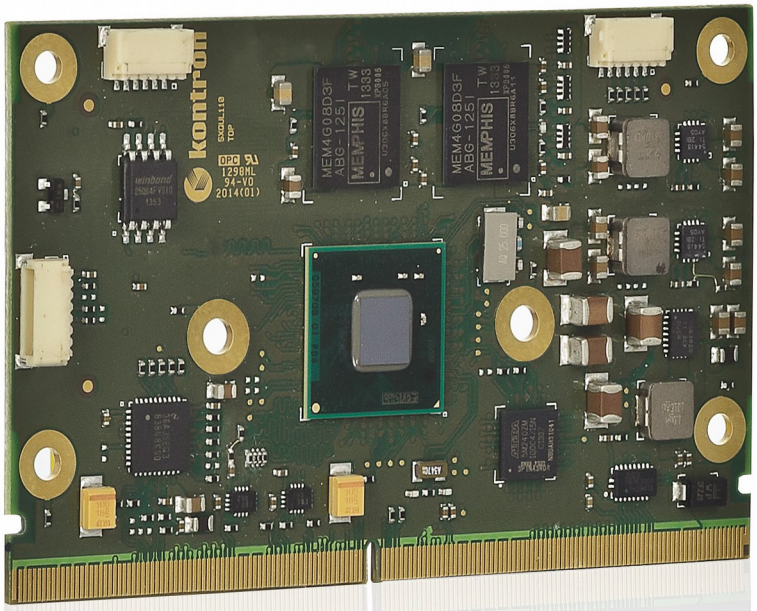

SMARC-sXQU

Document Revision 1.0

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1 User Information

1.1 About This Document

This document provides information about products from Kontron Europe GmbH and/or its subsidiaries. No warranty of suitability, purpose, or fitness is implied. While every attempt has been made to ensure that the information in this document is accurate, the information contained within is supplied “as-is” and is subject to change without notice.

For the circuits, descriptions and tables indicated, Kontron assumes no responsibility as far as patents or other rights of third parties are concerned.

1.2 Copyright Notice

1.3 Trademarks

The following lists the trademarks of components used in this board.

- IBM, XT, AT, PS/2 and Personal System/2 are trademarks of International Business Machines Corp.
- Microsoft is a registered trademark of Microsoft Corp.
- Intel is a registered trademark of Intel Corp.
- All other products and trademarks mentioned in this manual are trademarks of their respective owners.

1.4 Standards

Kontron Europe GmbH is certified to ISO 9000 standards.

1.5 Warranty

For this Kontron Europe GmbH product warranty for defects in material and workmanship exists as long as the warranty period, beginning with the date of shipment, lasts. During the warranty period, Kontron Europe GmbH will decide on its discretion if defective products are to be repaired or replaced.

Within the warranty period, the repair of products is free of charge as long as warranty conditions are observed.

Warranty does not apply for defects arising/resulting from improper or inadequate maintenance or handling by the buyer, unauthorized modification or misuse, as well as the operation outside of the product´s environmental specifications and improper installation and maintenance.

Kontron Europe GmbH will not be responsible for any defects or damages to other products not supplied by Kontron Europe GmbH that are caused by a faulty Kontron Europe GmbH product.

1.6 Technical Support

Technicians and engineers from Kontron Europe GmbH and/or its subsidiaries are available for technical support. We are committed to make our product easy to use and will help you use our products in your systems.

Please consult our Website at http://www.kontron.com/support for the latest product documentation, utilities, drivers and support contacts. Consult our customer section http://emdcustomersection.kontron.com for the latest BIOS downloads, Product Change Notifications, Board Support Packages, DemoImages, 3D drawings and additional tools and software. In any case you can always contact your board supplier for technical support.

The new Kontron SMARC-sXQU Computer-on-Modules has been developed to comply with the SGET specification and is equipped with Intel® Quark™ processor X1000 series and up to 1 GB RAM. Depending on the used processor they support the extended temperature range of -40°C to +85°C, measure only 82mm x 50mm and have an especially low-profile design thanks to the use of edge card connectors. A highlight of the pin-out is the posssibility to drive 2 10/100 Ethernetinterfaces. Further interfaces include 2x USB USB 2.0 hosts and 1x USB client, 12x GPIO, 2x UART and 1x SDIO, amongst others. Customer-specific extensions can be implemented via 2 SPI and 2 PCIe x1 lanes with 5GT/s.

1.7 SMARC™ Computer-on-Modules

The SMARC™ standard was developed especially for new modules with ARM- and SOC-processors and is characterized by the extremely flat build of its form factor. It is based on the MXM 3.0 connector with 314 pins and a construction height of just 4.3 millimeters and it thus allows robust and flatly constructed designs with a cost-effective card edge connector. The connector is also available in a shock- and vibration-resistant version for rough environmental conditions. Furthermore, the standard integrates dedicated interfaces for the latest ARM and SOC processors which not only means LVDS, 24-bit RGB and HDMI support but also support of embedded DisplayPort for future designs. In addition, and for the first time, dedicated camera interfaces are being incorporated into a COM standard. OEMs profit from minimized design effort and bill of material costs. SMARC™ defines two different module sizes in order to offer a high level of flexibility regarding different mechanical requirements: a short modules measuring 82 mm x 50 mm and a full-size module measuring 82 mm x 80 mm.

SMARC™ is the low-power embedded architecture platform for computer-on-modules based on ARM technology.

