Quality fanless computers

fit-PC4

Hardware Specification

Quality fanless computers

Legal Notice

CompuLab Ltd.
17 HaYetsira St., Yokneam Elite 20692,
P.O.B 687
ISRAEL
Tel: +972-4-8290100
http://www.compulab.co.il
http://fit-pc.com/web/
Fax: +972-4-8325251

Quality fanless computers

Revision History

Revision	Engineer	Revision Changes
1.0	Maxim Birger	Initial public release based on fit-PC4 HW Rev1.1
1.1	Maxim Birger	Based on fit-PC4 HW Rev1.2: a. Major improvement in power consumption values
1.2	Maxim Birger	Installing RAM memory instructions update

Quality fanless computers

Table of Contents

Table of Figures

Table of Tables

1 Introduction

1.1 About This Document

This document is part of a set of reference documents providing information necessary to operate Compulab's fit-PC4 computers.

1.2 Reference

For additional information not covered in this manual, please refer to the documents listed in ***Table 1***.

Table 1 – Reference Documents

Document	Location
FACE Module HW Specifications	http://fit-pc.com/download/face-modules/documents/face-modules-hw-specifications.pdf
AMD Virtualization Technology	http://sites.amd.com/uk/business/it-solutions/virtualization/Pages/amd-v.aspx

1.3 Terms and Acronyms

Table 2 – Terms and Acronyms

Term	Definition
APM	Advanced Power Management
APU	Accelerated Processing Unit
B2B	Board to Board (connectors)
BER	Bit error rate
bps	Bits per second
BT	Bluetooth
CAN	Controller Area Network
Codec	Coder decoder
DDR	Dual data rate
DMA	Direct Memory Access
DSP	Digital signal processor
FACE Module	**F**unction **A**nd **C**onnectivity **E**xtension Module
FCH	Platform Controller Hub
FM-xxxx	FACE Module – *connectivity options*
GB/s	Gigabytes per second
GPIO	General-purpose input/output
GT/s	Giga Transfers per second (throughput)
HW	Hardware
JTAG	Joint Test Action Group (ANSI/ICEEE Std. 1149.1-1990)
kbps	Kilobits per second
LAN	Local Area Network
MB/s	Megabytes per second
Mbps	Megabits per second
MT/s	Mega Transfers per second (throughput)
NVM	Non Volatile Memory
OTP	One Time Programmable
PCM	Pulse-coded Modulation
PEG	PCI Express Graphics
Rx	Receive
SCH	System Controller Hub
SDRAM	Synchronous dynamic random access memory
SoC	System-on-Chip
SPI	Serial peripheral interface
Tx	Transmit
UART	Universal asynchronous receiver transmitter
USB	Universal serial bus
USB-OTG	Universal serial bus on-the-go
USIM	UMTS subscriber interface module
VCTCXO	Voltage-controlled temperature-compensated crystal oscillator
WLAN	Wireless Local Area Network
XO	Crystal oscillator

2 System Overview

2.1 Highlights

Fit-PC4 is fully functional miniature computer based on AMD Embedded G-Series 64-bit dual and quad cores System-on-Chip.

Together with powerful AMD Radeon HD graphics engine, rich peripherals and connectivity options, completely fanless design delivers outstanding performance at lowest power consumption. The product offered in two SoC SKUs, offering low-end and mid-end processing power.

Cost/Performance ratio, low-power, rich I/O, miniature rugged design and cost competitiveness position fit-PC4 as an attractive solution for a wide range of applications – industrial control and automation, networking and communications infrastructures, media players and media centers, IPTV, infotainment system, digital signage and smart kiosks, gaming or small-footprint desktop replacement.

2.2 Specifications

Table 3 – Platform Specifications

Feature	Specifications
Processor	AMD Embedded G-Series (FT3) SoC: A4-1250 and GX-420CA
	Dual/Quad core 64-bit
	Clock speed 1GHz – 2GHz **(Note 1)**
	8W TDP (Value models) 25W TDP (Pro models)
Chipset	CPU and Chipset on the same die
Memory	Up to 16GB (2x 8GB) DDR3/DDR3L/DDR3U-1333/1600
	2x SO-DIMM 204-pin memory modules
Storage	1x SATA up to 6 Gbps (SATA 3.0) for internal 2.5” HDD/SSD, HDD to be used 5400rpm only
	1x mSATA slot up to 6 Gbps (SATA 3.0)
Advanced Technologies	AMD Virtualization Technology
Operating Systems	Windows 7/8, 32-bit and 64-bit Linux 32-bit and 64-bit Embedded OS

Table 4 – Display and Graphics Specifications

Feature	Specifications
GPU	AMD Radeon HD8210/ HD8400E (Value/Pro models) Dual display mode supported
Video Output 1	HDMI 1.4a up to 1920 x 1200 @ 60Hz
Video Output 2	HDMI 1.4a up to 1920 x 1200 @ 60Hz

Table 5 – Audio Specifications

Feature	Specifications
Codec	Realtek ALC886 HD audio codec
Audio Output	Analog stereo output Digital 7.1+2 channels S/PDIF output 3.5mm jack
Audio Input	Analog stereo Microphone input Digital S/PDIF input 3.5mm jack

Table 6 – Networking Specifications

Feature	Specifications
LAN	2x GbE LAN ports (extendable up to 3) LAN1: Intel I211 GbE controller (RJ-45) LAN2: Intel I211 GbE controller (RJ-45) LAN3-6: Depends on FACE Module installed **(Note 2)**
Wireless	Value Models WLAN 802.11 b/g/n (2.4GHz AzureWave AW-NB057H module) Bluetooth 3.0 + HS Pro Models WLAN 802.11ac (2.4/5GHz dual band Intel 7260HMW module) Bluetooth 4.0

Table 7 – Connectivity Specifications

Feature	Specifications
USB	2x USB 3.0 6x USB 2.0
Serial	1x RS232 serial communication COM1: Full RS232 via mini serial connector
SD	Micro-SD slot support SD/SDHC/SDXC cards Transfer rates up to 25 MB/s (50MHz clock)
Special I/O	1x micro SIM slot (6 pins)
Expansion	Half/Full-size mini-PCIe socket Half/Full-size mini-PCIe/mSATA socket **(Note 4)**

Table 8 – Mechanical and Environmental Specifications

Feature	Specifications
Input Voltage	Unregulated 10 – 15VDC input **(Note 5)**
Power Consumption	5W – 11W (Value models) 6W – 24W (Pro models)
Operating Temperatures	1. Commercial HDD models: 0°C – 50°C SSD models: 0°C – 70°C 2. Extended (TE) SSD models only: -20°C – 70°C 3. Industrial (TI) SSD models only: -40°C – 70°C
Enclosure Material	Die Cast Aluminum
Cooling	Passive Cooling Fanless Design
Dimensions	16cm x 16cm x 2.5cm (Value models) 19cm x 16cm x 4cm (Pro models)
Weight	1067/1100gr (Value/Pro model barebones)

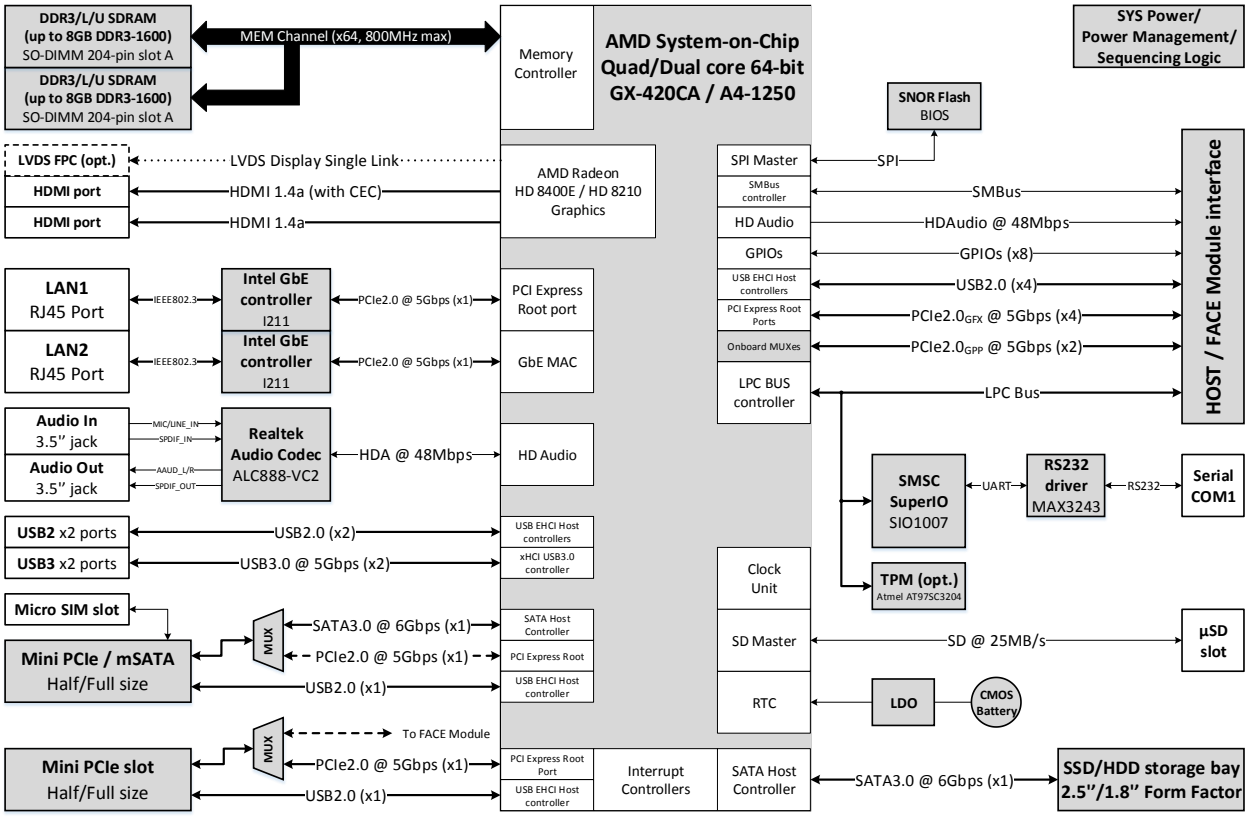
Notes:

1. For full processors specifications based on fit-PC4 model, please refer to models and platform SKU ***Table 9***.
2. Option for additional 1x GbE LAN port. LAN3-6 based on FACE Module installed:
    a. FM-4USB: Default
    b. FM-1LAN: LAN3 RTL8111F-CG GbE controller (RJ-45), LAN4-6: N/A
    c. FM-4LAN: Not Supported
    d. FM-POE: Not Supported
3. FACE Module HW specifications document - Table 1.
4. Shared with mSATA. Refer to ***Figure 15***.
5. Nominal input voltage: 12V

2.3 System Block Diagram

Fit-PC4 system Top Level Block Diagrams are shown below. Later chapters in this document describe functions and entities shown in the below diagrams.

Figure 1 – fit-PC4 Top Level Block Diagram



2.4 Models and Platform SKUs

Table 9 – Models and Platform SKUs

Model	Value	Pro
Processor/SoC	AMD Embedded SoC, A4-1250	AMD Embedded SoC, GX-420CA
Core Clock	1.0GHz	2.0GHz
Cores	64-bit dual core	64-bit quad core
TDP	8W	25W
Chipset	None	None
Graphics	AMD Radeon HD 8210	AMD Radeon HD 8400E

3 Platform

3.1 SoC Overview

The AMD Embedded G-Series SOC platform is a high-performance, low-power System-on-Chip (SOC) design, featured with DDR3 memory support, dual and quad core variants, integrated discrete-class GPU and I/O controller on the same die.

The AMD G-Series SOC achieves superior performance per watt in the low-power x86 microprocessor class of products when running multiple industry standard benchmarks. This helps enable the delivery of an exceptional HD multimedia experience and provides a heterogeneous computing platform for parallel processing. The small-footprint, capable SOC sets the new foundation for a power-efficient platform for content-rich multimedia processing and workload processing that is well-suited for a broad variety of embedded applications.

3.1.1 Superior Performance per Watt

The AMD Embedded G-Series SOC platform delivers an exceptionally high-definition visual experience and the ability to take advantage of heterogeneous computing while maintaining a low-power design.

- AMD G-Series SOC's next-generation "Jaguar" based CPU offers 113% improved CPU performance vs. AMD G-Series APU and greater than a 2x (125%) advantage vs. Intel Atom when running multiple industry-standard compute intensive benchmarks.
- AMD G-Series SOC's advanced GPU, supporting DirectX®11.1, OpenGL 4.2 and OpenCL™1.29, enables parallel processing and high-performance graphics processing that provides up to 20% improvement vs. AMD G-Series APU and a 5x (430%) advantage vs. Intel Atom when running multiple industry-standard graphics-intensive benchmarks.
- Excellent compute and graphics performance with enhanced hardware acceleration delivers up to 70% overall improvement vs. AMD G-Series APU and over 3x (218%) the overall performance advantage vs. Intel Atom in embedded applications when running multiple industry standard compute- and graphics-intensive benchmarks.

3.1.2 Enabling Low-Power, Innovative Small Form Factor Designs

The AMD G-Series SOC is a small footprint and low-power solution that reduces overall system costs.

- The SOC design offers 33% footprint reduction compared to AMD G-Series APU two-chip platform5, simplifying design with fewer board layers and simplified power supply.
- AMD G-Series SOC enables fan-less design that further helps drive down system cost and enhance system reliability by eliminating moving parts.
- With an array of performance options, the AMD G-Series SOC platform allows OEMs to utilize a single board design to enable solutions from entry-level to high-end.
- The SOC design enables new levels of performance in small SBC (single board computer) and COMs (computer-on-modules) form factors.

3.1.3 Highlights and Features

Highlights

First generation SOC design:

- Delivers up to 70% overall improvement over AMD G-Series APU
- Integrates Controller Hub functional block as well as CPU+GPU+NB
- 28nm process technology, 24.5mm x 24.5mm BGA package

"Jaguar" CPU core with performance increases:

- Dual-core and quad-core, up to 2MB shared L2
- 113% CPU performance improvement over AMD G-Series APU

Next generation graphics core with performance increase over previous generations:

- 20% compute performance improvement over AMD G-Series APU when running multiple industry-standard graphics intensive benchmark
- DirectX®11.1 graphics support

Features

- Two/Four high performance integrated x86 execution cores
- A 32-kB instruction and 32-KB data first-level cache (L1) for each core
- Up to 2MB shared instruction / data second-level cache (L2) for each core
- Compatible with Existing 32-bit x86 and 64-bit AMD64 Code Base
  - Including support for SSE, SSE2, SSE3, SSE4a,SSE4.1, SSE4.2, SSSE3, ABM, AVX, AES, BMI, XSAVE/XRSTOR, XGETBV/XSETBV, PCLMULQDQ, MOVBE, POPCNT, F16C, MMX™, and legacy x86 instructions
- Dedicated 128-bit floating-point unit (FPU)
- AMD Virtualization™ technology (AMD-V™)
- Integrated Memory Controller
  - DDR3 SDRAM: Compliant with JEDEC DDR3 1.5V, DDR3L 1.35V, and DDR3U 1.25V
  - DDR3 1.5V and DDR3L 1.35V up to 1600 MT/s, DDR3U 1.25V up to 1333 MT/s
  - 64-bit DDR3 SDRAM controller operating at throughputs up to 1600 MT/s (800 MHz)
  - Supports up to two dual-rank SODIMMs or unbuffered DIMMs
  - Theoretical max BW of 10.6 GB/s assuming DDR3 SDRAM 1333 MT/s
  - Theoretical max BW of 12.8 GB/s assuming DDR3 SDRAM 1600 MT/s
- Integrated graphics processor
- Power management
  - Multiple low-power states
  - System Management Mode (SMM)
  - ACPI-compliant, including support for processor performance states (P-states)
  - Supports processor power states C0, C1, CC6, and PC6
  - Supports sleep states including S0, S3, S4, and S5

3.2 Graphics Processor

This section lists the graphics features available for the AMD Embedded G-Series SoC.

