



# CPC507

**SoC AMD FP5 APU Based  
6U Compact PCI CPU Module**

## User Manual

Rev. 002

August 2022



*The product described in this manual is compliant with all related CE standards.*

Product Title: CPC507  
Document name: CPC507 User Manual  
Manual version: 002  
Ref. docs:

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## Revision Record

Rev. Index	Brief Description	Product Index	Date
001	Initial version	CPC507	February 2021
002	Compliance assessment	CPC507	August 2022

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## Safety requirements

This Fastwel Group's product is developed and tested for the purpose of ensuring compliance to the electric safety requirements. Its design provides long-term trouble-free operation. The service life of the product can be significantly reduced due to the improper handling during unpacking and installation. Therefore, in the interests of your safety and in order to ensure proper operation of the product, you should follow the recommendations below.

## Conventions



### **Caution, High Voltage!**

This sign and text warn of the dangers associated with electrical discharges (> 60 V) when touching the device or any part of it. Failure to follow the precautions mentioned or prescribed in the regulations may endanger your life or health, and may result in damages to the equipment.



### **Attention! Static-Sensitive Device!**

This sign and text indicate that the electronic boards and their components are sensitive to static electricity, so proper care should be taken when handling this device and performing inspections to ensure its integrity and functionality.



### **Attention! Hot surface!**

This sign and text warn of the dangers associated with touching hot surfaces of the device.



### **Attention!**

This sign is aimed at drawing your attention to aspects of this User Manual. Failure to fully understand or ignoring these aspects may endanger your health or cause damages to the equipment.



### **Note**

This sign is used to text fragments that should be read carefully.

## Safety requirements

This Fastwel Group product has been developed and tested to ensure compliance with electrical safety requirements. Its design provides long-term failsafe operation. Mishandling the product during unpacking and installation may significantly affect the product's life cycle. Therefore, for your own safety and for ensuring proper operation of the device, you should follow the recommendations given below.

### Rules for safe handling with high voltage



#### Attention!

All operations with this device should only be performed by personnel with sufficient qualifications.



#### Caution, High Voltage!

Before installing the board in the system, make sure that the mains power supply is off. The same also applies to the installation of expansion boards.

There is a serious risk of electric shock during installation, repairs, and maintenance of the device, so always unplug the power supply cord while carrying out of works. The same also applies to the other power supply cables.

### Board Handling Instructions



#### Static-sensitive device!

Electronic boards and their components are sensitive to static electricity. Therefore, special attention should be given when handling these devices to ensure their safety and operability.

- ✓ Do not leave the board in the non-operating position without protective packaging.
- ✓ If possible, always work with the board in workplaces protected against static electricity. Should this not be possible, the user should remove the static charge before touching the product with their hands or tools. The best way to do so is by touching any metal part of the system enclosure.
- ✓ It is especially important to observe precautions when replacing expansion boards, jumpers, etc. If the product is equipped with batteries to power the memory or real-time clock, avoid placing the board on conducting surfaces such as anti-static mats or sponges. They can cause short circuits and damage the battery and the board's conducting circuits.



## General rules of usage

- ✓ In order to keep the warranty, the product must not be altered or changed in any way. Any changes and improvements unauthorized by Fastwel Group other than those contained in this User Manual or received from the technical support service of Fastwel Group in the form of a set of instructions for their implementation will void the warranty.
- ✓ This device should be installed and connected only to systems that meet all necessary technical and climatic requirements. This also applies to the operating temperature range of a particular version of the board. You should also consider the temperature limits of the batteries installed on the board.
- ✓ Only follow the instructions in this User Manual when performing all necessary installation and configuration operations.
- ✓ Retain the original packaging for storing products in the future or to transport in case of a warranty claim. If it is necessary to transport or store the board, pack it the same way as it was packed at the time of receipt.
- ✓ Proceed with extra caution when handling and unpacking the device. Follow the instructions given above and in the below chapter “Transportation, Unpacking and Storage”.

## MANUFACTURER’S WARRANTIES

### Warranty liabilities

The manufacturer guarantees that the CPC507 Module meets the requirements of technical specifications for IMES.467444.117, provided that the Consumer complies with the operating conditions, transportation, storage, installation and mounting, set by the operational documents. The manufacturer guarantees that the products supplied by it will not show any manufacturing defects and materials used in compliance with the rules of operation and maintenance during the warranty period established at the moment. The Manufacturer's obligation under this warranty is to repair or replace, free of charge, any defective electronic component included in the returned product.

Products that failed through the Manufacturer’s fault during the warranty period will be repaired free of charge. In other cases, the Consumer will be billed based on current remuneration rates and the cost of consumables.

### Right of liability limitation

The manufacturer is not responsible for any damages caused to the Consumer’s property due to the failure of the product in the process of its use.

### Warranty period

The warranty period for the manufacturer's products is 36 months from the date of sale (unless otherwise provided by the delivery agreement).

For customized products, the warranty period is 60 months from the date of sale (unless otherwise provided by the delivery agreement).

### **Limitation of warranty obligations**

The above warranty does not apply to:

- the products (including software) that have been repaired or modified by the employees who do not represent the Manufacturer. The exception is when the Consumer has made repairs or made changes to the product strictly in accordance with the instructions previously agreed and approved by the Manufacturer in writing;
  
- the products which have failed because of inappropriate change of a polarity sign (to the opposite one) of the power supply source, incorrect operation, transportation, storage, installation, mounting or accident.

### **Procedure for returning products for repairs**

In order to return the products for repairs:

- contact the Product Supplier or any official dealer of the Product Supplier for return material authorization for the product;
- attach to the returned product the fault identification report made in the form adopted by the Consumer, indicating the list of circumstances and signs of malfunction;
- place the product in the consumer packaging of the Manufacturer (antistatic bag) and cardboard packaging (box)), in which the product was delivered to the Consumer. If there is no antistatic bag, the Consumer loses the right to warranty service unilaterally;
- the Consumer pays all the expenses related to the delivery of the product to the Supplier or any official dealer of the Supplier.

# Transportation, Unpacking and Storage

## Transportation

The modules should be transported in the separate manufacturer's packaging (container), consisting of an individual antistatic packaging and a cardboard box, in closed transport (road, rail, air in heated and sealed compartments) under storage conditions 5 according to the GOST standard 15150-69 or under storage conditions 3 for sea transportation.

It is allowed to transport the modules packed in individual antistatic bags in manufacturer's group packaging (container).

Transportation of packaged modules should be carried out in accordance with the rules of transportation of goods currently valid for this type of transport.

During handling operations and transportation, the packed modules should not be subjected to sudden shocks, drops, impacts and precipitation. The packed modules should be placed on the vehicle in such a way as to preclude their further movements.

## Unpacking

Before unpacking, after transportation at negative ambient temperatures, the modules must be kept for 6 hours under storage conditions 1, in accordance with the GOST standard 15150-69.

Do not place the packed modules near any heat sources before unpacking.

When unpacking the modules, it is necessary to observe all precautions to ensure their safety, as well as marketable condition of manufacturer's consumer packaging.

When unpacking, it is necessary to check the modules for any external mechanical damages after transportation.

## Storage

Storage conditions of the modules 1 comply with the GOST standard 15150-69.

## Three Year Warranty

Fastwel Co. Ltd. (Fastwel), warrants that its standard hardware products will be free from defects in materials and workmanship under normal use and service for the currently established warranty period. Fastwel's only responsibility under this warranty is, at its option, to replace or repair any defective component part of such products free of charge.

Fastwel neither assumes nor authorizes any other liability in connection with the sale, installation or use of its products. Fastwel shall have no liability for direct or consequential damages of any kind arising out of sale, delay in delivery, installation, or use of its products.

If a product should fail through Fastwel's fault during the warranty period, it will be repaired free of charge. For out of warranty repairs, the customer will be invoiced for repair charges at current standard labor and materials rates.

Warranty period for Fastwel products is 36 months since the date of purchase.

For customized products, the warranty period is 60 months from the date of sale (unless otherwise provided by the delivery agreement).

### **The warranty set forth above does not extend to and shall not apply to:**

1. Products, including software, which have been repaired or altered by other than Fastwel personnel, unless Buyer has properly altered or repaired the products in accordance with procedures previously approved in writing by Fastwel.
2. Products, which have been subject to power, supply reversal, misuse, neglect, accident, or improper installation.

### **Returning a product for repair**

1. Apply to Fastwel Company or to any of the Fastwel's official representatives for the Product Return Authorization.
2. Attach a failure inspection report with a product to be returned in the form, accepted by customer, with a description of the failure circumstances and symptoms.
3. Carefully package the product in the antistatic bag, in which the product had been supplied. Failure to package in antistatic material will VOID all warranties. Then package the product in a safe container for shipping.
4. The customer pays for shipping the product to Fastwel or to an official Fastwel representative or dealer.

# 1 Introduction

## 1.1 System overview

The CPC507 (IMES.467444.117) CPU module (hereinafter referred to as the Device or the Product) presented in this User Manual is manufactured in CompactPCI (CPCI) form-factor and supports the PCI architecture. This allows you to work with a wide range of equipment. For the information on the CompactPCI standard, please refer to the relevant specifications for PCI and CompactPCI Standards. For more information on these standards and their use, please visit the official website of the PCI Industrial Computer Manufacturers Group (PICMG) at: <http://www.picmg.org/>.

## 1.2 General Description of the Module

The CPC507 CPU module, implemented in accordance with the 6U CompactPCI standard, expands the line of Fastwel 6U modules. The most important feature of this module is the availability of two platforms for installation of PMC / XMC mezzanine modules. By using a single-chip solution based on AMD FP5 APU (Ryzen Embedded V-Series) SoC, together with 2 mezzanine modules, CPC507 can be used in compact and cost-effective computing systems.

The Ryzen Embedded platform is an up-to-date solution from AMD (launched in 2018, availability period: 10 years) based on the 14 nm technology. The System on a Chip (SoC) supports modern high-speed interfaces and also has an integrated graphics core with a large number of high-resolution digital video outputs.

## 1.3 Module versions

Module versions are specified in the Table 1-1 below.

**Table 1-1 – Versions of CPC507**

Name	Conventional name	Ordering name	Note
CPC507 CPU Module	CPC507	CPC507-01	AMD Ryzen Embedded V1404I processor 25W 4 cores, 16GB DDR4 SDRAM with ECC support, 3x LAN 10/100/1000 Mb, 3x USB 3.1, DisplayPort, CFast, 64 GB 3D NAND Flash, <b>from</b> -40 °C to +70 °C.
		CPC507-02	AMD Ryzen Embedded V1404I processor 15 W 4 cores, 8 GB DDR4 SDRAM with ECC support, 3 x LAN 10/100/1000 Mb, 3 x USB 3.1, DisplayPort, CFast, 64 GB 3D NAND Flash, from -40 °C to +85 °C.
Note – Application of conformal coating is available. When ordered, the -COATED option is added to the version name, for example CPC507-01-COATED.			

## 2 General Information

### 2.1 General Features of CPC507

- **Processor AMD Ryzen Embedded V1404I SoC APU:**

- 4 x cores x64, 8 x threads;
- 8 x graphics cores;
- 6 MB cache;

- **RAM:**

- DDR4-2400 SDRAM with ECC support:
- 16 GB (for CPC507-01);
- 8 GB (for CPC507-02).

