



CPC1302

CPU Module

User Manual

IMES.467444.083 UM

August 2017

Version 1.01

Revision Record

Revision No	Brief description of changes	Board index	Revision date
1:00	Initial version	CPC1302	November 2016
1.01	Graphics system characteristics were added. Adjustment of the delivery checklist: added screw M2,5x16. The subsection 1.3.3 has a clarification: recommended carrier-board Adlink Express-BASE6. Subsection 3.6 was added with clarification on fastening the module to Adlink Express-BASE6 board. Subsection 4.1 has an adjustment of BIOS update text.	CPC1302	May 2017

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Notation Conventions



Warning, high voltage!

This sign and inscription warn you about the dangers associated with electric discharges (> 60 V) at the time you touch the device or its parts. Noncompliance with the safety precautions, mentioned or prescribed by the rules could endanger your life or health, or lead to product damages. We also recommend you to familiarize with the below subsection dedicated to the high voltage safe handling rules.



Warning! ESD Sensitive Device!

This symbol draws your attention to the information related to electro static sensitivity of your product and its components. To keep product safety and operability it is necessary to handle it with care and follow the ESD safety directions.



Warning! Hot surface!

This sign marks warnings about hot surfaces. The surface of the heatsink and some components can get very hot during operation. Take due care when handling, avoid touching hot surfaces!



Warning!

Information marked by this symbol is essential for human and equipment safety. Read this information attentively, be watchful.



Note

This symbol and title marks important information to be read attentively for your own benefit.

General safety requirements

This product is designed and tested for the purpose of ensuring compliance with the electric safety requirements. Its design guarantees long-term failsafe operation. Life cycle of the device can be sufficiently reduced due to improper handling during unpacking and installation. Therefore, for your own safety and in order to ensure the proper operation of the device, you should observe the below recommendations. It is also required to observe safety regulations outlined in subsection 3.5.1.

High Voltage Safe Handling Rules



Warning!

All the works that involve this device should be carried out by the appropriately qualified personnel.



Warning, high voltage!

Before installing the board into the carrier-board, make sure that the mains supply is switched off.

During installation, repairs and maintenance of the device there is a real danger of exposure to electric shock, therefore you should always disconnect the power supply feeding cable from the socket at the time of works.

Board Handling Regulations



ESD Sensitive Device!

Electronic boards and their components are sensible to static electricity. This is why you should give special attention to handling with these devices in order to ensure their integrity and working efficiency.

- - Do not leave the board without protective packaging, when it is not operated.
- - When applicable, always operate the board at the workplace equipped with protection against static electricity. If it is impossible, the user should remove a static discharge before touching the device by hand or using tools. The best way to do it is touch a metal part of system enclosure.
- You should observe safety precautions during operations for installation of jumpers etc.. It is prohibited to remove/install jumpers when the power is on.

General Board Operation Rules

- To keep the warranty, the product should not be altered or modified in any way. Any alterations or improvements not authorized by Fastwel LLC, except for those specified in this document or obtained from the technical support department of Fastwel LLC as a set of instructions for their implementation, cancel the warranty.
- This device should be installed and connected only to the systems, meeting all the necessary technical and climatic requirements. This above is also true to the operating temperature range of a particular version of the board.
- While performing all the required operations for installation and adjustment, please follow the instructions specified only in this document.
- Keep the original package for subsequent storage of the device and transportation in the warranty event. If it is necessary to transport or store the board, please pack it the same way as it was packed upon delivery.
- Exercise special care when unpacking and handling the device. Act in accordance with the instructions given above and in the paragraph 5 Transportation, unpacking and storage.

MANUFACTURER'S WARRANTIES

Warranty liabilities

The manufacturer guarantees that device's quality corresponds to the requirements of technical specification TU 4013-022-72782511-08 provided that the Consumer meets operation, storage, transportation and installation conditions and procedures, specified by accompanying documents.

The Manufacturer hereby guarantees that the products supplied thereby are free from defects in workmanship and materials, provided operation and maintenance norms were observed during the currently established warranty period. The Manufacturer's obligation under this warranty is to repair or replace free of charge any defective electronic component being a part of a returned product.

Products that broke down through the Manufacturer's fault during the warranty period will be repaired free of charge. Otherwise the Consumer will be invoiced as per the current labor remuneration rates and expendable materials cost.

Liability limitation right

The Manufacturer shall not be liable for the damage inflicted to the Consumer's property because of the product breakdown in the process of its utilization.

Warranty period

The warranty period for the products made by Fastwel LLC is 36 months since the sale date (unless otherwise provided by the supply contract).

The warranty period for the custom-made products is 60 months since the sale date (unless otherwise provided by the supply contract).

Limitation of warranty obligations

The above warranty obligations shall not be applied:

- To the products (including software), which were repaired or were amended by the employees, that do not represent the manufacturer. Exceptions are the cases where the customer has made repairs or made amendments to the devices in the strict compliance with instructions, preliminary agreed and approved by the manufacturer in writing;
- To the products, broken down due to unacceptable polarity reversal (to the opposite sign) of the power supply, improper operation, transportation, storage, installation, mounting or accident.

Procedure of device returning for repairs

Sequence of activities when returning the products for repairs:

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

1 Description and operation of CPC1302 CPU Module

1.1 Purpose

CPC1302 CPU Module is implemented in COM Express Type 6 (PICMG COM.0 r.2.1) standard based on the 4th generation Intel Core i5 CPUs and 5th generation Core i7 CPU and is designed for embedded applications requiring high performance, low power consumption and high reliability.

1.2 Versions, ordering information

1.2.1 Versions

Module's versions and their designations at the time of the order (ordering information) are given in the table below 1-1:

Table 1-1: CPC1302 ordering information

	Versions	CPU	RAM	SSD	Temperature
1	CPC1302-01	Intel Core i7-5850EQ 2.7 GHz 4C 37 W	8 GB 1600 DDR3L	16 GB	-40...+85°C
2	CPC1302-02	Intel Core i7-5850EQ 2.7 GHz 4C 37 W	8 GB 1600 DDR3L	-	-40...+85°C
3	CPC1302-03	Intel Core i5-4422E 1.8 GHz 2C 25 W	4 GB 1600 DDR3L	16 GB	-40...+85°C
4	CPC1302-04	Intel Core i5-4422E 1.8 GHz 2C 25 W	4 GB 1600 DDR3L	-	-40...+85°C

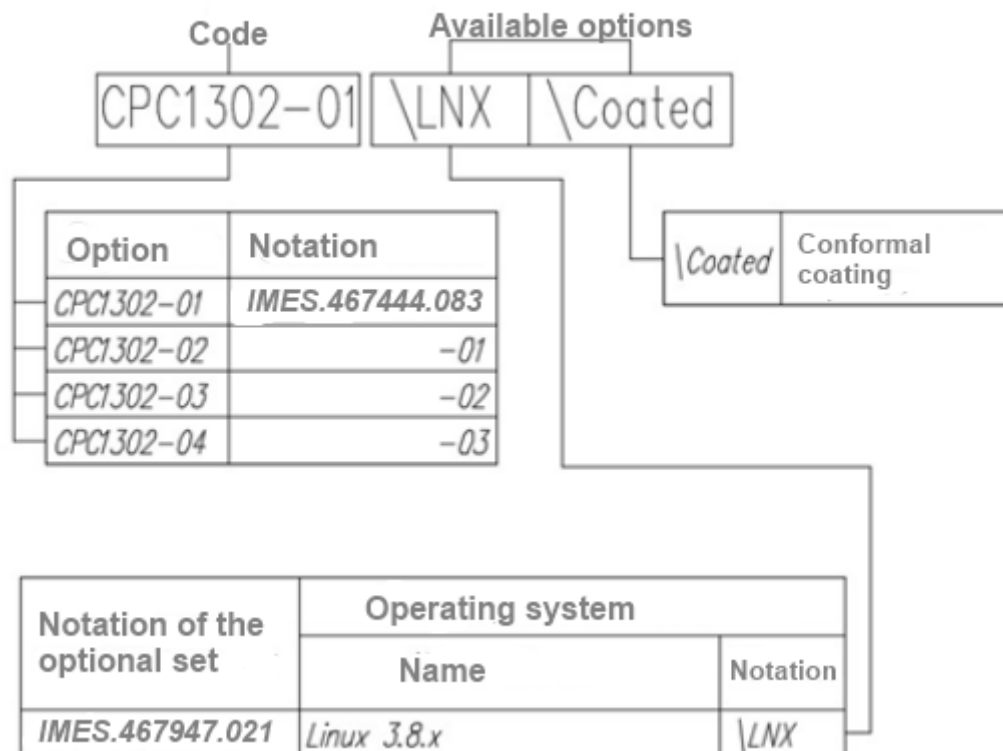


Fig. 1-1: Template for ordering CPC1302

1.2.2 Description of the supplied configurations

CPC1302-01: CPC1302 CPU Module, Intel Core i7-5850EQ 2.7 GHz 4 Core, 8GB DDR3L SDRAM, embedded SSD 16GB, -40...+85°C

CPC1302-02: CPC1302 CPU Module, Intel Core i7-5850EQ 2.7 GHz 4 Core, 8GB DDR3L SDRAM, -40...+85°C

CPC1302-03: CPC1302 CPU Module, Intel Core i5-4422E 1.8 GHz 2 Core, 4GB DDR3L SDRAM, embedded SSD 16GB, -40...+85°C

CPC1302-04: CPC1302 CPU Module, Intel Core i5-4422E 1.8 GHz 2 Core, 4GB DDR3L SDRAM, -40...+85°C

1.2.3 Available options for CPC1302

Table 1-2: CPC1302 ordering options

Pre-installed operating system (*)	
\LNX	Linux 3.8.x
(*) OS pre-installation is possible only for the versions with SSD.	
Coating	
\COATED	Conformal coating

1.3 Main and additional complete set

1.3.1 Delivery checklist

CPC1302 Module is delivered ready-assembled with the heat-spreading plate. Cooling system is delivered as an option.

Table 1-3: CPC1302 Delivery checklist

Notation Conventions	Name	Number
IMES.467941.047	Installation kit	1
IMES.421945.069	Packaging	1

Table 1-4: Installation kit IMES.467941.047

1	Screw DIN7985-M2,5x6-A2	5	
2	Screw DIN7985-M2, 5x16-A2	5	For mounting to the carrier-board Adlink Express-BASE6
3	Washer DIN125-2,7-A2	5	
4	Washer DIN6798A-2,7-A2	5	
5	Rack WE p/n 971 080 154	5	L=8 mm
6	Jumper TE Connectivity p/n 382575-2	1	Pitch 2 mm

1.3.2 Additional complete sets for heat removal

Additional accessories for heat-removal are specified in the table below:

Table 1-5: Additional sets for CPC1302

Heat-removal system (**)	
ACS30076-01	Heatsink
ACS30076-02	Heatsink with a fan

(**) Module is delivered ready-assembled with the heat-spreading plate.