3.2.1 Graphics Features

- AMD Radeon HD8400E GPU Core architecture for Pro models
- AMD Radeon HD8210 GPU Core architecture for VALUE models
- Dedicated graphics memory controller
- 2D Acceleration
  - Highly-optimized 128-bit engine, capable of processing multiple pixels per clock
- 3D Acceleration
  - DirectX® 11.1 compliant, including full speed 32-bit floating point per component operations
  - Support for OpenCL™ 1.2
  - Support for OpenGL 4.1/4.1+
- Motion Video Acceleration Features
  - Dedicated hardware (UVD 3) for H.264, MPEG4, VC-1, MVC and MPEG2 decode
  - Microsoft DirectX video acceleration (DXVA) API (application programming interface) for Windows operating system
  - Video scaling and YCrCb to RGB color space conversion for video playback and fully adjustable color controls
  - Motion adaptive and vector based de-interlacing filter eliminates video artifacts caused by displaying interlaced video on non-interlaced displays, and by analyzing image and using optimal de-interlacing functions on a per-pixel basis
  - HD HQV and SD HQV support: noise removal, detail enhancement, color enhancement, cadence detection, sharpness, and advanced de-interlacing
  - Advanced up-conversion for SD to HD resolutions

3.2.2 Display Interface

Display interface is fully integrated inside the chip. The SoC houses memory interface, display planes, pipes, transcoders and display interface. The number of planes, pipes, and transcoders decide the number of simultaneous and concurrent display devices that can be driven on a platform. Fit-PC4 SoC system architecture provides three Digital Ports. Each Digital Port can transmit data according to one or more protocols. Fit-PC4 Digital Ports configured to drive two HDMI displays. Each digital port has control signals that may be used to control, configure and/or determine the capabilities of an external device. Fit-PC4 design supports one or two simultaneous independent and concurrent display configurations, when two displays supported natively and for additional 3rd display provision is given.

For further display interface information refer to sections 5.2 and 5.3 .

3.2.3 PCI Express* Controller

The SoC provides 6 PCI Express Root Ports, supporting the PCI Express Base Specification, Revision 2.0. Four single lane General Purpose Ports (GPP) and one configurable GFX port (single/dual/quad lane).

Each Root Port lane supports up to 5 Gbps bandwidth in each direction (10 Gbps concurrent). Supports L0s and L1 link power states for power saving.

Implemented ports:

- 2x PCIe GPP root ports dedicated for Intel I211 GbE controllers
- 1x PCIe GPP root port shared with SATA and routed via MUX to mSATA slot or FACE Module
- 1x PCIe GPP root port shared between mini PCIe slot and FACE Module
- 4x PCIe GFX root ports routed to FACE Module (allows 1x1, 1x2, 1x4 configurations)

3.3 Integrated Controller Hub

The ICH provides extensive I/O support. Functions and capabilities include:

- Universal Serial Bus (USB) versions 1.1, 2.0, and 3.0
- Serial ATA revision 2.0, 3.0 (up to 6 Gb/s)
- Secure Digital (SD) 3.0 support SD/SDHC/SDXC cards
- System Management Bus (SMBus) controller, with additional support for I2C devices
- Low Pin Count (LPC) bus
- High Definition Audio
- Serial IRQ
- Serial Peripheral Interface (SPI)
- Advanced Configuration and Power Interface (ACPI)
- Functions
  - Real-Time Clock (RTC)
  - Programmable Interrupt Controller (PIC)
  - System Management Interrupt (SMI)
  - General-Purpose I/O (GPIO)
  - Power Management
  - Watchdog Timer (WDT)
  - Integrated Clock Generator

3.3.1 Serial ATA (SATA) Controller

The integrated Serial ATA controller processes host commands and transfers data between the host and Serial ATA devices. It supports two independent Serial ATA channels. Each channel has its own Serial ATA bus and supports one Serial ATA device. With respect to the transfer rate, the integrated SATA controller supports 1st generation (1.5 Gbps), 2nd generation (3 Gbps) and 3rd generation (6 Gbps) SATA transfer rates. The SATA controller operate in AHCI mode.

3.3.1.1 AHCI

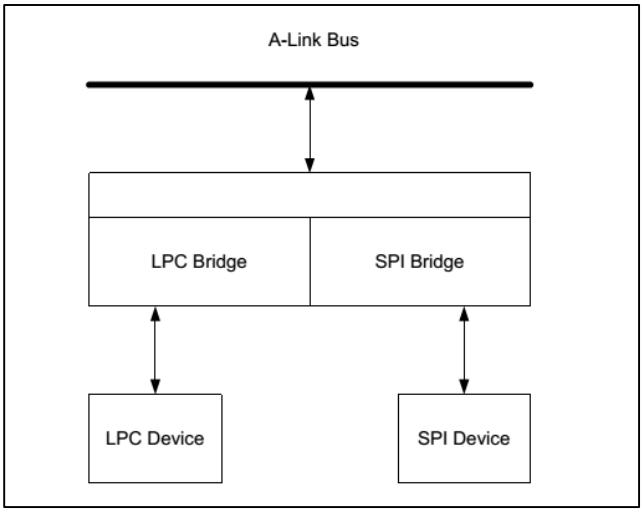
The ICH provides hardware support for Advanced Host Controller Interface (AHCI), a standardized programming interface for SATA host controllers. Platforms supporting AHCI may take advantage of performance features such as no master/slave designation for SATA devices—each device is treated as a master—and hardware assisted native command queuing. AHCI also provides usability enhancements such as Hot-Plug. AHCI requires appropriate software support (such as, an AHCI driver) and for some features, hardware support in the SATA device or additional platform hardware.

3.3.2 Low Pin Count (LPC) Bridge

The Low Pin Count (LPC) bus interface is a cost-efficient, low-speed interface designed to support low-speed legacy (ISA, X-bus) devices. The LPC interface essentially eliminates the need of ISA and X-bus in the system. A typical setup of the system with LPC interface is shown in ***Figure 2***. Here the ISA bus is internal to SoC and is used for connecting to the legacy Direct Memory Access (DMA) logic. The LPC host controller is typically integrated into the SoC. It connects to the internal A-Link bus on one side and the LPC and Serial Peripheral Interface (SPI) buses on the other side.

The ISA interface is only used for legacy DMA operation.

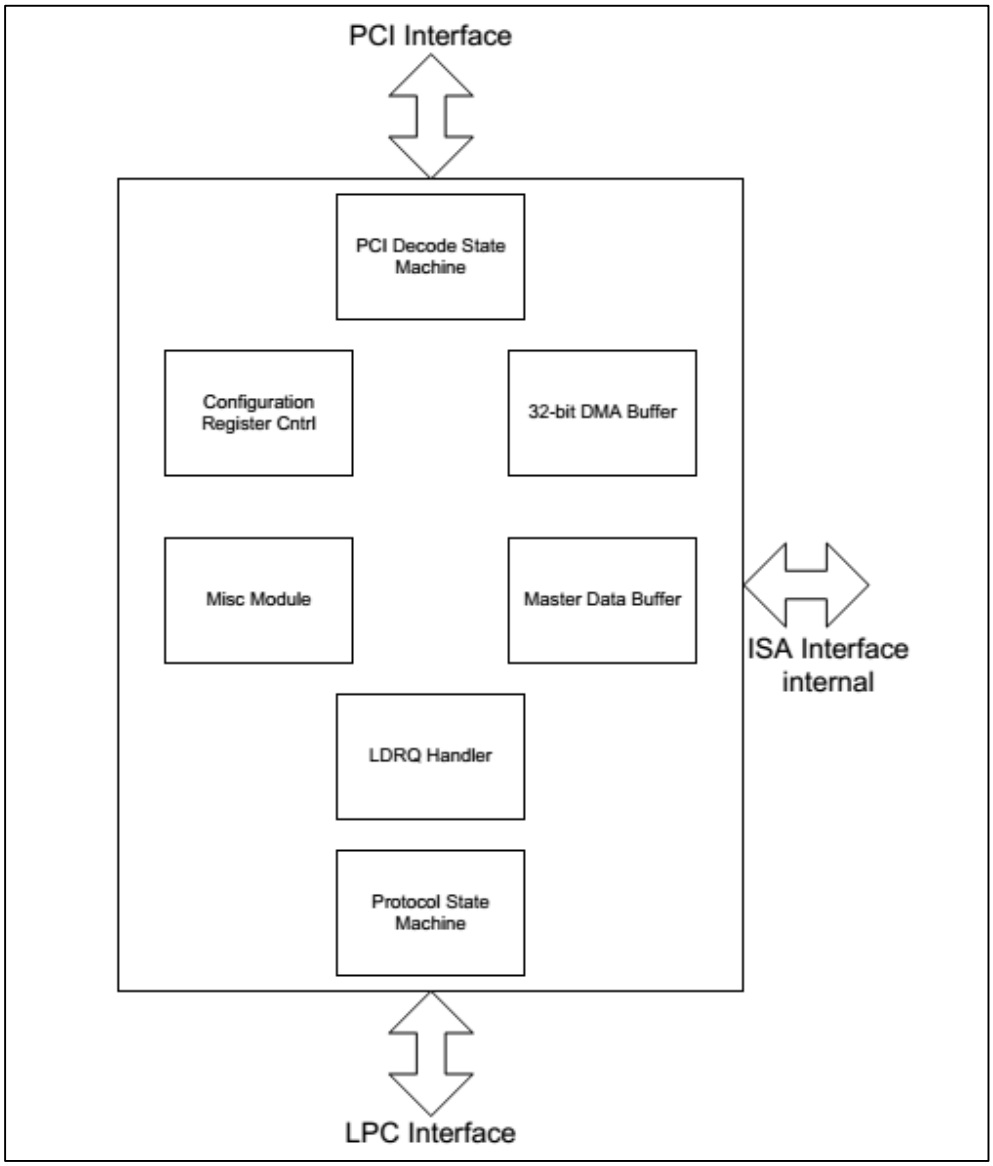
Figure 2 – Typical LPC Bus System



Examples of LPC devices include Super I/O (disk controller, keyboard controller), BIOS RAM, audio, Trusted Platform Module (TPM), and system management controller. A BIOS ROM can also be populated on the SPI interface.

LPC host controller has the A-Link bus on one side and the LPC bus on the other. The host controller supports memory and I/O read/write, DMA read/write, and bus master memory I/O read/write. It supports up to two bus masters and seven DMA channels.

Figure 3 – Block Diagram of LPC Module



3.3.3 Universal Serial Bus (USB) Controllers

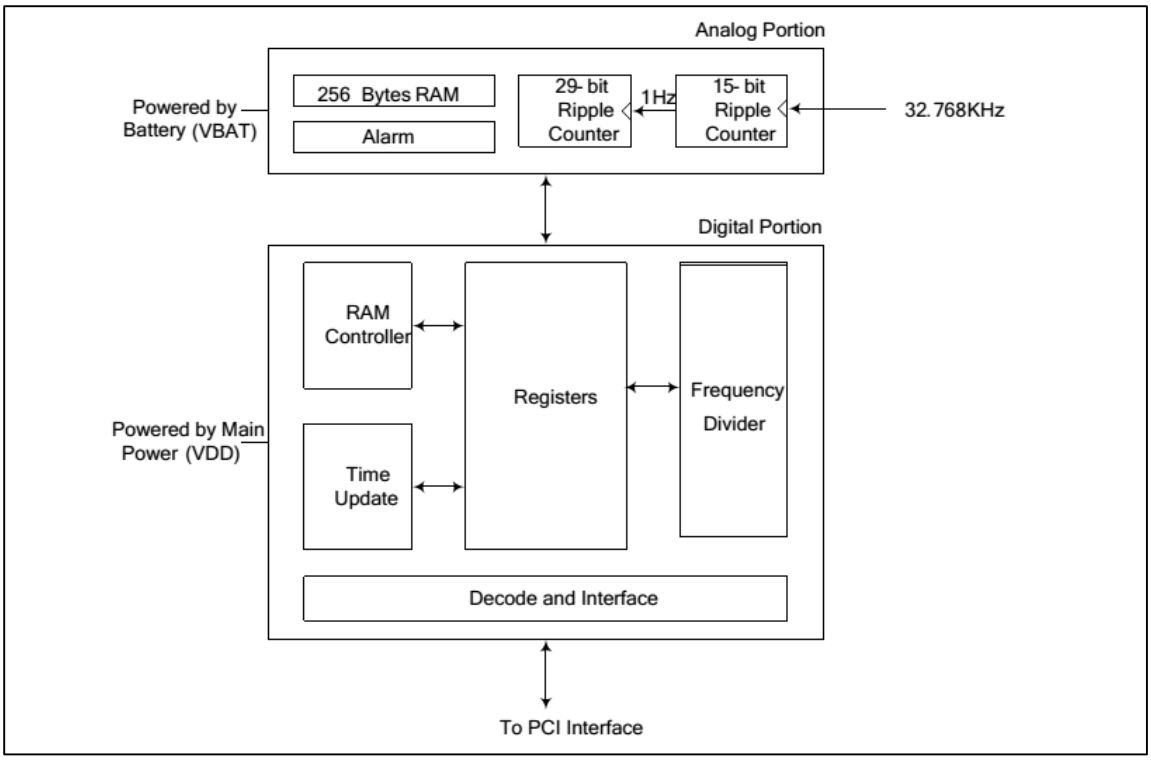
The SoC contains OHCI and EHCI host controllers to support eight USB2.0 ports that support high-speed signaling and two USB3.0 ports running at super-speed rates. High-speed USB2.0 allows data transfers up to 480 Mbps, while USB3.0 ports allow transfer rates up to 5Gbps. Supports ACPI S1 ~ S4, USB keyboard/mouse functionality for legacy Operating Systems, USB debug port and individual port disable capability.

3.3.4 RTC

The Real Time Clock (RTC) updates the computer's time and generates interrupts for periodic events and pre-set alarm. The RTC also makes hardware leap year corrections. SoC's RTC includes a 256-byte CMOS RAM, which is used to store the configuration of a computer such as the number and type of disk drive, graphics adapter, base memory, checksum value, etc.

The internal RTC is made of two parts—one part is an analog circuit, powered by a battery VBAT, and the other is a digital circuit, powered by a main power VDD. ***Figure 4*** shows the block diagram of the internal RTC. It contains hardware-based daylight saving feature and makes adjustments (spring forward or fall back) at the designated dates/times. Both the date and hour for the daylight and standard time are fully programmable, allowing for different daylight saving dates and hours for different parts of the world.

Figure 4 – RTC Block Diagram



3.3.5 GPIO

Various general purpose inputs and outputs are provided for custom system design. Refer to section 0.

3.3.6 System Management Bus (SMBus)

The SoC contains SMBus Host interface that allows it to communicate with SMBus slaves. This interface is compatible with most I2C devices.

3.3.7 High Definition Audio Controller

The High Definition (HD) Audio Controller communicates with the external HD Audio codec over the HD Audio Link. The HD Audio Controller consists of few independent output DMA engines and few independent input DMA engines that are used to move data between system memory and the external codec. The controller can support up to four audio or modem codec in any combinations.

3.3.8 Integrated Clock Generator

“Kabini” SoC has an integrated system clock generator that can be used to generate the required system clocks, thus eliminating the need for an external clock generator. However, it does support a mode of operation that allows an external clock generator to be used in the system. The clock generator mode is selected by a power-on configuration strap.

3.4 System Memory

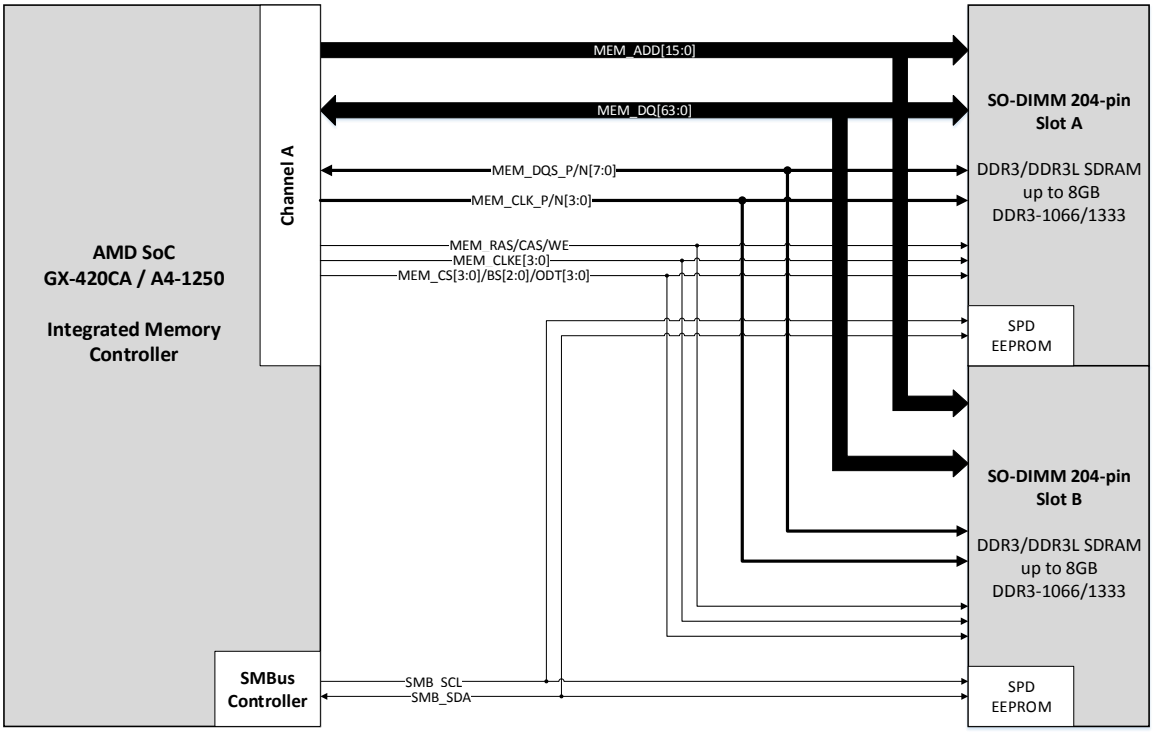
3.4.1 Integrated Memory Controller

SoC Memory Controller supports DDR3, DDR3L and DDRU protocols with single 64-bit wide channel, accessing one or two DIMMs. It supports one or two, unbuffered non-ECC 204-pin SO-DIMMs.