- **Video Output:**

- DisplayPort (4096x2160@60Hz) interface, routed to the front panel;

- **PCI Bus:**

- Routed to the CompactPCI J1/J2 connectors;
- 64bit/66MHz;
- Implemented on the bridge PCIe->PCI-X PI7C9X130;
- Operation in the peripheral slot (Non-transparent Bridge mode).

- **PCIe Bus:**

- PCIe Gen3 (up to 8GT/s) is routed to the P15 XMC connector with support of up to x8 devices;
- Possibility to use link x8 in the 2x4 mode (configurable in BIOS), links x4 are routed to the P15 XMC1 and XMC2 connectors;

- **FRAM:**

- Volume 32 KB;

- **Integrated SATA SSD:**

- Capacity 64 GB 3D NAND Flash (Pseudo-SLC);
- SATA III 6 Gbps interface;

- **CFast drive:**

- Speed SATA III 6 Gbps interface;

- **SPI interface:**

- FRAM support;

- **3 x LAN ports 10/100/1000 Mb on PCIe x4 Gen2:**

- 2 x channels are routed to the backplane (PICMG 2.16);
- 1 x channel is routed to the front panel;
- Intel® Ethernet Controller I350 is used;

- **USB ports:**

- Support of USB 2.0 (480 Mb/sec), USB 3.1 Gen 1 (5 Gb/sec);
- Connection of up to 3 x devices via connectors on the front panel (USB 3.1 Gen 1);
- **Real Time Clock:**
  - Power is supplied from the CR2032 (3V) lithium battery;
- **Watchdog Timer:**
  - 30  $\mu$ s to 512 s with program control option;
- **Hardware monitor:**
  - Implemented via the SMBus interface;
  - Monitoring of up to 7 power supply voltages;
  - Monitoring the board temperature at two points;
- **Support of XMC/PMC expansion boards:**
  - Support of 2 x PMC/XMC modules;
  - PCI-X 64bit/66MHz bus is routed to the P1-P4 PMC1 and PMC2 connectors;
  - PMC I/O P4 is routed to RIO for the both mezzanines (PICMG PMC on CompactPCI R1.0 Specification);
  - PCIe x8 Gen3 Bus is routed to the P15 XMC1 (ANSI/VITA 42.3, XMC: PCI Express Protocol Layer) connector, can be used in the x4 mode for 2 x mezzanines.
- **LEDs:**
  - Board start diagnostics LED;
  - LED for accessing SATA drives;
  - LED for indication of processor overheating;
  - Two program-controlled LEDs (User LEDs);
- **Software compatibility:**
  - Linux Debian 10;
  - Astra Linux Special Edition, "Smolensk" release v1.5, v1.6;
  - Microsoft Windows 10 IoT Enterprise 64bit.
- **MTBF:**
  - Min. 50,000 hours;

## 2.2 Compatibility with the PICMG/VITA standards

The CPC507 module is compatible with the following PICMG/VITA standards:

- PICMG 2.0 CompactPCI R3.0 Specification;
- PICMG 2.3 PMC on CompactPCI R1.0 Specification;
- PICMG 2.16 CompactPCI Packet Switching Backplane R1.0 Specification;
- ANSI/VITA 42.0 XMC: Switched Mezzanine Card Base Specification;
- ANSI/VITA 42.3 XMC: PCI Express Protocol Layer;
- ANSI/VITA 30.1 2mm Connector Practice for Conduction Cooled Euroboards;
- ANSI/VITA 39 PCI-X for PMC and Processor PMC;

## 2.3. Device dimensions

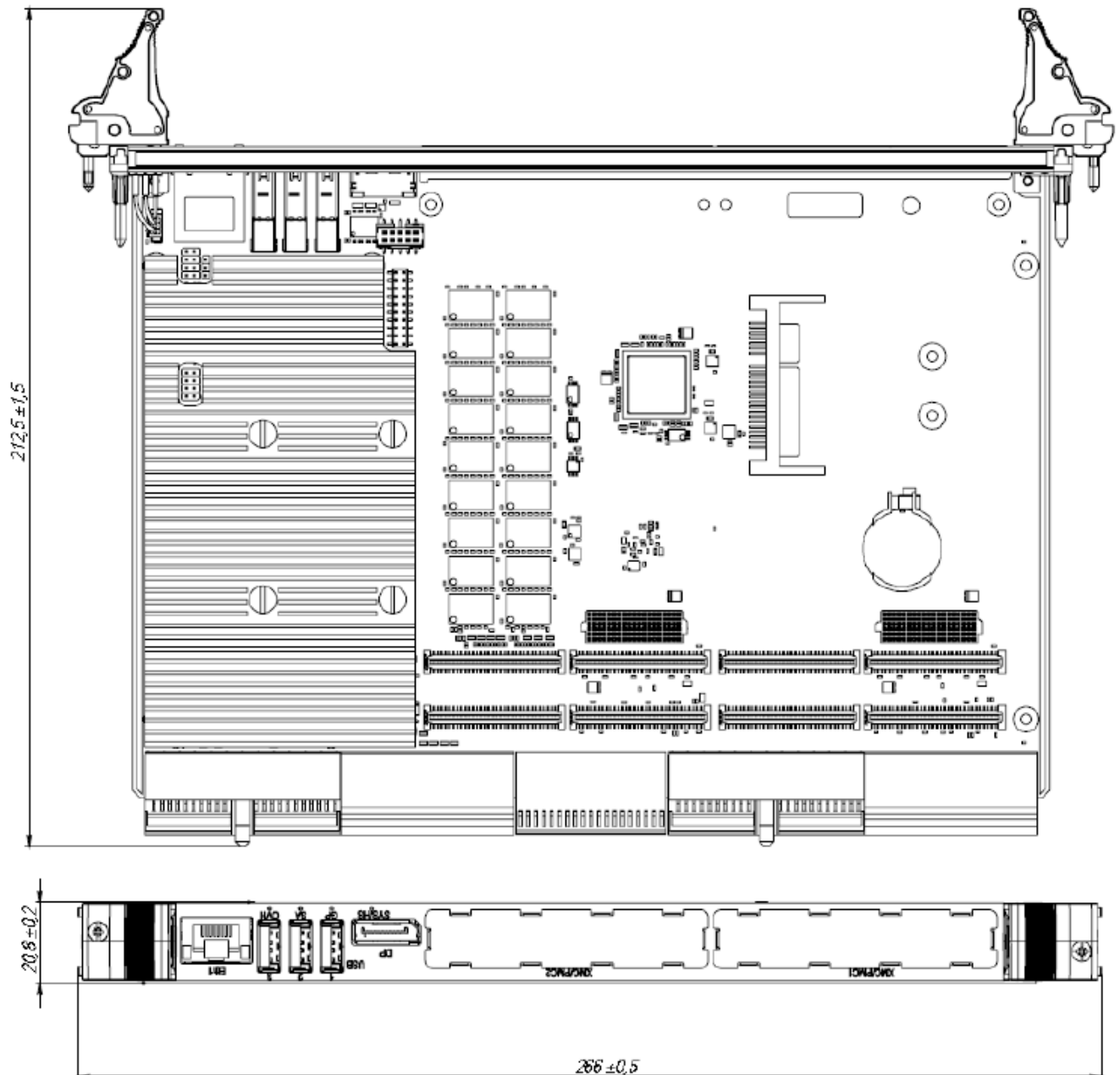


Figure 2-1: Device dimensions

## 2.4. Delivery checklist

The complete delivery checklist for CPC507 is specified in the Table 1-2.



Table 2-1: Delivery checklist

Designation	Name	Number	Note
IMES.467444.117 IMES.467444.117-01	CPC507-01 CPU Module CPC507-02 CPU Module	1 pcs.	
IMES.467941.057	An installation kit consisting of: - locking mechanism IMES.741124.233 - 1 pcs; - screw DIN7985-M2,5x6-A2 - 2 pcs.	1 pcs.	
IMES.421945.071-16	Packaging	1 pcs.	

## 2.5 Operational conditions

The product must be remain functional under climatic and mechanical effects given in Table 1-3.

Table 2-2: Operational ranges of external influencing factors

Influencing factor	Characteristics of the influencing factor	Value of the influencing factor
1. Sinusoidal vibration	Acceleration amplitude, m/s <sup>2</sup> (g)	20 (2)
	Frequency range, Hz	10-500
2. Single acting mechanical shock	Acceleration amplitude, m/s <sup>2</sup> (g)	300 (30)
	Duration of shock acceleration, ms	11
3. Repeated mechanical shock	Acceleration amplitude, m/s <sup>2</sup> (g)	100 (10)
	Duration of shock acceleration, ms	11
Influencing factor	Characteristics of the influencing factor	Value of the influencing factor
	Number of shocks	1000
4. Ambient temperature	Measuring range, °C	From -40 to +70 From -40 to +85
	<ul style="list-style-type: none"> <li>• version CPC507-01</li> <li>• version CPC507-02</li> </ul>	
5. Cyclic damp heat*	Temperature, °C	55

	Relative humidity, %	93
* - only for versions with conformal coating (additional option, when ordering – COATED is added to the product name)		

## 2.6 Product labeling

Product labelling shall contain:

- Name and trademark of the manufacturer;
- Product name;
- Factory number of the product;
- Product's version.

The package labelling shall contain:

- Product name;
- Product version;
- Factory number of the product.

## 2.7 Packaging information

The CPC507 Module is supplied in a box of the following size: 350x260x70 mm.  
Packaged weight of the device – no more than 0.8 kg.



### Note

Keep the module's anti-static bag and consumer packaging in their original form until the end of the warranty period.

## 3 Design and operation

### 3.1 Block diagram

The block diagram is specified in Figure 3-1 below.

