy RMS	30nS
PPS Time Accuracy 99%	60nS
Dynamic Operational Limit	<4G
Altitude Operation Limit	50,000m
Velocity Operational Limit	500m/s
Velocity Accuracy (50% @ 30ms)	0.05m/s
Heading Accuracy (50% @ 30ms)	0.3 degrees

GPS Receiver Key Parameters

GNSS Parameter	GPS & Glonass	GPS	Glonass	BeiDou	Galileo
Horizontal Position Accuracy	2.5m	2.5m	4m	3m	TBD
Navigation Update Rate ROM Flash	 10Hz 5Hz	 18Hz 10Hz	 18Hz 10Hz	 18Hz 10Hz	 18Hz 10Hz
First Fix Time Cold Start Hot Start Aided Start	 26s 1s 2s	 29s 1s 2s	 30s 1s 2s	 34s 1s 3s	 45s 1s 7s
Tracking Sensitivity	-167dBm	-166dBm	-166dBm	-160dBm	-159dBm
Re-acquisition Sensitivity	-160dBm	-156dBm	-156dBm	-157dBm	-153dBm
Cold Start Sensitivity	-148dBm	-145dBm	-145dBm	-143dBm	-138dBm
Hot Start Sensitivity	-157dBm	-157dBm	-156dBm	-155dBm	-151dBm

GPS Receiver GNSS Parameters

JTAG Programming Port

The primary purpose for the JTAG Port is for automated factory testing and to facilitate downloading the application program into Flash memory. This feature requires the GW16099 USB JTAG Programmer (sold as a GW11033 kit). The JTAG programming port also includes a CPU UART interface in a logic-level configuration. This serial port facilitates an operator console though the USB JTAG Programmer. Refer to Section 3 for USB JTAG Programmer instructions.

Status LEDs

The board includes a surface mount LED and a bi-color LED located towards the front edge of the board.

Label	Function
3.3V	Primary voltage rail is active
PRG	Programmable using i.MX8M GPIO[5]:DIO[4] and GPIO[5]:DIO[5]and digital I/O signal

Surface Mount Status LED Functionality

Power Architecture

DC input power is supplied through the barrel jack, one Ethernet connector using 802.3at Power over Ethernet, or the other Ethernet Port connector using Passive Power over Ethernet.

Barrel Jack Power

The barrel jack at location J19 has a 2.5mm inner pin diameter. The connector is polarized with the center pin being positive. The input voltage range is 8-60V. The mating connector is G/S SR2048A, available from Jameco as part number 195038.

802.3at Active Power over Ethernet

One Gigabit Ethernet Port supports 802.3at Power over Ethernet by acting as a Powered Device (PD) with power being supplied by Power Sourcing Equipment (PSE) such as an 802.3at compliant Ethernet switch. This includes providing detection signature, classification signature, and current inrush limiting after being instructed to power on. The input voltage range is 36-57V as defined by the PoE specification. The power and ground connections include full wave bridge rectification so that they can be connected on any two data pairs.

More PoE information is available on the Gateworks wiki here:
http://trac.gateworks.com/wiki/poe

Passive Power over Ethernet

One RJ45 Ethernet jack supports Passive Power over Ethernet. This configuration is most useful for powering the SBC through an Ethernet jack without an 802.3at compliant PSE switch. The input voltage range is 10-60V.

The positive input voltage and ground must be applied on specific data pairs unlike the 802.3at architecture. The positive input must be applied on the pin 1-2 and pin 4-5 data pairs and ground must be applied on the pin 3-6 and pin 7-8 data pairs.

The data pairs for Passive Power over Ethernet have a 0.8A current limit. It may be necessary to increase the input operating voltage to deliver the power needed for the Mini-PCIe radios and USB charging ports. As an example, assume the application includes a high power radio card that requires a total of 8W and a USB device that requires a total of 7W. The required power is 15W for the peripherals plus 4W for the SBC. The total power requirement is approximately 21W assuming 90% efficiency for the primary power supply.

More PoE information is available on the Gateworks wiki here:
http://trac.gateworks.com/wiki/poe

Switching DC/DC Regulators

All power supply voltage rails are generated with high efficiency DC to DC switching regulators. The SBC is classified as a SELF Safety Extra Low Voltage Device since the maximum input voltage is below the 60VDC SELV limit as defined by IEC 60950-1 and other standards.