Additional complete-sets for heat-removal are supplied as an option. Weigh and dimensions of the complete sets are given in the subsection 1.8.1.

1.3.3 Carrier-board for CPC1302

CPC1302 Module can be installed on the carrier-board compatible with the COM Express Type 6 (r.2.1) standard. We recommend using Adlink Express-BASE6 board as the carrier-board (to be purchased as an option). Procedure of module installation to the carrier-board is provided in the subsection 3.6.

1.4 Technical features

- **Intel Core i7-5850EQ 2.7Ghz CPU 5th Gen 37W**
 - 4 cores Intel x64;
 - 3 graphics engines;
 - 6 MB of cash-memory.
- **Intel Core i5-4422E 1.8Ghz CPU 4th Gen 25W**
 - 2 cores Intel x64;
 - 2 graphics engines;
 - 3 MB of cash-memory.
- **RAM:**
 - DDR3L-1600 SDRAM up to 8 GB (depending on the version) with ECC support;
 - 64-bit data bus.
- **Graphics subsystem characteristics:**
 - 64 bit 25.6 GB/sec;
 - Graphics in CPC1302-01 (-02):
 - Intel Iris Pro Graphics 6200;
 - Memory: up to 4GB;
 - DirectX 12, OpenGL 4.4, OpenCL 2.0, H.264/MPEG-4 (AVC), VC1, MPEG-2, VP8;
 - Graphics in CPC1302-03 (-04):
 - Intel HD Graphics 4600;
 - Memory: up to 2 GB;
 - DirectX 11.1, OpenGL 4.0, OpenCL 1.2, H.264/MPEG-4(AVC), MPEG-2.
- **FLASH BIOS:**
 - 128 Mb SPI-Flash;
 - modifiable within the system;
- **FRAM 32 Kbyte (SPI port) for storing user data**
- **COM-Express Type 6 connector:**
 - 1 port PCIe x16 GEN3, 8 GT/s;
 - 7(8) ports PCIe x1 GEN2, 5 GT/s;
 - 8x ports USB 2.0;
 - 4x ports USB 3.0;
 - 4x ports SATA III 6Gbps;
 - Port "LAN 0": Gbit Ethernet Intel 210;
 - Port SPI (External Boot);
 - Port "LVDS Channel ": LVDS Dual Channel 24bit 1920x1200@60Hz or port eDP 3840x2160@60H;
 - 3 x ports DDI 4096x2304@60Hz;
 - 1x port VGA CRT 1920x2000@60Hz;
 - Port LPC (Specification Rev. 1.1);
 - Port SMBus;
 - Port I2C;
 - Port HD Audio;
 - Speaker Out;
 - 4x ports GPIO;
 - 2x ports RS-232 (TTL, 128-byte FIFO, up to 3Mbps).
- **Real-Time Clock (with power fed from "RTC battery" port)**
- **SSD 16GB on SATA interface**
- **Watchdog timer:**
- **Monitor of 7 power supply voltages, monitor of PCB temperature**

- Console I/O via serial ports (COM1 / COM2)
- Software compatibility:
 - Linux 3.8.x;
 - QNX 6.5;
 - Microsoft Windows Embedded Standard 7.

1.5 Module power supply and current consumption

1.5.1 Power supply reset and monitoring

CPU reset signal is generated from the following sources:

- from supervisor at power on;
- from Reset button;
- from watchdog timer;
- from external reset signal.



Forbidden!

To restart the Module less than in 5 seconds after shutdown.

1.5.2 Power supply requirements

As the main power supply voltage, the board uses the voltage of +12 V from COM-Express connector. In order to support the sleep modes, the standby voltage is used. +5V_STBY from COM-Express connector (optional).

At 12 V input, protection against over-voltage and pulse interference is provided.

Acceptable range of the main supply voltage: 8-14 V.

Acceptable range of the standby supply voltage: 4.75-5.25 V.

1.5.3 Consumption currents of the modules

Table 1-6: Consumption currents of CPC1302

CPU Module	Module input voltage (Vin)	Average current (A) at TDP load	Starting current (A) (*)	Peak current (A) during OS
CPC1302-01 47 W	8V	~[8.9], 7.6	~3	~12
	12V	~[6.3], 5.2	~2.3	~7.5
	14V	~[5.3], 4.4A	~2.3	~6.2
CPC1302-01 37 W	8V	~[7.5], 6.1	~3	~11.4
	12V	~[5.1], 4.2	~2.2	~8
	14V	~[4.3], 3.5	~2.3	~6.2
CPC1302-03	8V	~[5.5], 4.6	~2.5	~6.7
	12V	~[3.68], 3.1	~2	~4.8
	14V	~[3.2], 2.7	~1.9	~3.6

Note:

Average current under load by synthetic benchmarks. (*)

Peak current within the range up to 100 ms.

Table 1-7: Consumption currents over input voltage +5V_STBY

CPU Module	Average current during	Peak current during module's start	Average current in S3 mode (mA)	Peak current when switching to S3 mode (mA)
CPC1302-01 (-03)	66	~340	200	280

1.6 Resistance to climatic effects

CPC1302 modules of industrial temperature range are resistant to the changes of ambient temperature within the range from - 40 to + 85°C with relative humidity of up to 80 %, no condensation, in accordance with the GOST 28209. Description of heat-removal features is given in subsections 3.3 and 3.4.

CPC1302 Modules are resistant to cyclic damp heat at ambient temperatures of + (55 ± 2)°C, relative humidity (93 ± 3) % (for modules with conformal coating) in accordance with the GOST 28216.

1.7 Resistance to mechanical effects

The modules complying with the GOST standard 28203 are resistant to sinusoidal vibrations for frequencies from 10 to 500 Hz with acceleration of 2 g.

The modules complying with the GOST standard 28213 are resistant to single shocks with the peak acceleration of 50 g.

The modules complying with the GOST standard 28215 are resistant to multiple shocks (with 1000 shocks) with the peak acceleration of 25 g.

1.8 Weight and dimensions characteristics (module and packaging)

Values of weight and overall dimensions of modules and packaging are given in the table below:

Table 1-8: Weight and dimensions of module and packaging

CPU Module	Weight in kg, no more than:	Packaged weight, in kg	Overall dimensions with head-spreading plate and racks, in mm	Overall dimensions of the packaging, in mm
CPC1302	0.4	0.5	125 x 95 x 18	140 x 150 x 45

Overall and connection dimensions of the module are shown in figure below.

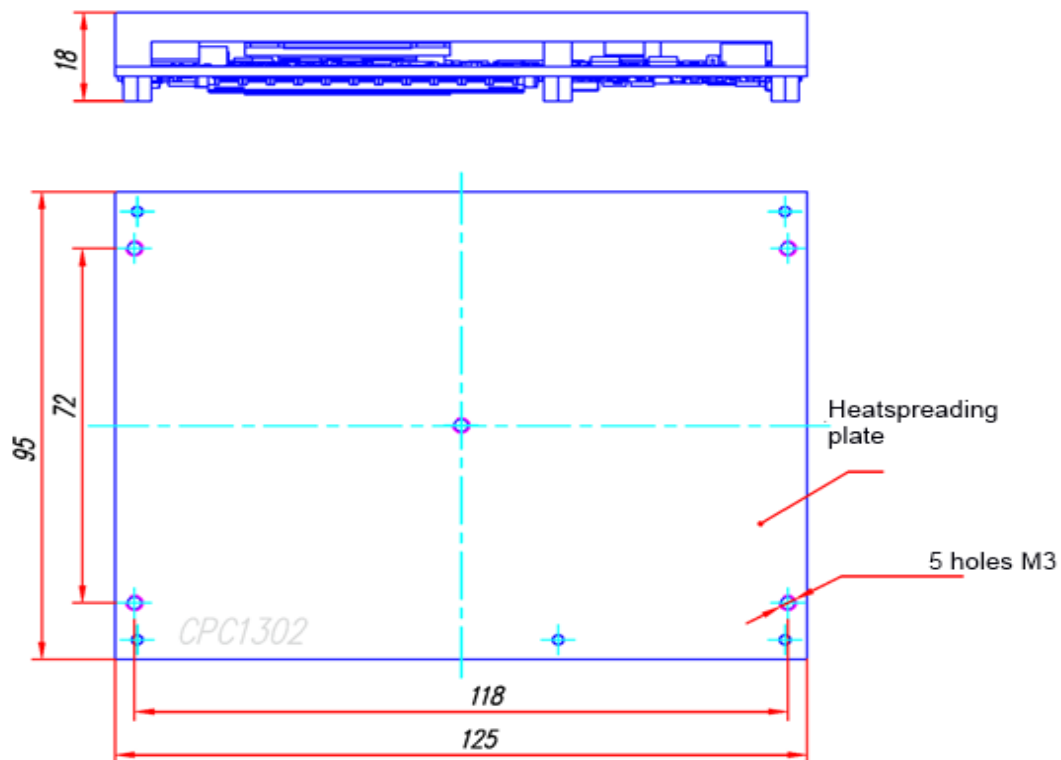


Fig. 1-2: Overall and connecting dimensions of the module

1.8.1 Weight and dimensions of additional complete sets for heat removal

Table 1-9: Weight and dimensions of additional complete sets for heat removal

Additional complete set	Overall dimensions, no more than:
ACS30076-01	125,5x95,5x25,0
ACS30076-02	125,5x95,5x40,0

Table 1-10: Weight and dimensions of additional complete sets for heat removal

Additional complete set	Weight in kg, no
ACS30076-01	280
ACS30076-02	380

1.9 MTBF

Mean time between failure (MTBF) for ambient temperature of +30°C corresponds to the values given in the table.

Table 1-11: MTBF

CPU Module	MTBF in hours, not less than:
CPC1302	150,000
Note – MTBF values are calculated according to the Telcordia Issue 1 computational model (calculation method - Method I Case 3) for continuous operation in case of the on-ground placement, under conditions corresponding to the Moderately Cold Climate 4 climatic category, in accordance with the GOST 15150-69, at the ambient temperature of + 30 °C.	

2 Description of operation of CPC1302 major components

2.1 Location of main components

Location of main components and connectors is given in Figure 2-1 and Figure 2-2. Purpose of indicators and XP1 switch is given in subsections 3.1 and 3.2.