» Creating mobile, embedded, connected solutions

» Scalable building blocks

» Optimized pin-out definition for ARM technology

» Ultra low-power, low-profile solutions

» Constructed to withstand harsh industrial environments

2 Product Specification

2.1 Modules & Accessories

The SMARC short sized Computer-on-Module SMARC-sXQU (SXQU) is based on Intel's Quark platform and is available in different variants to cover the demand of different performance, price and power:

Commercial temperature grade modules (0°C to +60°C operating)

Part Number	Product Name	Processor	Frequency	Memory	ECC	Secure Boot
51006-0200-04-1	SMARC-sXQU X1000 256MB	Intel® Quark X1000	400MHz	256MB	No	No
51006-0500-04-2	SMARC-sXQU X1010 512E	Intel® Quark X1010	400MHz	512MB	Yes	No

Industrial temperature grade modules (E2: -40°C to +85°C operating)

Part Number	Product Name	Processor	Frequency	Memory	ECC	Secure Boot
51006-1000-04-3	SMARC-sXQUi X1011 1E	Intel® Quark X1011	400MHz	1GB	Yes	No
51006-1000-04-4	SMARC-sXQUi X1021 1E	Intel® Quark X1021	400MHz	1GB	Yes	Yes

Memory configurations:

» MM = 02: 256MB DDR3 Memory

» MM = 05: 512MB DDR3 Memory

» MM = 10: 1024MB DDR3 Memory

Onboard Flash configurations

» FF = 00: without eMMC Flash

Accessories

Product Number	Carrier Boards
51100-0000-00-0	SMARC Evaluation Carrier
51100-0000-00-S	SMRAC Starterkit
Product Number	**Cooling & Mounting**
51006-0000-99-1	HSP SMARC-sXQU
Product Number	**Adapter & Cables**
59000-0000-00-0	ADA-SMARC sacrifice

2.2 Functional Specification

Processor

The 32nm Intel® Quark SOC (Quark SOC) CPU family supports:

» Idle States

» Execute Disable Bit

CPU specifications

Intel®	Quark	Quark	Quark	Quark
-	X1000	X1010	X1011	X1021
# of Cores	1	1	1	1
# of Threads	1	1	1	1
CPU Nominal frequency	**400MHz**	**400MHz**	**400MHz**	**400MHz**
Tjunction	0 to 110°C	0 to 110°C	-40 to 110°C	-40 to 110°C
Thermal Design Power (TDP)	2.3W	2.3W	2.3W	2.2W
Cache	16 KB	16 KB	16 KB	16 KB
Memory Type	DDR3-800	DDR3-800	DDR3-800	DDR3-800
Max Memory Size	2GB	2GB	2GB	2GB
ECC Memory(optional)	No	Yes	Yes	Yes
Secure Boot	No	No	No	Yes
Temperature Grade	Commercial	Commercial	Industrial	Industrial

Additionally following CPUs can be used on project base:

Intel®	Quark	Quark
-	X1001	X1020
# of Cores	1	1
# of Threads	1	1
CPU Nominal frequency	**400MHz**	**400MHz**
Tjunction	-40 to 110°C	0 to 110°C
Thermal Design Power (TDP)	2.3W	2.2W
Cache	16 KB	16 KB
Memory Type	DDR3-800	DDR3-800
Max Memory Size	2GB	2GB
ECC Memory(optional)	No	Yes
Secure Boot	No	Yes
Temperature Grade	Industrial	Commercial

Memory

Sockets	memory down
Memory Type	DDR3-800
Maximum Size	256kB - 1GB
Technology	single channel (32 bit)

Graphics Core

The integrated graphics supports:

Execution Units / Pixel Pipelines	-
Max Graphics Memory	-
GFX Memory Bandwidth (GB/s)	-
GFX Memory Technology	-
API (DirectX/OpenGL)	-
Shader Model	-
Hardware accelerated Video	-
Independent/Simultaneous Displays	-
Display Port	-
HDCP support	-

LVDS

LVDS Bits/Pixel	-
LVDS Bits/Pixel with dithering	-
LVDS max Resolution:	-
PWM Backlight Control:	-
Supported Panel Data:	-

Display Interfaces

Discrete Graphics	-
Digital Display Interface DDI1	-
Digital Display Interface DDI2	-
Digital Display Interface DDI3	-
Maximum Resolution on DDI	-

Storage

onboard SSD	-
SD Card support	yes
IDE Interface	-
Serial-ATA	-
SATA AHCI	-
SATA RAID	-

Connectivity

USB 2.0	2x USB 2.0 client, 1x USB 2.0 host
USB 3.0	-
USB Client	1 client (USB0)
PCI	-
PCI External Masters	-
PCI Express	2x PCIe x1 Gen2
Max PCI Express	-
PCI Express x2/x4 configuration	-
Ethernet	2x 10/100 Mbit
Ethernet controller	internal + Phy (DP8384K)

Ethernet

The internal + Phy (DP8384K) ethernet supports:

» Jumbo Frames

» Time Sync Protocol Indicator

Misc Interfaces and Features

Audio	-
Onboard Hardware Monitor	-
Trusted Platform Module	-
Miscellaneous	2x UART

Kontron Features

External I2C Bus	1 x I2C (GP)
M.A.R.S. support	-
Embedded API	-
Custom BIOS Settings / Flash Backup	-
Watchdog support	tbd

Additional features

» Real fast I2C with transfer rates up to 40kB/s.