Feature	Benefit
High efficiencies (up to 95%)	Reduces heat generated in enclosure
High power output (up to 10W)	Supports high power Mini-PCIe cards
Thermal shutdown	Protects against overheating
Output current limit	Protects against short circuits
Controlled startup	Reduces component stress and power surges
Common mode input filter	Reduces emissions for agency certification

Switching DC/ DC Regulator Features

2. CONNECTORS

The board interface connector pin assignments and signal descriptions are included in the following sections. The connectors are listed in the table below.

Connector	Populated	Function
J1	Yes	Micro SD / Nano SIM Socket
J2	No	GPS Receiver MMCX Antenna
J3	Yes	Coin Cell Battery Socket
J4	No	Optional External Coin Cell Header
J5	No	5V Power Supply Input
J6	Yes	3.3V Power Supply Input
J7	Yes	Serial Peripheral Interface (SPI)
J8	No	5V Fan Speed Control
J9	Yes	Peripheral Expansion (GPIO, UART, I2C, ADC)
J10	Yes	Mini-PCIe Socket with PCIe and USB 2.0 and SIM
J11	Yes	SOM Connector
J12	Yes	Mini-PCIe Socket with PCIe and USB 2.0
J13	Yes	SOM Connector
J14	Yes	Mini-PCIe Socket with PCIe and USB 2.0
J15	Yes	RS232/RS485 Serial Ports
J16	Yes	Tamper Switch
J17	Yes	MIPI CSI and DSI Header
J18	No	Optional Power Input Header
J19	Yes	Input Power Barrel Jack
J20	Yes	Gigabit Ethernet Port and 802.3af PoE Input Power
J21	Yes	Gigabit Ethernet Port and Passive PoE Input Power
J22	Yes	USB Host Type A Socket
J23	No	Optional USB Header
J24	Yes	USB OTG Micro B Socket
J25	Yes	Test Header
J26	No	Optional Push Button Switch Header

Connector Summary

Micro-SD Flash and Cellular Nano SIM Expansion Socket (J1)

Flash expansion is possible by installing an industry standard 11mm by 15mm Flash card into the socket. The Micro-SD Flash card cannot be installed or removed with power applied to the SBC. The Micro-SD and Nano SIM sockets are combined. The command signal is routed to the processor.by default. The Nano SIM socket is routed to Mini-PCIe socket J10.

Optional GPS MMCX or u.FL Antenna (J2)

The optional GPS feature includes an antenna connector for an externally mounted passive or active antenna. The 50 Ohm MMCX antenna connector (standard loading option) is a vertical mount Molex 73415-2061, or equivalent. The 50 Ohm U.FL connector (optional) is a vertical mount Sunridge MCBG-ST-00T, or equivalent.

Battery Coin Cell Socket (J3)

The 12.5mm backup battery socket allows for easy replacement of the battery. A standard 12.5mm, BR1225, 3V, 50mAH Lithium coin cell should be used when replacing the battery. Replacement batteries can be ordered from Digi-Key with part number P183-ND.

Optional Battery Coin Cell Header(J4)

The coin cell voltage is optionally provided through a 2-pin header in a 1x2 configuration with 2mm pin spacing. The mating connector is a JST PAP-02V-S, available from Digi-Key as part number 455-1486-ND. The mating connector pins are JST SPHD-002T-P05, available from Digi-Key as part number 455-1313-1-ND.

Optional Primary 5V Supply Bypass Connector (J5)

5V power can be applied through an optional latching 2-pin connector in a 1x2 configuration with 2mm spacing. The 2-pin mating connector is a JST PAP-02V-S, available from Digi-Key as part number 455-1486-ND. The mating connector pins are JST SPHD-002T-P05, available from Digi-Key as part number 455-1313-1-ND.

Pin	Signal
1	5V
2	Ground

5VDC Input Connector

Optional Primary 3.3V Supply Bypass Connector (J6)

3.3V power can be applied through an optional latching 2-pin connector in a 1x2 configuration with 2mm spacing. The 2-pin mating connector is a JST PAP-02V-S, available from Digi-Key as part number 455-1486-ND. The mating connector pins are JST SPHD-002T-P05, available from Digi-Key as part number 455-1313-1-ND.

Pin	Signal
1	3.3V
2	Ground

3.3VDC Input Connector

Serial Peripheral Interface (SPI) Expansion (J7)

An SPI port is available through a 6-pin header in a 1x6 configuration with 2mm spacing. The mating connector is a JST PAP-06V-S, available from Digi-Key as part number 455-1490-ND. The mating connector pins are JST SPHD-002T-P05, available from Digi-Key as part number 455-1313-1-ND.