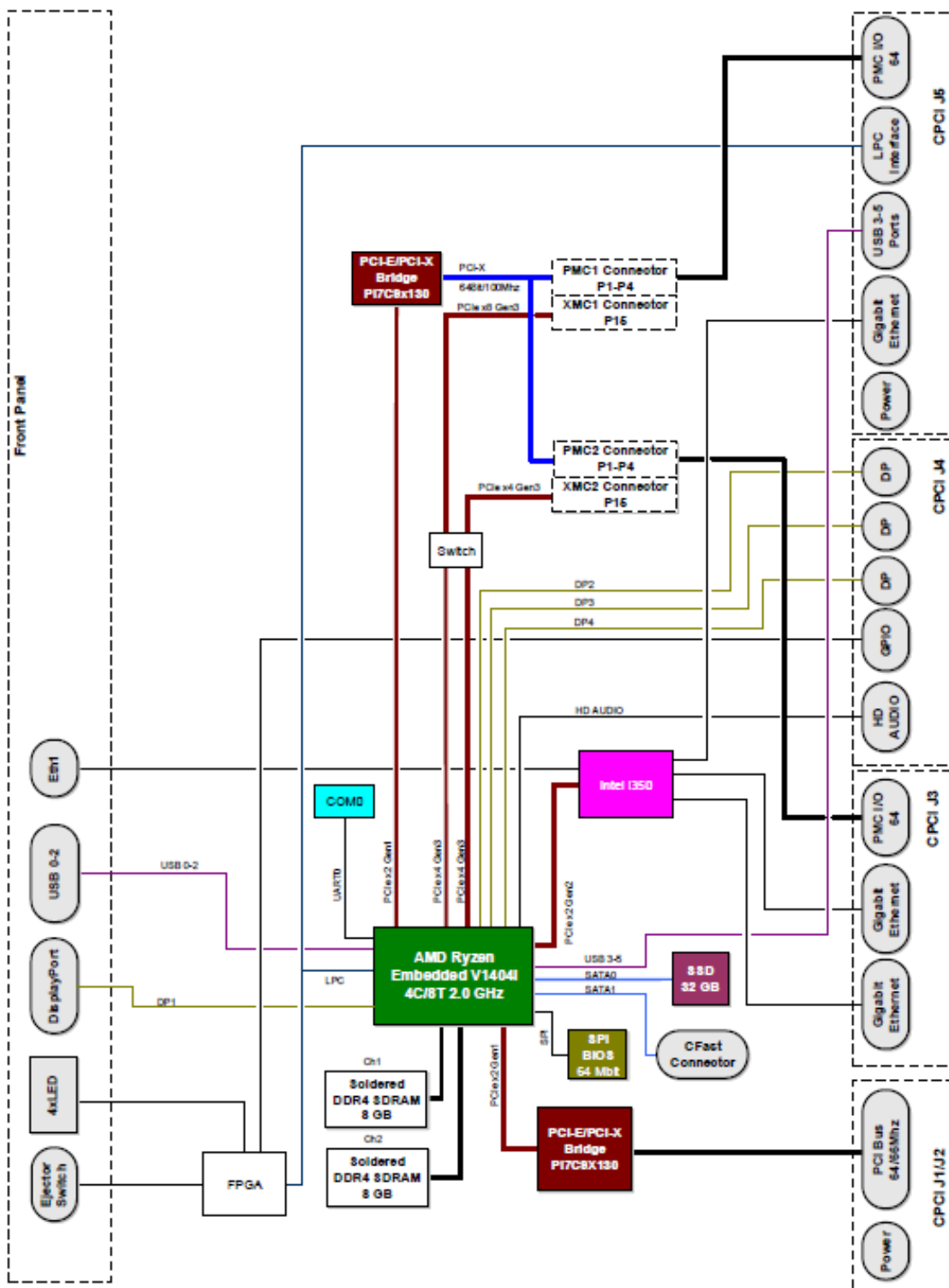


Fig. 3-1 – Block diagram of the device

## 3.2 Specific performance features of functional nodes

### ■ AMD Ryzen Embedded SoC APU

64-bit AMD CPU, manufactured on 14nm technology node, offering TDP of 25W and an industrial operating temperature range (from -40 to + 105°C).

This CPU is a single-chip solution that combines 4 x AMD “Zen” processing cores, a 64-bit dual-channel DDR4 SDRAM memory controller (up to 32 GB, 2400 MHz) and ECC support, the up-to-date AMD Radeon Vega graphics subsystem with 2D/3D acceleration, an I/O subsystem (PCIe, USB, SATA) and a set of standard hardware platform support (RTC, UART, Timers, GPIO).

The processor is implemented in the FP5-BGA1140 enclosure, 35x25mm.

### ■ DDR4 SDRAM

The board can have 18 x DDR4 2400 MHz SDRAM chips installed (soldered) on it with a total capacity of up to 16GB. (18 x 8 GB x 8). The operating mode is two-channel, with ECC support.

### ■ RTC, NVRAM

The real time clock is integrated into the SoC. The clock operation in the power-off state is ensured by a CR2032 lithium battery installed on the board. BIOS settings are stored in FRAM non-volatile memory.

### ■ FRAM

There is a non-volatile memory of 32 KB (Ramtron, FM25V02, SPI), which is required for storing user data (used as a replacement for standard non-volatile RAM). The manufacturer guarantees 100 trillion read/write cycles, which in this type of application corresponds to ~ 340 years of operation (in the case of a continuous cyclic write/ read procedure).

### ■ BGA SSD

The board is equipped with a 64 GB SATA III 6 Gbps SSD in a TFBGA 16x20mm Jedec MO-276 enclosure.

### ■ Ethernet

The board has 3 x integrated Gigabit Ethernet interfaces. One is routed to the front panel, the other two – to the backplane (PICMG 2.16). The interfaces are implemented on the high-speed Intel® Ethernet Controller I350.

### ■ USB

The board has 3 x USB 3.1 Gen 1 channels routed to type A USB connectors on the front panel.

### ■ CFast

The CFast is used for connecting appropriate drives. SATA III (6 Gbps) speed is supported.

### ■ DisplayPort

The interface is designed to connect digital monitors with a resolution up to 4096x2160@60Hz.

### ■ PCI Express

The PCIe Gen3 bus is routed to the P15 XMC1 connector in accordance with the ANSI/VITA 42.3 standard. The interface enables you to connect XMC expansion modules with a set of links x1, x2, x4, x8. A PCIe x4 link is routed to the P15 XMC2 connector. It can be used if the link on the XMC1 is narrowed down to x4.

### ■ PCI

The PCI bus is implemented on the Pericom PI7C9X130 reversible bridge chip connected to the PCIe x2 bus. The following operating modes are supported: PCI 32bit/33MHz, PCI 64bit/66MHz. The operation both in the system and in the peripheral slot is supported.

### ■ COM0

The debug COM port is routed to the IDC XP2 connector on the board.

### ■ LEDs

The LEDs for indication of startup diagnostics, drive activities, overheating as well as User LEDs are routed to the front panel. The diagnostics LED enables you to distinguish 4 board states: power OFF, power ON, BIOS start, BIOS shutdown (operating system start). The drive activities LED informs about the activities of the SATA interfaces. Two program-controlled LEDs are intended for user needs.

### ■ Watchdog

The module is equipped with a watchdog timer, which is built into the supervisor's microchip and has an adjustable actuation interval (30.52 $\mu$ s - 512s).

### ■ Jumpers

The board has a switch for resetting BIOS to default settings.

## 3.3 System expansion options

The number of interfaces routed from the CPC507 module can be increased by installing 2 x XMC/PMC expansion modules.

### 3.3.1 PMC/XMC Modules

PMC/XMC interface of the CPC507 board supports two expansion modules of the XMC/PMC standard, which ensures an easy and flexible adaptation of CPC507 in accordance with the requirements of various applications.

## 3.4 Using the module in the CPCI system

Table 3-1: System information

Characteristics	Note
Operation in the system slot as the System Master	The CPC507 module is designed for the use as the System Master. In this capacity, it can interrelate with seven peripheral boards via a 64-bit 33/66 MHz bus.
Operation in the peripheral slot of the system	The CPC507 module, when installed in the system's peripheral slot, is connected to the PCI bus through the "nontransparent" bridge. The CPC507 is powered from the backplane and can operate in the PICMG 2.16 packet switching mode (if the system supports the PICMG 2.16 standard) with support of up to 2 x Gigabit Ethernet channels.

### 3.5 Location of main components

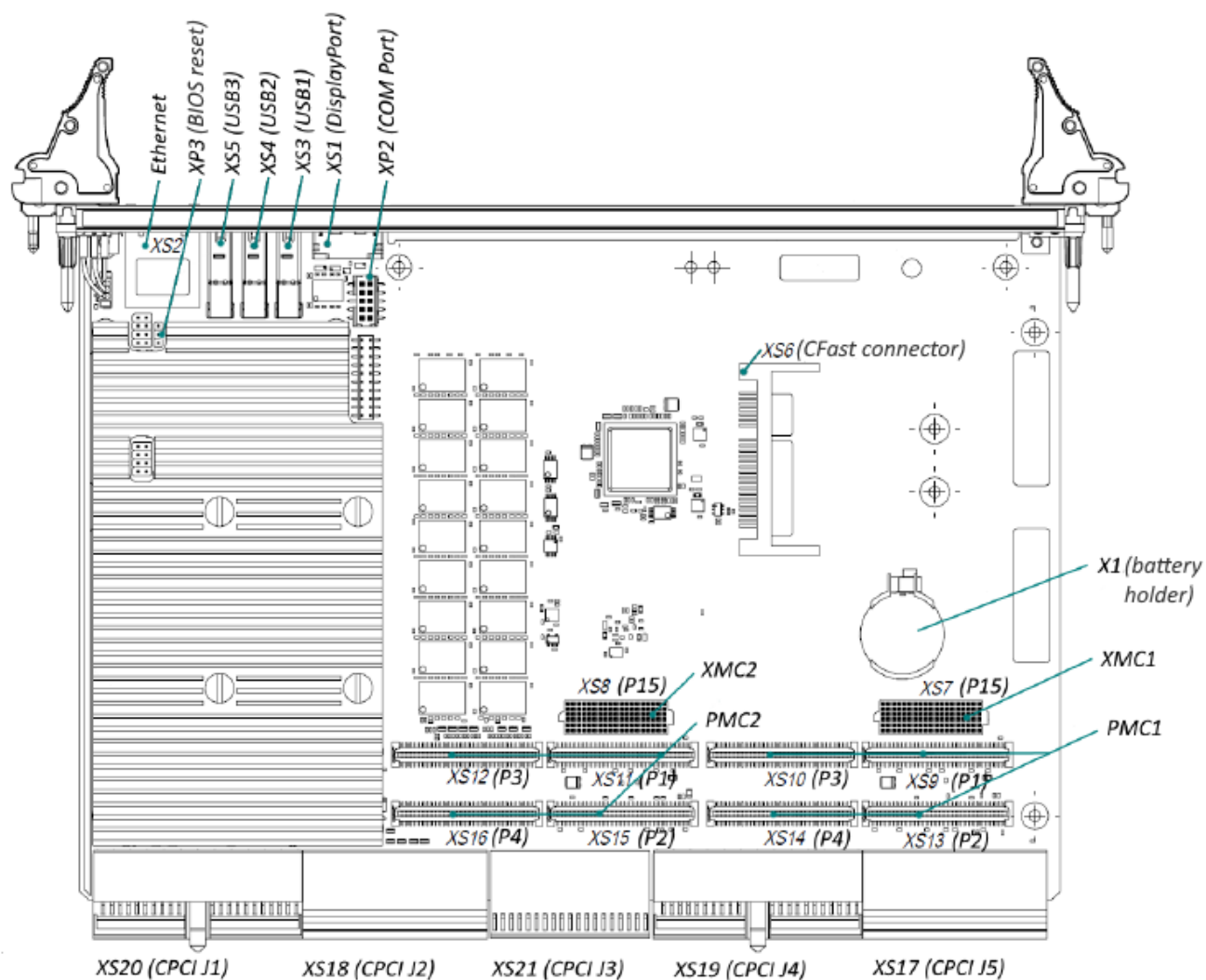


Figure 3-2: Location of the main components of CPC507

The appearance of the module versions may slightly differ from the one shown in this figure.

## 4 Intended use

### 4.1 Module Interfaces

#### 4.1.1 XMC interface

For XMC expansion modules, the CPC507 board is equipped with XS7 (P15) and XS8 (P15) connectors.

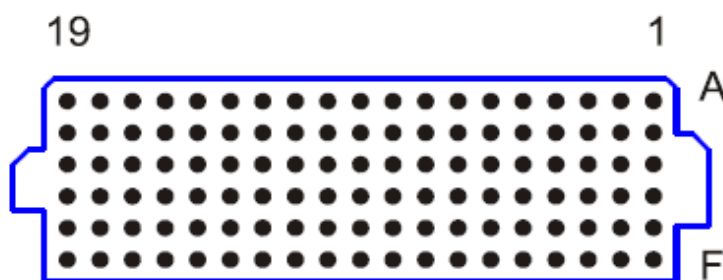


Figure 4-1: XMC XS7 (P15) and XS8 (P15) connectors

Below you can find the pinout tables for XMC connectors.