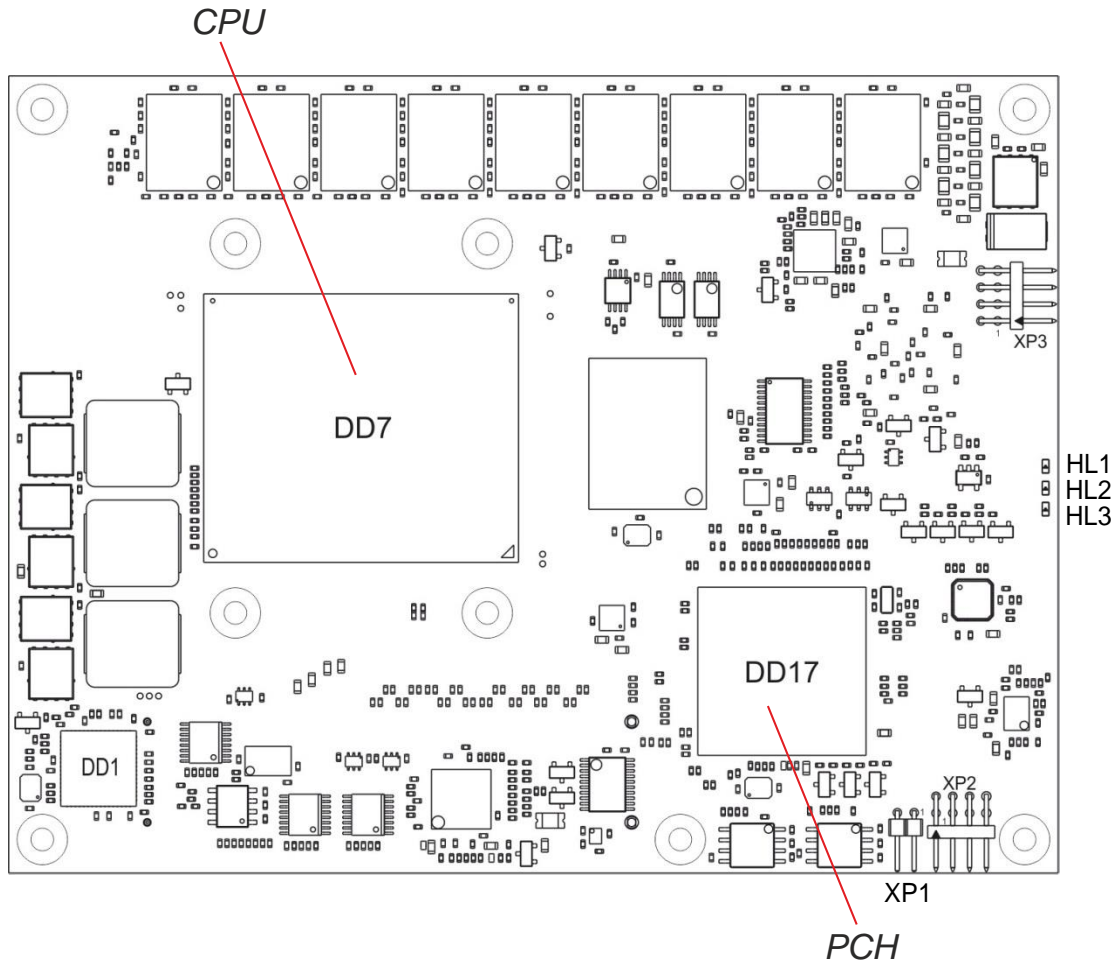


Fig. 2-1: Location of main components of CPC1302 (top view)

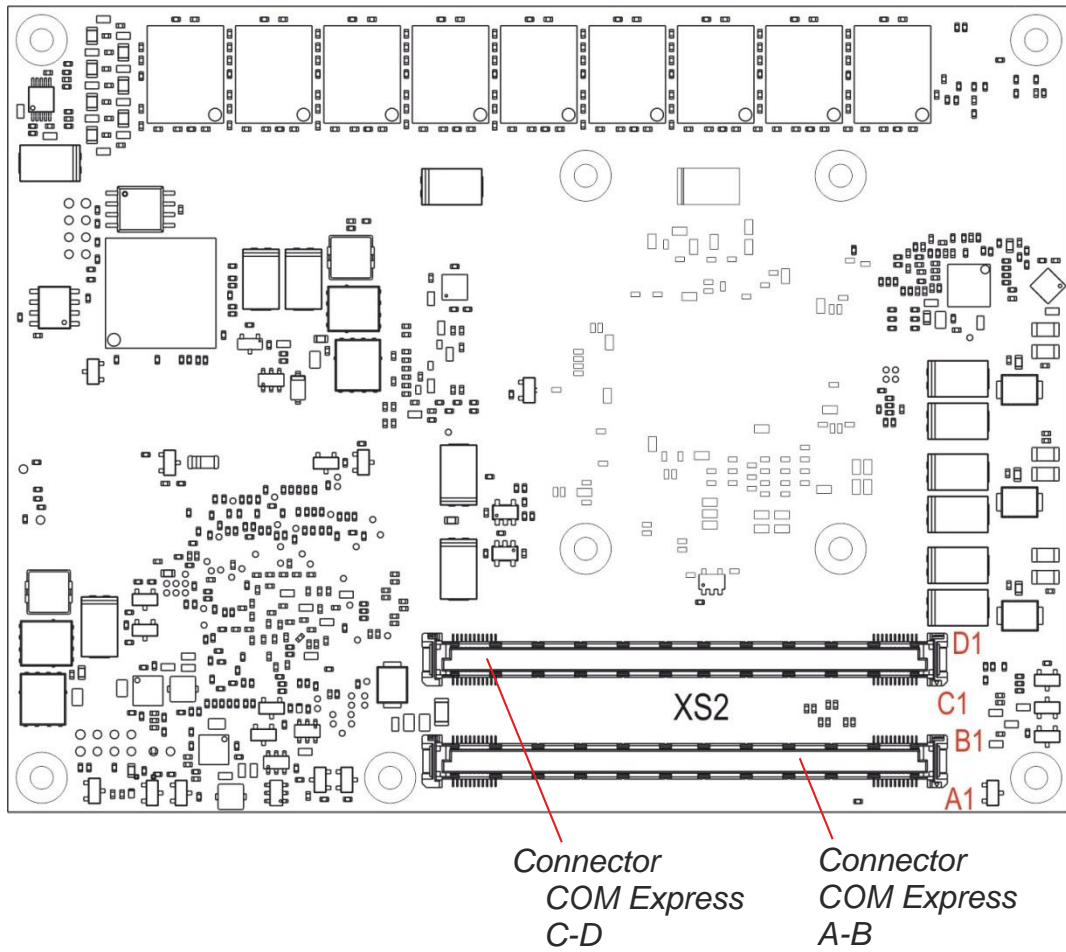


Fig. 2-2: Location of COM Express connectors of CPC1302 (bottom view)

2.2 Functional structure of CPC1302

Block diagram of CPC1302 is shown in Figure 2-3:

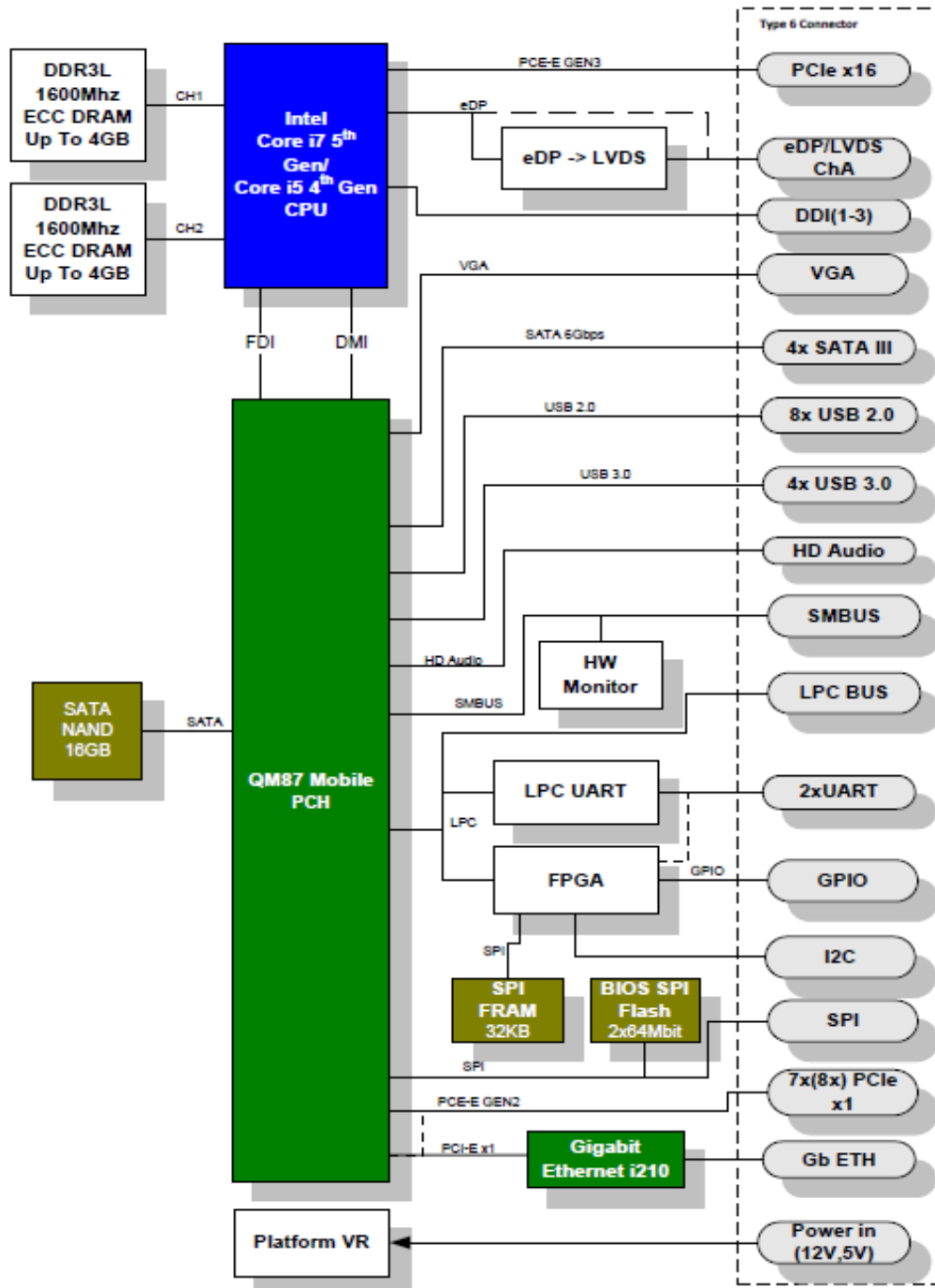


Fig. 2-3: Module block diagram

■ CPU Intel Core i7-5850EQ 2.7 GHz

64-bit Intel microprocessor manufactured using 14 nm process, with 37 W TDP (switching to the 47 W TDP mode is available in BIOS Setup with a plate temperature limitation up to +70°C).