Pin	Signal
1	SPI_MOSI
2	SPI_MISO
3	SPI_SCLK
4	SPI_SS0
5	3.3VDC
6	Ground

SPI Interface Connector

5V Fan Speed Control (J8)

A programmable 5V power rail is available through a latching 4-pin connector in a 1x4 configuration with 1.25mm pin spacing. The mating connector is a Hirose DF13-4S-1.25C, available from Digi-Key as part number H2181-ND. The mating connector pins are Hirose DF13-2630SCF, available from Digi-Key as part number H9992CT-ND.

Pin	Signal
1	5V
2	Gateworks System Controller - Fan Control Output
3	Gateworks System Controller - Tachometer Input
4	Ground

Fan Speed Control Connector

Peripheral Expansion (J9)

The peripheral expansion connector includes digital I/O, optional serial I/O, analog input, system reset, optional I2C, and power. The CPU connections support a 3.3V interface. The connector is an 10-pin header in a 1x10 configuration with 2mm pin spacing. The mating connector is a JST PAP-10V-S, available from Digi- Key as part number 455-1494-ND. The mating connector pins are purchased separately.

Pin	Signal
1	i.MX8M GPIO[1]:DIO[7]
2	i.MX8M GPIO[1]:DIO[9]
3	UART[1] RXD (logic level) **
4	UART[1] TXD (logic level) **
5	Serial Clock i.MX8M I2C3 SCL
6	Serial Data i.MX8M I2C3 SDA
7	GSC ADC1
8	GSC ADC2
9	3.3VDC
10	Ground

** UART[1] is shared with optional GPS

Peripheral I/O Connector

Mini-PCIe (J10 & J12 & J14)

The PCI Express Mini Card socket is an industry standard form factor.

- Slot J10 Supports PCIe, USB 2.0, SIM
- Slot J12 can support PCIe and USB 2.0.
- Slot J14 can support PCIe and USB 2.0.

Pin	Signal	Connect	Pin	Signal	Connect
1	WAKE#	No Connect	2	3.3VAUX	3.3V
3	COEX1	No Connect	4	GND	Ground
5	COEX2	No Connect	6	1.5V	No Connect
7	CLKREQ#	No Connect	8	USIMPWR	Note 2
9	GND	Ground	10	USIMDAT	Note 2
11	REFCLK-	REFCLK-	12	USIMCLK	Note 2
13	REFCLK+	REFCLK+	14	USIMRST	Note 2
15	GND	Ground	16	USIMVPP	Note 2
17	RSVD	No Connect	18	GND	Ground
19	RSVD	No Connect	20	WDIS#	No Connect
21	GND	Ground	22	PERST#	Note 3
23	PERN0/SATA+B	Note 1	24	3.3VAUX	3.3V
25	PERP0/SATA-B	Note 1	26	GND	Ground
27	GND	Ground	28	1.5V	No Connect
29	GND	Ground	30	SMBCLK	No Connect
31	PETN0/SATA-A	Note 1	32	SMBDAT	No Connect
33	PETP0/SATA+A	Note 1	34	GND	Ground
35	GND	Ground	36	USBD-	Note 4
37	GND	Ground	38	USBD+	Note 4
39	3.3VAUX	3.3V	40	GND	Ground
41	3.3VAUX	3.3V	42	LEDWWAN#	No Connect
43	GND	Ground	44	LEDWLAN#	No Connect
45	RSVD	No Connect	46	LEDWPAN#	No Connect
47	RSVD	No Connect	48	1.5V	No Connect
49	RSVD	No Connect	50	GND	Ground
51	RSVD	No Connect	52	3.3VAUX	3.3V

Mini-PCIe Socket

SOM Header (J11 & J13)

The System on Module (SOM) with the CPU, DRAM and Flash connects to sockets J11 and J13 on the baseboard. There are roughly 180 pins between the 2 sockets. The system is not designed in a way that the SOM would be removed and the user would interface with J11 and J13 directly. If more information is required, please contact Gateworks support.

Software Programmable RS232/422/485 Serial Port (J15)

A RS232/422/485 serial port is available through a 5-pin header in a 1x5 configuration with 2mm spacing. The mating connector is a JST PAP-05V-S, available from Digi-Key as part number 455-1489-ND. The mating connector pins are JST SPHD-002T-P05, available from Digi-Key as part number 455-1313-1-ND.