Table 4-1: Purpose of XMC1 XS7 (P15) and XMC2 XS8 (P15) connector pins on the CPC507 board

P15						
Pin	A	B	C	D	E	F
1	RX0+	RX0-	+3.3V	RX1+	RX1-	+5V
2	GND	GND	NC	GND	GND	PCIRST#
3	RX2+	RX2-	+3.3V	RX3+	RX3-	+5V
4	GND	GND	NC	GND	GND	RSTO#
5	RX4+	RX4-	+3.3V	RX5+	RX5-	+5V
6	GND	GND	NC	GND	GND	+12V
7	RX6+	RX6-	+3.3V	RX7+	RX7-	+5V
8	GND	GND	NC	GND	GND	-12V
9	NC	NC	NC	NC	NC	+5V
10	GND	GND	NC	GND	GND	GA0
11	TX0+	TX0-	GA1	TX1+	TX1-	+5V
12	GND	GND	GND	GND	GND	PRSNT#
13	TX2+	TX2-	+3.3V_SBY	TX3+	TX3-	+5V
14	GND	GND	GA2	GND	GND	MSDA
15	TX4+	TX4-	NC	TX5+	TX5-	+5V
16	GND	GND	MVMRO	GND	GND	MSCL
17	TX6+	TX6-	NC	TX7+	TX7-	NC
18	GND	GND	NC	GND	GND	NC
19	CLK0+	CLK0-	NC	WAKE#	ROOT#	NC

### 4.1.2. PMC interface

The PMC expansion modules are plugged into XS9 (P1), XS10 (P3), XS13 (P2) and XS14 (P4) connectors for PMC1 and XS11 (P1), XS12 (P3), XS15 (P2), XS16 (P4) connectors for PMC2.

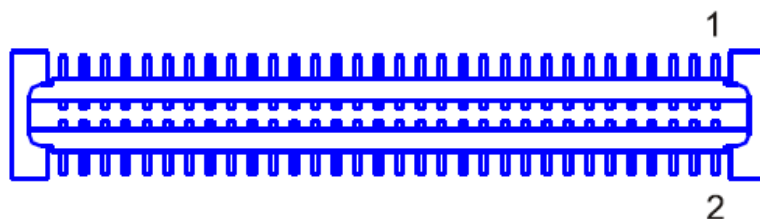


Figure 4-2: Connectors PMC XS10 (P3), XS11 (P1), XS12 (P3) and XS13 (P2)

The PMC connectors have 64-bit PCI bus lines routed to them. The user-defined I/O signals are supported and are routed to J5 and J3 CompactPCI connectors.

The PMC interface complies with the ANSI/VITA 39 specification, which defines the PCI-X electrical interface for the boards of the Common Mezzanine Card (CMC) form-factor. CPC507 allows operation of the 3.3V PCI bus.



**Note:**

The PMC I/O signals are routed to the J5, J3 CompactPCI connectors. Their pin assignments can be found in this chapter below.

The table with the PMC connector pinouts can be found on the next page.



Table 4-2: PMC connector pin assignment

Number of pin XS9(P1)/XS11( P1)	Function	Number of pin XS13(P2)/XS 15(P2)	Function	Number of pin XS10(P3)/XS12 (P3)	Function	Number of pin XS14(P4)/ XS16(P4)	Function
P1_1	NC	P2_1	+12V	P3_1	NC	P4_1	PMC_I/O
P1_2	-12V	P2_2	NC	P3_2	GND	P4_2	PMC_I/O
P1_3	GND	P2_3	NC	P3_3	GND	P4_3	PMC_I/O
P1_4	INTD#	P2_4	NC	P3_4	C_BE7#	P4_4	PMC_I/O
P1_5	INTE#	P2_5	NC	P3_5	C_BE6#	P4_5	PMC_I/O
P1_6	INTF#	P2_6	GND	P3_6	C_BE5#	P4_6	PMC_I/O
P1_7	NC	P2_7	GND	P3_7	C_BE4#	P4_7	PMC_I/O
P1_8	VCC	P2_8	NC	P3_8	GND	P4_8	PMC_I/O
P1_9	INTG#	P2_9	NC	P3_9	VIO	P4_9	PMC_I/O
P1_10	NC	P2_10	NC	P3_10	PAR64	P4_10	PMC_I/O
P1_11	GND	P2_11	PULL_UP	P3_11	AD63	P4_11	PMC_I/O
P1_12	NC	P2_12	+3,3V	P3_12	AD62	P4_12	PMC_I/O
P1_13	PCICLK	P2_13	PCIRST#	P3_13	AD61	P4_13	PMC_I/O
P1_14	GND	P2_14	PULL_DOWN	P3_14	GND	P4_14	PMC_I/O
P1_15	GND	P2_15	+3,3V	P3_15	GND	P4_15	PMC_I/O
P1_16	GNT#	P2_16	PULL_DOWN	P3_16	AD60	P4_16	PMC_I/O
P1_17	REQ#	P2_17	PME#	P3_17	AD59	P4_17	PMC_I/O
P1_18	VCC	P2_18	GND	P3_18	AD58	P4_18	PMC_I/O
P1_19	VIO	P2_19	AD30	P3_19	AD57	P4_19	PMC_I/O
P1_20	AD31	P2_20	AD29	P3_20	GND	P4_20	PMC_I/O
P1_21	AD28	P2_21	GND	P3_21	VIO	P4_21	PMC_I/O
P1_22	AD27	P2_22	AD26	P3_22	AD56	P4_22	PMC_I/O
P1_23	AD25	P2_23	AD24	P3_23	AD55	P4_23	PMC_I/O
P1_24	GND	P2_24	+3,3V	P3_24	AD54	P4_24	PMC_I/O
P1_25	GND	P2_25	IDSEL(AD19/AD21)	P3_25	AD53	P4_25	PMC_I/O
P1_26	C_BE3#	P2_26	AD23	P3_26	GND	P4_26	PMC_I/O
P1_27	AD22	P2_27	+3,3V	P3_27	GND	P4_27	PMC_I/O
P1_28	AD21	P2_28	AD20	P3_28	AD52	P4_28	PMC_I/O
P1_29	AD19	P2_29	AD18	P3_29	AD51	P4_29	PMC_I/O
P1_30	VCC	P2_30	GND	P3_30	AD50	P4_30	PMC_I/O
P1_31	VIO	P2_31	AD16	P3_31	AD49	P4_31	PMC_I/O
P1_32	AD17	P2_32	C_BE2#	P3_32	GND	P4_32	PMC_I/O
P1_33	FRAME#	P2_33	GND	P3_33	GND	P4_33	PMC_I/O
P1_34	GND	P2_34	IDSELB(AD20/AD22)	P3_34	AD48	P4_34	PMC_I/O
P1_35	GND	P2_35	TRDY#	P3_35	AD47	P4_35	PMC_I/O
P1_36	IRDY#	P2_36	+3,3V	P3_36	AD46	P4_36	PMC_I/O
P1_37	DEVSEL#	P2_37	GND	P3_37	AD45	P4_37	PMC_I/O
P1_38	VCC	P2_38	STOP#	P3_38	GND	P4_38	PMC_I/O
P1_39	GND	P2_39	PERR#	P3_39	VIO	P4_39	PMC_I/O
P1_40	LOCK#	P2_40	GND	P3_40	AD44	P4_40	PMC_I/O
P1_41	SCL	P2_41	+3,3V	P3_41	AD43	P4_41	PMC_I/O
P1_42	SDA	P2_42	SERR#	P3_42	AD42	P4_42	PMC_I/O
P1_43	PAR	P2_43	C_BE1#	P3_43	AD41	P4_43	PMC_I/O
P1_44	GND	P2_44	GND	P3_44	GND	P4_44	PMC_I/O
P1_45	VIO	P2_45	AD14	P3_45	GND	P4_45	PMC_I/O
P1_46	AD15	P2_46	AD13	P3_46	AD40	P4_46	PMC_I/O
P1_47	AD12	P2_47	M66EN	P3_47	AD39	P4_47	PMC_I/O
P1_48	AD11	P2_48	AD10	P3_48	AD38	P4_48	PMC_I/O
P1_49	AD9	P2_49	AD8	P3_49	AD37	P4_49	PMC_I/O
P1_50	VCC	P2_50	+3,3V	P3_50	GND	P4_50	PMC_I/O
P1_51	GND	P2_51	AD7	P3_51	GND	P4_51	PMC_I/O
P1_52	C_BE0#	P2_52	NC	P3_52	AD36	P4_52	PMC_I/O
P1_53	AD6	P2_53	+3,3V	P3_53	AD35	P4_53	PMC_I/O
P1_54	AD5	P2_54	NC	P3_54	AD34	P4_54	PMC_I/O

P1_55	AD4	P2_55	NC	P3_55	AD33	P4_55	PMC_I/O
P1_56	GND	P2_56	GND	P3_56	GND	P4_56	PMC_I/O
P1_57	VIO	P2_57	NC	P3_57	VIO	P4_57	PMC_I/O
P1_58	AD3	P2_58	EREADEY	P3_58	AD32	P4_58	PMC_I/O
P1_59	AD2	P2_59	GND	P3_59	NC	P4_59	PMC_I/O
P1_60	AD1	P2_60	RSTOUT#	P3_60	NC	P4_60	PMC_I/O
P1_61	AD0	P2_61	ACK64#	P3_61	NC	P4_61	PMC_I/O
P1_62	VCC	P2_62	+3,3V	P3_62	GND	P4_62	PMC_I/O
P1_63	GND	P2_63	GND	P3_63	GND	P4_63	PMC_I/O
P1_64	REQ64#	P2_64	NC	P3_64	NC	P4_64	PMC_I/O

### 4.1.3 SATA interface

The CPC507 module has two interfaces for connecting drives: one interface is routed to the CFast connector (XS6); the second interface is used for connection of the integrated SSD.

The XS6 connector (located on the top side of the CPC507 board, see Figure 3-2: Location of the main components of CPC507) enables installing a CFast drive on the CPC507 module together with the PMC/XMC expansion module.

**Table 4-3: Assignment of SATA XS6 connector pins**

XS6	
Pin	Assignment
S1	GND
S2	A+
S3	A-
S4	GND
S5	B-
S6	B+
S7	GND
P1	GND
P2	GND
P3	NC
P4	NC
P5	NC
P6	NC
P7	GND
P8	NC
P9	NC
P10	NC
P11	NC
P12	NC
P13	+3.3V
P14	+3.3V
P15	GND
P16	GND
P17	CDO

Subparagraph 5.6 describes how to install a CFast drive on a CPC507 module.

#### 4.1.4 COM port

The module has a COM0 (XP2) debug connector for connecting a cable with an IDC connector. The pin assignment of the connector is given in the table below:

**Table 4-4: Assignment of XP2 connector pins**

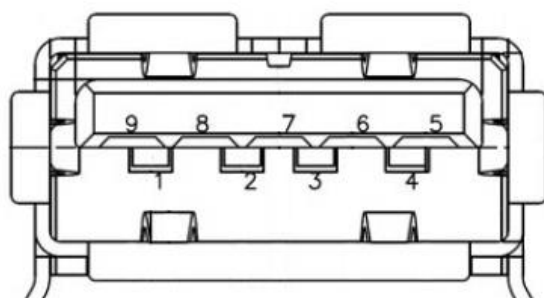
XP2	
Pin	Assignment
1	NC
2	NC
3	RXD
4	RTS
5	TXD
6	CTS
7	NC
8	NC
9	GND
10	GND

#### 4.1.5 Connectors on the front panel of CPC507

##### 4.1.5.1 USB interfaces

CPC507 has 3 x USB3.1 Gen 1 ports located on the front panel. The following modes are supported: high-speed, full-speed, and low-speed. USB 2.0 in the high-speed mode enables data transfer at the rates up to 480 Mb/sec, USB 3.1 Gen1 - up to 5 Gb/sec.