Includes 4 improved cores 5th generation Intel Core i7, two-channel 64-bit DDR3L SDRAM memory controller with ECC support, modern graphics subsystem with 2D/3D acceleration GT3e, input-output subsystem PCI-Ex16 Gen3. The modern high-speed DDI graphics interfaces.

The processor is implemented in BGA enclosure, 37.5 x 32 mm.

■ CPU Intel Core i5-4422E 1.8 GHz

64-bit Intel microprocessor, manufactured using 22 nm processor, with maximum TDP of 25W.

Includes 2 cores 4th generation Intel Core i5, two-channel 64-bit DDR3L SDRAM memory controller with ECC support, modern graphics subsystem with 2D/3D acceleration GT2, input-output subsystem PCI-Ex16 Gen3. The modern high-speed DDI graphics interfaces.

The processor is implemented in BGA enclosure, 37.5 x 32 mm.

■ PCH Intel QM87

Highly integrated controller of interfaces, including standard peripherals of IBM PC AT platform and modern high-speed interfaces PCI-E Gen2, SATA 6 Gps, USB 2.0/3.0. Implemented in BGA enclosure 20x20mm, has a heat dissipation, which is by 20% lower as compared to the one of the previous controller QM77.

■ DDR3L SDRAM

The board can be equipped with 18 (soldered) microchips DDR3L 1600 SDRAM with a total volume of up to 8GB. (18x4Gbx8). Operating mode - two-channel with ECC support.

■ BIOS

For storing the main (working) copy of BIOS, two microchips SPI-Flash 64 Mb are used.

Booting from an external carrier (SPI interface on COM-Express connector) is supported. By default, the booting is carried out from SPI Flash soldered on the module. Switching to the booting from an external SPI Flash (COM-Express) or LPC bus is possible.

■ RTC, CMOS

The Real-Time Clock is integrated in PCH QM87. Operability of the clock when the power is off is ensured via the port "RTC battery" of COM-Express connector from the carrier-board. CMOS settings are stored in the FRAM non-volatile memory.

■ SPI FRAM

The non-volatile memory 32 Kbyte (Ramtron, FM25L256, SPI), required for storage of user data (used as a replacement for a standard non-volatile RAM).

■ PCI-E 3.0 ports

Port PCI-E Gen3 x16 with a bandwidth capacity of up to 128 GT/sec is routed to COM-Express connector. Possible port configurations: 1x16, 2x8, 1x8 + 2x4.

■ PCI-E 2.0 ports

The COM-Express connector is equipped with 8 routed ports PCI-E Gen2 x1 with bandwidth capacity of up to 5 GT/sec. Possible port configurations: 8x1, 2x4, 4x2, 2x2+4x1, (while switching off the integrated LAN). When LAN is on there are 7 ports with configurations 7x1, 1x4 + 3x1, 3x2 + 1x1 available at the connector.

■ SATA ports

COM-Express is equipped with 4 routed SATA ports. SATA III specification (up to 6Gbit/s) is supported.

■ SATA Flash Disk

As an option, the board can be equipped with SSD Flash Disk with a total volume of 16 GB RC03GW1AAB manufactured by RunCore. Distinguishing features: Memory SLC, support of ECC, extended temperature range (-40°C + 85°C). Enclosure FBGA 16x20 mm. SATA port is used.

■ USB 2.0 port

The COM-Express connector is equipped with 8 USB 2.0 ports with protection and short circuits.

■ USB 3.0 port

The COM-Express connector is equipped with 4 routed USB 3.0 ports (Super Speed).

■ Gbit Ethernet port

The board is equipped with 1 Gbit Ethernet channel. External controller Gigabit Ethernet I210, connected to the 8-th port PCI-E, is used. Controller can be switched off in BIOS, in this case, the COM-Express connector will have 8 ports available.

■ COM1/COM2 ports

The ports are implemented on EXAR XR28V382 controller, connected to the LPC bus. Software-compatible with 16550UART and are supported by standard drivers of COM-ports. Size of FIFO – 128 bytes.

COM1, COM2 – 2-wire interface RS-232 (TTL), with a speed up to 3 Mb/sec. May be used as console I/O port. Routed to COM-Express connector.

■ Video ports

For connection of LCD (TFT)-panels DDI interfaces routed to the COM-Express connector, are used. Maximum resolution: 4096x2304@60 Hz (for CPU Core i5 – 3200x2000@60 Hz). Independent operation of three displays is supported. Support of LVDS two-channel interface is implemented in microchip NXP PTN3460. Maximum resolution 1920x1200@60 Hz, 18/24 bpp. Routing eDP port instead of LVDS is possible – maximum resolution 3840x2160@60 Hz (for CPU Core i5 – 3200x2000@60 Hz).

■ Audio port

For connection of audio-devices, COM-Express connector is equipped with the routed High Definition Audio interface.

■ GPIO port (8 I/O channels)

GPIO port is used in FPGA. Is designed for input of 4 and output of 4 logical signals.

■ Sensors

Digital temperature sensor of CPU (integrated in CPU), dual-zone temperature sensor LM95235 is connected to SMBUS. Monitor of 7 power supply voltages (12V, 5V, 3.3V, 1.5V, 1.05V, 1.34V, VCPU) AMC80AIPW is connected to SMBUS.

■ FGA Xilinx Spartan-6

Used for implementation of SPI, I2C interfaces, GPIO ports, Watchdog-timer, diagnostics LED\start and control of power supply modes.

■ WDT

The module uses one hardware watchdog timer with modifiable actuation interval from 1 µsec up to 10 minutes, is implemented in FPGA.

2.3 Connectors COM Express A-B, C-D

CPC1302 is equipped with the standard COM Express connectors (see Fig. 2-2), using which CPC1302 is connecting with the carrier-board. Purpose of the contacts is specified in the Table A-1: Purpose of COM Express connector contacts.

2.4 Possible PCIe x16 Gen3 configuration options

Table 2-1: PCIe x16 Gen3 configurations

				Physical Lanes															
				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
x16	Off	Off	Direct	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
x8	x8	Off	Direct	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
x8	x4	x4	Direct	0	1	2	3	4	5	6	7	0	1	2	3	0	1	2	3
x16	Off	Off	Reverse	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
x8	x8	Off	Reverse	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
x8	x4	x4	Reverse	3	2	1	0	3	2	1	0	7	6	5	4	3	2	1	0

The configuration is set in BIOS Setup. Switching to the Reverse mode – over the signal PEG_LANE_RV# from COM Express connector.

2.5 Possible configurations of PCIe x8 Gen2

Number of available PCIe ports at COM Express connector depends on the fact whether the integrated Gigabit Ethernet is used. If it is integrated into BIOS Setup, then PCIe [0:6] ports are available on the connector, if it is off – all the 8 ports will be available. The possible configuration options depend on whether the Gigabit Ethernet used and they are not used and are available only when the custom version of BIOS is applied. The groups of [0:3] and [4:7] ports can be configured regardless of each other.

During the standard supply, the ports are configured as 7x1 when Ethernet is activated and 8x1 when Ethernet is deactivated.

Port0	Port1	Port2	Port3
X4			
X2		X2	
X2		X1	X1
X1	X1	X1	X1

Gbe is off:

Port4	Port5	Port6	Port7
X4			
X2		X2	
X2		X1	X1
X1	X1	X1	X1

Gbe is on:

Port4	Port5	Port6	Port7
X2		X1	N/A
X1	X1	X1	N/A

2.6 Devices on SMBus

SMBus (System Management Bus) ensures monitoring and system configuration functions. This bus uses a two-wire interface I2C™.

Device addresses on SMBus are given in the table below.

Table 2-2: Addresses of devices on SMBus

Name	Address
SPD1 EEPROM	A0h
SPD2 EEPROM	A2h
LM95235DIMM	4Ch
PTN3460BS/F	40h
AMC80A	50h

2.7 FRAM controller registers

FRAM controller is implemented in FPGA as a device on LPC bus. Controller is activated in BIOS Setup. The device is operated via registers in the field of input-output (I/O) ports. Base register address (BASE), set in BIOS, is specified in "Help" section of BIOS Setup, to the right side of the item dedicated to activation/deactivation of FRAM controller.

INDEX	Input/output 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 [5:1] – Reserved [0] – BURST mode

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

The last kilobyte from 32 Kbyte is backed up for storing the BIOS Setup settings. Bit <0> in the control register (Base+3) includes the mode of automatic increase of address during reading/writing of data register (base+2), upon completion of the packet exchange it should be reset.

Programming SPI devices

Work with FRAM is carried out in the field of I/O at the addresses, specified in BIOS Setup. The example shows base address 310H.

- 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
```

- 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 containing three FRAM data bytes starting from the 208h address