Power Features

Singly Supply Support	YES
Supply Voltage	3,0V - 5,25V
ACPI	-
S5 Eco Mode	-

Power Consumption and Performance

Full Load Power Consumption	tbd

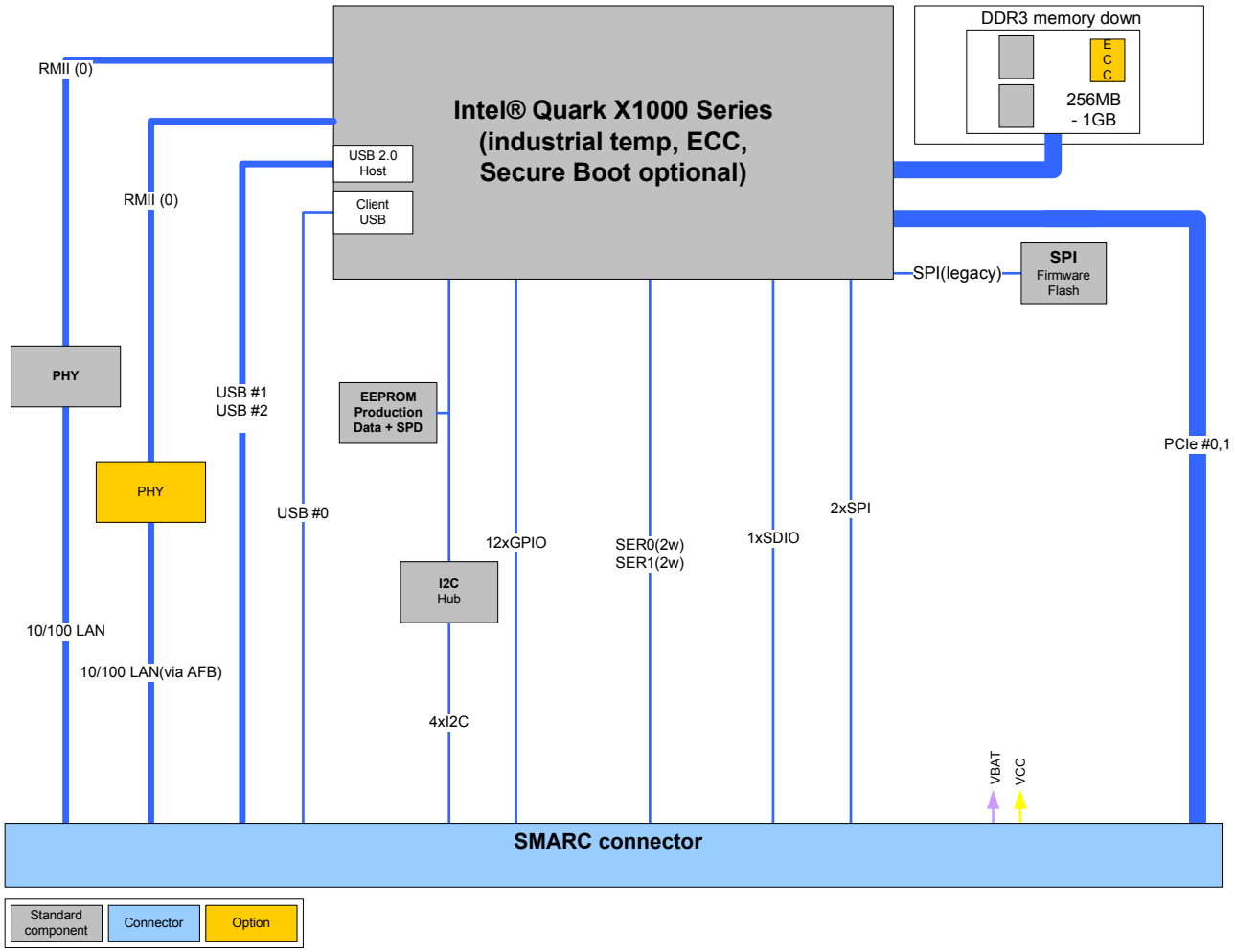
Supported Operating Systems

The SMARC-sXQU supports:

» Intel Gateway Solutions for IoT

» Yocto Linux

2.3 Block Diagram



2.4 Electrical Specification

2.4.1 Supply Voltage

Following supply voltage is specified at the SMARC™ connector:

VCC:	3,0V - 5,25V
RTC:	2.5V - 3.3V

2.4.2 Power Supply Rise Time

» The input voltages shall rise from ≤10% of nominal to within the regulation ranges within 0.1ms to 20ms.

» There must be a smooth and continuous ramp of each DC input voltage from 10% to 90% of its final set-point

2.4.3 Supply Voltage Ripple

» Maximum 100 mV peak to peak 0 – 20 MHz

2.5 Power Control

Power Supply

The SMARC-sXQU supports a power input from 3,0V - 5,25V. The supply voltage is applied through the VCC pins (VCC) of the module connector.

Power Button (PWR_BTN#)

The power button (Pin P128) is available through the module connector described in the pinout list. To start the module via Power Button the PWRBTN# signal must be at least 50ms (50ms ≤ t < 4s, typical 400ms) at low level (Power Button Event).

Pressing the power button for at least 4seconds will turn off power to the module (Power Button Override).

CB_POWER_BAD#

The SMARC-sXQU provides an external input for a Carrier Board Power Bad signal (Pin S150). The implementation of this subsystem complies with the SMARC Specification. CB_POWER_BAD# is internally pulled up to 3.3V and must be high level to power on the module.

Reset Button (RST_CB_IN#)

The reset button (Pin P127) is available through the module connector described in the pinout list. The module will stay in reset as long as RST_CB_IN# is grounded.

2.6 Environmental Specification

2.6.1 Temperature Specification

General Specification	Operating	Non-operating
Commercial grade	0°C to +60°C	-30°C to +85°C
Extended (E1)	-25°C to +75°C	-30°C to +85°C
Industrial grade (E2)	-40°C to +85°C	-40°C to +85°C

Standard modules are available for industrial grade temperature range. Please see chapter Product Specification for available variants for extended or commercial temperate grade

With Kontron heatspreader plate assembly

The operating temperature defines two requirements:

» the maximum ambient temperature with ambient being the air surrounding the module.

» the maximum measurable temperature on any spot on the heatspreader's surface

Without Kontron heatspreader plate assembly

The operating temperature is the maximum measurable temperature on any spot on the module's surface.

2.6.2 Humidity

» Operating: 10% to 90% (non condensing)

» Non operating: 5% to 95% (non condensing)

2.7 Standards and Certifications

RoHS

The **SMARC-sXQU** is compliant to the directive 2002/95/EC on the restriction of the use of certain hazardous substances (RoHS) in electrical and electronic equipment.

CE marking

The **SMARC-sXQU** is CE marked according to Low Voltage Directive 2006/95/EC – Test standard EN60950

WEEE Directive

WEEE Directive 2002/96/EC is not applicable for Computer-on-Modules.