The USB power supply is protected by a 1500mA automatic fuse.



**Figure 4-3: USB connectors on the front panel of CPC507**

Table 4-5: Assignment of USB connector pins on the front panel of CPC507

Pin	Circuit	Function
1	VBus	+5V Power
2	USB D-	Differential USB-
3	USB D+	Differential USB+
4	GND	Ground for power return
5	StdA_SSRX-	SuperSpeed RX-
6	StdA_SSRX+	SuperSpeed RX+
7	GND_DRAIN	Ground for signal return
8	StdA_SSTX-	SuperSpeed TX-
9	StdA_SSTX+	SuperSpeed TX+

#### 4.1.5.2 Gigabit Ethernet interface

The front panel of CPC507 is equipped with the 10Base-T/100Base-TX/1000Base-T Ethernet port based on the Gigabit Ethernet I350 network controller.

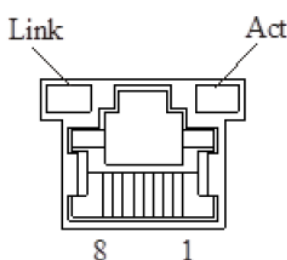


Figure 4-4: Gigabit Ethernet RJ45 connector

The interface provides automatic detection of transmission speed and switching between 10Base-T, 100Base-TX and 1000Base-T data transmission modes.

Table 4-6: Assignment of Gigabit Ethernet connector pins

Pin	10Base-T		100Base-TX		1000Base-T	
	I/O	Signal	I/O	Signal	I/O	Signal
1	O	TX+	O	TX+	I/O	BI_DA+
2	O	TX-	O	TX-	I/O	BI_DA-
3	I	RX+	I	RX+	I/O	BI_DB+
4	-	-	-	-	I/O	BI_DC+
5	-	-	-	-	I/O	BI_DC-
6	I	RX-	I	RX-	I/O	BI_DB-
7	-	-	-	-	I/O	BI_DD+
8	-	-	-	-	I/O	BI_DD-

#### LEDs indicating the state of Ethernet channel

The green and orange “Link” LED is ON, when the line is connected.

The green LED is on if a 100 Mb/sec. link is set, the orange LED is on if a 1000 Mb/sec. link is set. The yellow “Act” LED is on when the computer is receiving or sending packets through the RJ45 connector.

#### 4.1.5.3 DisplayPort

The DisplayPort connector on the front panel of the CPC507 is designed for connecting digital monitors with resolution up to 4096x2160@60Hz. The output also makes it possible to connect DVI-D monitors via a passive adapter and VGA and other monitor types via an active adapter.

#### DisplayPort



Figure 4-3: DisplayPort connector

Table 4-7: Assignment of XS1 DisplayPort connector pins of the CPC507 module

XS1 (DP)	
Pin	Assignment
1	LANE0+
2	GND
3	LANE0-
4	LANE1+
5	GND
6	LANE1-
7	LANE2+
8	GND
9	LANE2-
10	LANE3+
11	GND
12	LANE3-
13	AUX_EN#
14	CONFIG2
15	AUX+
16	GND
17	AUX-
18	HP_DETECT
19	GND
20	+3.3V

### 4.1.6 LEDs on the front panel of CPC507

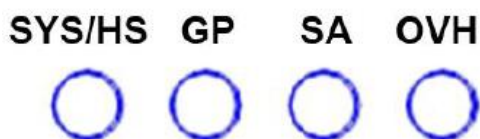
The front panel of CPC507 is equipped with the following LEDs:

- The diagnostics LED (SYS/HS, two-color green and blue) enables you to distinguish 4 states of the board: power off, power on, BIOS start, BIOS shutdown (operating system start). The state of the SYS LED is shown in the below Table 4.8. The state of the SYS LED is shown in the below table:

**Table 4-8: State of the SYS LED of the CPC507 module**

SYS LED	State
Off	The power is not supplied to the module
Blinking green ~8 Hz	Processor is running BIOS
Blinking green ~1 Hz	Processor is executing POST procedures
Solid green	POST procedure is complete, OS boot is in progress

- The program-controlled GP LED is designed for user needs (two-color, red and green), see subparagraph 4.4 SPI Controller / LEDs / GPIO. The red GP LED can alert the user that the device is malfunctioning (see section **8 Troubleshooting**).
- The indicator for drive activity (SA, orange) informs of the activity of the SATA interfaces.
- Overheating (OVH) LED.



**Figure 4-6: LEDs on the front panel of CPC507**

### 4.1.7 Using the module in CompactPCI system

The CPC507 module has a flexible CompactPCI interface. If the board is installed into the system slot, then the PCIE-PCI bridge operates in the PCI bus master mode, and if the board is installed into the peripheral slot, the bridge operates in the “non-transparent” mode.

#### 4.1.7.1 Operation in system slot (System Master)

Being in the system slot, the CPC507 module can exchange information with all other CompactPCI boards through the 64-bit Pericom PI7C9X130 PCIE-PCI reversible bridge operating at 33/66 MHz.

The module supports a maximum of 7 x CompactPCI devices via the passive backplane (for 33 MHz), 6 x devices can operate in BUS Master Mode.

The module supports 3.3V and 5V PCI bus levels.

The module fully complies with the PCI Local Bus Specification Rev. 3.0.

#### 4.1.7.2 Operation in peripheral slot (Slave Mode)

In the peripheral slot, the bridge operates in the “non-transparent” mode, while there is a possibility of data exchange via the PCI bus

#### 4.1.7.3 Packet Switching Backplane PICMG 2.16

2 x Gigabit Ethernet ports are available on the XS21 connector of the device in accordance with the PICMG specification for CompactPCI Packet Switching Backplane Specification PICMG 2.16, version 1.0. By the CompactPCI Packet Switching Backplane these ports are connected with special-purpose Ethernet hub fabric slots.

These Ethernet slots can be used with any slots that support installation of end devices of the PICMG 2.16 standard (Node slots).

#### 4.1.7.4 Ejector's lever button

The button on the lower ejector's lever can be used to turn off or reset the device. If you press the button quickly (holding it down for less than 3 seconds) restarts the device. If you hold down for a longer period (e.g. when the ejector's lever is pulled down) this initiates the device shutdown procedure. The lever operation mode can be changed in the BIOS Setup.

#### 4.1.8 Compact PCI connectors

The complete set of CompactPCI connectors includes 5 connectors J1 through J5. Their purposes are described below:

- ✓ J1 and J2 - 64-bit CompactPCI interface, including PCI bus signals, arrangement of bus access, timing, and power;
- ✓ J3 provides interface Rear I/O and PICMG 2.16 functions;
  
- ✓ J4 and J5 provide additional Rear I/O interface functions.

The device is designed in accordance with the CompactPCI bus architecture. The CompactPCI standard is electrically identical to the local PCI bus, but these systems have been improved in order to allow them to be used in harsh industrial environments with an increased number of expansion slots.

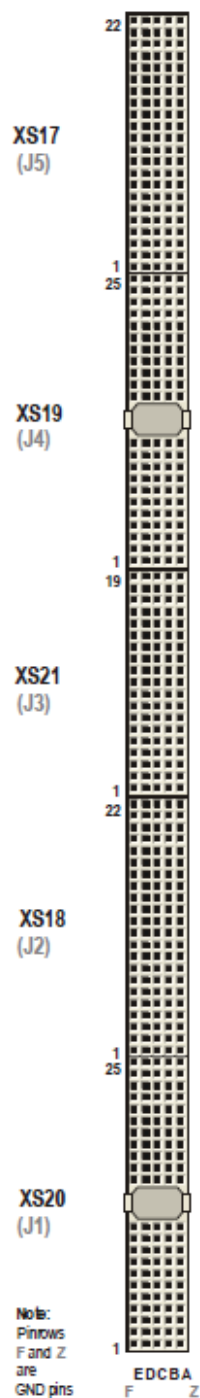


Figure 4-7: CompactPCI connectors (J1 – J5 in accordance with the CompactPCI specification)

#### 4.1.8.1 Color code designations of CompactPCI connectors

The CompactPCI connectors use guide lugs in order to ensure proper connection. To avoid wiring errors, color coding is also used for the various standard operating voltages. The color coding prevents 5V peripheral cards from being mounted into the sockets designed for 3.3V voltage, and vice versa. The backplane connectors are always labeled in accordance with the signal voltage level (VIO).



Table 4-9: Color code designations of connectors

Signal voltage	Color
3.3 V	Cadmium yellow
5 V	Bright-blue
Multipurpose board (5 V and 3.3 V)	No

#### 4.1.8.2 Pin assignment of CompactPCI XS20 and XS18 connectors

CPC507 is equipped with 2 CompactPCI bus connectors, where the pins have a pitch of 2×2 mm – XS20 and XS18.

Table 4-10: Assignment of pins of the CompactPCI XS20 (J1) system connector

XS20							
Pin	Z	A	B	C	D	E	F
25	GND	5V	REQ64#	ENUM#	3.3V	5V	GND
24	GND	AD[1]	5V	LNG_VIO	AD[0]	ACK64#	GND
23	GND	3.3V	AD[4]	AD[3]	LNG_5V	AD[2]	GND
22	GND	AD[7]	GND	LNG_3.3V	AD[6]	AD[5]	GND
21	GND	3.3V	AD[9]	AD[8]	M66EN	C/BE[0]#	GND
20	GND	AD[12]	GND	VIO	AD[11]	AD[10]	GND
19	GND	3.3V	AD[15]	AD[14]	LNG_GND	AD[13]	GND
18	GND	SERR#	GND	3.3V	PAR	C/BE[1]#	GND
17	GND	3.3V	IPMB_SCL	IPMB_SDA	LNG_GND	PERR#	GND
16	GND	DEVSEL#	GND	VIO	STOP#	LOCK#	GND
15	GND	3.3V	FRAME#	IRDY#	SHRT_GND	TRDY#	GND
14	GND						GND
13	GND						GND
12	GND						GND
11	GND	AD[18]	AD[17]	AD[16]	LNG_GND	C/BE[2]#	GND
10	GND	AD[21]	GND	3.3V	AD[20]	AD[19]	GND
9	GND	C/BE[3]#	SHRT_GND	AD[23]	LNG_GND	AD[22]	GND
8	GND	AD[26]	GND	VIO	AD[25]	AD[24]	GND
7	GND	AD[30]	AD[29]	AD[28]	LNG_GND	AD[27]	GND
6	GND	REQ0#	GND	LNG_3.3V	CLK0	AD[31]	GND
5	GND	BRSVP1A5	BRSVP1B5	RST#	LNG_GND	GNT0#	GND
4	GND	IPMB_PWR	HEALTHY#	LNG_VIO	INTP	INTS	GND
3	GND	INTA#	INTB#	INTC#	LNG_5V	INTD#	GND
2	GND	NC	5V	NC	NC	NC	GND
1	GND	5V	-12V	NC	+12V	5V	GND