- GPIO[4]:DIO[0] selects between RS232 and RS485
  - 0 = RS232
  - 1 = RS485
- GPIO[1]:DIO[0] selects UART_TERM (RS485 Termination)
  - 0 = No termination for RS485
  - 1 = 120 Ohm termination for RS485 RX and TX
- GPIO[4]:DIO[2] selects UART_HALF (RS485 Half or Full Duplex)
  - 0 = Full Duplex for RS485
  - 1 = Half Duplex for RS485

Pin	RS232 Signal	RS422/485 Half Duplex	RS422/485 Full Duplex
1	Transmit Data 2 (output) CPU UART2 TXD	Transmit/Receive Data-	Transmit Data-
2	Receive Data 2 (input) CPU UART2 RXD	Reserved	Receive Data+
3	Transmit Data 4 (output) CPU UART4 TXD or CPU GPIO[5]:DIO[29] as RS232 RTS	Transmit/Receive Data+	Transmit Data+
4	Receive Data 4 (input) CPU UART4 RXD or CPU GPIO[5]:DIO[28] as RS232 CTS	Reserved	Receive Data-
5	Ground	Ground	Ground

Software Programmable RS232/422/485 Serial Port Connector

External Tamper Switch (J16)

The tamper switch signals are available through a latching 2-pin connector in a 1x2 configuration with 2mm pin spacing. The mating connector is a JST PAP-02V-S, available from Digi-Key as part number 455-1486-ND. The mating connector pins are JST SPHD-002T-P05, available from Digi-Key as part number 455-1313-1-ND.

Pin	Signal
1	Gateworks System Controller Tamper Switch Input
2	Ground

External Tamper Switch Connector

MIPI CSI and DSI Header (J17)

The Mobile Industry Processor Interface (MIPI) Camera Sensor Interface (CSI) and Display Serial Interface (DSI) are available together in a 2x25 configuration with .4mm pin spacing. The mating connector is a Hirose DF40C-50DP-0.4V(51), available from Digi-Key.

Pin	Signal	Pin	Signal
1	Ground	2	Ground
3	CSI 0-	4	DSI 0-
5	CSI 0+	6	DSI 0+
7	Ground	8	Ground
9	CSI 1-	10	DSI 1-
11	CSI 1+	12	DSI 1+
13	Ground	14	Ground
15	CSI CLK-	16	DSI CK-
17	CSI CLK+	18	DSI CK+
19	Ground	20	Ground
21	CSI 2-	22	DSI 2-
23	CSI 2+	24	DSI 2+
25	Ground	26	Ground
27	CSI 3-	28	DSI 3-
29	CSI 3+	30	DSI 3+
31	Ground	32	Ground
33	Audio3 CLK	34	I2C CLK
35	Audio3 TX	36	I2C DATA
37	Audio3 TXFS	38	Ground
39	Audio3 RX	40	VDD 1.8V
41	Audio3 TXC	42	VDD 1.8V
43	MIPI GPIO1	44	VDD 3.3V
45	MIPI GPIO2	46	VDD 3.3V
47	MIPI GPIO3	48	VDD 5V
49	MIPI GPIO4	50	VDD 5V

MIPI CSI and DSI Header

Optional Input Power (J18)

Power is normally applied to through the barrel jack or through the GbE Ethernet connector in either a Passive or 802.3af Compatible Power over Ethernet configuration. The barrel jack can be replaced with a 2-pin header in a 1x2 configuration with 0.156-inch pin spacing as an ordering option. The mating connector is a JST B2P-VH-FB-B. The mating connector pins are a JST SVH-21T-P1.1.

Pin	Signal
1	8VDC to 60VDC
2	Ground

Optional Input Power Connector

Input Power Barrel Jack (J19)

Power is normally applied through the barrel jack or through the GbE Ethernet connector in a Passive or 802.3af Compatible Power over Ethernet configuration. The barrel jack should have the positive input voltage on the inner sleeve and ground on the outer sleeve. The barrel jack inner pin diameter is 2.5mm. The input voltage requirements are given in Section 3. The mating connector is a G/S SR2048A-R, available from Jameco as part number 190538PS. The schematic symbol representing this configuration is shown below.

Barrel Jack Schematic

Gigabit Ethernet Port and Active PoE Input Power (J20)

The GbE Ethernet Port is available through a standard 8-pin RJ45 connector. The connector supports both passive and 802.3af Compatible Power over Ethernet. The power inputs are diode protected to prevent back feeding with other power inputs. The RJ45 connector can be replaced with a 8-pin dual-row 2mm header as an ordering option. The input voltage requirements are given in the Specifications section.