```

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      ; activation of batch 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     ; deactivation of batch mode

```

2.8 Watchdog timer

The watchdog is implemented in FPGA as a device on LPC bus. Deactivation of the watchdog timer and selection of hardware interrupt (IRQ) is carried out in BIOS Setup. Work with timer is carried out via the registers in the field of input-output (I/O) ports. Base register address (BASE), set in BIOS, is specified in "Help" section of BIOS Setup, to the right side of the item dedicated to activation/deactivation of watchdog timer.

The watchdog timer contains 24-bit counter register [Timer Current Value Register], decremented with the frequency of 32768 kHz and initial value register [Timer Initial Value Register]. When the counter register is zeroed, it could lead to either interrupt or board automatic reset (in case of counter double zeroing). Actuation time can be set from 0 though 512 seconds with a pitch of 30,52 μ s.

The watchdog timer is inactive by default. Below is the formula for calculation of duration of TWD actuation delay (μ s) depending on the decimal value in the register [Timer Initial Value Register] (KWD):

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

E.g. the decimal value $K_{WD} = 1$ (000001h) corresponds to actuation delay time of 30.52 μ s, and the value $K_{WD} = 16777215$ (FFFFFFh) – to the delay time of 512 seconds.

Reset of the counter to the initial value can be performed by recording of any number to the counter register [Timer Current Value Register].

During the first zeroing of the counter register, TMF flag is set, during the second one – the STF flag, the counter is set and the board reboot will be performed (if allowed).

Operation algorithm with watchdog timer via I/O registers:

- 1) The counter decrement is stopped.
- 2) Timeout value is recorded to the initial value registers.
- 3) Counter register is initiated by recording 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, allow the board automatic reset.
- 5) After that, with a period of the lesser or equal timeout value we regularly perform counter reset (using any of the methods described above). If the counter is not reset during the first timeout interval – TMF flag is set and interrupt will appear (if allowed), If the counter is not reset during the second timeout interval – STF flag is set and the board will reboot, if the reset was allowed.

2.8.1 Watchdog timer's registers

Input/output address	Type	HARD RESET	Configuration register
Base+0	R/W		Timer current value [7:0]
Base+1	R/W		Timer current value [15:8]
Base+2	R/W		Timer current value [23:16]
Base+3	R/W	00h	Timer initial value [7:0]
Base+4	R/W	40h	Timer initial value [15:8]
Base+5	R/W	00h	Timer initial value [23:16]
Base+6	R/W	00h	Status register
Base+7	R/W	00h	Control register

2.8.2 Description of watchdog timer's registers

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

Timer Initial Value Register [23:0]

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

Status Register

Base+6h		
Bit	Name	Description
7:3	-	Reserved
2	STF	Write/Read: Second timeout flag is set to "1" provided that the timer's counter was reset to zero for the second time, the counter stops. In case the board reset RSTE=1 is allowed, the hardware reset will be carried out. The reset is carried out by writing any number to the registers of the current value.
1	-	Reserved
0	TMF	Write/Read: Timeout flag. Installed into "1" when resetting the timer counter. An interrupt is generated over this flag. The reset is carried out by writing any number to the registers of the current value.

Control Register

Base+7h		
Bit	Name	Description
7:3	-	Reserved
2	INTM	Write/Read 1 – interrupt is on 0 – interrupt is off
1	CNTE	Write/Read: Counter 1 decrement is ON 0 – switched off
0	RSTE	Write/Read: Board reset on timeout 1 – Reset is permitted 0 – Reset is prohibited

2.9 I2C Controllers/ input-output ports

Controller I2C supports the "Master" mode and transfer frequency of 100 KHz. Base address in the field of I/O, installed by BIOS is specified in the section "help", to the right of the item dedicated to I2C controller activation/ deactivation.

Register GPIO (BASE+3) enables to read and set input-output signals GPI[3:0], GPO[3:0], routed to the COM Express connector.

2.9.1 Algorithm of I2C controller operation

Operation of I2C controller is shown in Fig. 2-4 as exemplified by recording 1 data byte.

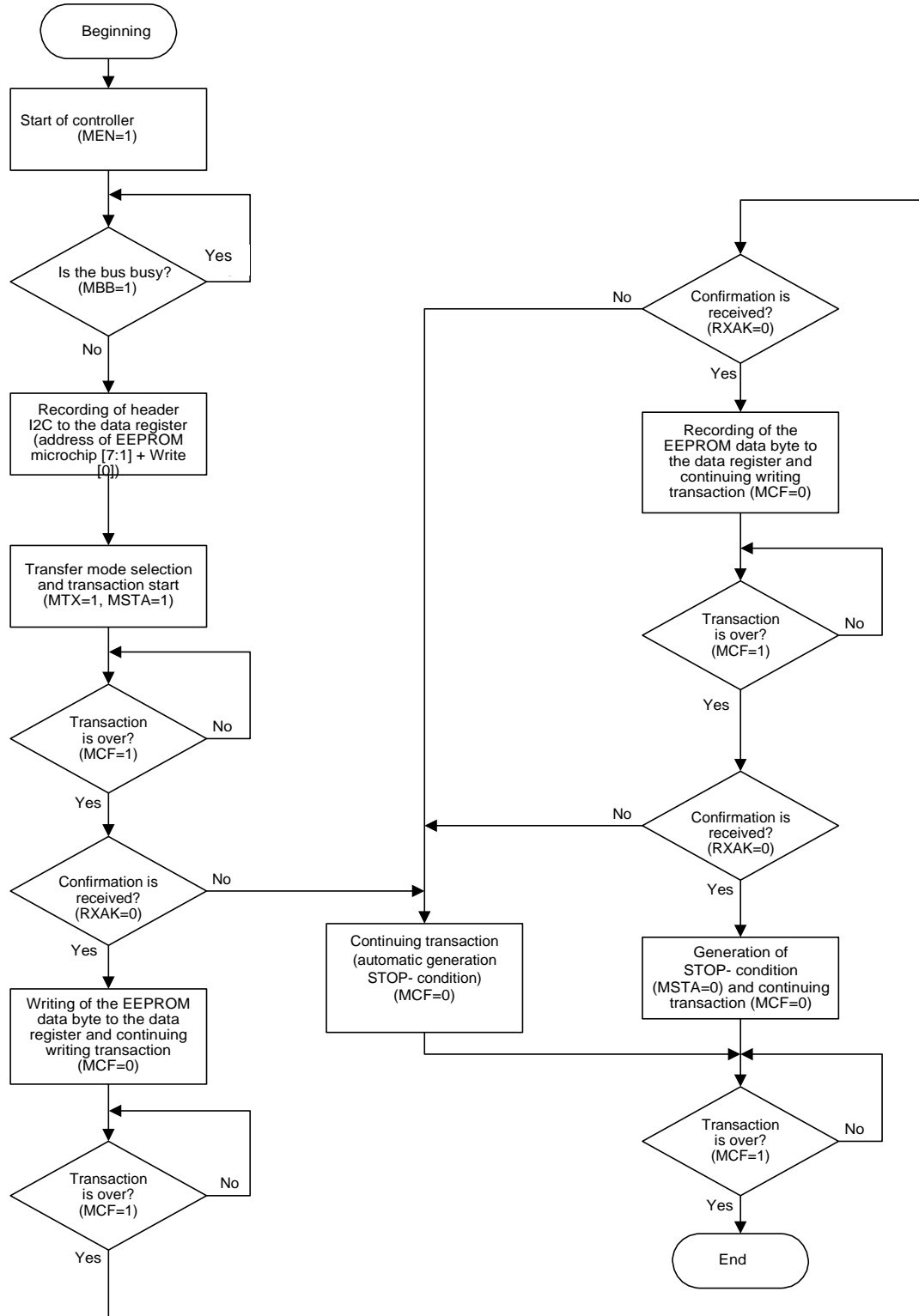


Fig. 2-4: Algorithm of I2C controller operation (example of writing 1 byte of data to EEPROM Atmel AT24C02)

2.9.2 Registers of I2C controller

Input/output address	Type	HARD RESET	Configuration register
Base+0	R/W	00h	Status Register
Base+1	R/W	00h	Control Register
Base+2	R/W	00h	Data Register
Base+3	R/W	0xh	GPIO Register

2.9.3 Description of I2C controller registers

Status Register (Base+0)

Bit number	Name	Type	Description
7	MCF	R/W	Flag of transaction ending / continuation. Is set to "1" after acknowledgement (ACK) condition and STOP Condition of the transaction. For start of the next transaction it should be reset by writing "1" to this bit.
6	-		Reserved
5	MBB	R	Bus busy flag. Is set to "1" if the START condition was recorded and is reset to "0" if the STOP condition was recorded.
4	MAL	R/W	Flag of the bus arbitration loss. Is set to "1" at bus arbitration loss (in START/STOP/Transmit conditions). Should be reset by writing "1" to this bit.
3	-		Reserved
2	-		Reserved
1	MIF	R/W	Interrupt flag. Is installed in the "1" under condition of MCF="1" or MAL="1". Interrupt occurs when MIEN bit is set in the Control Register should be reset by writing "1" to this bit.
0	RXAK	R	Flag of transaction acknowledgement (ACK). This will be reset to "0" if ACK was obtained, and will be set to "1" if ACK wasn't obtained. Where there is no acknowledgement of (RXAK=1) of the transmit transaction, MSTA bit will be automatically reset to "0" and the Stop Condition will be initiated.