Conformal Coating

Conformal Coating is available for Kontron Computer-on-Modules and for validated SO-DIMM memory modules. Please contact your local sales or support for further details.

EMC

Validated in Kontron reference housing for EMC the **SMARC-sXQU** follows the requirements for electromagnetic compatibility standards

» EN55022

2.8 MTBF

The following MTBF (Mean Time Before Failure) values were calculated using a combination of manufacturer's test data, if the data was available, and the Telcordia (Bellcore) issue 2 calculation for the remaining parts.

The calculation method used is "Telcordia Method 1 Case 3" in a ground benign, controlled environment (GB,GC). This particular method takes into account varying temperature and stress data and the system is assumed to have not been burned in.

Other environmental stresses (extreme altitude, vibration, salt water exposure, etc) lower MTBF values.

System MTBF (hours):

Fans usually shipped with Kontron Europe GmbH products have 50,000-hour typical operating life. The above estimates assume no fan, but a passive heat sinking arrangement Estimated RTC battery life (as opposed to battery failures) is not accounted for in the above figures and need to be considered separately. Battery life depends on both temperature and operating conditions. When the Kontron unit has external power; the only battery drain is from leakage paths.

2.9 Mechanical Specification

2.9.1 Module Dimension

» 50mm x 82mm

2.9.2 Height on Top

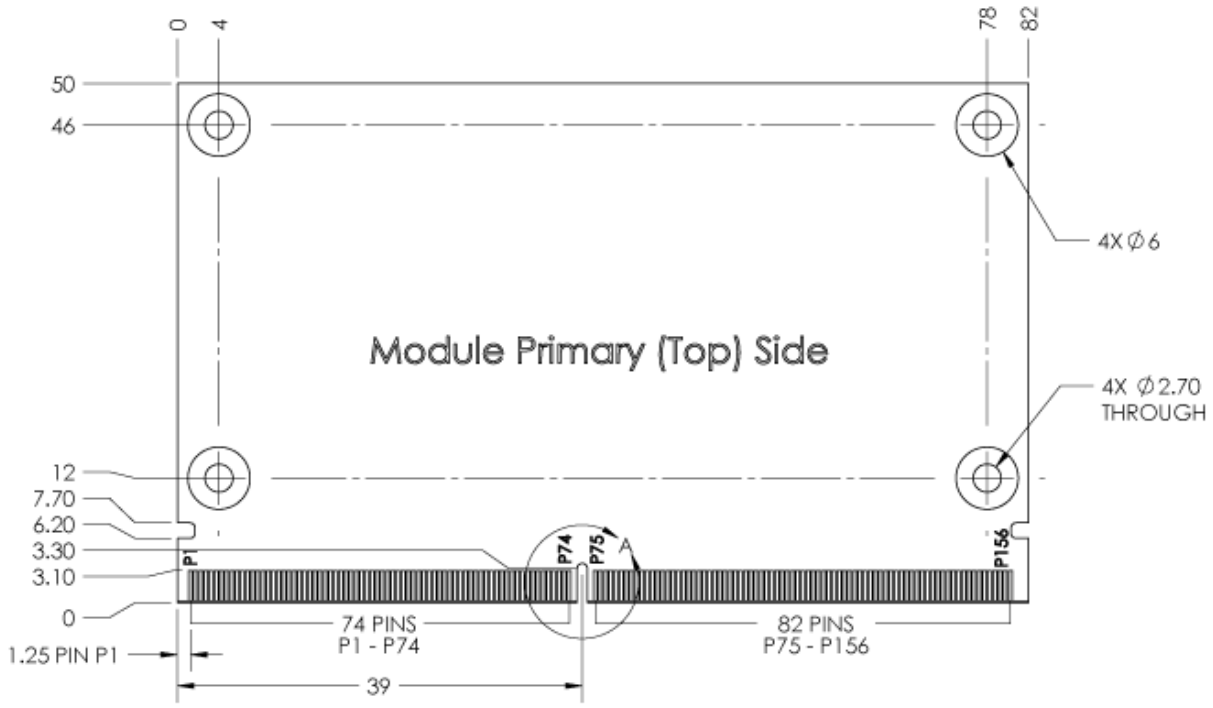
» Maximum 3.0mm (without printed circuit board)

» Height is depending on (optional) CPU cooler / heat spreader

2.9.3 Height on Bottom

» Maximum approx. 1.3mm (without printed circuit board)

2.9.4 Mechanical Drawing



All dimensions are shown in millimeters. Tolerances should be ± 0.25mm [±0.010"], unless otherwise noted.

note

CAD drawings will be available at EMD CustomerSection

2.10 Thermal Management, Heatspreader and Cooling Solutions

A heatspreader plate assembly is available from Kontron Europe GmbH for the SMARC-sXQU. The heatspreader plate on top of this assembly is NOT a heat sink. It works as a SMARC-standard thermal interface to use with a heat sink or external cooling devices.

External cooling must be provided to maintain the heatspreader plate at proper operating temperatures. Under worst-case conditions, the cooling mechanism must maintain an ambient air and heatspreader plate temperature on any spot of the heatspreader's surface according the module specifications:

» 60°C for commercial grade modules

» 75°C for extended temperature grade modules (E1)

» 85°C for industrial temperature grade modules (E2/XT)

The aluminum slugs and thermal pads or the heat-pipe on the underside of the heatspreader assembly implement thermal interfaces between the heatspreader plate and the major heat-generating components on the SMARC-sXQU. About 80 percent of the power dissipated within the module is conducted to the heatspreader plate and can be removed by the cooling solution.

You can use many thermal-management solutions with the heatspreader plates, including active and passive approaches. The optimum cooling solution varies, depending on the SMARC application and environmental conditions. Active or passive cooling solutions provided from Kontron Europe GmbH for the SMARC-sXQU are usually designed to cover the power and thermal dissipation for a commercial grade temperature range used in a housing with proper air flow.