GX-420CA supports up to DDR3/DDR3L-1600 and up to DDR3U-1333 memories speeds.

A4-1250 supports up to DDR3/DDR3L/DDR3U-1333 memories speeds.

Figure 5 – Memory Interface



Fit-PC4 system architecture provides support for DDR3 (1.5V), DDR3L (1.35V) and DDR3U (1.25V) SO-DIMMs. The adjustment of power rail for the memories and Memory Host Controller IOs is performed automatically without user or BIOS intervention. During boot SMBus Host Controller reads serial presence-detect (SPD) EEPROM on each SO-DIMM and adjust the voltage according to memory type. In case DDR3/DDR3L/DDR3U mixed memory modules are placed, the BUCK regulator will generate 1.5V output voltage, which may cause undesired behavior or permanent damage of the modules, unless DDR3L memory is tolerant to such voltages.

Notes:

1. It is important to keep both slots populated with the same memory technology.
2. If single SO-DIMM to be used, it should populate the slot closer to an edge (P7) of the PCB.

3.4.2 System Supported Memory

- DDR3 SDRAM memory with unbuffered SO-DIMM 204-pin modules
- Up to 16GB (2x 8GB) DDR3/DDR3L/DDR3U-1333/1600
- Supports up to two dual-rank SO-DIMMs
- Non-ECC, Unbuffered DDR3 SO-DIMMs only
- System Memory Interface I/O Voltage of 1.5V, 1.35V and 1.25V
- DDR3 SDRAM SO-DIMMs running at 1.5 V, 1.35V and 1.25V
- Single 64-bit wide channel
- Theoretical maximum memory bandwidth of:
  — 10.6 GB/s assuming DDR3 SDRAM 1333 MT/s
  — 12.5 GB/s assuming DDR3 SDRAM 1600 MT/s
- 1Gb, 2Gb, and 4Gb DDR3 SDRAM device technologies are supported
  — Standard 1-Gb, 2-Gb, and 4-Gb technologies and addressing are supported for x16 and x8 devices. There is no support for memory modules with different technologies or capacities on opposite sides of the same memory module. If one side of a memory module is populated, the other side is either identical or empty.
- On-Die Termination (ODT)

Table 10 – Supported Memory Technologies

Raw Card Version	DIMM Capacity	DRAM Device Technology	DRAM Organization	# of DRAM Devices	# of Physical Device Ranks	# of Row/Col Address Bits	# of Banks Inside DRAM	Page Size
A	2 GB	2 Gb	128 M x 16	8	2	14/10	8	8K
	4 GB	4 Gb	256 M x 16	8	2	15/10	8	8K
B	1 GB	1 Gb	128 M x 8	8	1	14/10	8	8K
	2 GB	2 Gb	256 M x 8	8	1	15/10	8	8K
	4 GB	4 Gb	512 M x 8	8	1	16/10	8	8K
C	1 GB	2 Gb	128 M x 16	4	1	14/10	8	8K
	2 GB	4 Gb	256 M x 16	4	1	15/10	8	8K
F	2 GB	1 Gb	128 M x 8	16	2	14/10	8	8K
	4 GB	2 Gb	256 M x 8	16	2	15/10	8	8K
	8 GB	4 Gb	512 M x 8	16	2	16/ 10	8	8K

3.4.3 System Memory Organization Modes

The IMC supports single-channel organization mode only.

3.4.4 Rules for Populating Memory Slots

The frequency and latency timings of the system memory is the lowest supported frequency and slowest supported latency timings of all memory SO-DIMM modules placed in the system.

3.4.5 AMD Evaluated DDR3 SDRAM Modules (Examples)

1600@1.5V

	DIMM Module				DRAM Component					Testing Data	
	Mfg	PN	Capacity	Rank/Width	Mfg	PN	Rev	IC Capacity	IC Date Code	Speed/Config	Date tested
Kabini FT3	Micron	MT4JTF25664HZ-1G6E1	2GB	1Rx16	Micron	MT41K256M16HA-125:E	E	4Gb	1222	1600/2DPC	4/10/2013
		MT8JTF51264HZ-1G6E1	4GB	1Rx8		MT41K512M8RH-125:E	E	4Gb	1216	1600/2DPC	4/10/2013
	SK Hynix	HMT451S6AFR8C-PB	4GB	1Rx8	SK Hynix	H5TC4G83AFR-PBA	A	4Gb	1247	1600/2DPC	4/10/2013
	Ramaxel	RMT3170EB68F9W-1600	4GB	1Rx8	Elpida	EDJ4208EBBG-GN-F	B	4Gb	1223	1600/2DPC	4/28/2013

BOLD = New Entry

1600@1.35V

	DIMM Module				DRAM Component					Testing Data	
	Mfg	PN	Capacity	Rank/Width	Mfg	PN	Rev	IC Capacity	IC Date Code	Speed/Config	Date tested
Kabini FT3	Ramaxel	RMT3170ED58F8W-1600	2GB	1Rx8	Elpida	EDJ2108BDBG-GN-F	D	2Gb	1243	1600/1DPC	1/28/2013
		RMR3170MJ68F9F-1600	4GB	1Rx8	Micron	MT41K512M8RH-125:J	J	4Gb	1252	1600/1DPC	4/28/2013
	Elpida	EBJ40UG8EFU0-GN-F	4GB	1Rx8	Elpida	EDJ4208EFBG-GN-F	F	4Gb	1229	1600/1DPC	4/19/2013

BOLD = New Entry

1333@1.5V

	DIMM Module				DRAM Component					Testing Data	
	Mfg	PN	Capacity	Rank/Width	Mfg	PN	Rev	IC Capacity	IC Date Code	Speed/Config	Date tested
Kabini FT3	Micron	MT16JTF1G64HZ-1G6E1	8GB	2Rx8	Micron	MT41K512M8RH-125:E	E	4Gb	1308	1333/1DPC	4/1/2013

BOLD = New Entry

1333@1.35V

	DIMM Module				DRAM Component					Testing Data	
	Mfg	PN	Capacity	Rank/Width	Mfg	PN	Rev	IC Capacity	IC Date Code	Speed/Config	Date tested
Kabini FT3	Elpida	EBJ41UG6EFU0-GNL-F	4GB	2Rx16	Elpida	EDJ4216EFBG-GNL-F	F	4Gb	1246	1333/2DPC	3/11/2013
		EBJ40UG8EFU0-GN-F	4GB	1Rx8		EDJ4208EFBG-GN-F	F	4Gb	1229	1333/2DPC	4/10/2013
		EBJ41UG6EFU0-GN-F	4GB	2Rx16		EDJ4216EFBG-GN-F	F	4Gb	1243	1333/2DPC	4/19/2013
		EBJ81UG8EFU0-GN-F	8GB	2Rx8		EDJ4208EFBG-GN-F	F	4Gb	1229	1333/2DPC	4/10/2013
	Micron	MT4KTF25664HZ-1G6E1	2GB	1Rx16	Micron	MT41K256M16HA-125:E	E	4Gb	1220	1333/2DPC	4/10/2013
		MT8KTF51264HZ-1G6E1	4GB	1Rx8		MT41K512M8RH-125:E	E	4Gb	1214	1333/2DPC	4/10/2013
		MT16KTF51264HZ-1G6M1	**4GB**	**2Rx8**		**MT41K256M8DA-125:M**	**M**	**2Gb**	**1112**	**1333/2DPC**	**5/22/2013**
		MT16KTF1G64HZ-1G6E1	8GB	2Rx8		MT41K512M8RA-125:D	D	4Gb	*	1333/2DPC	4/10/2013
	Samsung	**M471B5173DB0-YK0**	**4GB**	**1Rx8**	Samsung	**K4B4G08460-BYK0**	**D**	**4Gb**	**1312**	**1333/2DPC**	**5/3/2013**
		M471B5273CH0-YK0	4GB	2Rx8		K4B2G0846C-HYK0	C	2Gb	1216	1333/2DPC	4/23/2013
	SK Hynix	HMT425S6AFR6A-PB	2GB	1Rx16	SK Hynix	H5TC4G63AFR-PBA	A	4Gb	1245	1333/2DPC	4/10/2013
		HMT451S6AFR8A-PB	4GB	1Rx8		H5TC4G83AFR-PBA	A	4Gb	1244	1333/2DPC	4/10/2013
		HMT41GS6AFR8A-PB	8GB	2Rx8		H5TC4G83AFR-PBA	A	4Gb	1242	1333/2DPC	4/10/2013

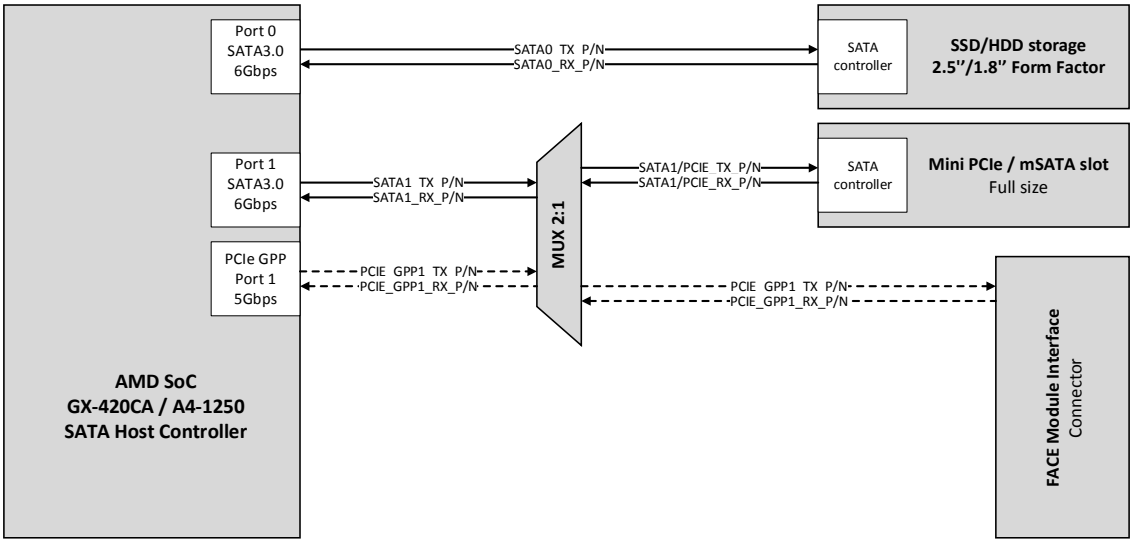
BOLD = New Entry

3.5 Storage

Fit-PC4 supports various types of storage devices due to advanced SATA Host Controller capabilities and I/O availability, described in section 3.3.1. Supported devices include HDD and SSD storage devices in 2.5'' form factor. HDD limited to 5400rpm only due to power dissipation reasons. mSATA NAND Flash solid state drive modules supported as well and share mini PCIe full size slot. For detailed system architecture refer to section 6.1.

Fit-PC4 SATA system diagram is show in ***Figure 6 – SATA Interface***.

Figure 6 – SATA Interface



3.5.1 Certified storage devices (examples)

3.5.1.1 HDD examples

Table 11 – WD Scorpio Blue HDD series

Specifications	1 TB	1 TB	750 GB	750 GB	500 GB
Model number	WD10SPCX	WD10JPVX WD10JPVT	WD7500LPCX	WD7500BPVX WD7500BPVT	WD5000LPVX WD5000LPVT
Interface	SATA 6 Gb/s	SATA 6 Gb/s (JPVX) SATA 3 Gb/s (JPVT)	SATA 6 Gb/s	SATA 6 Gb/s (BPVX) SATA 3 Gb/s (BPVT)	SATA 6 Gb/s (LPVX) SATA 3 Gb/s (LPVT)
Formatted capacity[1]	1,000,204 MB	1,000,204 MB	750,156 MB	750,156 MB	500,107 MB
User sectors per drive	1,953,525,168	1,953,525,168	1,465,149,168	1,465,149,168	976,773,168
Advanced Format (AF)	Yes	Yes	Yes	Yes	Yes
Form factor	2.5-inch	2.5-inch	2.5-inch	2.5-inch	2.5-inch
RoHS compliant[2]	Yes	Yes	Yes	Yes	Yes
Performance					
Data transfer rates Interface speed Internal transfer rate (max)	 6 Gb/s 140 MB/s	 6 Gb/s (JPVX) 3 Gb/s (JPVT) 144 MB/s	 6 Gb/s 140 MB/s	 6 Gb/s (BPVX) 3 Gb/s (BPVT) 138 MB/s	 6 Gb/s (LPVX) 3 Gb/s (LPVT) 147 MB/s
Cache (MB)	16	8	16	8	8
Average latency (ms)	5.5	5.5	5.5	5.5	5.5
Rotational speed (RPM)	5400	5400	5400	5400	5400
Average drive ready time (sec)	2.8	3.0 (JPVX) / <3.5 (JPVT)	2.8	3.0 (BPVX) / 4.0 (BPVT)	2.8 (LPVX) / <3.5 (LPVT)
Reliability/Data Integrity					
Load/unload cycles[3]	600,000	600,000	600,000	600,000	600,000
Non-recoverable read errors per bits read	<1 in 10^{14}	<1 in 10^{14}	<1 in 10^{14}	<1 in 10^{14}	<1 in 10^{14}
Limited warranty (years)[4]	2	2	2	2	2
Power Management					
5VDC ±10% (A, peak)	1.00	1.00 (JPVX) / 0.900 (JPVT)	1.00	1.00 (BPVX) / 0.975 (BPVT)	1.00 (LPVX) / 0.900 (LPVT)
Average power requirements (W) Read/Write Idle Standby/Sleep	 1.7 0.57 0.18	 1.4 0.59 0.18	 1.7 0.57 0.18	 1.6 0.65 0.20	 1.4 0.55 0.13
Environmental Specifications[5]					
Temperature (°C) Operating Non-operating	 0 to 60 -40 to 65	 0 to 60 -40 to 65	 0 to 60 -40 to 65	 0 to 60 -40 to 65	 0 to 60 -40 to 65
Shock (Gs) Operating (2 ms, read) Non-operating	 350 1000 (2 ms)	 400 1000 (2 ms)	 350 1000 (2 ms)	 350 1000 (2 ms)	 400 1000 (2 ms)
Acoustics (dBA)[6] Idle Seek (average)	 20 21	 24 25	 20 21	 24 25	 17 22
Physical Dimensions					
Height (in./mm, max)	0.28/7.0	0.374/9.50	0.28/7.0	0.374/9.50	0.28/7.0
Length (in./mm, max)	3.94/100.20	3.94/100.20	3.94/100.20	3.94/100.20	3.94/100.20
Width (in./mm, ± .01 in.)	2.75/69.85	2.75/69.85	2.75/69.85	2.75/69.85	2.75/69.85
Weight (lb./kg, ± 10%)	0.21/0.09	0.27/0.12	0.21/0.09	0.34/0.15	0.20/0.09

Table 12 – WD Scorpio Blue HDD series (cont.)