Control Register (Base+1)

Bit number	Name	Type	Description
7	MEN	R/W	Start/reset of controller. Writing "1" to this bit switches on the I2C controller. Writing "0" to this bit resets and switches off the I2C controller.
6	MIEN	R/W	Interrupt activation Writing "1" to this bit enables interrupt. Interrupt occurs when MIF bit is set in the Status Register.
5	MSTA	R/W	Start of the transaction. Writing "1" to this bit calls the Start condition and transmit/receive condition, depending on the MTX bit setting. Writing "0" to this bit calls the Stop condition. Where there is no acknowledgement of (RXAK=1) of the transmit transaction, the bit will automatically reset to "0" and the Stop Condition will be initiated.
4	MTX	R/W	Selection of transaction mode. Writing "1" to this bit sets the transmission mode, writing "0" – to receipt mode.
3	TXAK	R/W	Reception transaction acknowledgement bit. Writing "0" to this bit performs acknowledgement (ACK), writing "1" – no acknowledgement is performed.
2	RSTA	R/W	Restart. Writing "1" to this bit calls the Repeated Start Condition. The bit is automatically reset to "0" upon completion of the Repeated Start Condition.
1	-		Reserved
0	-		Reserved

Data Register (Base+2)

Bit number	Name	Type	Description
7-0		R/W	Data for transfer mode during recording or data of receipt mode during reading.

GPIO Register (Base+3)

Bit number	Name	Type	Description
7-4	GPO	R/W	Values of output signals GPO[3:0].
3-0	GPI	R	Values of input signals GPO[3:0].

3 Intended use of CPC1302

3.1 Reset of BIOS Setup settings

In order to reset BIOS Setup settings (Table. 3-1), it is necessary to set the jumper XP1 (see Fig. 2-1), switch on the module, wait for the BIOS information to appear on the screen, switch off the module and remove the jumper XP1.



It is prohibited:

to remove/install the jumper when the power is on.

Table 3-1: Reset of BIOS Setup settings of CPC1302 using XP1 switch

Connector name	Purpose	
XP1	Contacts 1-2 are closed	CMOS Reset (factory reset)

3.2 Description of indicators

Table 3-2: Description of CPC1302 indicators

Indicator names	Purpose
HL1	Indication of power supply +5V_STBY
HL2	Activity LED of SATA
HL3	Indicator of module's diagnostics\start

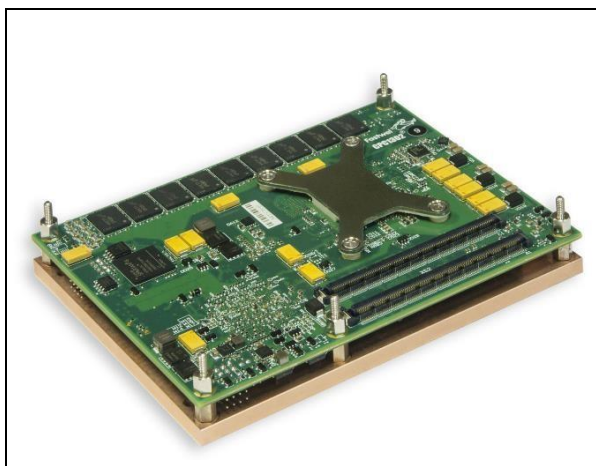
3.2.1 Description of HL3 LED operation

Table 3-3: Description of HL3 indicator of CPC1302

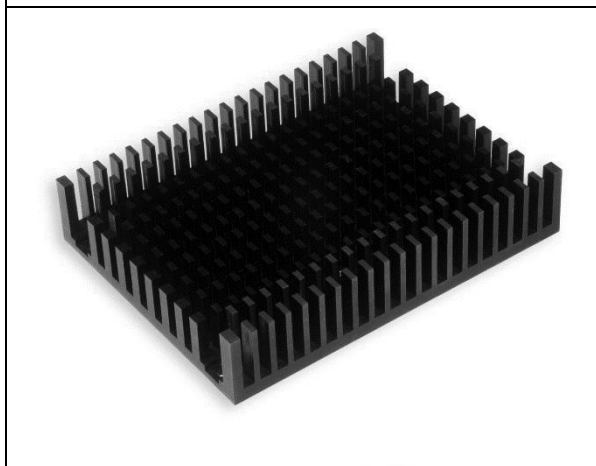
State of HL3 indicator	Function
Off	Module's primary supply is off
Flashing at ~8 Hz	CPU is started for BIOS operation
Flashing at ~1 Hz	CPU performs POST procedures
Flashing constantly	POST is completed, OS booting is performed

3.3 Possible heat removal options

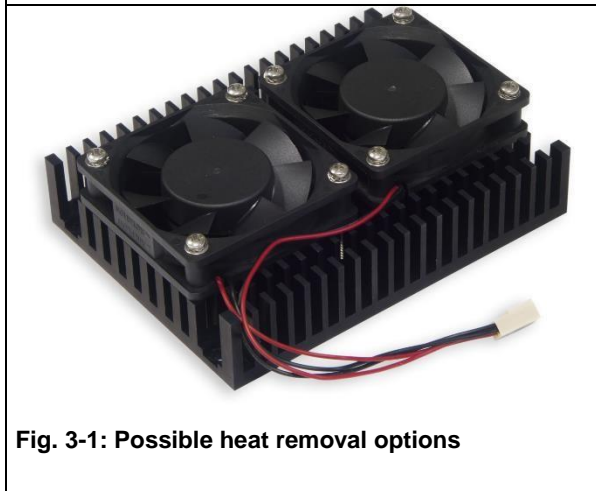
Subsection 3.4 contains technical specifications, which the user should consider during development of the proprietary cooling system. Heat-removal options are shown in the figure below.



The side of the CPU of CPC1302 module is equipped with the heat-spreading plate, to which the heat from the CPU and PCH microchip is withdrawn. With such a configuration, it is possible to ensure heat dissipation by installing the module immediately on the enclosure or chassis (the enclosure fulfills a function of a large heatsink).



The module 1302 can be additionally equipped with a heatsink from the set ACS30076-01 (to be purchased as an option) or a user-made heatsink. The heatsink is installed to the heatspreading plate (using a thermal conductive paste) and is fixed with the screws from the heatsink delivery checklist.



CPC1302 can also be equipped with a heatsink with a fan (set ACS30076-02, to be purchased as an option).

Fig. 3-1: Possible heat removal options

CPC1302 with the installed heat-removal set ACS30076-02 is shown in Fig. 3-2.

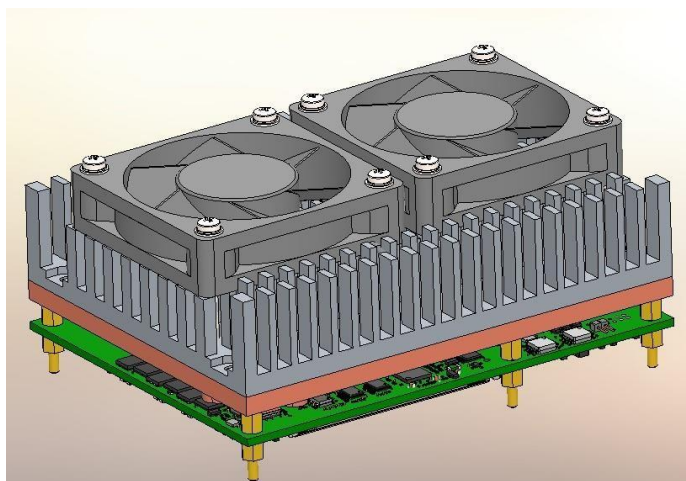


Fig. 3-2: CPC1302 with the installed heat removal set ACS30076-02

3.4 Heat removal requirements

Operation of CPC1302 is possible only with additional cooler, which ensures temperature of CPU cores no higher than the maximum temperature allowed by CPU manufacturer. For CPC1302-01 (-02) the maximum allowed temperature of the core is 105°C, for CPC1302-03 (-04) – 100°C. Possibility to control the temperature of CPU cores is ensured by the internal digital temperature sensor (DTS). Description of DTS registers is provided in documentation of CPU manufacturer.

Reduction of CPU performance is permitted at the board temperature above 85°C, temperature control is performed in accordance with Fig. 3-3.

For versions CPC1302-01 (-02) it is possible to increase CPU performance by setting in BIOS Setup of an item "Configurable TDP" to the value "Nominal", in this case CPU performance is increased up to 47W and decrease of performance is permitted at the board temperature above +70°C.

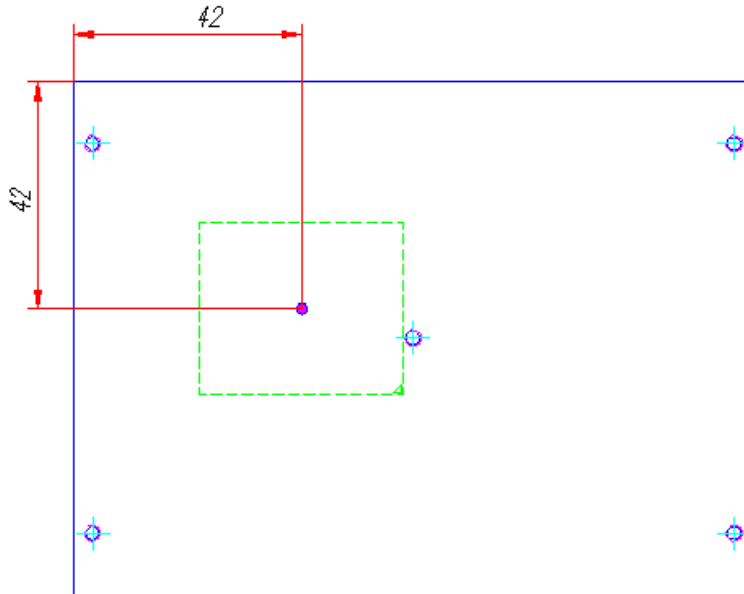


Fig. 3-3: Point for temperature control on heat-spreading plate

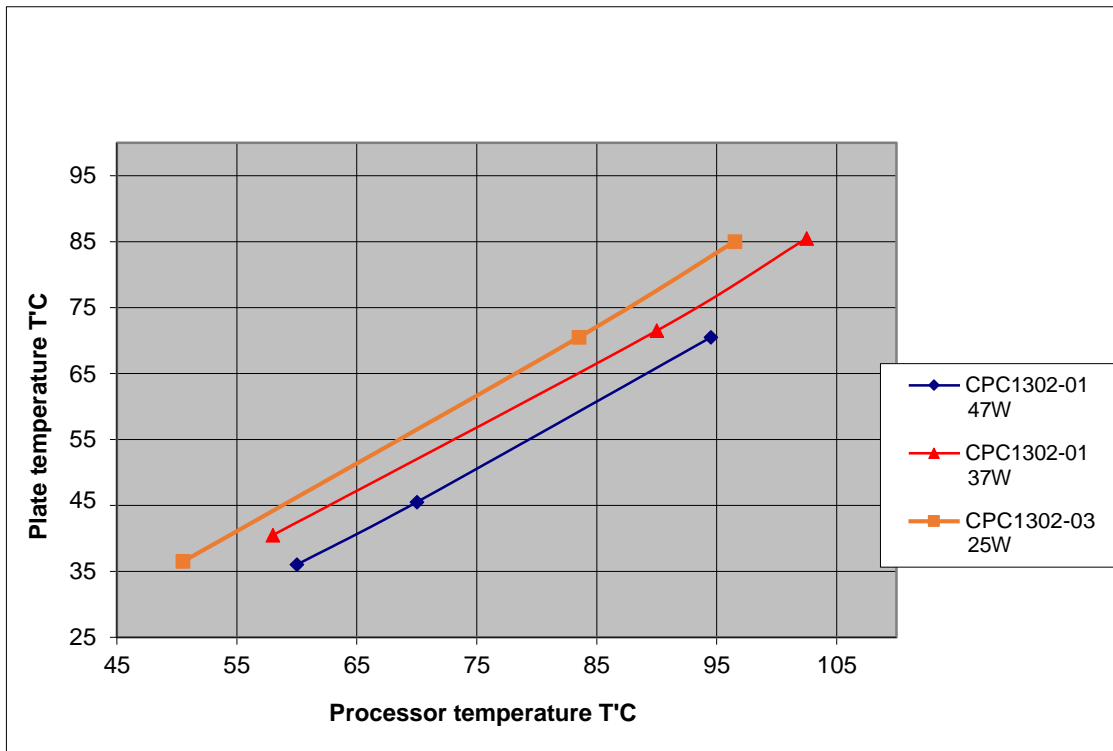


Fig. 3-4: Diagram of CPU temperature dependency on the temperature on plate (*)

CPC1302-01 (-02) modules with heat-removal sets ACS30076-02 can be operated at ambient temperatures of up to +70°C without reduction in performance. (When using the mode "47W" – up to +55°C). (*)

CPC1302-03 (-04) modules equipped with the heat-removal sets ACS30076-01 can be operated at ambient temperatures of up to +30°C, without reduction in performance under conditions of natural convection. (*)

CPC1302-03 (-04) modules with heat-removal sets ACS30076-02 can be operated at ambient temperatures of up to +75°C without reduction in performance. (*)

(*) *It specifies operating modes under the load of processor cores and graphics engine with synthetic benchmarks, ensuring maximum Thermal Design Power (TDP).*

3.5 Installation of CPC1302

CPC1302 Module can be installed on the carrier-board compatible with the COM Express Type 6 r.2.1 standard.

3.5.1 Safety requirements

For proper installation of CPC1302 it is required to strictly follow the below rules and safety requirements in order to avoid damages to the device and not to injure the health of people. Manufacturer shall not be liable for any damages, arising out as a result of non-observance of such requirements.