Pin	Signal	Power
1	TX1+/RX1+	PoE V+
2	TX1-/RX1-	PoE V+
3	TX2+/RX2+	PoE Ground
4	TX3+/RX3+	PoE V+
5	TX3-/RX3-	PoE V+
6	TX2-/RX2-	PoE Ground
7	TX4+/RX4+	PoE Ground
8	TX4-/RX4-	PoE Ground

GbE Ethernet Port Connector

Gigabit Ethernet Port and Passive PoE Input Power (J21)

The Gigabit Ethernet Port is available through a standard 8-pin RJ45 connector. The connector also supports Passive Power over Ethernet. The power inputs are diode protected to prevent back feeding with other power inputs. The Passive PoE architecture is discussed in more detail in Section 1 and the input voltage requirements are listed in Section 3. The RJ45 connector can be replaced with an 8-pin dual-row 2mm header as an ordering option.

Pin	Signal	Passive Power
1	TX1+/RX1+	PoE V+
2	TX1-/RX1-	PoE V+
3	TX2+/RX2+	PoE Ground
4	TX3+/RX3+	PoE V+
5	TX3-/RX3-	PoE V+

6	TX2-/RX2-	PoE Ground
7	TX4+/RX4+	PoE Ground
8	TX4-/RX4-	PoE Ground

GbE Ethernet Port Connector

USB Type-A Socket (J22)

The USB port is available through a standard Type-A connector with the following pin assignment. By default this is USB 2.0 in the default configuration. If the upper SOM supports USB 3.0, USB 3.0 will be available.

Pin	Signal
1	USB Host Switched 5V
2	USB 2.0 Host Data-
3	USB 2.0 Host Data+
4	Ground
5	USB 3.0 SSRX-
6	USB 3.0 SSRX+
7	Ground
8	USB 3.0 SSTX-
9	USB 3.0 SSTX+

USB 3.0 Type-A Connector

Optional USB Header (J23)

The standard USB Host port Type-A connector and the standard USB OTG Micro-B connector can be replaced with a single 8-pin Molex dual-row 2mm connector as an ordering option.

Pin	Signal	Pin	Signal
1	USB Host Switched 5V	2	USB OTG Switched 5V
3	USB 2.0 Host Data-	4	USB OTG Data-
5	USB 2.0 Host Data+	6	USB OTG Data+
7	Ground	8	USB OTG Detect

USB Header

USB OTG Port (J24)

The OTG USB port is available through a standard Micro-B connector.

Pin	Signal
1	USB OTG Switched 5V
2	USB 2.0 OTG Data-
3	USB 2.0 OTG Data+
4	USB 2.0 OTG Detect
5	Ground

USB 3.0 Type-A Connector

Test Header (J25)

A test header is at J25. This is for internal Gateworks use. Please contact Gateworks technical support with any further questions.

Optional Pushbutton Switch Connector (J26)

The pushbutton switch signal can be applied through an optional latching 2-pin connector in a 1x2 configuration with 2mm spacing. The 2-pin mating connector is a JST PAP-02V-S, available from Digi-Key as part number 455-1486-ND. The mating connector pins are JST SPHD-002T-P05, available from Digi-Key as part number 455-1313-1-ND.

Pin	Signal
1	Switch Input
2	Ground

Pushbutton Connector

JTAG Programming and Serial Console (SOM J4)

The JTAG programming port and serial console port are both available through a single 10-pin header in a 2x5 configuration with 0.05-inch pin spacing. The mating cable is a Samtec FFSD series, or equivalent. For example the FFSD-05-S-05.00-01-N is a 5-inch ribbon cable with a mating connector on one end.

The primary purpose for the JTAG Port is for automated factory testing and to facilitate downloading the application program into Flash memory. This feature requires the GW16099 USB JTAG Programmer. The JTAG programming port also includes the CPU UART[2] interface in a logic-level configuration. This serial port facilitates an operator console though the USB JTAG Programmer. See ordering options for more information. Refer to Section 3 for USB JTAG Programmer instructions.

Pin	Signal	Pin	Signal
1	JTAG TRST	2	3.3V
3	JTAG TDI	4	Ground
5	JTAG TMS	6	UART[2]:TXD (logic level)
7	JTAG TCK	8	UART[2]:RXD (logic level)
9	JTAG TDO	10	System Reset

JTAG Programming Port and Serial Console Connector

3. SOFTWARE

3.1. Getting Started

The board is factory configured with the U-boot loader and Ubuntu Linux programmed into Flash memory. The software can be configured by using the console through the JTAG serial port or over Ethernet using a Telnet session. Follow the http://trac.gateworks.com/wiki/gettingstarted link for additional software information.