Specifications	500 GB	500 GB	320 GB	320 GB	250 GB	250 GB
Model number	WD5000MPCK	WD5000BPVT	WD3200LPVX WD3200LPVT	WD3200BPVT	WD2500LPVX WD2500LPVT	WD2500BPVT
Interface	SATA 6 Gb/s	SATA 3 Gb/s	SATA 6 Gb/s (LPVX) SATA 3 Gb/s (LPVT)	SATA 3 Gb/s	SATA 6 Gb/s (LPVX) SATA 3 Gb/s (LPVT)	SATA 3 Gb/s
Formatted capacity[1]	500,107 MB	500,107 MB	320,072 MB	320,072 MB	250,059 MB	250,059 MB
User sectors per drive	976,773,168	976,773,168	625,142,448	625,142,448	488,397,168	488,397,168
Advanced Format (AF)	Yes	Yes	Yes	Yes	Yes	Yes
Form factor	2.5-inch	2.5-inch	2.5-inch	2.5-inch	2.5-inch	2.5-inch
RoHS compliant[2]	Yes	Yes	Yes	Yes	Yes	Yes
Performance						
Data transfer rates Interface speed Internal transfer rate (max)	 6 Gb/s 145 MB/s	 3 Gb/s 136 MB/s	 6 Gb/s (LPVX) 3 Gb/s (LPVT) 147 MB/s (LPVX) 109 MB/s (LPVT)	 3 Gb/s 116 MB/s	 6 Gb/s (LPVX) 3 Gb/s (LPVT) 147 MB/s (LPVX) 109 MB/s (LPVT)	 3 Gb/s 116 MB/s
Cache (MB)	16	8	8	8	8	8
Average latency (ms)	5.5	5.5	5.5	5.5	5.5	5.5
Rotational speed (RPM)	5400	5400	5400	5400	5400	5400
Average drive ready time (sec)	2.8	4.0	2.8 (LPVX) / <3.5 (LPVT)	4.0	2.8 (LPVX) / <3.5 (LPVT)	4.0
Reliability/Data Integrity						
Load/unload cycles[3]	600,000	600,000	600,000	600,000	600,000	600,000
Non-recoverable read errors per bits read	<1 in 10^{14}	<1 in 10^{14}	<1 in 10^{14}	<1 in 10^{14}	<1 in 10^{14}	<1 in 10^{14}
Limited warranty (years)[4]	2	2	2	2	2	2
Power Management						
5VDC ±10% (A, peak)	0.900	0.950	1.00 (LPVX) / 0.900 (LPVT)	1.00	1.00 (LPVX) / 0.900 (LPVT)	1.00
Average power requirements (W) Read/Write Idle Standby/Sleep	 1.5 0.55 0.15	 1.6 0.65 0.20	 1.4 0.55 0.13	 2.5 0.85 0.20	 1.4 0.55 0.13	 2.5 0.85 0.20
Environmental Specifications[5]						
Temperature (°C) Operating Non-operating	 0 to 60 -40 to 65	 0 to 60 -40 to 65	 0 to 60 -40 to 65	 0 to 60 -40 to 65	 0 to 60 -40 to 65	 0 to 60 -40 to 65
Shock (Gs) Operating (2 ms, read) Non-operating	 400 1000 (2 ms)	 350 1000 (2 ms)	 400 1000 (2 ms)	 350 1000 (2 ms)	 400 1000 (2 ms)	 350 1000 (2 ms)
Acoustics (dBA)[6] Idle Seek (average)	 15 17	 22 25	 17 22	 22 25	 17 22	 22 25
Physical Dimensions						
Height (in./mm, max)	0.20/5.0	0.374/9.50	0.28/7.0	0.374/9.50	0.28/7.0	0.374/9.50
Length (in./mm, max)	3.95/100.30	3.94/100.20	3.94/100.20	3.94/100.20	3.94/100.20	3.94/100.20
Width (in./mm, ± .01 in.)	2.75/69.85	2.75/69.85	2.75/69.85	2.75/69.85	2.75/69.85	2.75/69.85
Weight (lb./kg, ± 10%)	0.16/0.07	0.22/0.10	0.20/0.09	0.22/0.10	0.20/0.09	0.22/0.10

Table 13 – Hitachi CinemaStar C5K750 HDD models

Model(s)	HCC547575A9E380 HCC547564A9E380 HCC547550A9E380
Configuration	
Interface	SATA 3Gb/s
Capacity (GB)[1]	750 / 640 / 500
Sector size (bytes)[2]	512e
Recording zones	24
Max. areal density (Gbits/sq. in.)	492
Performance	
Data buffer (MB)[3]	8
Rotational speed (RPM)	5400
Latency average (ms)	5.5
Media transfer rate (Mbits/sec, max.)	996
Interface transfer rate (MB/sec, max.)	300
Seek time, read (ms, typical)[4]	15
Reliability	
Load/unload cycles	600,000
Power on Hours (POH) per month	730
Availability[5] (hrs/day x days/wk)	24x7
Power	
Requirement	+5 VDC (+/-5%)
Startup (W, peak, max.)	3.5
Operating[6] (W, avg.)	1.5
Low power idle (W, avg.)	0.5
Physical size	
z-height (mm)	9.5
Dimensions (width x depth, mm)	70 x 100
Weight (g, typical)	102
Environmental (operating)	
Shock (half-sine wave)	400G (2ms), 225G (1ms)
Operating temperature[7]	0° to 70°C
Environmental (non-operating)	
Shock (half-sine wave)	1000G (1ms)
Ambient temperature	-40° to 65°C
Acoustics (A-weighted sound power)	
Idle (Bels, typical)	2.4
Seek (Bels, typical)	2.5

Table 14 – Seagate Momentus HDD series

Seagate® Momentus® 2.5" Internal Drive

Instant Add-on Storage

Interface SATA
Capacities 250GB, 320GB, 500GB, 640GB, 750GB

Momentus LP Drive – Energy Efficient, High Capacity Storage

Engineered specifically for low-power applications, the Momentus LP internal drive has a 5400RPM spindle speed and a 8MB cache to provide energy-efficient performance at whisper-quiet acoustic levels. With reduced power consumption and heat generation, this drive will reduce power costs up to 50% over the life of the system compared to standard drives. It is optimized for standard laptops and small form factor PCs.

- 5400RPM
- 8MB cache
- SATA 3Gb/s interface with Native Command Queueing
- QuietStep™ technology enables ultra-quiet load/unload acoustics
- Perpendicular recording technology increases performance and reliability

3.5.1.2 mSATA SSD examples

Table 15 – Micron mSATA NAND Flash SSD

Micron

M500 mSATA NAND Flash SSD Features

M500 mSATA NAND Flash SSD

MTFDDAT120MAV, MTFDDAT240MAV, MTFDDAT480MAV

Features

- Micron® 20nm MLC NAND Flash
- RoHS-compliant package
- SATA 6 Gb/s interface
- TCG/Opal 2.0-compliant self-encrypting drive (SED)
- Hardware-based AES-256 encryption engine
- ATA modes supported
  - PIO mode 3, 4
  - Multiword DMA mode 0, 1, 2
  - Ultra DMA mode 0, 1, 2, 3, 4, 5
- Industry-standard, 512-byte sector size support
- Device Sleep (DEVSLP), extreme low power mode
- Native command queuing support with 32-command slot support
- ATA-8 ACS2 command set compliant
- ATA security feature command set and password login support
- Secure erase (data page) command set: fast and secure erase
- Sanitize device feature set support
- Self-monitoring, analysis, and reporting technology (SMART) command set
- Windows 8 drive telemetry
- Adaptive thermal monitoring
- Performance[1, 2]
  - PCMark® Vantage (HDD test suite score): up to 80,000
  - Sequential 128KB READ: up to 500 MB/s
  - Sequential 128KB WRITE: up to 400 MB/s
  - Random 4KB READ: up to 80,000 IOPS
  - Random 4KB WRITE: up to 80,000 IOPS
  - READ/WRITE latency: 5ms/25ms (MAX)
- Reliability
  - MTTF: 1.2 million device hours[3]
  - Static and dynamic wear leveling
  - Uncorrectable bit error rate (UBER): <1 sector per 10^{15} bits read
- Low power consumption
  - 150mW TYP[4]
- Endurance: Total bytes written (TBW) – 72TB
- Capacity[5] (unformatted): 120GB, 240GB, 480GB
- Mechanical
  - mSATA connector: 3.3V ±5%
  - Caseless design: 50.80mm x 29.85mm x 3.75mm
  - Weight: 10g (MAX)
- Secure firmware update with digitally signed firmware image
- Operating temperature
  - Commercial (0°C to +70°C)[6]

Notes:
1. Typical I/O performance numbers as measured fresh-out-of-box (FOB) using Iometer with a queue depth of 32 and write cache enabled.
2. 4KB transfers used for READ/WRITE latency values.
3. The product achieves a mean time to failure (MTTF) based on population statistics not relevant to individual units.
4. Active average power measured during execution of MobileMark® with DIPM (device-initiated power management) enabled.
5. 1GB = 1 billion bytes; formatted capacity is less.
6. Drive on-board sensor temperature.

Warranty: Contact your Micron sales representative for further information regarding the product, including product warranties.

Table 16 – ACPI CMS2G-M SSD

Specification	
Model Name	CMS2G-M
Interface	SATA III 6Gb/s compatible
NAND Flash Type	MLC
Connector Type	miniPCIe mSATA
External DRAM Buffer	Yes
Capacity	32GB~256GB
Sequential R/W (128KB, Typ.)	Max 530/330 MB/s
Random R/W (4KB, Typ.)	Max 94K/75K IOPS
Temperature	Operating Temp.:0˚C~+70˚C Storage Temp.: -40˚C~+90˚C
TRIM	Support
S.M.A.R.T. (Health Monitor)	Support
Security Tool	-
MTBF	> 1.2 million hours
Vibration (Operating)	20G Peak, 7~2000Hz
Shock	1500G, 0.5ms
Dimension (LxWxH)	50.8*29.85*3.7mm
Weight	8 gram
Warranty	3 Year

4 Peripherals

4.1 Network

The following section provides information about fit-PC4 main network components and features.

4.1.1 Intel I211AT GbE Controller

Intel Ethernet I211 controller is a single port, compact, low power component that supports GbE designs. The I211 offers a fully-integrated GbE Media Access Control (MAC), Physical Layer (PHY) port and supports PCI Express 2.1 (5GT/s). The I211 enables 1000BASE-T implementations using an integrated PHY. It can be used for server system configurations such as rack mounted or pedestal servers, in an add-on NIC or LAN on Motherboard (LOM) design. Another possible system configuration is for blade servers as a LOM or mezzanine card. It can also be used in embedded applications such as switch add-on cards and network appliances.

One independent interface is used to connect the I211 port to external devices. The following protocol is supported: MDI (copper) support for standard IEEE 802.3 Ethernet interface for 1000BASE-T, 100BASE-TX, and 10BASE-T applications (802.3, 802.3u, and 802.3ab).

4.1.2 Intel I211AT Features

Intel I211 Gigabit Ethernet controller main features show below:

- Integrated 10/100/1000 transceiver
- Auto-Negotiation with Next Page capability
- PCIe v2.1 (5 GT/s) x1, with Switching Voltage Regulator (iSVR)
- Integrated Non-Volatile Memory (iNVM)
- Platform Power Efficiency
- IEEE 802.3az Energy Efficient Ethernet (EEE)
- Proxy: ECMA-393 and Windows logo for proxy offload
- Jumbo frames
- Interrupt moderation, VLAN support, IP checksum offload
- RSS and MSI-X to lower CPU utilization in multi-core systems
- Advanced cable diagnostics, auto MDI-X
- ECC – error correcting memory in packet buffers
- Four Software Definable Pins (SDPs)
- Built-in switching regulator
- Supports Customized LEDs
- Supports 1-Lane 2.5Gbps PCI Express Bus
- Supports hardware ECC (Error Correction Code) function
- Supports hardware CRC (Cyclic Redundancy Check) function

4.1.3 LAN Ports LEDs notifications

LAN ports LEDs status notifications shown in the table below:

Table 17 – LAN ports LEDs status notification

LED color	Mode	Function
Yellow	Blink	Activity
Green	On	10/100/1000 Mbps

4.2 Wireless Networks

Fit-PC4 Pro configured with Intel 7260HMW module in mini PCIe half size form factor. The 7260HMW is highly integrated 2.4/5GHz dual band IEEE 802.11ac and Bluetooth 4.0 in a single Intel 7260 chip with two host interfaces, PCI Express Host interface used for communication with WLAN part of a baseband chip and USB Host interface used for communication with BT part of a baseband chip, thus allowing higher and more effective data management and throughput.

Intel® Dual Band Wireless-AC 7260 code name Wilkins Peak 2 (WP2) shall be the VHT-5G WiFi 2x2 and Bluetooth combination single chip solution. WP2 shall use Intel's 1st generation 802.11ac WiFi solution and shall support both 2.4, and 5GHz bands. On 5GHz band, it shall operate on an 80MHz wide channel reaching PHY rates of up to 867Mbps. WP2 shall use a Bluetooth core that shall support Bluetooth 4.0 standard including Bluetooth 3.0 High Speed and Bluetooth 4.0 Low Energy (BLE). WP2 shall have 2 antenna ports: one shall be WiFi only and the second will be shared between WiFi and Bluetooth. WiFi shall support Rx antenna diversity.

Notes:

- Fit-PC4 Value configured with AzureWave AW-NB057H (2.4GHz WLAN 802.11 b/g/n + BT3)
- Any other mini PCIe half size RF module can be installed and with relevant driver package can provide wireless infrastructure for the system

4.3 Wireless Module Features

Table 18 – Wireless Module Features

WLAN	**Features**
WiFi	802.11ac 2x2
Antennas	2
WLAN TX/RX chains	2x2 chains
WLAN Frequency band	2.4GHz, 5GHz
Antenna Allocation	a. WLAN only b. WLAN/BT shared
Wi-Fi TX/RX Throughput	867Mbps
Security	Authentication**:** WPA, WPA2 Encryption: 64-bit and 128-bit WEP, AES-CCMP, TKIP Management Frame Protection: 802.11w
BT	**Features**
Bluetooth Core	Bluetooth 4.0
BT Throughput	24Mbps
BT Frequency band	2.4GHz
Host Interface	USB
General	**Features**
Intel® WiDi Support	Intel® WiDi 4
AMT Support (Windows OS only)	AMT9.5 AMT9.0.20

For more information, including WLAN/BT detailed channel list contact Intel or Compulab.

Figure 7 – Wireless Module Block Diagram

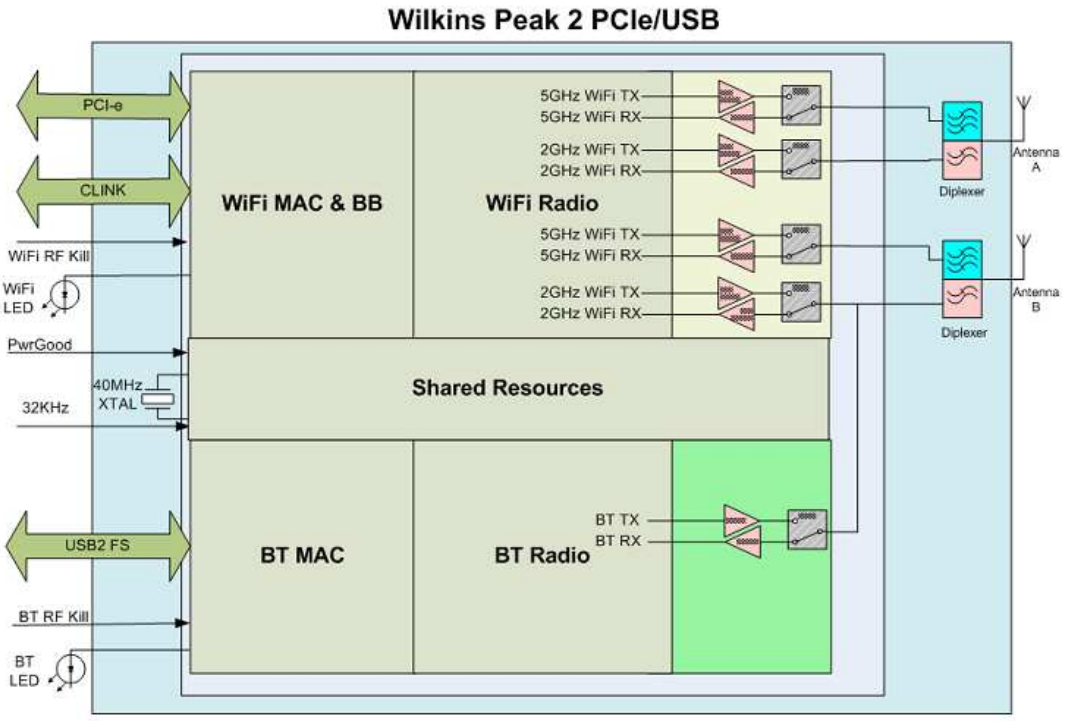
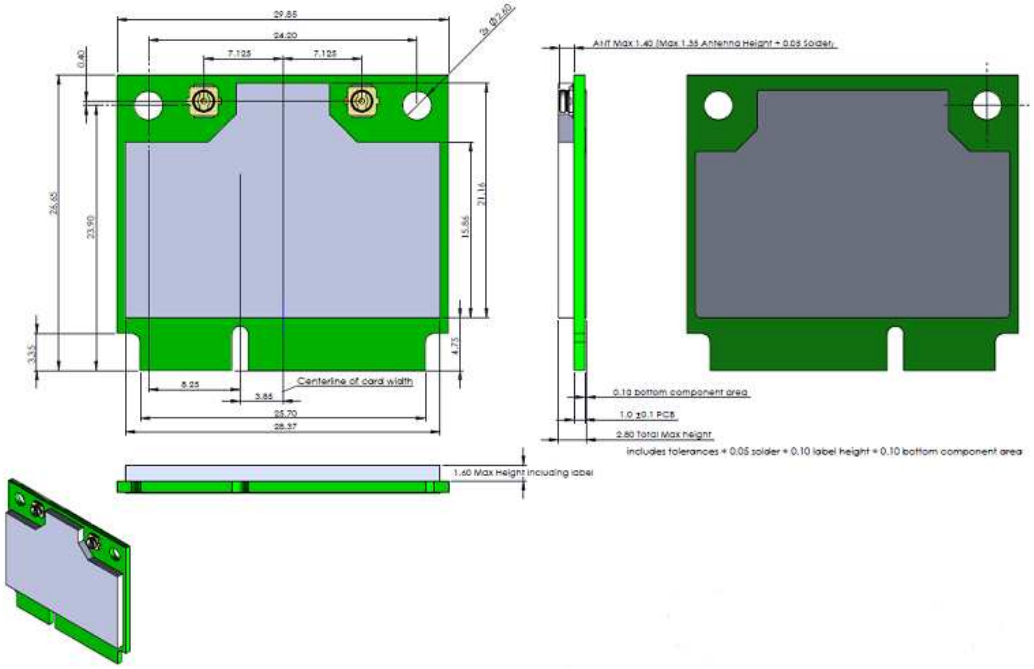


Figure 8 – Wireless Module Mechanical Dimensions



4.4 Audio

Fit-PC4 systems support analog and digital inputs/outputs via standard 3.5'' audio jacks. For system audio specifications refer to **Table 5 – Audio Specifications**.