Table 4-11: Pin assignment of the XS18 (J2) system connector of 64-bit CompactPCI bus

XS18							
Pin	Z	A	B	C	D	E	F
22	GND	GA4	GA3	GA2	GA1	GA0	GND
21	GND	CLK6	GND	RSV	RSV	RSV	GND
20	GND	CLK5	GND	RSV	GND	RSV	GND
19	GND	GND	GND	RSV	RSV	RSV	GND
18	GND	BRSVP2A18	BRSVP2B18	BRSVP2C18	GND	BRSVP2E18	GND
17	GND	BRSVP2A17	GND	PRST#	REQ6#	GNT6#	GND
16	GND	BRSVP2A16	BRSVP2B16	DEG#	GND	BRSVP2E16	GND
15	GND	BRSVP2A15	GND	FAL#	REQ5#	GNT5#	GND
14	GND	AD[35]	AD[34]	AD[33]	GND	AD[32]	GND
13	GND	AD[38]	GND	VIO	AD[37]	AD[36]	GND
12	GND	AD[42]	AD[41]	AD[40]	GND	AD[39]	GND
11	GND	AD[45]	GND	VIO	AD[44]	AD[43]	GND
10	GND	AD[49]	AD[48]	AD[47]	GND	AD[46]	GND
9	GND	AD[52]	GND	VIO	AD[51]	AD[50]	GND
8	GND	AD[56]	AD[55]	AD[54]	GND	AD[53]	GND
7	GND	AD[59]	GND	VIO	AD[58]	AD[57]	GND
6	GND	AD[63]	AD[62]	AD[61]	GND	AD[60]	GND
5	GND	C/BE[5]#	GND	VIO	C/BE[4]#	PAR64	GND
4	GND	VIO	BRSVP2B4	C/BE[7]#	GND	C/BE[6]#	GND
3	GND	CLK4	GND	GNT3#	REQ4#	GNT4#	GND
2	GND	CLK2	CLK3	SYSEN#	GNT2#	REQ3#	GND
1	GND	CLK1	GND	REQ1#	GNT1#	REQ2#	GND

#### 4.1.8.3 I/O CompactPCI XS21, XS19, XS17 connectors (J3 - J5) and their pin assignment

In CPC507, part of the I/O signals are routed to the XS21, XS19 and XS17 connectors. A special backplane is required for using Rear I/O modules. The XS21, XS19 and XS17 connectors of the board are compatible with all standard 6U CompactPCI backplanes with I/O support through the corresponding connectors in the system slot.

The pin assignment of the XS21 (J3) connector complies with the PICMG 2.16 standard.

Table 4-12: Pin assignment of the XS21 (J3) connector of CPC507

XS21						
Pin	A	B	C	D	E	F
1	+VI/O	PMC2_IO63	PMC2_IO62	PMC2_IO61	PMC2_IO60	GND
2	PMC2_IO59	PMC2_IO58	PMC2_IO57	PMC2_IO56	PMC2_IO55	GND
3	PMC2_IO54	PMC2_IO53	PMC2_IO52	PMC2_IO51	PMC2_IO50	GND
4	PMC2_IO49	PMC2_IO48	PMC2_IO47	PMC2_IO46	PMC2_IO45	GND
5	PMC2_IO44	PMC2_IO43	PMC2_IO42	PMC2_IO41	PMC2_IO40	GND
6	PMC2_IO39	PMC2_IO38	PMC2_IO37	PMC2_IO36	PMC2_IO35	GND
7	PMC2_IO34	PMC2_IO33	PMC2_IO32	PMC2_IO31	PMC2_IO30	GND
8	PMC2_IO29	PMC2_IO28	PMC2_IO27	PMC2_IO26	PMC2_IO25	GND
9	PMC2_IO24	PMC2_IO23	PMC2_IO22	PMC2_IO21	PMC2_IO20	GND
10	PMC2_IO19	PMC2_IO18	PMC2_IO17	PMC2_IO16	PMC2_IO15	GND
11	PMC2_IO14	PMC2_IO13	PMC2_IO12	PMC2_IO11	PMC2_IO10	GND
12	PMC2_IO9	PMC2_IO8	PMC2_IO7	PMC2_IO6	PMC2_IO5	GND
13	PMC2_IO4	PMC2_IO3	PMC2_IO2	PMC2_IO1	PMC2_IO0	GND
14	GND	GND	GND	GND	GND	GND
15	ETH2_1+	ETH2_1-	GND	ETH2_3+	ETH2_3-	GND
16	ETH2_0+	ETH2_0-	GND	ETH2_2+	ETH2_2-	GND
17	ETH1_1+	ETH1_1-	GND	ETH1_3+	ETH1_3-	GND
18	ETH1_0+	ETH1_0-	GND	ETH1_2+	ETH1_2-	GND
19	GND	GND	GND	GND	GND	GND

Table 4-13: Assignment of the XS19 (J4) connector pins of the CPC507 module

XS19						
Pin	A	B	C	D	E	F
1	GND	GND	DP1_HPD	GND	GND	GND
2	DP1_LANE0+	DP1_LANE0-	GND	NC	LAN_LED0	GND
3	DP1_LANE1+	DP1_LANE1-	GND	NC	LAN_LED1	GND
4	DP1_LANE2+	DP1_LANE2-	GND	NC	LAN_LED2	GND
5	DP1_LANE3+	DP1_LANE3-	GND	NC	LAN_LED3	GND
6	DP1_AUX-	DP1_AUX+	GND	NC	NC	GND
7	NC	DP_CTRL_DAT	GND	GND	GND	GND
8	GND	GND	DP2_HPD	DP3_LANE0+	DP3_LANE0-	GND
9	DP2_LANE0+	DP2_LANE0-	GND	DP3_LANE1+	DP3_LANE1-	GND
10	DP2_LANE1+	DP2_LANE1-	GND	DP3_LANE2+	DP3_LANE2-	GND
11	DP2_LANE2+	DP2_LANE2-	GND	DP3_LANE3+	DP3_LANE3-	GND
12						GND
13						GND
14						GND
15	DP2_LANE3+	DP2_LANE3-	GND	DP3_AUX-	DP3_AUX+	GND
16	DP2_AUX-	DP2_AUX+	GND	GND	GND	GND
17	GND	GND	DP3_HPD	KBRST#	USB_OC3	GND
18	NC	VDD_EN	GND	GND	GND	GND
19	NC	LVDS_DDC_DAT	GND	A20GATE	HDA_SPKR	GND
20	GND	GND	SDIN0	NC	HDA_RST#	GND
21	HDA_SDOUT	HDA_SDIN3	GND	GND	GND	GND
22	HDA_BIT_CLK	HDA_SYNC	GND	GPIO0	GPIO3	GND
23	NC	RSTIN#	+5V	GPIO1	GPIO4	GND
24	GND	GND	+3.3V	GPIO2	GPIO5	GND
25	NC	NC	NC	GPIO6	GPIO7	GND

Table 4-14: Assignment of the XS17 (J5) connector pins of CPC507

XS17						
Pin	A	B	C	D	E	F
1	LPC_AD0	LPCCLK	+3,3V	+5V	+5V	GND
2	LPC_AD1	SIOCLK	+3,3V	GND	GND	GND
3	LPC_AD2	SUSCLK	+3,3V	USB1_DP	USB1_DM	GND
4	LPC_AD3	SERIRQ	+5V	USB3_DP	USB3_DM	GND
5	LPC_FRAME#	LPC_RST#	+5V	USB0_DP	USB0_DM	GND
6	GND	GND	GND	GND	GND	GND
7	ETH_MDI1+	ETH_MDI1-	GND	ETH_MDI3+	ETH_MDI3-	GND
8	ETH_MDI0+	ETH_MDI0-	GND	ETH_MDI2+	ETH_MDI2-	GND
9	GND	GND	GND	GND	GND	GND
10	+VI/O	PMC1_IO63	PMC1_IO62	PMC1_IO61	PMC1_IO60	GND
11	PMC1_IO59	PMC1_IO58	PMC1_IO57	PMC1_IO56	PMC1_IO55	GND
12	PMC1_IO54	PMC1_IO53	PMC1_IO52	PMC1_IO51	PMC1_IO50	GND
13	PMC1_IO49	PMC1_IO48	PMC1_IO47	PMC1_IO46	PMC1_IO45	GND
14	PMC1_IO44	PMC1_IO43	PMC1_IO42	PMC1_IO41	PMC1_IO40	GND
15	PMC1_IO39	PMC1_IO38	PMC1_IO37	PMC1_IO36	PMC1_IO35	GND
16	PMC1_IO34	PMC1_IO33	PMC1_IO32	PMC1_IO31	PMC1_IO30	GND
17	PMC1_IO29	PMC1_IO28	PMC1_IO27	PMC1_IO26	PMC1_IO25	GND
18	PMC1_IO24	PMC1_IO23	PMC1_IO22	PMC1_IO21	PMC1_IO20	GND
19	PMC1_IO19	PMC1_IO18	PMC1_IO17	PMC1_IO16	PMC1_IO15	GND
20	PMC1_IO14	PMC1_IO13	PMC1_IO12	PMC1_IO11	PMC1_IO10	GND
21	PMC1_IO9	PMC1_IO8	PMC1_IO7	PMC1_IO6	PMC1_IO5	GND
22	PMC1_IO4	PMC1_IO3	PMC1_IO2	PMC1_IO1	PMC1_IO0	GND

## 4.2 Timers

The module is equipped with the following timers:

### ■ RTC (Real-Time Clock)

PCH includes a battery powered real time clock.

### ■ Watchdog Timer

See the description below.

#### 4.2.1 Watchdog Timer

The watchdog timer is implemented in the FPGA as a device based on the LPC bus. The watchdog timer is enabled and the hardware interrupt (IRQ) is selected in the BIOS Setup. The timer is operated through the registers in the area of the input/output (I/O) ports. The base address of the registers (BASE) set by the BIOS is specified in the "Help" section of the BIOS Setup, to the right of the item for enabling/disabling the watchdog timer.

The watchdog timer consists of a 24-bit Timer Current Value Register, decremented at the frequency of 32.768 KHz, and a Timer Initial Value Register. When zeroing the counter's register, either an interrupt or an automatic reset of the board can occur (at the time of double zeroing of the counter). The actuation time can be set from 0 to 512 seconds inclusively, with a pitch of 30.52  $\mu$ s.

By default, the watchdog timer is not active. Below is the formula for calculating the response delay (TWD) ( $\mu$ s) depending on the Timer Initial Value Register (KWD):

$$T_{WD} [\mu s] = K_{WD} * 10^6 / 2^{15}$$

E.g. the decimal value KWD = 1 (000001h) corresponds to a delay time of 30.52  $\mu$ s, and the value KWD = 16777215 (FFFFFFh) corresponds to a delay time of 512 seconds.

The counter can be reset to its initial value in several ways:

- 1) By writing any number to the Timer Current Value Register;
- 2) By writing any number to port 80h (the mode is enabled in Bios Setup and operates only when the cycles of access to the port 80h are broadcasted to the LPC bus);

When the counter register is set to zero for the first time, the TMF flag is set, when it is set to zero for the second time - the STF flag is set.