3.2. Gateworks System Controller

The GSC Gateworks System Controller is a custom battery-backed micro-controller designed by Gateworks to implement many of the embedded features found on the board. A complete list of GSC features is shown in the table below. The GSC communicates with processor I2C interface and the GPIO signal configured as an interrupt. Follow the http://trac.gateworks.com/wiki/gsc link for complete GSC programming information.

Function	Support
Real Time Clock	Yes
Voltage & Temperature Monitor	Yes
Configuration EEPROM	Yes
Fan Controller	No
System Specialized Functions	----
GPS Antenna Fault Monitoring	No
USB OTG System Boot	Yes
Panel LED	Yes
External Status LED	No
Panel Pushbutton Switch	Yes
External Pushbutton Switch	No
External Tamper Switch	Yes
Encryption Key Support	Yes
Programmable Sleep & Wake-up	Yes
GSC Flash CRC	Yes
GSC Revision	Yes

Gateworks System Controller Supported Functions

3.3. JTAG Programming

One method of programming the Flash with application software is through the JTAG programming interface using the GW16099 USB JTAG Programmer. The GW16099 USB JTAG Programming Adapter transfers the application software from the developer's computer to the flash memory. Follow the http://trac.gateworks.com link for JTAG programmer instructions. The GW16099 programmer is included in development kits of available

3.4. Manufacturer's Website Links / Support Mailing List

This section provides relevant links. Gateworks is committed to open source software.

Links

Product Change Notification (PCN): http://trac.gateworks.com/wiki/pcn.
Gateworks Quick Start: http://www.gateworks.com/quickstart
Gateworks Board Support Packages: http://trac.gateworks.com
Linux: http://www.linux.org/
OpenWrt: http://openwrt.org
U-Boot: http://u-boot.sourceforge.net
Ubuntu: https://ubuntu.com/
Gateworks Software Source: https://github.com/gateworks

4. SPECIFICATIONS

4.1. Electrical

Parameter Operating Voltage	Specification	
	Min	**Max**
Input Voltage Range		
Barrel Jack	8VDC	60VDC
Passive PoE	8VDC	60VDC
Active 802.3at PoE	36VDC	57VDC
Digital I/O – VIH	2.3VDC	3.6VDC
Digital I/O – VIL	0	1.0VDC
Digital I/O – VOH (IOH = 9.6mA)	1.44VDC	1.8VDC
Digital I/O – VOH (IOH = 12mA)	2.2VDC	3.3VDC
Digital I/O – VOL (IOL = 2mA)	0	0.36VDC
Digital I/O – VOL (IOL = 2mA)	0	0.66VDC

Parameter Operating Current@25°C	Specification	
	Typ	**Max**
Input Current (no Mini-PCIe cards)	0.25A @ 24VDC	