Documentation and CAD drawings of SMARC-sXQU heatspreader and cooling solutions are provided at http://emdcustomersection.kontron.com.

3 System Ressources

3.1 Interrupt Request (IRQ) Lines

INT#	Used For	Comment
0	IO_APIC-edge	timer
7	IO_APIC-edge	-
8	IO_APIC-edge	rtc0
9	IO_APIC-fasteoi	acpi, gpio_sch
16	IO_APIC-fasteoi	mmc0, ohci_hcd:usb1
17	IO_APIC-fasteoi	INTEL_MID_DMAC2, intel_quark_uart
19	IO_APIC-fasteoi	ehci_hcd:usb2
40	PCI_MSI-edge	eth0
41	PCI_MSI-edge	eth0-rx-0
42	PCI_MSI-edge	eth0-tx-0
43	PCI_MSI-edge	pxa2xx-spi.0
45	PCI_MSI-edge	intel_qrk_gip
46	PCI_MSI-edge	pxa2xx-spi.1
NMI	Non-maskable interrupts	-
LOC	Local timer interrupts	-
SPU	Spurious interrupts	-
PMI	Performance monitor interrrupts	-
IWI	IRQ work interrupts	-
RTR	APIC ICR read retries	-
TRM	Thermal event interrupts	-
THR	Threshold APIC interrupts	-
MCE	Machine check execptions	-
MCP	Machine check polls	-
ERR	-	-
MIS	-	-

3.2 Memory Area

Memory	Size	Comment
0000000000097000-0000000000097FFF	69,632	reserved
000000000E27E000-000000000E288FFF	729,088	LoaderCode
000000000E10C000-000000000E121FFF	90,112	LoaderData
000000000E294000-000000000E296FFF	1,200,128	BS_code
0000000001FDE000-0000000001FFFFFF	14,114,816	BS_data
000000000F01F000-000000000F07EFFF	393,216	RT_code
000000000F07F000-000000000F0DEFFF	393,216	RT_data
0000000000000000-0000000000096FFF	234,995,712	available
000000000EFDF000-000000000F01EFFF	262,144	ACPI_recl
000000000F0DF000-000000000FDDEFFF	13,631,488	ACPI_NVS
0000000E0000000-00000000E1FFFFFF	33,570,816	MemMapIO

3.3 I/O Address Map

I/O Address	Used for
0000-0cf7	PCI Bus 0000:00
0000-001f	dma1
0020-0021	pic1
0040-0043	timer0
0050-0053	timer1
0060-0060	keyboard
0064-0064	keyboard
0070-0073	rtc0
0080-008f	dma page reg
00a0-00a1	pic2
00c0-00df	dma2
00f0-00ff	fpu
0cf8-0cff	PCI conf1
0d00-ffff	PCI Bus 0000:00
1000-100f	pnp 00:03
1000-1003	ACPI PM1a_EVT_BLK
1004-1005	ACPI PM1a_CNT_BLK
1008-100b	ACPI PM_TMR
1010-101f	pnp 00:03
1010-1015	ACPI CPU throttle
1020-103f	pnp 00:03
1040-107f	pnp 00:03
1080-10bf	sch_gpio.2398
1080-10bf	pnp 00:03
1080-10bf	sch_gpio
1100-113f	pnp 00:03
1100-1107	ACPI GPE0_BLK
1140-117f	pnp 00:03
2000-2fff	PCI Bus 0000:02
2000-201f	0000:02:00.0
3000-3fff	PCI Bus 0000:01

3.4 Peripheral Component Interconnect (PCI) Devices

PCI Device	Bus Address	Vendor-ID/Device-ID
Host bridge	0000:00:00.0	0x8086 / 0x0958
SD Host controller	0000:00:14.0	0x8086 / 0x08a7
Serial controller	0000:00:14.1	0x8086 / 0x0936
USB Controller (USB Device)	0000:00:14.2	0x8086 / 0x0939
USB Controller (EHCI)	0000:00:14.3	0x8086 / 0x0939
USB Controller (OHCI)	0000:00:14.4	0x8086 / 0x093a
Serial controller	0000:00:14.5	0x8086 / 0x0936
Ethernet controller	0000:00:14.6	0x8086 / 0x0937
Ethernet controller	0000:00:14.7	0x8086 / 0x0937
Serial bus controller	0000:00:15.0	0x8086 / 0x0935
Serial bus controller	0000:00:15.1	0x8086 / 0x0935
Serial bus controller	0000:00:15.2	0x8086 / 0x0934
PCI bridge (Normal decode)	0000:00:17.0	0x8086 / 0x11c3
PCI bridge (Normal decode)	0000:00:17.1	0x8086 / 0x11c4
ISA bridge	0000:00:1f.0	0x8086 / 0x095e
Ethernet controller	0000:02:00.0	0x8086 / 0x1533

3.5 I2C Bus

I2C Address	Used For	Available
A0h	Module EEPROM	No
ECh	Multiplexer	No
B0h	CPLD	No
42h	SMBus I/O expander	No

4 Connectors

The pinouts for Interface Connector are documented for convenient reference. Please see the SMARC Specification and SMARC Design Guide for detailed, design-level information.