Algorithm for operation with the watchdog timer through the I/O registers:

- 1) Stop the counter decrement;
- 2) Write the timeout value to the initial value registers;
- 3) Initialize the counter register by any of the reset methods (for instance, by writing any number to the counter register). In this case, the timeout value from the initial value register is overwritten to the counter register;
- 4) Start the counter for decrement and, if required, enable automatic reset of the board.
- 5) After that, with a period less than the timeout value, perform the regular reset of the counter (by any of the above methods). If the counter is not reset during the first timeout interval - the TMF flag will be set and an interrupt will occur (if enabled), if the counter is not reset during the second timeout interval - the STF flag will be set and a second interrupt will occur (or the board will reboot, if reset was allowed).

## 4.2.2 Description of I/O registers of WDT controller

**Table 4-15: Timer Current Value Register [23:0]**

Base+0h		
Bit	Name	Description
7:0	Timer_Current_Value[7:0]	Write/Read: Bits 7:0 of the counter initial value
Base+1h		
Bit	Name	Description
7:0	Timer_Current_Value[15:8]	Write/Read: Bits 15:8 of the counter initial value
Base+2h		
Bit	Name	Description
7:0	Timer_Current_Value[23:16]	Write/Read: Bits 23:16 of the counter initial value

**Table 4-16: Timer Initial Value Register [23:0]**

Base+3h		
Bit	Name	Description
7:0	Timer_Initial_Value[7:0]	Write/Read: Bits 7:0 of the counter initial value
Base+4h		
Bit	Name	Description
7:0	Timer_Initial_Value[15:8]	Write/Read: Bits 15:8 of the counter initial value
Base+5h		
Bit	Name	Description
7:0	Timer_Initial_Value[23:16]	Write/Read: Bits 23:16 of the counter initial value

Table 4-17: Status Register

Base+6h		
Bit	Name	Description
7:3	-	Reserved
2	STF	Write/Read: Second timeout flag. It is set to "1" if TMF = 1. This flag initiates an interrupt. If the board reset is enabled RSTE = 1, a hardware reset is carried out. Can be reset by writing "1" to this bit.
1	-	Reserved
0	TMF	Write/Read: Timeout flag. It is set to "1" when the timer counter is reset. This flag initiates an interrupt. To reset this flag, write "1" to this bit or to the port 80h (if this mode is enabled).

Table 4-18: Control Register

Base+7h		
Bit	Name	Description
7:2	-	Reserved
1	CNTE	Write/Read: Counter decrement 1 – enabled 0 – disabled
0	RSTE	Write/Read: Board reset by timeout 1 – reset is allowed 0 – reset is forbidden



## 4.3 SPI controller / LEDs / GPIO

### 4.3.1 Description of SPI controller registers

Table 4-19: Registers of the SPI controller

I/O port address	Type	HARD RESET	Configuration register
Base+0	R/W	00h	FRAM address value [7:0]
Base+1	R/W	00h	FRAM address value [14:8]
Base+2	R/W	00h	SPI data value [7:0]
Base+3	R/W	00h	SPI Control/Status register [7] – busy status [6] – last 1K fram lock status [5] – Reserved [4] - Reserved [3] – Reserved [2] – Reserved [1] – Reserved [0] – BURST mode
Base+4	R/W	00h	Reserved
Base+5	R/W	00h	RIO GPIO Direction  [7:0] – GPIO Direction 0 – input 1 – output
Base+6	R/W	00h	RIO GPIO DATA  [7:0] – GPIO DATA
Base+7	R/W	00h	User LEDs control [7:2] – Reserved [2] – RIO LED On/Off [1] – GREEN LED On/Off [0] – RED LED On/off

The controller automatically generates the FRAM access sequence on the SPI bus (address from the registers BASE + 0, BASE + 1, read/write mode and data - register BASE + 2).

The last kilobyte of 32 KB is reserved for storing the BIOS Setup settings. Bit <0> in the control register (Base + 3) enables the automatic address incrementation mode when reading/writing the data register (base + 2); after the end of the packet exchange, it must be reset.

### 4.3.2 Programming SPI device

The work with FRAM is carried out in the I/O area at addresses 310h-313h.

- Writing data byte (32h) to FRAM at the address (144h)
 

```
MOV DX, 310H
MOV AL, 44H
OUT DX, AL
MOV DX, 311H
MOV AL, 01H
OUT DX, AL
MOV DX, 312h
MOV AL, 32h
OUT DX, AL
```
- Reading data byte from FRAM at the address (101h)
 

```
MOV DX, 310H
MOV AL, 01H
OUT DX, AL
MOV DX, 311H
MOV AL, 10H
OUT DX, AL
MOV DX, 312h
IN AL, DX
```
- Reading data packet from the three FRAM data bytes, starting from the address 208h
 

```
MOV DX, 310H
MOV AL, 08H
OUT DX, AL
MOV DX, 311H
MOV AL, 20H
OUT DX, AL
MOV DX, 313h
MOV AL, 01H
OUT DX, AL ; enabling packet mode
MOV DX, 312h
IN AL, DX ; reading data byte at the address 208h
...
IN AL, DX ; reading data byte at the address 209h
...
IN AL, DX ; reading data byte at the address 20Ah
...
MOV DX, 313h
MOV AL, 00H
OUT DX, AL ; disabling packet mode
```

### 4.3.3 FRAM with sequential access

The module has a FRAM memory chip with sequential access on the SPI bus. This non-volatile memory is used to store BIOS settings and user data. Access to the microchip is possible through the SPI controller registers (see subparagraph 4.3.1). The microchip has a capacity of 32 KB, the last kilobyte is reserved for storing service data and BIOS Setup settings (not available to the user).

## 4.4 Devices on the local SMBus

System monitoring and configuration functions are ensured by the SMBus (System Management Bus). This bus uses a two-wire I<sup>2</sup>C™ interface. Below you can see the table of device addresses on the SMBus:

**Table 4-20: Device addresses on SMBus**

No	SMB Address (7-bit)	Device
1	28H	AMC80 Hardware monitor
2	4CH	Memory temperature sensor
3	50H	1 SPD memory module
4	52H	2 SPD memory module
5	61H	PCI-E Bridge Compact PCI
6	62H	PCI-E Bridge PMC

## 4.5 Battery

The CPC507 uses one 3.0 V lithium battery to power the real time clock. In case of prolonged use of the module in temperatures below -20C°, it is recommended to use an external clock synchronization (e.g. via NTP protocol) and to save all necessary BIOS settings as defaults. For details, see the section "Replacing the battery".

## 5 Installation

The below rules, warnings and procedures must be strictly followed in order to properly install the module, to avoid any damages to the device and system components, and to prevent injuries to the employees.

The procedure for installing the drivers for all peripheral devices mounted on the module is shown in the descriptions supplied with these devices. This User Manual also has no descriptions on how to install operating systems. Please refer to the documentation attached to your operating system.

### 5.1 Safety requirements

When handling CPC507, you should strictly follow the safety requirements listed below. The manufacturer – Fastwel Group, shall not be responsible for any damages resulting from noncompliance with these requirements.



#### Careful!

Be very careful while handling the module since the cooling heatsink can become very hot. Do not touch the heatsink when installing or removing the module.

In addition, the module should not be placed on any surface or placed in any container until both the module and the heatsink have cooled down to room temperature.



#### Attention!

Turn off the power supply of the CompactPCI system before installing the board in an empty slot. Failure to do so may result in damages to the system or the board. There is a risk of electric shock during installation, repair and maintenance of the device. Therefore, always unplug the power cord from the power outlet during work. This also applies to other supply lines.



### Static-sensitive device (ESD)!

The CompactPCI board contains electrostatic sensitive components. In order to avoid damages to the board, the following precautions should be observed:

- Do not leave the device without its protective packaging when not in use
- Do not touch electronic components or connector pins;
- If possible, always work with the board in workplaces protected against static electricity.
- Prior to touching the module, remove the static charge from the clothes, also remove the charge from the tools before using them. The easiest way to do that is to touch any metal part of the system case.
- It is especially important to take precautions when performing the works on replacing expansion boards, jumpers, etc. If the device is equipped with batteries to power the memory or real-time clock, do not place the board on conductive surfaces, such as anti-static mats or sponges. They can cause a short circuit and damage the battery and the board's conductive circuits.

## 5.2 CPC507 installation procedure

The below procedure refers to the installing the CPC507 into the system. The removal procedure is described in other subparagraphs.

In order to install the board into the system, follow the below procedure:

1. Make sure that the safety requirements listed in subparagraph 5.1 have been observed.



### Attention!

Non-compliance with the instructions below may damage the board and cause the system malfunctions. The following operations should be performed with care so as not to damage the device or other system boards.

2. In order to install the CPC507, the following steps should be performed:

1. Make sure that the system power is off.



### Attention!

When performing the following operation, **do not apply force** by inserting the CPC507 into the backplane connector. Use the handles on the front panel to install the module into the slot.

2. Carefully place the module in the required slot, sliding it along the guiderails until it touches the backplane connector.
3. Using the both handles on the front panel, insert the CPC507 into the backplane connector. The handles will snap when the module is fully inserted.

4. Secure the two front panel locking screws.
  5. Connect all the required external interface cables to the module.
  6. Make sure both the module and all the attached cables are securely fastened.
3. The CPC507 is now ready for operation. Refer to the proper documentation for programs, devices, and the system in general for further instructions.

### 5.3 Board Removal Procedure

To remove the board, you should follow the below steps:

1. Shut down the operating system.
2. After all the LEDs are off, power off the system.
3. Disconnect all interface cables from the module.
4. Make sure that all safety requirements listed in subparagraph 5.1 have been met. Particular consideration should be given to the warning regarding the heatsink temperature!



#### Attention!

The subsequent operations should be performed carefully so as not to damage either the CPC507 module or other boards in the system.

5. Unscrew the locking screws on the front panel.



#### Attention!

Be careful when handling the module as the cooling heatsink can become very hot. Avoid touching the heatsink when replacing the board.

6. Using the handles on the front panel, slide the module out of the backplane connector and carefully remove it from the system.

### 5.4 Installing peripherals to CPC507

A wide range of peripheral devices can be connected to the CPC507, where their installation methods can vary greatly. The following sections contain general installation instructions rather than detailed algorithms.

### 5.4.1 Connecting USB devices

CPC507 supports any Plug & Play USB computer peripherals (e.g. drive, keyboard, mouse, printer, etc.).

**Note**

All USB devices can be connected and disconnected while the power of these devices and the head system is on.

## 5.5 Battery replacement

To replace the lithium battery, you should use the same battery or the one of the CR2032 form-factor recommended for replacement by the manufacturer. The battery should have a maximum operating temperature of at least +85 ° C and a capacity of at least 200 mAh..

**Important note:**

Observe the proper polarity when replacing the battery.

The used battery should be disposed in accordance with the established standards.

The expected time of operation for a 200mAh battery is approximately 5-6 years based on 8 hours of use per day at 30°C. However, battery life is highly dependent on operating temperature as well as how long the system has been with its power off. The battery installed by the manufacturer is validated for use within the operating temperature range of the device. Note that at temperatures below -20°C the battery capacity decreases significantly, so the battery replacement period should be shortened if the device is left powered off for a long time at these temperatures.

It is recommended to replace the battery after 4-5 years of operation, without waiting for the end of its service life. The battery is considered fully discharged when the voltage reaches 2.0 V.

## 5.6 Installing CFast Drive

The CFast drive is plugged into the XS6 connector. It is possible to install the drive together with the PMC/XMC expansion module.