Warning!

Be careful when handling the module, since the heat-spreading plate (and heatsink, if installed) can become too hot. Moreover, the module should not be placed on any surface or put in any container until both module and heatsink will have the room temperature.



Warning!

Switch off the power supply prior to installation of the module to the carrier-board. Non-compliance with this rule could pose threat to your health, as well as could lead to the failures of operation of the module and the entire system.

**ESD Sensitive Device!**

CPC1302 contains components sensible to static electricity. In order to prevent module damages, the following precaution measures should be observed:

- Before touching the module, discharge the static electricity from your clothes, as well as from the tools before using them.
- Do not touch electronic components and connector contacts.
- If you have a professional workplace equipped with antistatic protection, don't forget to use it.

Be especially careful in cold and dry weather.

Forbidden!

To restart the Module less than in 5 sec. after shutdown

3.6 Installation of CPC1302 to the carrier-board

In order to install CPC1302 to the carrier-board, follow the below procedure:

1. Make sure that the safety requirements, listed in section 3.5.1 have been met.

**Warning!**

Noncompliance with the following directions could lead module damages and improper operation of the system.

2. Prior to installation, make sure that the carrier -board is compatible with the standard COM Express Type 6 r.2.1 and that the height of the COM Express connectors on the carrier-board corresponds to the height of racks on CPC1302. (The module is supplied with the installed 5 mm racks, 8 mm height racks are supplied in the delivery checklist.) If the carrier-board Adlink Express-BASE6 is used, the 5 mm racks installed on the module should be removed (since the board Adlink Express-BASE6 is already equipped with the fasteners similar to the racks). If heatsink ACS30076 from the delivery checklist or user-made heatsink are used, then you will have to preliminary install the heatsink, see subsection 3.3.
3. Connectors XS2 of CPC1302 module (see Figure 2-2) should be inserted into the relevant connectors of the carrier-board. Fix the module on the carrier-board using fastening screws and washers from the installation kit (supplied to the customer with the module, see subsection 1.3.1).

3.7 Procedure of module removal

In order to remove the module, the following operations should be performed:

1. Make sure that the safety requirements, listed in section 3.5.1, have been met. Pay special attention to the warning related to heatsink temperature!
2. Before starting operations, make sure that system power supply is switched off.
3. Unscrew the fastening screws and remove the module from connectors of the carrier - board. Do not touch the heatsink since it could get too hot during operation.
4. Do not place the module in the box or packaging, till the module and cooling heatsinks cool down to the ambient temperature.

3.8 Elimination of CPC1302 malfunctions

The Table 3-4 contains possible malfunctions of CPC1302 and the ways of their elimination.

Table 3-4: Elimination of CPC1302 malfunctions

Malfunction	Cause	Solution
The board fails to start, HL1 LED is off.	No triggered voltage +5 V on the board.	Check the availability of the triggered voltage at COM_Express connector (B84-B87 contacts) (if used). Or check the availability of the feeding voltage +12V and PWR_OK signal (contact B24) at COM_Express connector.
The board fails to start, HL1 LED is on, HL3 is off.	No feeding power supply of +12 V.	Check the availability of the feeding voltage +12 V, supplied from the carrier of the board and PWR_OK signal (B24) at COM_Express connector.
	Feeding power supply sources on the board are not functioning properly. FPGA firmware is absent or damaged. Signal PCIRST# is active.	Contact the service center.
The board fails to start, HL1 LED is on, HL3 is flashing fast (~8 Hz).	BIOS is absent or damaged/	Check the accuracy of BIOS selection on the carrier-board (if the selection is available). Check the accuracy of BIOS_DIS0# (A34) signals and BIOS_DIS#1 (B88) signals at COM_Express connector. Boot the board from BIOS backup, if such is stipulated for the carrier-board, and restore BIOS on the board.
	The board is	Contact the service center.
The board fails to start, HL1 LED is on, HL3 LED is flashing slowly (~1 Hz), the board makes sounds.	The BIOS implementation has failed to reach the call of OS boot INT19H.	Run the diagnostics of the BIOS implementation over the POST codes and sound signals. If it is impossible to carry out diagnostics/eliminate the reason, please contact the service center.
	BIOS is damaged.	Boot the board from BIOS backup, if such is stipulated for the carrier-board, and restore BIOS on the board.

4 AMI® BIOS

Your module has an installed adapted version of AMI® BIOS, which is a standard system for IBM PC AT-compatible computers. It supports Intel®x86 and Intel®x86-compatible CPUs, ensures low-level support for CPU, memory and I/O subsystems.

Using BIOS Setup program you can change BIOS parameters and control special computer operation modes. It enables to change basic parameters of system configuration.

4.1 BIOS update

BIOS update is carried out using the Flash Programming Tool utility (is available on network file-servers of the manufacturer and official distributor).

Actions for updating BIOS

There is a BIOS version for CPC1302 available on FTP: **1302_Vxxx.bin**.

Example of BIOS update via an integrated UEFI SHELL:

1. Copy EFI utility to USB drive root directory.
2. Copy with the new BIOS to the EFI catalog.
3. Connect USB drive to the CPC1302 module.
4. In BIOS SETUP select the menu "Save & Exit -> Launch EFI Shell from filesystem device".
5. Type in the command line:

```
fs0:  
cd efi64  
fpt64.efi -f <file name>
```
6. Wait for update completion and message "FPT Operation Passed" to appear on the screen.
7. Restart the system

5 Transportation, unpacking and storage

5.1 Transportation

The module should be transported in a separate packaging box (transport packaging) of the manufacturing facility, which consists of an individual antistatic bag and a cardboard box, in the closed transport (automobile, railway, air transportation in heated and pressurized compartments) in storage conditions 5 defined in the GOST standard 15150-69 (IEC 721-2-1 standard) or in storage conditions 3 during sea transportation.

It is possible to transport modules, packaged in individual antistatic packages, in multiple packaging (transport packaging) of the manufacturing facility.

The packaged modules should be transported in accordance with the shipping rules, operating with this particular type of transport.

During handling and transportation operations, the packaged modules should not undergo sharp pounding, falls, shocks and exposure to atmospheric precipitation. The packaged modules should be stored in a carrier vehicle in such a manner which will prevent their moving.

5.2 Unpacking

Prior to unpacking, before transportation at subzero temperature of ambient air the modules should be kept within 6 hours under storage conditions 1 defined in the GOST standard 15150-69. (IEC 721-2-1 standard).

It is prohibited to place the packaged module close to the heat source, prior to unpacking.

While unpacking, it is required to comply with all safety precautions, which ensure its safety, as well as marketable condition of consumer packaging of the manufacturing company.

At the time of unpacking it is required to check the module that it has no external mechanical damages after transportation.

5.3 Storage

Module storage conditions for group 1 are defined in the GOST standard 151-50-69 (IEC 721-2-1 standard).

Annex A

A Purpose of COM Express connector contacts

Table A-1: Purpose of COM Express connector contacts

Contact	Description	Note
A1	GND	
A2	GBE0_MDI3-	
A3	GBE0_MDI3+	
A4	GBE0_LINK100#	OD, 330oHm
A5	GBE0_LINK1000#	OD, 330oHm
A6	GBE0_MDI2-	
A7	GBE0_MDI2+	
A8	GBE0_LINK#	OD, 330oHm
A9	GBE0_MDI1-	
A10	GBE0_MDI1+	
A11	GND	
A12	GBE0_MDI0-	
A13	GBE0_MDI0+	
A14	NC	
A15	SUS_S3#	PP 3.3V_STBY,PD 10K
A16	SATA0_TX+	
A17	SATA0_TX-	
A18	SUS_S4#	PP 3.3V_STBY,PD 10K
A19	SATA0_RX+	
A20	SATA0_RX-	
A21	GND	
A22	SATA2_TX+	
A23	SATA2_TX-	
A24	SUS_S5#	PP 3.3V_STBY,PD 10K
A25	SATA2_RX+	
A26	SATA2_RX-	
A27	BATLOW#	PU 10K 3.3V_STBY
A28	(S)ATA_ACT#	OD, 3.3V_STBY
A29	AC/HDA_SYNC	PP 3.3V
A30	AC/HDA_RST#	PP 3.3V
A31	GND	
A32	AC/HDA_BITCLK	PP 3.3V
A33	AC/HDA_SDOUT	PP 3.3V
A34	BIOS_DIS0#	PU 10K 3.3V_STBY
A35	THRMTRIP#	PU 10K 3.3V_STBY
A36	USB6-	
A37	USB6+	
A38	USB_6_7_OC#	PU 10K 3.3V_STBY

A39	USB4-	
A40	USB4+	
A41	GND	
A42	USB2-	
A43	USB2+	
A44	USB_2_3_OC#	PU 10K 3.3V_STBY
A45	USB0-	
A46	USB0+	
A47	VCC_RTC	
A48	EXCD0_PERST#	PP 3.3V_STBY
A49	EXCD0_CPPE#	PP 3.3V_STBY
A50	LPC_SERIRQ	OD 3.3V,PU 3.3V
A51	GND	
A52	PCIE_TX5+	
A53	PCIE_TX5-	
A54	GPIO	CM 3.3V_STBY
A55	PCIE_TX4+	
A56	PCIE_TX4-	
A57	GND	
A58	PCIE_TX3+	
A59	PCIE_TX3-	
A60	GND	
A61	PCIE_TX2+	
A62	PCIE_TX2-	
A63	GPI1	CM 3.3V_STBY
A64	PCIE_TX1+	
A65	PCIE_TX1-	
A66	GND	
A67	GPI2	CM 3.3V_STBY
A68	PCIE_TX0+	
A69	PCIE_TX0-	
A70	GND	
A71	LVDS_A0+	
A72	LVDS_A0-	
A73	LVDS_A1+	
A74	LVDS_A1-	
A75	LVDS_A2+	
A76	LVDS_A2-	
A77	LVDS_VDD_EN	PP 3.3V
A78	LVDS_A3+	
A79	LVDS_A3-	
A80	GND	
A81	LVDS_A_CK+	
A82	LVDS_A_CK-	
A83	LVDS_I2C_CK	2.2K PU 3.3V
A84	LVDS_I2C_DAT	2.2K PU 3.3V

A85	GPI3	CM 3.3V_STBY
A86	NC	
A87	NC	
A88	PCIE0_CK_REF+	
A89	PCIE0_CK_REF-	
A90	GND	
A91	SPI_POWER	PP +3.3V_STBY, 0.16A
A92	SPI_MISO	CM/PP +3.3V_STBY
A93	GPO0	PP 3.3V_STBY
A94	SPI_CLK	PP 3.3V_STBY
A95	SPI_MOSI	CM/PP +3.3V_STBY
A96	PP_TPM	CM 3.3V
A97	NC	
A98	SER0_TX	OD 3.3V
A99	SER0_RX	CM 3.3V
A100	GND	
A101	SER1_TX	OD 3.3V
A102	SER1_RX	CM 3.3V
A103	LID#	
A104	VCC_12V	
A105	VCC_12V	
A106	VCC_12V	
A107	VCC_12V	
A108	VCC_12V	
A109	VCC_12V	
A110	GND	
B1	GND	
B2	GBE0_ACT#	OD, 330oHm
B3	LPC_FRAME#	PP 3.3V
B4	LPC_AD0	PP 3.3V
B5	LPC_AD1	PP 3.3V
B6	LPC_AD2	PP 3.3V
B7	LPC_AD3	PP 3.3V
B8	LPC_DRQ0#	PP 3.3V
B9	LPC_DRQ1#	PP 3.3V
B10	LPC_CLK	PP 3.3V
B11	GND	
B12	PWRBTN#	PU 10K, +3.3V_STBY
B13	SMB_CK	2.2K PU 3.3V_STBY
B14	SMB_DAT	2.2K PU 3.3V_STBY
B15	SMB_ALERT#	10K PU 3.3V_STBY
B16	SATA1_TX+	
B17	SATA1_TX-	
B18	SUS_STAT#	PP 3.3V_STBY
B19	SATA1_RX+	
B20	SATA1_RX-	

B21	GND	
B22	SATA3_TX+	
B23	SATA3_TX-	
B24	PWR_OK	100K PD
B25	SATA3_RX+	
B26	SATA3_RX-	
B27	WDT	PP 3.3V_STBY
B28	AC/HDA_SDIN2	
B29	AC/HDA_SDIN1	
B30	AC/HDA_SDINO	
B31	GND	
B32	SPKR	PP 3.3V
B33	I2C_CK	2.2K PU 3.3V
B34	I2C_DAT	2.2K PU 3.3V
B35	THRM#	10K PU 3.3V
B36	USB7-	
B37	USB7+	
B38	USB_4_5_OC#	10K PU 3.3V_STBY
B39	USB5-	
B40	USB5+	
B41	GND	
B42	USB3-	
B43	USB3+	
B44	USB_0_1_OC#	10K PU 3.3V_STBY
B45	USB1-	
B46	USB1+	
B47	EXCD1_PERST#	PP 3.3V_STBY
B48	EXCD1_CPPE#	PP 3.3V_STBY
B49	SYS_RESET	10K PU 3.3V
B50	CB_RESET#	PP 3.3V_STBY, 10K PD
B51	GND	
B52	PCIE_RX5+	
B53	PCIE_RX5-	
B54	GPO1	PP 3.3V_STBY
B55	PCIE_RX4+	
B56	PCIE_RX4-	
B57	GPO2	PP 3.3V_STBY
B58	PCIE_RX3+	
B59	PCIE_RX3-	
B60	GND	
B61	PCIE_RX2+	
B62	PCIE_RX2-	
B63	GPO3	PP 3.3V_STBY
B64	PCIE_RX1+	
B65	PCIE_RX1-	
B66	WAKE0#	PU 1K, +3.3V_STBY

B67	WAKE1#	PU 10K, +3.3V_STBY
B68	PCIE_RX0+	
B69	PCIE_RX0-	
B70	GND	
B71	LVDS_B0+	
B72	LVDS_B0-	
B73	LVDS_B1+	
B74	LVDS_B1-	
B75	LVDS_B2+	
B76	LVDS_B2-	
B77	LVDS_B3+	
B78	LVDS_B3-	
B79	LVDS_BKLT_EN	PP 3.3V
B80	GND	
B81	LVDS_B_CK+	
B82	LVDS_B_CK-	
B83	LVDS_BKLT_CTRL	PP 3.3V
B84	VCC_5V_SBY	
B85	VCC_5V_SBY	
B86	VCC_5V_SBY	
B87	VCC_5V_SBY	
B88	BIOS_DIS1#	PU 10K, +3.3V_STBY
B89	VGA_RED	PD 150ohm
B90	GND	
B91	VGA_GRN	PD 150ohm
B92	VGA_BLU	PD 150ohm
B93	VGA_HSYNC	22.6 ohm series
B94	VGA_VSYNC	22.6 ohm series
B95	VGA_I2C_CK	PU 2.2K, 3.3V
B96	VGA_I2C_DAT	PU 2.2K, 3.3V
B97	SPI_CS#	PU 100K, +3.3V_STBY
B98	NC	
B99	NC	
B100	GND	
B101	FAN_PWMOUT	
B102	FAN_TACHIN	
B103	SLEEP#	
B104	VCC_12V	
B105	VCC_12V	
B106	VCC_12V	
B107	VCC_12V	
B108	VCC_12V	
B109	VCC_12V	
B110	GND	
C1	GND	
C2	GND	

C3	USB_SSRX0-	
C4	USB_SSRX0+	
C5	GND	
C6	USB_SSRX1-	
C7	USB_SSRX1+	
C8	GND	
C9	USB_SSRX2-	
C10	USB_SSRX2+	
C11	GND	
C12	USB_SSRX3-	
C13	USB_SSRX3+	
C14	GND	
C15	NC	
C16	NC	
C17	NC	
C18	NC	
C19	PCIE_RX6+	
C20	PCIE_RX6-	
C21	GND	
C22	PCIE_RX7+	
C23	PCIE_RX7-	
C24	DDI1_HPDP	100K PD
C25	NC	
C26	NC	
C27	NC	
C28	NC	
C29	NC	
C30	NC	
C31	GND	
C32	DDI2_CTRLCLK_AUX+	PU 2.2K, 3.3V / PD 100K
C33	DDI2_CTRLCLK_AUX-	PU 2.2K, 3.3V / PU 100K 3.3V
C34	DDI2_AUXSEL	PD 1M
C35	NC	
C36	DDI3_CTRLCLK_AUX+	PU 2.2K, 3.3V / PD 100K
C37	DDI3_CTRLCLK_AUX-	PU 2.2K, 3.3V / PD 100K
C38	DDI3_AUXSEL	PD 1M
C39	DDI3_PAIR0+	
C40	DDI3_PAIR0-	
C41	GND	
C42	DDI3_PAIR1+	
C43	DDI3_PAIR1-	
C44	DDI1_HPDP	100K PD
C45	NC	
C46	DDI3_PAIR2+	
C47	DDI3_PAIR2-	

C48	NC	
C49	DDI3_PAIR3+	
C50	DDI3_PAIR3-	
C51	GND	
C52	PEG_RX0+	
C53	PEG_RX0-	
C54	NC	
C55	PEG_RX1+	
C56	PEG_RX1-	
C57	NC	
C58	PEG_RX2+	
C59	PEG_RX2-	
C60	GND	
C61	PEG_RX3+	
C62	PEG_RX3-	
C63	NC	
C64	NC	
C65	PEG_RX4+	
C66	PEG_RX4-	
C67	NC	
C68	PEG_RX5+	
C69	PEG_RX5-	
C70	GND	
C71	PEG_RX6+	
C72	PEG_RX6-	
C73	GND	
C74	PEG_RX7+	
C75	PEG_RX7-	
C76	GND	
C77	NC	
C78	PEG_RX8+	
C79	PEG_RX8-	
C80	GND	
C81	PEG_RX9+	
C82	PEG_RX9-	
C83	NC	
C84	GND	
C85	PEG_RX10+	
C86	PEG_RX10-	
C87	GND	
C88	PEG_RX11+	
C89	PEG_RX11-	
C90	GND	
C91	PEG_RX12+	
C92	PEG_RX12-	
C93	GND	

C94	PEG_RX13+	
C95	PEG_RX13-	
C96	GND	
C97	NC	
C98	PEG_RX14+	
C99	PEG_RX14-	
C100	GND	
C101	PEG_RX15+	
C102	PEG_RX15-	
C103	GND	
C104	VCC12	
C105	VCC12	
C106	VCC12	
C107	VCC12	
C108	VCC12	
C109	VCC12	
C110	GND	
D1	GND	
D2	GND	
D3	USB_SSTX0+	
D4	USB_SSTX0-	
D5	GND	
D6	USB_SSTX1-	
D7	USB_SSTX1+	
D8	GND	
D9	USB_SSTX2-	
D10	USB_SSTX2+	
D11	GND	
D12	USB_SSTX3-	
D13	USB_SSTX3+	
D14	GND	
D15	DDI1_CTRLCLK_AUX+	PU 2.2K, 3.3V / PD 100K
D16	DDI1_CTRLDATA_AUX-	PU 2.2K, 3.3V / PU 100K 3.3V
D17	NC	
D18	NC	
D19	PCIE_TX6+	
D20	PCIE_TX6-	
D21	GND	
D22	PCIE_TX7+	
D23	PCIE_TX7-	
D24↔	NC	
D25	NC	
D26	DDI1_PAIR0+	
D27	DDI1_PAIR0-	
D28	NC	

D29	DDI1_PAIR1+	
D30	DDI1_PAIR1-	
D31	NC	
D32	DDI1_PAIR2+	
D33	DDI1_PAIR2-	
D34	DDI1_AUXSEL	PD 1M
D35	NC	
D36	DDI1_PAIR3+	
D37	DDI1_PAIR3-	
D38	NC	
D39	DDI2_PAIR0+	
D40	DDI2_PAIR0-	
D41	GND	
D42	DDI2_PAIR1+	
D43	DDI2_PAIR1-	
D44	DDI2_HPD	100K PD
D45	NC	
D46	DDI2_PAIR2+	
D47	DDI2_PAIR2-	
D48	NC	
D49	DDI2_PAIR3+	
D50	DDI2_PAIR3-	
D51	GND	
D52	PEG_TX0+	
D53	PEG_TX0-	
D54	PEG_LANE_RV#	PU 10K 3.3V
D55	PEG_TX1+	
D56	PEG_TX1-	
D57	GND	
D58	PEG_TX2+	
D59	PEG_TX2-	
D60	GND	
D61	PEG_TX3+	
D62	PEG_TX3-	
D63	NC	
D64	NC	
D65	PEG_TX4+	
D66	PEG_TX4-	
D67	GND	
D68	PEG_TX5+	
D69	PEG_TX5-	
D70	GND	
D71	PEG_TX6+	
D72	PEG_TX6-	
D73	GND	
D74	PEG_TX7+	

D75	PEG_TX7-	
D76	GND	
D77	NC	
D78	PEG_TX8+	
D79	PEG_TX8-	
D80	GND	
D81	PEG_TX9+	
D82	PEG_TX9-	
D83	NC	
D84	GND	
D85	PEG_TX10+	
D86	PEG_TX10-	
D87	GND	
D88	PEG_TX11+	
D89	PEG_TX11-	
D90	GND	
D91	PEG_TX12+	
D92	PEG_TX12-	
D93	GND	
D94	PEG_TX13+	
D95	PEG_TX13-	
D96	GND	
D97	NC	
D98	PEG_TX14+	
D99	PEG_TX14-	
D100	GND	
D101	PEG_TX15+	
D102	PEG_TX15-	
D103	GND	
D104	VCC12	
D105	VCC12	
D106	VCC12	
D107	VCC12	
D108	VCC12	
D109	VCC12	
D110	GND	

Interpretation:

OD - open drain PP PD - pull down

PU - pull up CM – CMOS input

PP -push-pull output of CMOS

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.