4.1 SMARC™ Connector Top Side

Pin	Signal	Module Direction	Module Termination	Type / Tolerance	Controller	Controller Pin Name	Port	Power Rail
P1	PCAM_PXL_CK1	-	-	-	-	-	-	-
P2	GND_P2	-	-	-	-	-	-	-
P3	CSI1_CK+/PCAM_D0	-	-	-	-	-	-	-
P4	CSI1_CK-/PCAM_D1	-	-	-	-	-	-	-
P5	PCAM_DE	-	-	-	-	-	-	-
P6	PCAM_MCK	-	-	-	-	-	-	-
P7	CSI1_D0+/PCAM_D2	-	-	-	-	-	-	-
P8	CSI1_D0-/PCAM_D3	-	-	-	-	-	-	-
P9	GND_P9	-	-	-	-	-	-	-
P10	CSI1_D1+/PCAM_D4	-	-	-	-	-	-	-
P11	CSI1_D1-/PCAM_D5	-	-	-	-	-	-	-
P12	GND_P12	-	-	-	-	-	-	-
P13	CSI1_D2+/PCAM_D6	-	-	-	-	-	-	-
P14	CSI1_D2-/PCAM_D7	-	-	-	-	-	-	-
P15	GND_P15	-	-	-	-	-	-	-
P16	CSI1_D3+/PCAM_D8	-	-	-	-	-	-	-
P17	CSI1_D3-/PCAM_D9	-	-	-	-	-	-	-
P18	GND_P18	-	-	-	-	-	-	-
P19	GBE_MDI3-	-	-	-	-	-	-	-
P20	GBE_MDI3+	-	-	-	-	-	-	-
P21	GBE_LINK100#	Out / OD	-	CMOS 1.8V	DP83848K / CPLD	-	RMII	-
P22	GBE_LINK1000#	-	-	-	-	-	-	-
P24	GBE_MDI2+	-	-	-	-	-	-	-
P23	GBE_MDI2-	-	-	-	-	-	-	-
P25	GBE_LINK_ACT#	Out / OD	-	-	DP83848K / CPLD	-	RMII	-
P26	GBE_MDI1-	Bi-Dir	PU-49R9	-	DP83848K	RD +	RMII	V_3V3_S0
P27	GBE_MDI1+	Bi-Dir	PU-49R9	-	DP83848K	RD -	RMII	V_3V3_S0
P28	GBE_CTREF	Out	-	V-Ref	-	-	RMII	-
P29	GBE_MDI0-	Bi-Dir	PU-49R9	-	DP83848K	TD +	RMII	V_3V3_S0
P30	GBE_MDI0+	Bi-Dir	PU-49R9	-	DP83848K	TD -	RMII	V_3V3_S0
P31	SPI0_CS1#	Out	PU-100k	CMOS 1.8V	-	-	-	V_1V8_S0
P32	GND_P32	-	-	-	-	-	-	-
P33	SDIO_WP	In	Serial 0R / PD-20k	CMOS 3.3V	QUARK	SD_WP	SDIO	V_3V3_S0
P34	SDIO_CMD	Bi-Dir	PU-20k	CMOS 3.3V	QUARK	SD_CMD	SDIO	V_3V3_S0
P35	SDIO_CD#	In	W-PU	CMOS 3.3V	QUARK / CPLD	-	-	V_3V3_S0
P36	SDIO_CK	Out	Serial 33R	CMOS 3.3V	QUARK	SD_CLK	SDIO	V_3V3_S0
P37	SDIO_PWR_EN	Out	-	CMOS 3.3V	QUARK	SD_PWR	SDIO	V_3V3_S0
P38	GND_P38	-	-	-	-	-	-	-
P39	SDIO_D0	Bi-Dir	Serial 33R / PU-20k	CMOS 3.3V	QUARK	SD_DATA_0	SPI0	V_3V3_S0
P40	SDIO_D1	Bi-Dir	Serial 33R / PU-20k	CMOS 3.3V	QUARK	SD_DATA_1	SPI0	V_3V3_S0
P41	SDIO_D2	Bi-Dir	Serial 33R / PU-20k	CMOS 3.3V	QUARK	SD_DATA_2	SPI0	V_3V3_S0
P42	SDIO_D3	Bi-Dir	Serial 33R / PU-20k	CMOS 3.3V	QUARK	SD_DATA_3	SPI0	V_3V3_S0
P43	SPI0_CS0#	Out	Serial 33R	CMOS 1.8V	QUARK / LEVEL SHIFTER	SPI0_SS_B	SPI0	V_1V8_S0
P44	SPI0_CK	Out	Serial 33R	CMOS 1.8V	QUARK / LEVEL SHIFTER	SPI0_SCK	SPI0	V_1V8_S0
P45	SPI0_DIN	In	Serial 33R / PU-20k	CMOS 1.8V	QUARK / LEVEL SHIFTER	SPI0_MISO	SPI0	V_1V8_S0
P46	SPI0_DO	Out	Serial 33R	CMOS 1.8V	QUARK / LEVEL SHIFTER	SPI0_MOSI	SPI0	V_1V8_S0
P47	GND_P47	-	-	-	-	-	-	-
P48	SATA_TX+	-	-	-	-	-	-	-
P49	SATA_TX-	-	-	-	-	-	-	-
P50	GND_P50	-	-	-	-	-	-	-
P51	SATA_RX+	-	-	-	-	-	-	-
P52	SATA_RX-	-	-	-	-	-	-	-
P53	GND_P53	-	-	-	-	-	-	-
P54	SPI1_CS0#	Out	Serial 33R	CMOS 1.8V	QUARK / LEVEL SHIFTER	SPI1_SS_B	SPI1	V_1V8_S0
P55	SPI1_CS1#	Out	PU-100k	CMOS 1.8V	-	-	-	V_1V8_S0
P56	SPI1_CK	Out	Serial 33R	CMOS 1.8V	QUARK / LEVEL SHIFTER	SPI1_SCK	SPI1	V_1V8_S0
P57	SPI1_DIN	In	Serial 33R / PU-20k	CMOS 1.8V	QUARK / LEVEL SHIFTER	SPI1_MISO	SPI1	V_1V8_S0
P58	SPI1_DO	Out	Serial 33R	CMOS 1.8V	QUARK / LEVEL SHIFTER	SPI1_MOSI	SPI1	V_1V8_S0