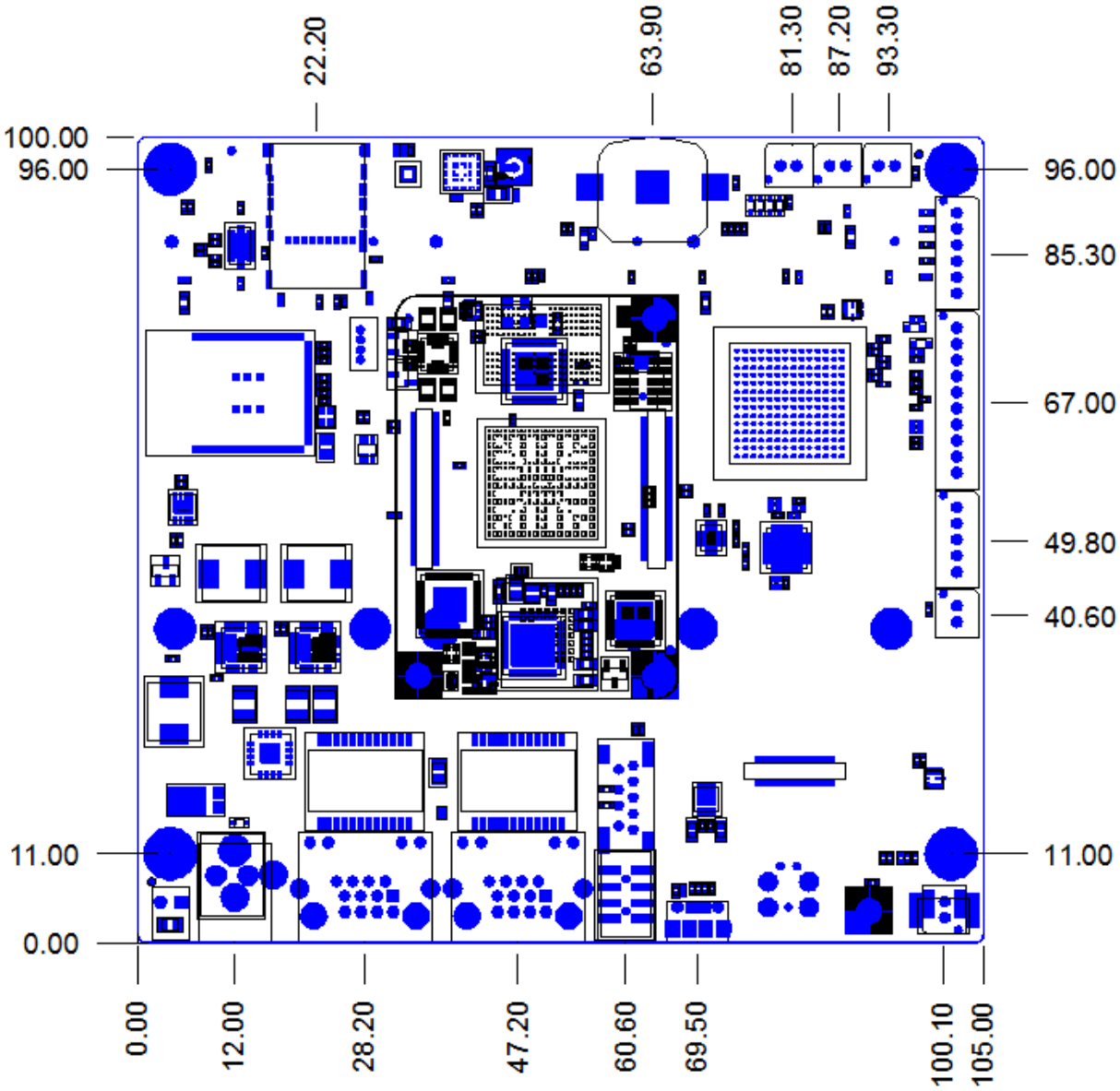
4.2. Environmental

Parameter	Specification
Operating Temperature	-40°C to +85°C
Storage Temperature	-40°C to +85°C
Non-condensing Relative Humidity	Less than 95% at 40°C
Mean Time Between Failure	TBD years at 55°C