The drive is fastened on the module using a locking mechanism and screws from the installation kit.

---

## 6 System Setup

### 6.1 Resetting the BIOS Setup settings

The XP3 connector located on the module (see Figure 2-2: Location of the main components of CPC507) is designed to reset the BIOS settings to the state specified by the manufacturer (factory defaults) if the system does not boot (e.g. due to the BIOS setup errors or invalid password).

In order to reset the BIOS parameters of the CPC507 module, the sequence of actions should be as follows:

1. De-energize the system;
2. Place the jumper on pins 1-2 of the XP3 connector;
3. Switch on the module;
4. Wait for the BIOS information to appear on screen;
5. Switch off the module;
6. Remove the jumper from the XP3 connector.



# 7 AMI Aptio BIOS Setup

## 7.1 Starting and Updating BIOS Setup

An adapted version of the Aptio™ TSE (Text Setup Environment) BIOS is installed on your computer, which is the standard system for IBM PC AT-compatible computers. It supports Intel® x86 and compatible processors and provides low-level support for processor, memory, and I/O subsystems.

Using the BIOS Setup program, you can change the BIOS settings and manage the special modes of the computer. It enables you to change the basic system settings. These parameters are stored in non-volatile memory.

### 7.1.1 Starting BIOS Setup

In order to start the BIOS Setup program, when booting the system during the POST (Power On Self Test) procedure, press the “F2” key on the keyboard. When using a console connection, the login key in the BIOS may be different, for example, when using “Hyperterminal” as a terminal program, you must press DEL on the keyboard of the console PC.

After pressing the “F2” key, the BIOS Setup program menu will appear with the “Main” active tab.

### 7.1.2 Navigation keys

Selection of the BIOS menu items is performed using the keyboard with the following keys:

```

→←: Select Screen
↑↓: Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previous Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit

```

Figure 7-1: Assignment of navigation keys

Table 7-1: Assignment of navigation keys

Key	Assignment
ENTER	The “ENTER” key helps the user to select a value for the edited option or go to a submenu.
→←	The “Left” and “Right” keys enable to select the Aptio™ TSE screen (used for navigation through the menu tabs). For example, “Main”, “Advanced”, etc.
↑↓	The “Up” and “Down” keys enable you to move to the submenu line (used for moving through the menu items).
+ -	The “+” and “-” keys on the numeric keyboard enables you to change any values in the selected menu item. For example, “Date” and “Time”.
Tab	The <Tab> key enables you to select the Aptio™ TSE value field.
F1	This key is used for opening the main help window.

F2	Using this key the user can load the previous value into TSE.
F3	With this key, the user can load the optimum default settings into TSE.
F4	With this key, user can save current settings and exit the TSE.
ESC	The <ESC> key enables you to discard the changes made and exit Aptio™ TSE. Press the <ESC> key to leave Aptio™ TSE without saving changes. The next screen will show a message: Press <Enter> to discard changes and exit. Alternatively, you can use the arrow keys to select "Cancel" and then press <Enter> to exit this menu item and return to the previous screen.
Function keys	When additional function keys become available, they are displayed in the help window in accordance with their functions.



#### Note

This algorithm for working with the menu refers to all other tabs in the BIOS Setup program.

### 7.1.3 BIOS Update

Updating the BIOS, as well as the FPGA firmware, is possible using special utility software launched in the EFI Shell environment.

## 7.2 Advanced

The tab is used for making additional module settings.

### 7.2.1 Fastwel Features

This tab is used for configuring module's devices.

**Table 7-2: Setting the Fastwel Features**

Function	Purpose	Default value
Ejector switch function [PWR Button+Reset/ PWR Button/ <b>Disabled</b> ]	Operation mode of the board's ejector switch.	<b>Disabled</b>
External watchdog [Enabled/ <b>Disabled</b> ]	Possibility to enable the Watchdog timer using the base address 0x308 in I/O space.	<b>Disabled</b>
XMC Port (XS7) x8 width [Enabled/ <b>Disabled</b> ]	Allocation of PCIe links across mezzanines XMC1 / XMC2 - x8 / x0 (Enabled) or x4 / x4 (Disabled)	<b>Disabled</b>

## 8 CPC507 Troubleshooting

Before contacting the service center, please read the troubleshooting information, since the problem may not be related to the device failure.

**Table 8-1: Causes of module faults and their rectifications**

Issue	Cause	Rectification
The board does not start, the SYS LED is off	There are no +5 V, +3.3 V and +12 V supply voltages.	Check for the supply voltages on the backplane.
	The module is not fully inserted into the backplane	Make sure the module is fully inserted into the backplane.
The board does not start, the SYS LED is on, solid blue	The ejector lever is not latched or the button in the ejector lever is pressed.	Check the state of the ejector lever.
	The module is not fully inserted into the backplane.	Make sure the module is fully inserted into the backplane.
The board does not start, the SYS LED blinks quickly (~ 8 Hz) with red and blue.	<ol style="list-style-type: none"> <li>1) BIOS is missing or faulty.</li> <li>2) The board is defective.</li> </ol>	Contact the service center.
The board does not start, the SYS LED blinks slowly (~ 1 Hz).	<ol style="list-style-type: none"> <li>1) BIOS execution has failed to call the INT19H OS boot.</li> <li>2) BIOS is faulty.</li> </ol>	<ol style="list-style-type: none"> <li>1) Reset the BIOS Setup settings using the XP3 jumper.</li> <li>2) Contact the service center.</li> </ol>

## 9 Power Consumption

The CPC507 module is designed with due consideration of the optimum power consumption and distribution. However, we should pay attention to certain requirements that are vital to ensure stability and reliability. The table below shows the values of the maximum allowable voltages on the power lines, which, if exceeded, can result in module damages. The power supplies with which the CPC507 will be used must be verified to comply with these requirements.

The table below defines the operating ranges for the various supply voltages of the module. If the supply voltages exceed the specified limits, the functionality of the module is not guaranteed.

The backplane should ensure optimal distribution of the +3.3 V and +5 V supply voltages. It is recommended to use only those backplanes that have two planes for each voltage.

Power line and backplane connections should provide minimum losses and ensure stable operating characteristics. You should avoid long supply lines, small section conductors and high resistance connections.

The modules must be powered from an external DC source with the characteristics shown in the below table:

**Table 9-1: Supply voltage of +5 V,+3.3 V,+12 V,-12 V fed from the CPCI bus**

Voltage (V)	Minimum (V)	Maximum (V)
+5	4.75	5.25
+12	11.4	12.6
-12	-12.6	-11.4
+3.3	3.15	3.46

# ANNEX A

**Table A 1 – Terms, acronyms and abbreviations**

<b>Term</b>	<b>Value</b>
BIOS	Basic Input-Output System
cPCI	CompactPCI
DDR SDRAM	Double Data Rate Synchronous Dynamic Random Access Memory
ECC	Error Correction Code
EIDE	Enhanced Integrated Drive Electronics
GPIO	General Purpose Input Output.
I2C™	Inter Integrated Circuit
LCD	Liquid crystal display
LPC	Low Pin Count
LVDS	Low Voltage Differential Signal
NAND Flash	Not And (electronic logic gate)
MDI	Media Dependent Interface
NVRAM	Non Volatile Random Access Memory
PC	Personal Computer
PICMG	PCI Industrial Computer Manufacturers Group
POST	Power On Self Test
RTC	Real Time Clock
SATA	Serial AT Attachment
SMBus	System Management Bus
SoC AMD FP5 APU	SoC AMD FP5 APU (Ryzen Embedded V-Series)
SODIMM	Small Outline Dual In-Line Memory Module
SoM	System on a module
SSD	Solid State Drive
UART	Universal Asynchronous Receiver-Transmitter
USB	Universal Serial Bus

## ANNEX B: DISCLAIMER

This Disclaimer contains special operating conditions of Fastwel in the following areas: intellectual property, warranty policy, conditions of the order and delivery.

### 1 INTELLECTUAL PRORETY

1.1 If any infraction, interference, improper use, illegitimate exploitation and/or violation of the industrial and/or intellectual property rights of any third party and/or property, exploitation during the use of Fastwel Embedded Module will take place – Fastwel does not guarantee to replace the materials, computer programs, procedures or equipment affected by the complaint and under no circumstances doesn't bear responsibility in any form for possible refusal in case of such a replacement.

1.2 Use of the Fastwel products as well as the objects of intellectual property containing in them, in the ways and for the purposes, not provided by the present user manual and datasheet isn't allowed without preliminary written approval of Fastwel.

1.3 Fastwel is not responsible for possible incidents and losses, related to the operation of end devices, in which the original Fastwel equipment is used.

### 2 WARRANTY POLICY

2.1 When the detected flaws in an element can be corrected without decreasing the foreseen technical features and functionality for it, User may demand Fastwel the urgent correction of the failures in additionally agreed period and an increasing of the period of the guarantee of the element equal as the time elapsed from the formal request to repair the failures, until the receipt of the repaired element. All costs associated to the correction of failures, included those of assembly, dismantle, transport, tests, etc., if they exist, shall be prosecuted according the Warranty Policy of Fastwel.

### 3 ORDER AND DELIVERY CONDITIONS

3.1 The general rule is that all Fastwel equipment prices are determined with due consideration of delivery under the EXW terms and conditions (Incoterms 2010). Delivery of the products under other terms and conditions should be preliminary agreed and stated in writing between the parties.

3.2 Unless otherwise expressly agreed with Fastwel, all the deliveries of Fastwel equipment will be carried out only after the official purchase order is obtained and provided that the ordered products have been prepaid in full. Other terms and conditions of cooperation should be made in writing.

3.3 Any delivery of Fastwel electronics is submitted with the right package in accordance with the current rules and standards in the Member States of the European Economic Area. The purchaser independently bears all risks regarding the compliance of package and marking of Fastwel products with legislation requirements being in effect at the place of purchased products destination (in the buyer's country). The specified condition excludes unequivocally any liability of Fastwel for possible non-compliance of package and marking of products with the requirements of legislation of the country of products destination.

3.4 In general, all components of the supply are properly protected with respect to freight, in order to avoid any damage to the supply, third parties, environmental damages or unrelated goods, as consequence of wrong packaging.

3.5 Each package unit is labeled on the exterior area with the indications of product's Part Number and Serial Number.

3.6 The support documents for the order should be made either in English or in Russian unless otherwise agreed between parties in writing.

3.7 Fastwel does not pay penalties and does not cover costs associated with delay in the delivery of the products caused by actions of the third parties, force-majeure etc. - Fastwel doesn't bear any responsibility for non-execution or inadequate execution of the obligations in a case when it is caused by actions of the third parties (for example producers or suppliers of accessories), force majeure etc.

3.8 Fastwel declares that independently and at any time without damage, it has an exclusive right to define and change functionality architecture, bill of materials of its products without any preliminary coordination and approvals of the third parties.

### 4 OTHER CONDITIONS

4.1 Fastwel has the obligation to respect the current Russian legislation (including, but not limited to environmental, labor, social laws) in each moment and to apply it to its embedded electronics considering all and each execution phase, that is to say, from the design until the commissioning and subsequent maintenance. In this regard Fastwel is not liable to the user or other persons in connection with possible changes of the company's rules (including, but not limited to warranty, ordering policy) caused by changes of the Russian legislation.

4.2 Unless otherwise expressly agreed in writing, Fastwel provides no training for assembly\installation\adjustment\operation of its equipment.