4.4.1 Audio Codec General Description

Fit-PC4 incorporates Realtek ALC886 audio codec. ALC886 is a high-performance 7.1+2 Channel High Definition Audio Codec with two independent S/PDIF outputs. It feature ten DAC channels that simultaneously support 7.1 sound playback, plus independent stereo sound output (multiple streaming) through the front panel stereo outputs, and integrate two stereo ADCs that can support a stereo microphone, and feature Acoustic Echo Cancellation (AEC), Beam Forming (BF), and Noise Suppression (NS) for voice applications.

The ALC886 supports 16/20/24-bit S/DPIF input and output functions with sampling rate of up to 192 kHz, offering easy connection of PCs to high quality consumer electronic products such as digital decoders and Minidisk devices. In addition to the standard (primary) S/PDIF output function, the ALC886 features another independent (secondary) S/PDIF-OUT output and converters that transport digital audio output to a High Definition Media Interface (HDMI) transmitter (becoming more common in high-end PCs).

All analog IO are input and output capable, and headphone amplifiers are also integrated at each analog output. All analog IOs can be re-tasked according to user's definitions, or automatically switched.

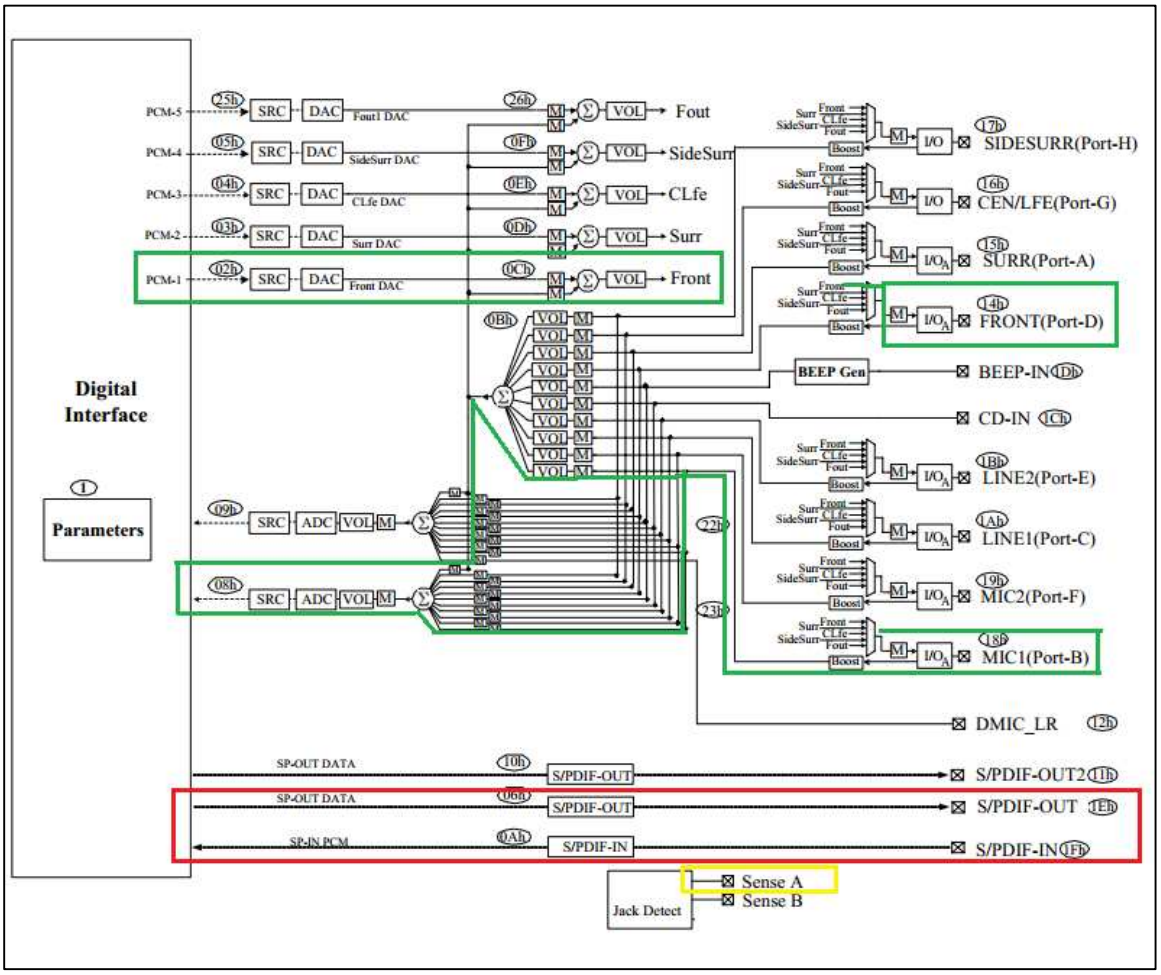
The ALC886 support host audio controller from the AMD SoC, and also from any other HDA compatible audio controller. With EAX/Direct Sound 3D/I3DL2/A3D compatibility, and excellent software utilities like environment sound emulation, multiple-band software equalizer and dynamic range control, optional Dolby® Digital Live, DTS® CONNECT™, and Dolby® Home Theater programs, the ALC886 provides an excellent home entertainment package and game experience for PC users.

4.4.2 Audio Codec Features

- High-performance DACs with 97dB SNR (A-Weighting), ADCs with 89dB SNR (A-Weighting)
- Meets premium audio requirements for Microsoft WLP 3.10
- 8 DAC channels support 7.1 sound playback, plus 2 channels of independent stereo sound output (multiple streaming) through the front panel output
- Two ADCs support one stereo microphone and one legacy mixer recording simultaneously
- All DACs supports 16/20/24-bit, 44.1k/48k/96k/192kHz sample rate
- All ADCs supports 16/20/24-btt, 44.1k/48k/96k/192kHz sample rate
- Two jack detection pins each designed to detect up to 4 jacks
- Supports legacy analog mixer architecture
- Wide range (–80dB ~ +42dB) volume control with 1.5dB resolution of analog to analog mixer gain
- Software selectable boost gain (+10/+20/+30dB) for analog microphone input
- All analog jacks are stereo input and output re-tasking for analog plug & play

- Built-in headphone amplifiers for each re-tasking jack
- Integrates high pass filter to cancel DC offset generated from digital microphone
- Support low voltage IO (1.5V~3.3V) for HDA Link
- Intel low power ECR compliant, supports power status control for each analog converter and pin widgets, supports jack detection and wake up event in D3 mode

Figure 9 – Audio Codec Functional Block Diagram



The markers in the ***Figure 9*** apply to audio functionality implemented in Fit-PC4 systems and summarized below:

1. Audio Jack Detect function implemented via Sense A:
2. Analog audio output: Port D, FRONT_HOUT_R/L (detect via 5k)
3. Analog audio input: Port B, MIC_IN_R/L (detected via 20k)
4. Digital audio output: S/PDIF-OUT
5. Digital audio input: S/PDIF-IN

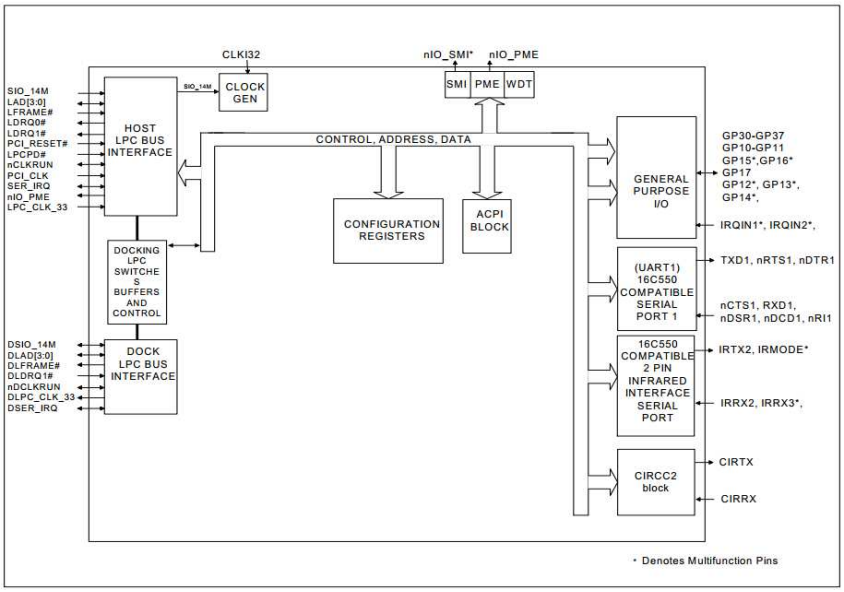
4.5 Super-I/O Controller

Fit-PC4 design provides RS232 serial communication between Data Terminal Equipment (Host) and Data Communication Equipment (Device) by the means of Super-I/O Controller SMSC SIO1007, which implements LPC Bus to UART Bridge. The SIO1007 implements the LPC interface with the LPC PortSwitch interface. The LPC PortSwitch interface is a hot switchable external docking LPC interface. It also features a full 16bit internally decoded address bus, a Serial IRQ interface with PCI clock support, relocatable configuration ports and three DMA channel options.

The SIO1007 incorporates one complete 8-pin UART.

- **Main Features**
  - One full function Serial port
  - High Speed UART with Send/Receive 16-Byte FIFOs
  - Support 115k Baud rates
  - Programmable baud rate generator
  - Modem control circuit
  - LPC bus Host interface
  - LPC PortSwitch interface
  - Two IRQ input pins
  - PC99a and ACPI 1.0 Compliant
  - Intelligent Auto Power Management

Figure 10 – SMSC SIO1007 Super-I/O Controller functional block diagram



5 Interfaces

5.1 PCI Express*

This section describes the PCI Express interface capabilities of the SoC. See the PCI Express Base Specification for details of PCI Express. The SoC has one PCI Express controller that can support eight root ports, four GPP single lane only ports and another four GFX ports that can be configured to support x1, x2 and x4 lanes interface.

5.1.1 PCI Express* Architecture

Compatibility with the PCI addressing model is maintained to ensure that all existing applications and drivers may operate unchanged.

The PCI Express configuration uses standard mechanisms as defined in the PCI Plug-and-Play specification. The processor external graphics ports support Gen 2 speed.

PCI Express* Gen 1.1 and Gen 2 uses 8b/10b encoding scheme.

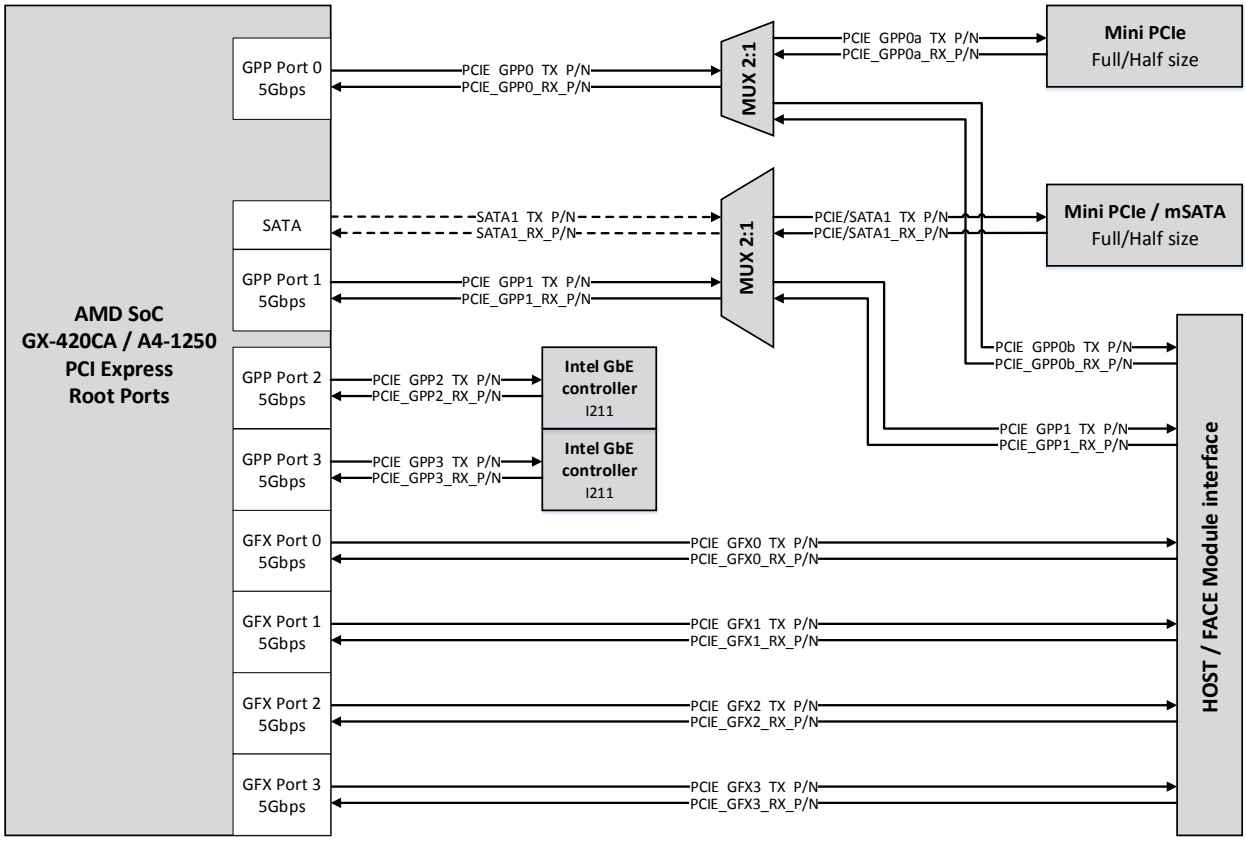
5.1.2 PCI Express* Specifications

- The port may negotiate down to narrower widths.
  Support for x4/x1 widths for a single PCI Express* mode.
- 2.5 GT/s and 5.0 GT/s PCI Express* frequencies are supported.
- Gen1 Raw bit-rate on the data pins of 2.5 GT/s, resulting in a real bandwidth per pair of 250 MB/s given the 8b/10b encoding used to transmit data across this interface. This also does not account for packet overhead and link maintenance.
- Maximum theoretical bandwidth on the interface of 1.25 GB/s in each direction simultaneously, for an aggregate of 2.5 GB/s when x4 Gen 1.
- Gen 2 Raw bit-rate on the data pins of 5.0 GT/s, resulting in a real bandwidth per pair of 500 MB/s given the 8b/10b encoding used to transmit data across this interface. This also does not account for packet overhead and link maintenance.
- Maximum theoretical bandwidth on the interface of 2.5 GB/s in each direction simultaneously, for an aggregate of 5 GB/s when x4 Gen 2.
- PCI Express* reference clock is 100 MHz differential clock.
- Power Management Event (PME) functions.