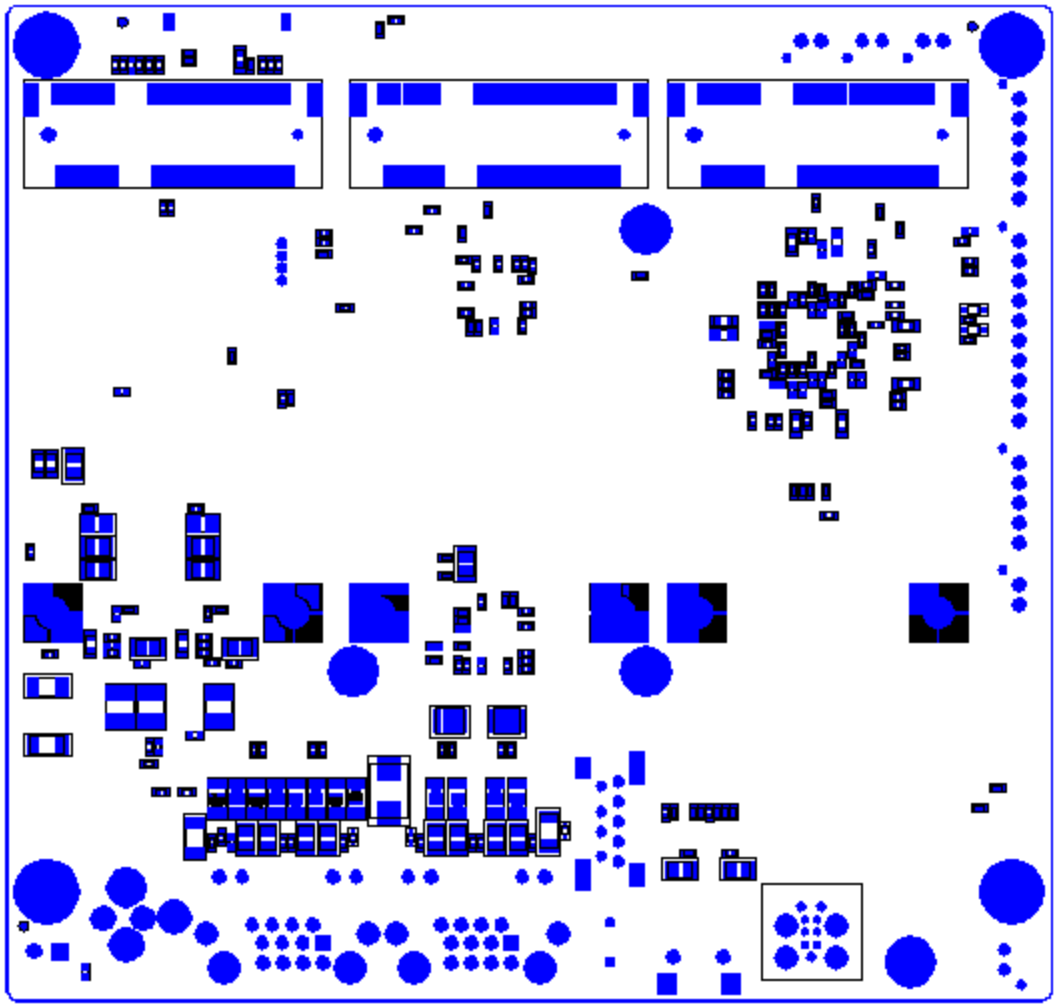
4.3. Mechanical

Parameter	Specification
Dimensions, Length x Width	105 x 100.0mm (4.1 x 3.93in)
Dimensions, Height	
Top Side	15.5mm (0.61in)
Bottom Side	6mm (0.24in)
Total including circuit board	23mm (0.91in)
Weight	4 ounces (113g)

Note a 3D model is available for download on the Gateworks website on the respective product page under the Documentation tab.



Top Side with Mechanical Dimensions



Bottom Side

5. CUSTOMER SUPPORT

5.1. Product Revision History

View revision history online at the Gateworks Wiki SBC Revision page:
http://trac.gateworks.com/wiki/sbcrevisions

5.2. Technical Assistance

Gateworks technical support staff is available to assist you with questions that you may have. Please contact Gateworks using one of the methods shown below.

Phone: (805) 781-2000
Email: support@gateworks.com
Website: http://www.gateworks.com

5.3. Warranty

Standard hardware warranty period is one year from the date of purchase. Gateworks will, solely at its option, repair or replace products, which prove to be defective in materials or workmanship, provided they are returned to a Gateworks authorized repair center. Shipment to Gateworks is at the customer's expense. Gateworks pays return shipping by ground.

Products, which in Gateworks opinion, have been subject to misuse, abuse, neglect or unauthorized alteration or repair are excluded from this warranty.

Products not manufactured by Gateworks are limited to the warranty provided by the original manufacturer and should be returned to the manufacturer in case of defect. Software is licensed AS IS.

The liability of Gateworks under this agreement is limited to a refund of the purchase price of the product. In no event shall Gateworks be liable for loss of profits or other damage.

5.4. Return for Repair

You must obtain a Returned Material Authorization (RMA) number before sending any product to Gateworks. Please contact Gateworks using one of the methods shown below to obtain an RMA number. Please be ready with your name, telephone number, company name, company address, shipping address, invoicing address, product serial number, and a technical description of the problem. A service charge will be applied to units that are out of warranty. Please pack the unit being returned in anti-static material and ship in a sturdy cardboard box with adequate packing material. Mark the RMA number clearly on the outside of the box before returning.

Phone: (805) 781-2000

Fax: (805) 781-2001
Email: support@gateworks.com
Website: http://www.gateworks.com
Address: 3026 South Higuera Street, San Luis Obispo, CA 93401

5.5. Life Support Policy

Gateworks products are not authorized for use as critical components in life support devices or systems without the express written approval of the president of Gateworks Corporation. Refer to the following for definitions of critical components and life support devices.

1. A critical component is any component of a life support device or system whose failure to perform can be expected to cause the failure of the life support device or system, affect its safety, or limit its effectiveness.

2. Life support devices or systems are devices or systems which support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.

5.6. Copyright & Trademarks

END OF DOCUMENT