P59	GND_P59	-	-	-	-	-	-	-
P60	USB0+	Bi-Dir	-	USB	QUARK	USBD_DP	USB0	-
P61	USB0-	Bi-Dir	-	USB	QUARK	USBD_DN	USB0	-
P62	USB0_EN_OC#	Bi-Dir /OD	-	CMOS 1.8V	QUARK / CPLD	-	-	V_1V8_S0
P63	USB0_VBUS_DET	In	PD-100k	-	-	-	-	-
P64	USB0_OTG_ID	-	-	-	-	-	-	-
P65	USB1+	Bi-Dir	-	USB	QUARK	USBH0_DP	USB1	-
P66	USB1-	Bi-Dir	-	USB	QUARK	USBH0_DN	USB1	-
P67	USB1_EN_OC#	Bi-Dir /OD	-	CMOS 1.8V	QUARK / CPLD	-	-	V_1V8_S0
P68	GND_P68	-	-	-	-	-	-	-
P69	USB2+	Bi-Dir	-	USB	QUARK	USBH1_DP	USB2	-
P70	USB2-	Bi-Dir	-	USB	QUARK	USBH1_DN	USB2	-
P71	USB2_EN_OC#	Bi-Dir /OD	-	CMOS 1.8V	QUARK / CPLD	-	-	V_1V8_S0
P72	PCIE_C_PRSNT#	-	-	-	-	-	-	-
P73	PCIE_B_PRSNT#	In	-	CMOS 3.3V	QUARK	GPIO_9	GPIO	V_3V3_S0
P74	PCIE_A_PRSNT#	In	-	CMOS 3.3V	QUARK	GPIO_8	GPIO	V_3V3_S0
P75	PCIE_A_RST#	Out	-	CMOS 3.3V	CPLD	-	-	V_3V3_S5
P76	PCIE_C_CKREQ#	-	-	-	-	-	-	-
P77	PCIE_B_CKREQ#	In	PU-100k	-	-	-	PCIe	V_3V3_S0
P78	PCIE_A_CKREQ#	In	PU-100k	-	-	-	PCIe	V_3V3_S0
P79	GND_P79	-	-	-	-	-	-	-
P80	PCIE_C_REFCK+	-	-	-	-	-	-	-
P81	PCIE_C_REFCK-	-	-	-	-	-	-	-
P82	GND_P82	-	-	-	-	-	-	-
P83	PCIE_A_REFCK+	Out	Serial 0R	PCIe	QUARK	REF0_OUTCLK_P	CPU / PLL	V_1V0_S0
P84	PCIE_A_REFCK-	Out	Serial 0R	PCIe	QUARK	REF0_OUTCLK_N	CPU / PLL	V_1V0_S0
P85	GND_P85	-	-	-	-	-	-	-
P86	PCIE_A_RX+	In	-	PCIe	QUARK	PCIE_PERP_0	PCIe	-
P87	PCIE_A_RX-	In	-	PCIe	QUARK	PCIE_PERN_0	PCIe	-
P88	GND_P88	-	-	-	-	-	-	-
P89	PCIE_A_TX+	Out	Serial 100n	PCIe	QUARK	PCIE_PETP_0	PCIe	-
P90	PCIE_A_TX-	Out	Serial 100n	PCIe	QUARK	PCIE_PETN_0	PCIe	-
P91	GND_P91	-	-	-	-	-	-	-
P92	HDMI_D2+	-	-	-	-	-	-	-
P93	HDMI_D2-	-	-	-	-	-	-	-
P94	GND_P94	-	-	-	-	-	-	-
P95	HDMI_D1+	-	-	-	-	-	-	-
P96	HDMI_D1-	-	-	-	-	-	-	-
P97	GND_P97	-	-	-	-	-	-	-
P98	HDMI_D0+	-	-	-	-	-	-	-
P99	HDMI_D0-	-	-	-	-	-	-	-
P100	GND_P100	-	-	-	-	-	-	-
P101	HDMI_CK+	-	-	-	-	-	-	-
P102	HDMI_CK-	-	-	-	-	-	-	-
P103	GND_P103	-	-	-	-	-	-	-
P104	HDMI_HPD	-	-	-	-	-	-	-
P105	HDMI_CTRL_CK	-	-	-	-	-	-	-
P106	HDMI_CTRL_DAT	-	-	-	-	-	-	-
P107	HDMI_CEC	-	-	-	-	-	-	-
P108	GPIO0	Bi-Dir	-	CMOS 1.8V	PCAL6416A	P0_1	12C	V_1V8_S0
P109	GPIO1	Bi-Dir	-	CMOS 1.8V	PCAL6416A	P0_2	12C	V_1V8_S0
P110	GPIO2	Bi-Dir	-	CMOS 1.8V	PCAL6416A	P0_3	12C	V_1V8_S0
P111	GPIO3	Bi-Dir	-	CMOS 1.8V	PCAL6416A	P0_4	12C	V_1V8_S0
P112	GPIO4	Bi-Dir	-	CMOS 1.8V	PCAL6416A	P0_5	12C	V_1V8_S0
P113	GPIO5	Bi-Dir	-	CMOS 1.8V	PCAL6416A	P0_6	12C	V_1V8_S0
P114	GPIO6	Bi-Dir	-	CMOS 1.8V	PCAL6416A	P0_7	12C	V_1V8_S0
P115	GPIO7	Bi-Dir	-	CMOS 1.8V	PCAL6416A	P0_8	12C	V_1V8_S0
P116	GPIO8	Bi-Dir	-	CMOS 1.8V	PCAL6416A	P1_0	12C	V_1V8_S0
P117	GPIO9	Bi-Dir	-	CMOS 1.8V	PCAL6416A	P1_1	12C	V_1V8_S0
P118	GPIO10	Bi-Dir	-	CMOS 1.8V	PCAL6416A	P1_2	12C	V_1V8_S0
P119	GPIO11	Bi-Dir	-	CMOS 1.8V	PCAL6416A	P1_3	12C	V_1V8_S0
P120	GND_P120	-	-	-	-	-	-	-
P121	I2C_PM_CK	Out	PU-2k2	CMOS 1.8V	PCA9518 / LEVEL SHIFTER	SCL1	12C	V_1V8_S0
P122	I2C_PM_DAT	Bi-Dir	PU-2k2	CMOS 1.8V	PCA9518 / LEVEL SHIFTER	SDA1	12C	V_1V8_S0
P123	BOOT_SEL0#	In	W_PU	CMOS 1.8V	CPLD	-	-	V_1V8_S0
P124	BOOT_SEL1#	In	W_PU	CMOS 1.8V	CPLD	-	-	V_1V8_S0
P125	BOOT_SEL2#	In	W_PU	CMOS 1.8V	CPLD	-	-	V_1V8_S0
P126	RESET_OUT#	Out - OD	-	CMOS 1.8V	CPLD	-	-	V_1V8_S0