5.1.3 PCI Express Implementation

- 2x PCIe GPP root ports dedicated for Intel I211 GbE controllers
- 1x PCIe GPP root port shared with SATA and routed via MUX to mSATA slot or FACE Module
- 1x PCIe GPP root port shared between mini PCIe slot and FACE Module
- 4x PCIe GFX root ports routed to FACE Module (allows 1x1, 1x2, 1x4 configurations)

Figure 11 – fit-PC4 PCI Express Interface scheme



5.1.4 Mini PCI Express* Edge Connector

Table 19 – mini PCI Express edge connector pinout

mini PCI Express edge connector					
Pin #	**Pin Name**	**Signal Description**	**Pin #**	**Pin Name**	**Signal Description**
1	WAKE#	Open drain, active low signal driven low by a mini PCIe card to reactivate the PCIe link	2	3.3Vaux	3.3V power rail
3	COEX1/Reserved	Reserved for future wireless coexistence control interface between radios (if needed)	4	GND	Ground connection
5	COEX2/Reserved		6	1.5V	1.5V power rail
7	CLKREQ#	Clock request - open drain, active low driven by mini PCIe card to request PCIe reference clock	8	UIM_PWR/Reserved	The UIM signals are defined on the system connector to provide the interface between the removable User Identity Module (UIM) Interface - an extension of SIM and WWAN.
9	GND	Ground connection	10	UIM_DATA/Reserved	
11	REFCLK-	PCI Express differential reference clock (100 MHz)	12	UIM_CLK/Reserved	
13	REFCLK+		14	UIM_RESET/Reserved	
15	GND	Ground connection	16	UIM_VPP/Reserved	
Mechanical Notch Key					
17	Reserved/UIM_C8	Reserved	18	GND	Ground connection
19	Reserved/UIM_C4	Reserved	20	W_DISABLE#	Active low signal when asserted by the system disable radio operation. Reserved for future use.
21	GND	Ground connection	22	PERST#	Asserted when power is switched off and also can be used by the system to force HW reset
23	PERn0	PCI Express differential receive pair	24	3.3Vaux	3.3V power rail
25	PERp0		26	GND	Ground connection
27	GND	Ground connection	28	1.5V	1.5V power rail
29	GND	Ground connection	30	SMB_CLK	Optional SMBus two-wire interface for Host/mini PCIe module communication
31	PETn0	PCI Express differential transmit pair	32	SMB_DATA	
33	PETp0		34	GND	Ground connection
35	GND	Ground connection	36	USB_D-	USB Host Interface
37	GND	Ground connection	38	USB_D+	
39	3.3Vaux	3.3V power rail	40	GND	Ground connection
41	3.3Vaux	3.3V power rail	42	LED_WWAN#	Active low output signals are provided to allow status indications to users via system provided LEDs
43	GND	Ground connection	44	LED_WLAN#	
45	Reserved	Reserved for future second PCI Express Lane	46	LED_WPAN#	
47	Reserved		48	1.5V	1.5V power rail
49	Reserved		50	GND	Ground connection
51	Reserved		52	3.3Vaux	3.3V power rail

5.2 Digital Display Interface

The SoC can drive a number of digital interfaces natively. The Digital Ports can drive HDMI and DVI displays. Fit-PC4 system architecture provide HDMI interfaces on its digital video outputs. One of the HDMI interface features CEC support.

Both HDMI ports support Full HD display resolutions of up to 1920 x 1200 at 60Hz.

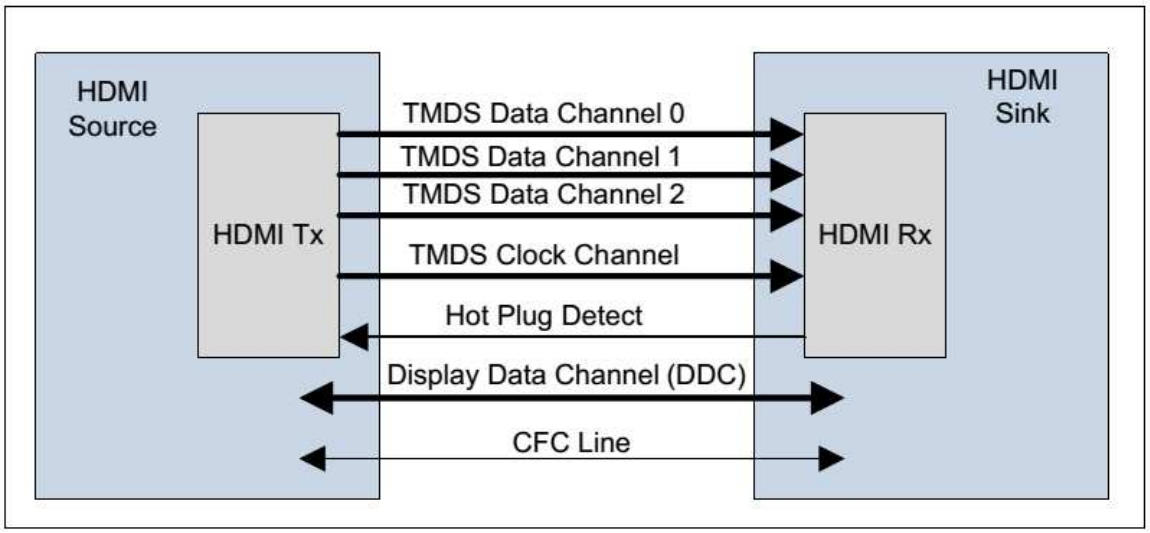
5.2.1 High Definition Multimedia Interface (HDMI)

The High-Definition Multimedia Interface (HDMI) is provided for transmitting uncompressed digital audio and video signals from DVD players, set-top boxes and other audiovisual sources to television sets, projectors and other video displays. It can carry high quality multi-channel audio data and all standard and high-definition consumer electronics video formats. HDMI display interface connecting the SoC and display devices utilizes transition minimized differential signaling (TMDS) to carry audiovisual information through the same HDMI cable.

HDMI includes three separate communications channels: TMDS, DDC, and the optional CEC (consumer electronics control) which is not supported by the SoC. As shown in ***Figure 12*** the HDMI cable carries four differential pairs that make up the TMDS data and clock channels. These channels are used to carry video, audio, and auxiliary data. In addition, HDMI carries a VESA DDC. The DDC is used by an HDMI Source to determine the capabilities and characteristics of the Sink.

Audio, video and auxiliary (control/status) data is transmitted across the three TMDS data channels. The video pixel clock is transmitted on the TMDS clock channel and is used by the receiver for data recovery on the three data channels. The digital display data signals driven natively through the SoC are AC coupled and needs level shifting to convert the AC coupled signals to the HDMI compliant digital signals. SoC HDMI interface is designed as per High-Definition Multimedia Interface Specification 1.4a.

Figure 12 – HDMI Link Diagram



5.2.1.1 HDMI Connector

Table 20 shows the pin assignments of the HDMI external connector on a downstream port on a Source device (fit-PC4), and ***Table 21*** signal description on the HDMI port.

Table 20 – Downstream Port HDMI Connector Pinout

Pin #	Signal	Pin #	Signal
1	TMDS_DATA2+	2	TMDS_DATA2 Shield
3	TMDS_DATA2-	4	TMDS_DATA1+
5	TMDS_DATA1 Shield	6	TMDS_DATA1-
7	TMDS_DATA0+	8	TMDS_DATA0 Shield
9	TMDS_DATA0-	10	TMDS_CLK+
11	TMDS_CLK Shield	12	TMDS_CLK-
13	CEC	14	Reserved
15	DDC_SCL	16	DDC_SDA
17	GND	18	PWR_5V
19	HPD		

Table 21 – Downstream Port HDMI Connector Signal Description

Pin #	Signal	Source Direction	Description
1	TMDS_DATA2+	Out	
2	TMDS_DATA2 Shield	-	
3	TMDS_DATA2-	Out	Data differential pair 2 - Link 1
4	TMDS_DATA1+	Out	
5	TMDS_DATA1 Shield	-	
6	TMDS_DATA1-	Out	Data differential pair 1 - Link 1
7	TMDS_DATA0+	Out	
8	TMDS_DATA0 Shield	-	
9	TMDS_DATA0-	Out	Data differential pair 0 - Link 1
10	TMDS_CLK+	Out	
11	TMDS_CLK Shield	-	
12	TMDS_CLK-	Out	Clock differential pair - Link 1
13	CEC	In/Out	Consumer Electronics Control
14	Reserved	-	
15	DDC_SCL	Out	
16	DDC_SDA	In/Out	EDID Communication channel
17	GND	-	Ground
18	PWR_5V	Out	Power
19	HPD	In	Hot Plug Detect

5.2.2 Digital Video Interface (DVI)

The SoC Digital Ports can drive DVI-D display via HDMI to DVI passive adapter. DVI uses TMDS for transmitting data from the transmitter to the receiver which is similar to the HDMI protocol but without the audio and CEC. Refer to the HDMI section for more information on the signals and data transmission. To drive DVI-I through the back panel the VGA DDC signals is connected along with the digital data and clock signals from one of the Digital Ports. The digital display data signals driven natively through the SoC are AC coupled and needs level shifting to convert the AC coupled signals to the HDMI compliant digital signals.

5.3 LVDS single link

Fit-PC4 architecture support additional optional display interface, LVDS single link 18bpp interface, available for PCB customized assemblies. The interface routed to FPC onboard connector, which is not mounted by default, and accessible in open chassis configuration only (SBC).

Notes:

- LVDS FPC connector is not assembled by default but available for custom orders with MOQ (minimum order quantity) > 100 units
- LVDS single link support resolutions up to 1600 x 900 at 60Hz

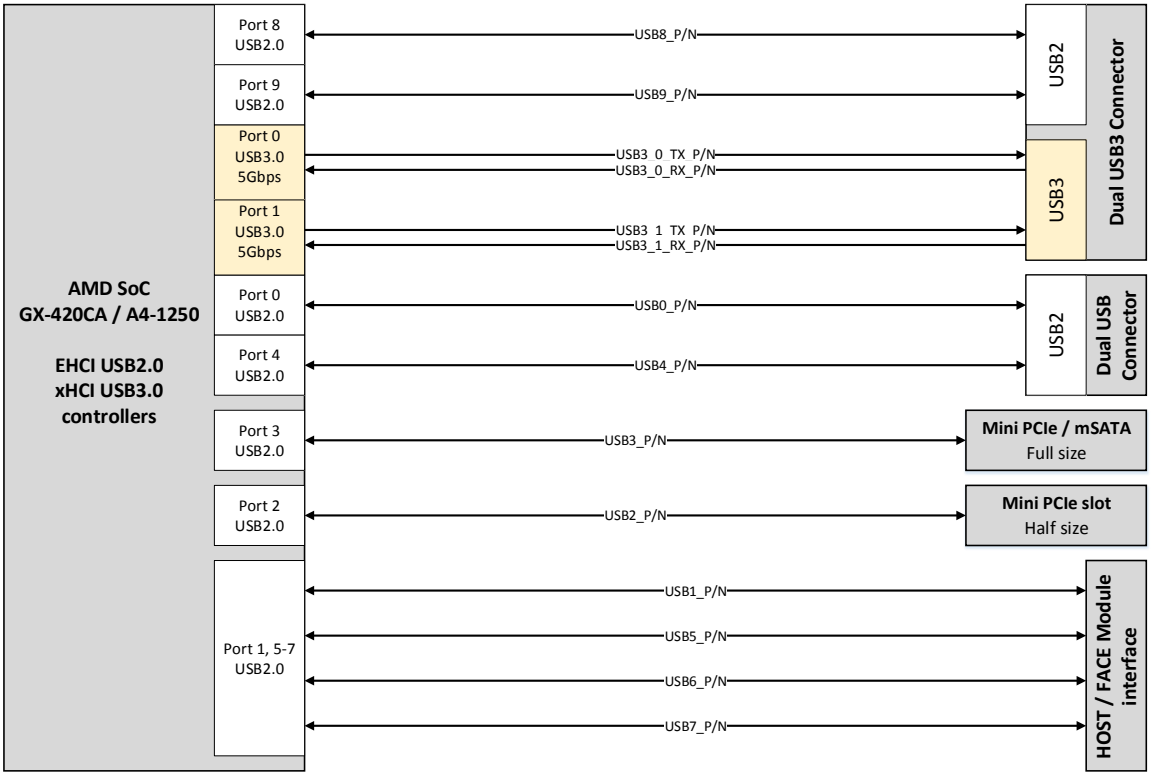
5.4 USB Interface

Fit-PC4 platform provides ten downstream USB interface ports for bus-powered and self-powered devices, two USB3.0 SuperSpeed 5Gbps and eight USB2.0 compliant. USB ports implemented as follows:

- 2x USB3.0 ports on the back panel
- 2x USB2.0 ports on the back panel
- 2x USB2.0 interfaces connected to mini PCIe slots
- 4x USB2.0 ports on the front panel feat. default FACE Module (FM-4USB)

Fit-PC4 USB interface scheme shown in the following diagram:

Figure 13 – fit-PC4 USB Interface scheme



5.5 RS232 Serial Interface

Fit-PC4 design provide RS232 serial communication port (COM1) and support seven RS232 signal set by the means of Super-I/O Controller described in 4.5 and RS232/UART line driver transceiver device. Due to small dimension physical port is implemented with ultra mini serial connector with the pinout in the table below.

Table 22 – COM1 Serial Port Pinout

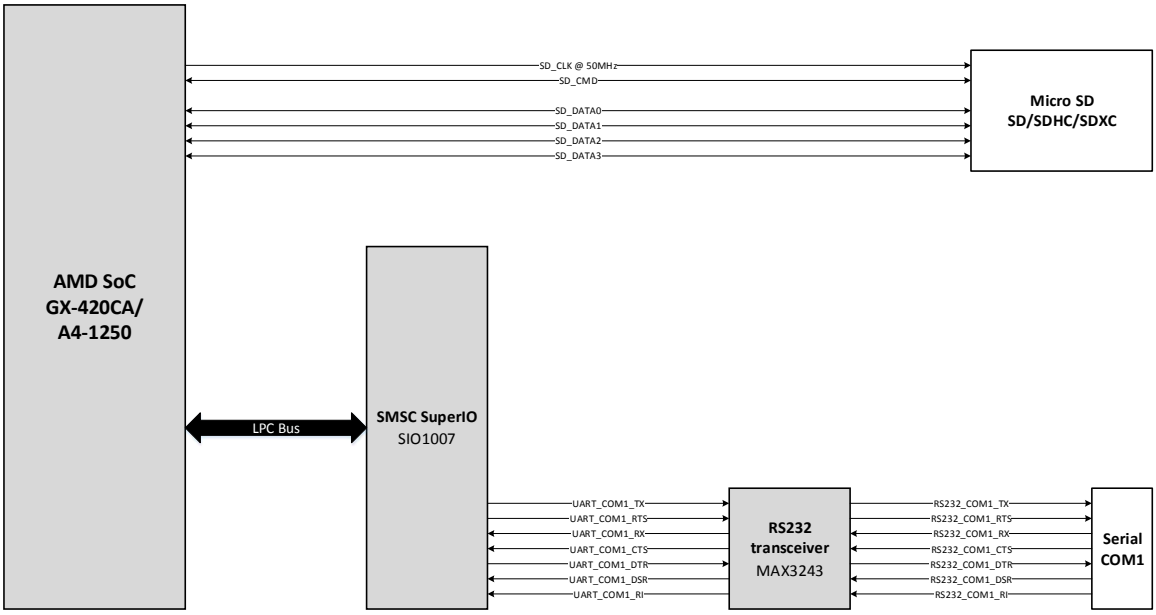
Pin #	Signal	Host Direction	Description
1	COM1_TX	Out	Transmit Data – Carries data from DTE to DCE
2	COM1_RTS	Out	Request To Send – DTE requests the DCE prepare to receive data
3	COM1_RX	In	Receive Data – Carries data from DCE to DTE
4	COM1_CTS	In	Clear To Send – Indicates DCE is ready to accept data
5	COM1_DTR	Out	Data Terminal Ready – Indicates presence of DTE to DCE
6	COM1_DSR	In	Data Set Ready – DCE is ready to receive commands or data
7	COM1_RI	In	Ring Indicator – DCE has detected an incoming ring signal on the telephone line
8	GND	-	Ground

5.6 Micro SD Card

Fit-PC4 design features SD interface via micro SD slot supporting SD/SDHC/SDXC cards, running with transfer rates of up to 200Mbps (25MHz clock DDR signaling).

Note that fit-PC4 doesn't support boot from micro SD. This feature is not provided in BIOS by AMD and Phoenix. It is possible to boot from micro SD card when it's connected via adaptor or reader to USB port, which are accessible during boot.

Figure 14 – SD and RS232 serial interface



6 Miscellaneous Features

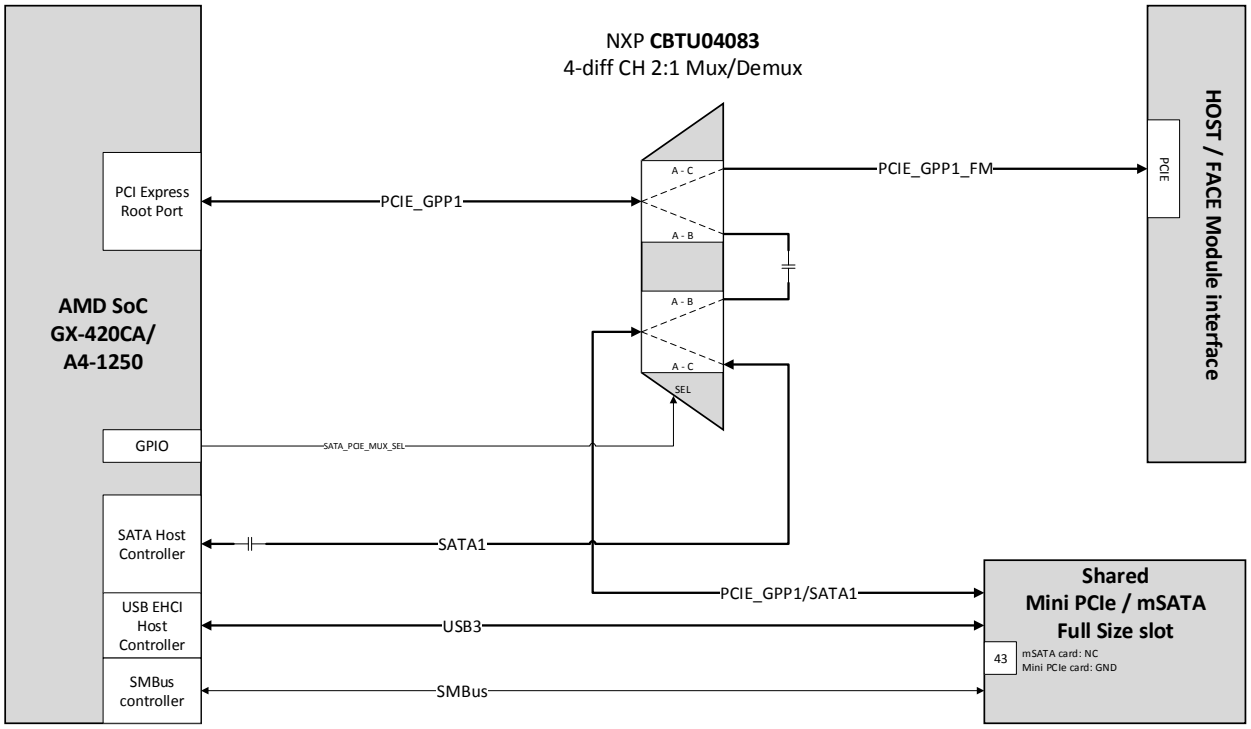
6.1 Mini PCI Express/mSATA sharing

Fit-PC4 advanced platform components and Compulab's flexible system design offers extremely high utilization of different functionalities and mechanical Form Factors to be implemented on the same HW.

Mini PCIe and mSATA share the same slot, and allow the flexibility to install both storage and PCI express devices. PCI Express/SATA interface switching implemented with 4-channel differential bi-directional multiplexer/de-multiplexer as shown in ***Figure 15***.

Note: Proper functionality requires BIOS configuration to set the MUX to desired connectivity option (mSATA by default).

Figure 15 – fit-PC4 PC Mini PCIe/mSATA scheme



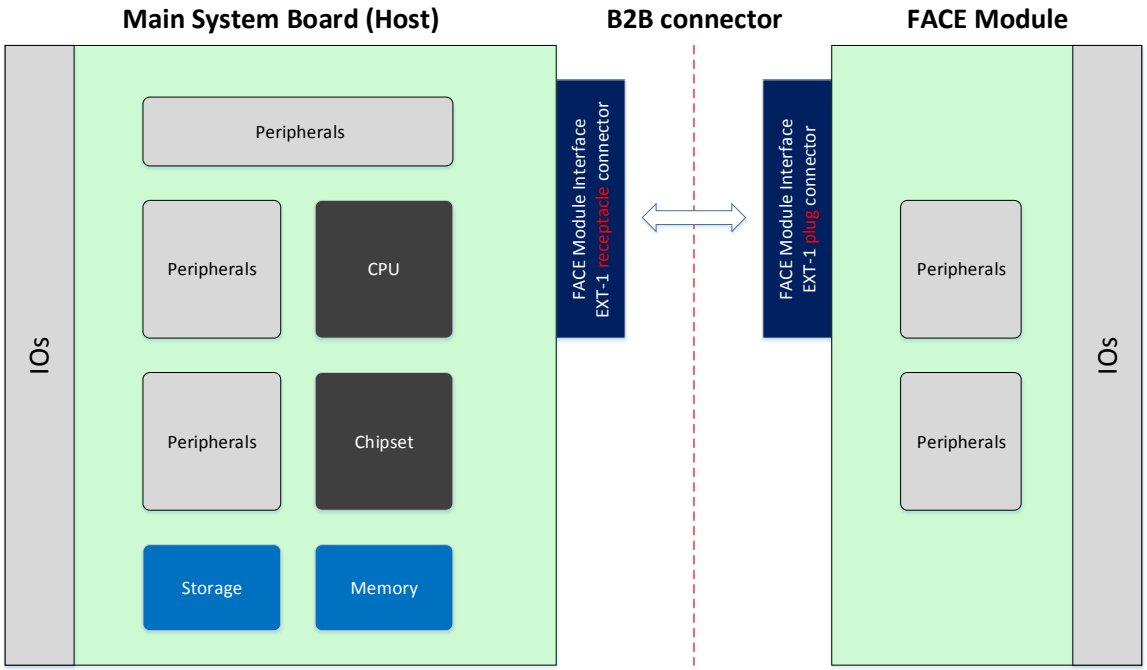
6.2 SIM Interface

Fit-PC4 system incorporates micro SIM slot with dedicated interface to mini PCIe full size slot. In conjunction with cellular modem and authenticated micro SIM card from your mobile operator, the system can be used for cellular communication, data and/or voice (depends on modem). 2G/3G/4G cellular modems in mini PCIe card form factor supported. The micro SIM slot uses 6-pin interface.

6.3 FACE Module Interface

FACE Module (**F**unction **A**nd **C**onnectivity **E**xtension Module) designed as additional/optional system board providing extended functionality and IO connectivity options. The interface between main system board and FACE module implemented with high speed, low pitch, and high pin count board-to-board connectors (B2B). Connectors' pinout including signals mapping and description described later in this chapter.

Figure 16 – FACE Module concept



6.3.1 Extension Connectors

Complete B2B receptacle and plug connector's specifications shown in the tables below.

Table 23 – B2B receptacle connector HOST side

Item	Option A	Option B	Option C
Manufacturer	FCI	Tyco	Oupiin
PN	61082-10260	5-5179180-4	2382-100C00DP1T-M
Type	Receptacle	Receptacle	Receptacle
Positions	2x50	2x50	2x50
Pitch	0.8mm	0.8mm	0.8mm
Current rating	0.5A	0.5A	0.5A
Height	7.7mm	7.7mm	7.7mm
Stacking height	12mm	12mm	12mm

Table 24 – B2B plug connector FACE Module side

Item	Option A	Option B	Option C
Manufacturer	FCI	Tyco	Oupiin
PN	61083-10460	3-5177986-4	2381-100C00DP4T-M
Type	Plug	Plug	Plug
Positions	2x50	2x50	2x50
Pitch	0.8mm	0.8mm	0.8mm
Current rating	0.5A	0.5A	0.5A
Height	7.7mm	7.7mm	7.7mm
Stacking height	12mm	12mm	12mm

6.3.2 Connectors Pinout

The tables below provide complete pinout of extension connectors EXT1 signals mapping.

Table 25 – EXT1 connector HOST side pinout

EXT-1 connector HOST side					
Pin #	**Signal Name**	**Signal Description**	**Pin #**	**Signal Name**	**Signal Description**
A1	GND	Ground connection	B1	GND	Ground connection
A2	GFX_TX1_CP	PCIe GFX differential transmit pair 1	B2	DP_STEREOSYNC	Signal used to drive active shutter glasses for stereoscopic 3D viewing on 120-Hz panels. Requires additional analog circuitry on face module
A3	GFX_TX1_CN		B3	SPDIFOUT	Digital output from 7.1 CODEC
A4	GE16	General Event #16	B4	HDD_ACT#	SATA Channel active
A5	GFX_RX1_CP	PCIe GFX differential receive pair 1	B5	GE7	General Event #7
A6	GFX_RX1_CN		B6	GPIO32	GPIO32
A7	GND	Ground connection	B7	V5SBY	5V power domain
A8	GFX_TX2_CP	PCIe GFX differential transmit pair 2	B8	GPIO65	GPIO65
A9	GFX_TX2_CN		B9	GPIO50	GPIO50
A10	SMB_ALRT#	SMBus Alert used to wake the system	B10	SLP_S4#	SLP_S4# - S4 state flag active low output
A11	GFX_RX2_CP	PCIe GFX differential receive pair 2	B11	GPIO51	GPIO51
A12	GFX_RX2_CN		B12	GPIO170	GPIO170
A13	5V_S5	5V power domain	B13	V5SBY	5V power domain
A14	SMB_CLK	SMBus host clock output. Connect to SMBus slave	B14	USB5P	USB2.0 Host interface 5
A15	SMB_DAT	SMBus bidirectional data. Connect to SMBus slave	B15	USB5N	
A16	HDA_RST#	High Definition Audio host reset	B16	USBOC2#	USB Overcurrent Indicator
A17	HDA_SYNC	High Definition Audio host sync	B17	USB1P	USB2.0 Host interface 1
A18	HDA_BITCLK	High Definition Audio host bit clock out 24MHz	B18	USB1N	
A19	HDA_SDOUT	High Definition Audio serial host data out	B19	V5SBY	5V power domain
A20	HDA_SDIN1	High Definition Audio serial host data in1	B20	COM2_RX	UART2 Rx (TTL levels)
A21	HDA_SDIN2	High Definition Audio serial host data in2	B21	COM2_TX	UART2 Tx (TTL levels)
A22	GP184	General Event #184	B22	LPC_SERIRQ	Serial Interrupt Request
A23	GND	Ground connection	B23	LPC_CLK	Single Ended 33MHz CLK host out to PCI devices
A24	USB6P	USB2.0 Host interface 6	B24	LPC_FRAME#	LPC interface frame signal
A25	USB6N		B25	GND	Ground connection
A26	USBOC3#	USB Overcurrent Indicator	B26	Reserved	For internal use only
A27	USB7P	USB2.0 Host interface 7	B27	Reserved	For internal use only
A28	USB7N		B28	Reserved	For internal use only
A29	GND	Ground connection	B29	Reserved	For internal use only
A30	LPC_AD0	LPC bus multiplexed command, address and data. Internal PU provided on LPC[3:0]	B30	Reserved	For internal use only
A31	LPC_AD1		B31	PCIE_RST#	Active Low Platform Reset driven by the Host
A32	LPC_AD2		B32	GFX_PEX_CLK_P	

A33	LPC_AD3		B33	GFX_PEX_CLK_N	Host PCIe CLK output differential pair - 100MHz
A34	GND	Ground connection	B34	GE4	General Event #4
A35	GFX3_PEX3_TX_CP	PCIe2.0 PEX_GFX differential transmit pair 3	B35	GFX3_PEX3_RX_CP	PCIe2.0 PEX_GFX differential receive pair 3
A36	GFX3_PEX3_TX_CN		B36	GFX3_PEX3_RX_CN	
A37	PCIE_WAKE_UP#	PCI Express Wake Event from Device to Host	B37	X_SPI_BOOT	For internal use only
A38	GPP0_PEX2_TX_CP	PCIe2.0 PEX_GPP differential transmit pair 2	B38	GPP0_PEX2_RX_CP	PCIe2.0 PEX_GPP differential receive pair 2
A39	GPP0_PEX2_TX_CN		B39	GPP0_PEX2_RX_CN	
A40	GND	Ground connection	B40	GND	Ground connection
A41	GPP1_PEX1_TX_CP	PCIe2.0 PEX_GPP differential transmit pair 1	B41	GPP1_PEX1_RX_CP	PCIe2.0 PEX_GPP differential receive pair 1
A42	GPP1_PEX1_TX_CN		B42	GPP1_PEX1_RX_CN	
A43	PWR_BTN#	System power button signal	B43	SLP_S3#	S3 state flag active low output
A44	GFX0_PEX0_TX_CP	PCIe2.0 PEX_GFX differential transmit pair 0	B44	GFX0_PEX0_RX_CP	PCIe2.0 PEX_GFX differential receive pair 0
A45	GFX0_PEX0_TX_CN		B45	GFX0_PEX0_RX_CN	
A46	X_PW_OK	Voltage Regulators circuitry of the face module is up indicator	B46	GE22	General Event #22
A47	VCC_12V		B47	VCC_12V	
A48	VCC_12V		B48	VCC_12V	
A49	VCC_12V		B49	VCC_12V	
A50	VCC_12V	Main 12V power domain	B50	VCC_12V	Main 12V power domain

6.4 Custom Design GPIOs

Fit-PC4 incorporates general purpose input output signals for user application implementations and custom system design.

Table 26 – Custom Design GPIO table (TBD)

SoC GPIO	Signal	Direction	Default Drive	Default Pull (PU/PD)	EXT1 pin#

7 Advanced Technologies

7.1 AMD Virtualization Technology

Virtualization helps companies save money and increase agility. But it can also impose some serious CPU and memory demands on your hardware. You need a computing platform that can provide a robust and scalable environment for virtualization while maintaining power efficiency.

AMD Virtualization (AMD-V™) Technology is a set of hardware extensions to the x86 system architecture that allows you to better utilize your resources, which make your servers, clients, and datacenters more effective.

AMD-V™ is designed to help simplify virtualization solutions, enabling a more satisfying user experience and near native application performance. AMD-V technology includes features such as:

- **Virtualization extensions to the x86 instruction set** – Enables software to more efficiently create virtual machines so that multiple operating systems and their applications can run simultaneously on the same computer.
- **Tagged TLB** – Hardware features that facilitate efficient switching between virtual machines for better application responsiveness.
- **Rapid Virtualization Indexing (RVI)** – Helps accelerate the performance of many virtualized applications by enabling hardware-based virtual machine memory management.
- **AMD-V™ Extended Migration** - Hardware feature that helps virtualization software enable live migration of virtual machines between all available AMD Opteron™ processor generations.
- **I/O Virtualization** - Enables direct device access by a virtual machine, bypassing the hypervisor for improved application performance and improved isolation of virtual machines for increased integrity and security.

8 Power Management

8.1 Power Manager

In fit-PC4 system architecture the SoC itself responsible for all Power Management functionality and activity.

Power management and its HW/FW defined by Compulab's system architecture and AMD platform architecture. It is responsible for power management and housekeeping functionality in the platform. It interfaces with system power supplies and power sequencing logic. It is essential part for proper system operation.

9 Electrical Characteristics

9.1 Absolute Maximum Ratings

Operating the fit-PC4 under conditions beyond its absolute maximum ratings may damage the device. Absolute maximum ratings are limiting values to be considered individually when all other parameters are within their specified operating ranges. Functional operation and specification compliance under any absolute maximum condition, or after exposure to any of these conditions, are not guaranteed or implied. Exposure may affect device reliability.

Table 27 – Absolute Maximum Ratings

Parameter	Min	Typ.	Max	Unit
Main power supply voltage	8.5	-	16	V

9.2 Recommended Operating Conditions

Operating conditions include parameters that are under the control of the user: power-supply voltage and ambient temperature. The fit-PC4 meets all performance specifications when used within the recommended operating conditions, unless otherwise noted.

Table 28 – Recommended Operating Condition

Parameter	Min	Typ.	Max	Unit
Main power supply voltage	10	12	15	V

9.3 DC Electrical Characteristics

Table 29 – DC Electrical Characteristics

Parameter	Operating Conditions	Min	Typ.	Max	Unit
3.3V Digital I/O					
V_{IH}	GPIOs	1.5	-	-	V
V_{IL}		-	-	1.5	V
V_{OH}		2.4	-	-	V
V_{OL}		-	-	0.4	V
RS232					
TX Voltage Swing		±5.0	±5.4	-	V
Input Voltage Range		-25	-	25	V

9.4 Power Supply

Fit-PC4 wall power supply:

- Input: 100-240VAC 50/60Hz
- Output: 12VDC 3A, 36W

10 Mechanical Characteristics

10.1 Mechanical Drawings

10.1.1 Fit-PC4 Pro

Figure 17 – fit-PC4 Pro Isometric Front

Figure 18 – fit-PC4 Pro Isometric Back

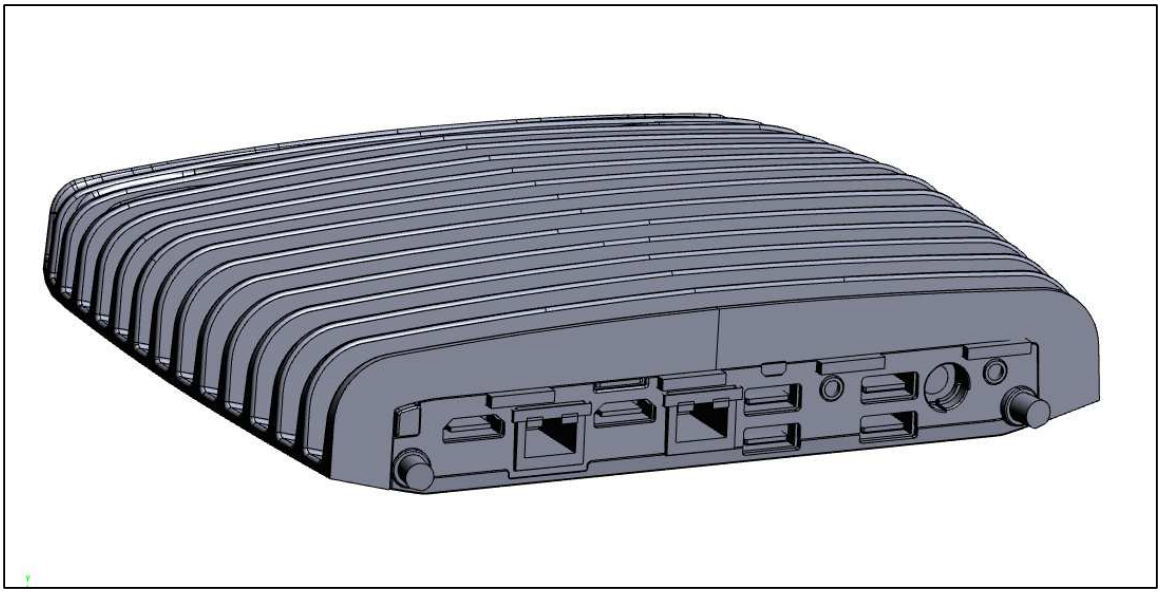


Figure 19 – fit-PC4 Pro Front Panel

Figure 20 – fit-PC4 Pro Back Panel

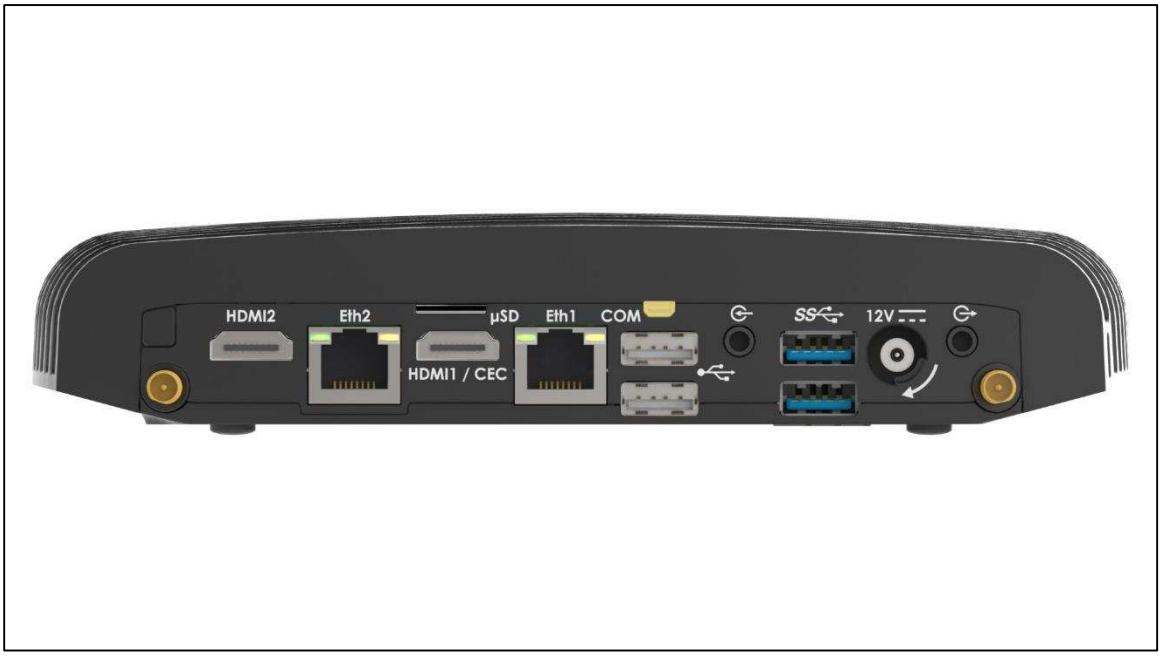
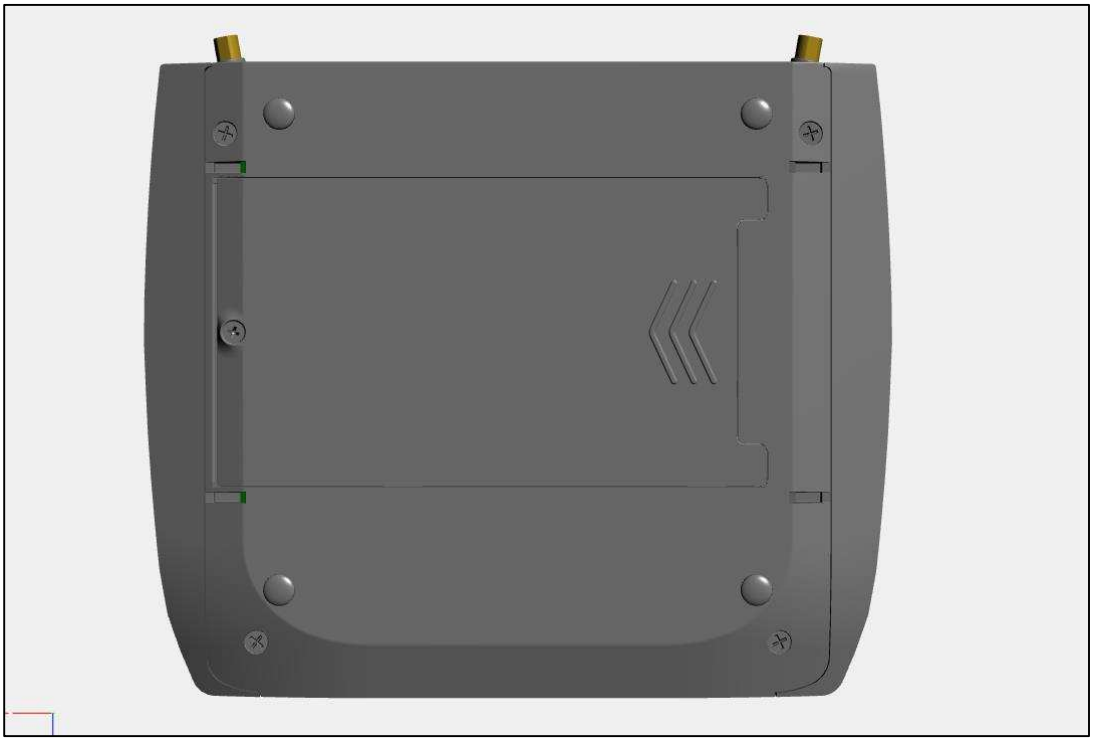


Figure 21 – fit-PC4 Pro Top

Figure 22 – fit-PC4 Pro Bottom



10.1.2 Fit-PC4 Value

Figure 23 – fit-PC4 Value Front Panel

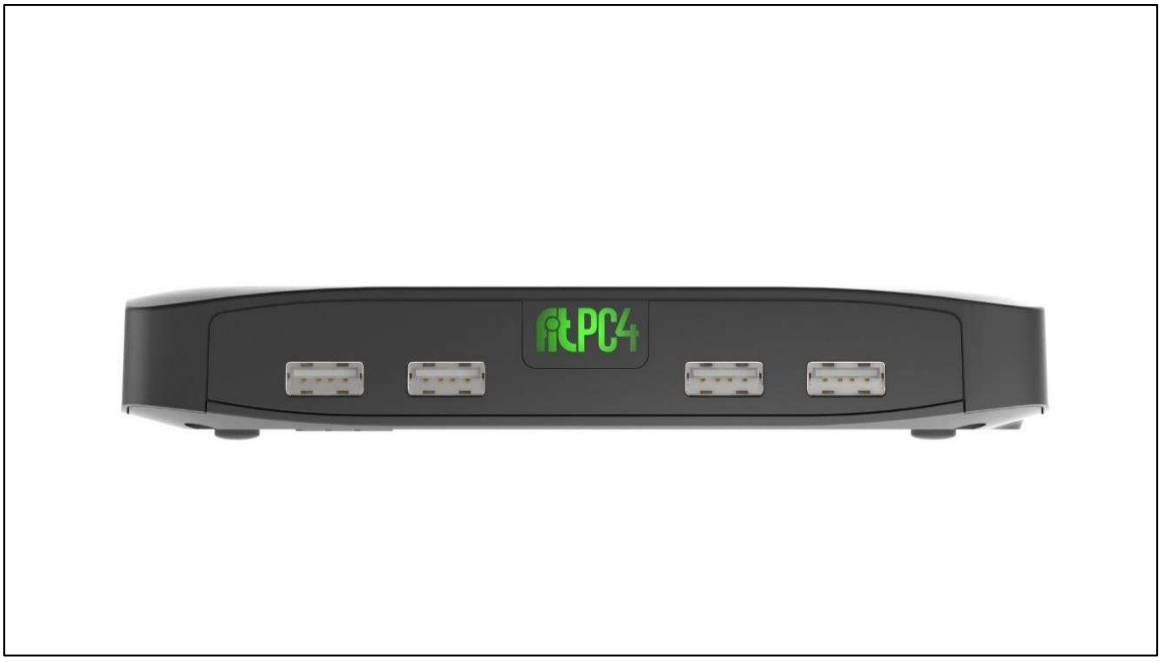
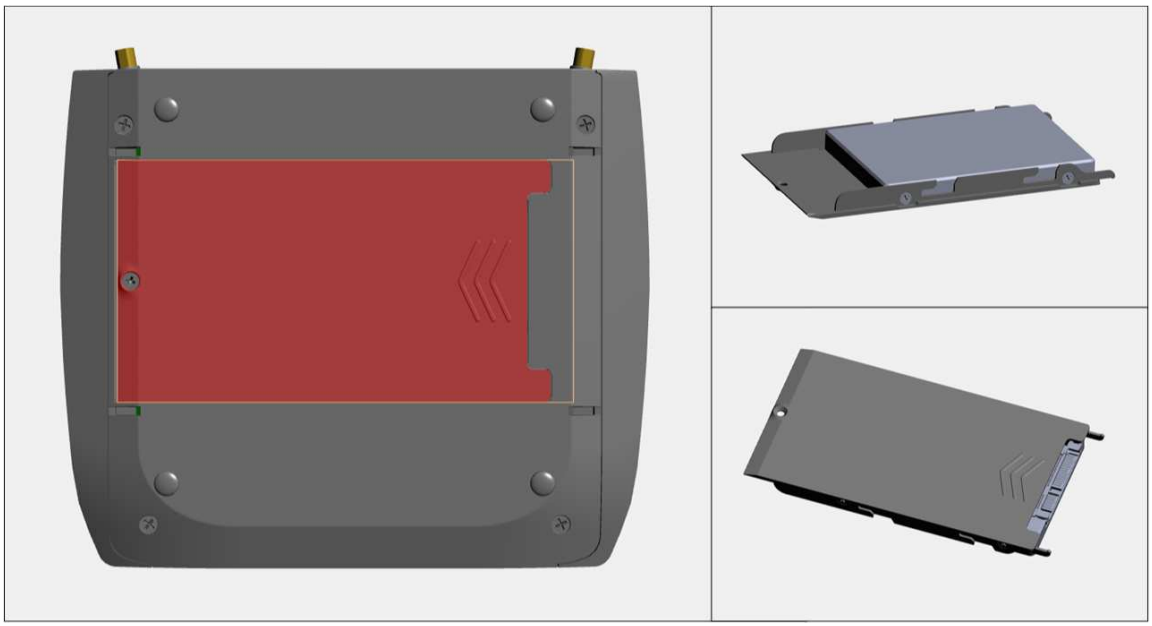


Figure 24 – fit-PC4 Value Back Panel

Figure 25 – fit-PC4 service door with mounted HDD/SSD storage drive



10.1.3 Single Board Computer

Single Board Computers or Open Chassis platforms based on fit-PC4 HW available for system integration and industrial business applications. Available in both variations with or without FACE Module. SBC HW should be thermally coupled to a passive or active cooling system in order to guarantee proper operation and maximal performance.

SBC supplied with a heat plate in order to simplify system integration and provide an easy way to attach it to a heat sink.

Note: Heat plate alone does NOT guarantee sufficient cooling in order to provide maximal performance, therefore in order to avoid system throttling or thermal shut down in worst cases, system integrators must supply additional system cooling method.

Figure 26 – SBC-FITPC4 Top

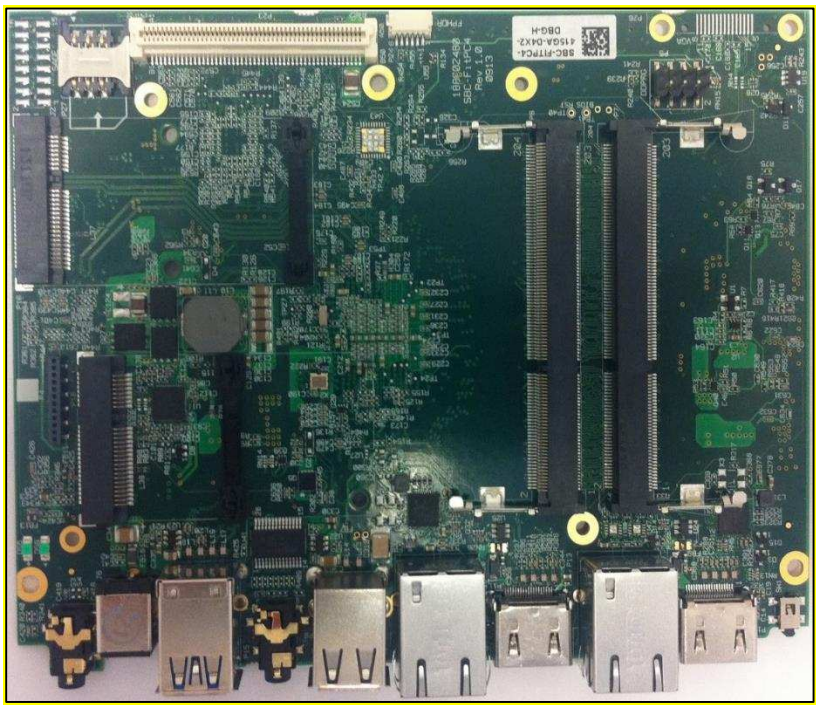
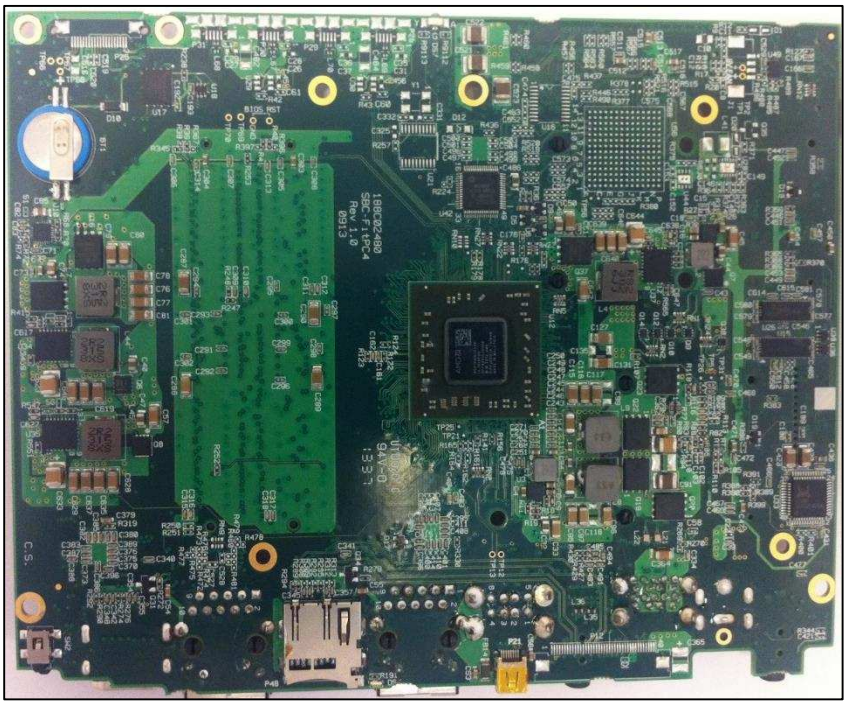


Figure 27 – SBC-FITPC4 Bottom



10.2 Environmental

Fit-PC4 models available in 3 operating temperature grades – Commercial, Extended and Industrial. Please refer to the table below:

Table 30 – Operating Temperature Grades

Operating Conditions	Op. Temp. grades		
	Commercial	Extended (TE)	Industrial (TI)
HDD models	0°C – 50°C	N/A	N/A
SSD models	0°C – 70°C	-20°C – 70°C	-40°C – 70°C

11 Resources

For more Compulab resources please use the following links:

1. Fit-PC website:

   http://www.fit-pc.com/web/

2. fit-PC4 product page:
   http://www.fit-pc.com/web/products/fit-pc4/

3. Wiki pages for additional documentation and driver download:

   http://www.fit-pc.com/wiki/index.php/Main_Page

4. Forum:
   http://www.fit-pc.com/forum/viewforum.php?f=71