P127	RESET_IN#	In	W_PU	CMOS 1.8V	CPLD	-	-	V_1V8_S0
P128	POWER_BTN#	In	W_PU	CMOS 1.8V	CPLD	-	-	V_1V8_S0
P129	SER0_TX	Out	-	CMOS 1.8V	QUARK / LEVEL SHIFTER	SIU0_TXD	UART0	V_1V8_S0
P130	SER0_RX	In	PU-20k	CMOS 1.8V	QUARK / LEVEL SHIFTER	SIU0_RXD	UART0	V_1V8_S0
P131	SER0_RTS#	Out	-	CMOS 1.8V	QUARK / LEVEL SHIFTER	SIU0_RTS_B	UART0	V_1V8_S0
P132	SER0_CTS#	In	PU-20k	CMOS 1.8V	QUARK / LEVEL SHIFTER	SIU0_CTS_B	UART0	V_1V8_S0
P133	GND_P133	-	-	-	-	-	-	-
P134	SER1_TX	Out	-	CMOS 1.8V	QUARK / LEVEL SHIFTER	SIU1_TXD	UART1	V_1V8_S0
P135	SER1_RX	In	PU-20k	CMOS 1.8V	QUARK / LEVEL SHIFTER	SIU1_RXD	UART1	V_1V8_S0
P136	SER2_TX	-	-	-	-	-	-	-
P137	SER2_RX	-	-	-	-	-	-	-
P138	SER2_RTS#	-	-	-	-	-	-	-
P139	SER2_CTS#	-	-	-	-	-	-	-
P140	SER3_TX	-	-	-	-	-	-	-
P141	SER3_RX	-	-	-	-	-	-	-
P142	GND_P142	-	-	-	-	-	-	-
P143	CAN0_TX	-	-	-	-	-	-	-
P144	CAN0_RX	-	-	-	-	-	-	-
P145	CAN1_TX	-	-	-	-	-	-	-
P146	CAN1_RX	-	-	-	-	-	-	-
P147	VDD_IN_P147	PWR	-	-	-	-	-	3.0V-5.25V
P148	VDD_IN_P148	PWR	-	-	-	-	-	3.0V-5.25V
P149	VDD_IN_P149	PWR	-	-	-	-	-	3.0V-5.25V
P150	VDD_IN_P150	PWR	-	-	-	-	-	3.0V-5.25V
P151	VDD_IN_P151	PWR	-	-	-	-	-	3.0V-5.25V
P152	VDD_IN_P152	PWR	-	-	-	-	-	3.0V-5.25V
P153	VDD_IN_P153	PWR	-	-	-	-	-	3.0V-5.25V
P154	VDD_IN_P154	PWR	-	-	-	-	-	3.0V-5.25V
P155	VDD_IN_P155	PWR	-	-	-	-	-	3.0V-5.25V
P156	VDD_IN_P156	PWR	-	-	-	-	-	3.0V-5.25V

4.2 SMARC™ Connector Top Side

Pin	Signal	Module Direction	Module Termination	Type / Tolerance	Controller	Controller Pin Name	Port	Power Rail
S1	PCAM_VSYNC	-	-	-	-	-	-	-
S2	PCAM_HSYNC	-	-	-	-	-	-	-
S3	GND_S3	-	-	-	-	-	-	-
S4	PCAM_PXL_CK0	-	-	-	-	-	-	-
S5	I2C_CAM_CK	Out	PU-2k2	CMOS 1.8V	PCA9518 / LEVEL SHIFTER	SCL2	12C	V_1V8_S0
S6	CAM_MCK	-	-	-	-	-	-	-
S7	I2C_CAM_DAT	Bi-Dir	PU-2k2	CMOS 1.8V	PCA9518 / LEVEL SHIFTER	SCL2	12C	V_1V8_S0
S8	CSI0_CK+/PCAM_D10	-	-	-	-	-	-	-
S9	CSI0_CK-/PCAM_D11	-	-	-	-	-	-	-
S10	GND_S10	-	-	-	-	-	-	-
S11	CSI0_D0+/PCAM_D12	-	-	-	-	-	-	-
S12	CSI0_D0-/PCAM_D13	-	-	-	-	-	-	-
S13	GND_S13	-	-	-	-	-	-	-
S14	CSI0_D1+/PCAM_D14	-	-	-	-	-	-	-
S15	CSI0_D1-/PCAM_D15	-	-	-	-	-	-	-
S16	GND_S16	-	-	-	-	-	-	-
S17	MBE1_CTREF	Out	-	V-Ref	-	-	RMII	-
S18	S3_PGOOD	Out	-	CMOS 3.3V	CPLD	-	-	V_3V3_S5
S19	S5_PGOOD	Out	-	CMOS 3.3V	CPLD	-	-	V_3V3_S5
S20	AFB3_IN	-	-	-	-	-	-	-
S21	AFB4_IN	-	-	-	-	-	-	-
S22	AFB5_IN	-	-	-	-	-	-	-
S23	MBE1_LINK100#	Out / OD	-	CMOS 1.8V	DP83848K / CPLD	-	RMII	-
S24	S0_PGOOD	Out	-	CMOS 3.3V	CPLD	-	-	V_3V3_S5
S25	GND_S25	-	-	-	-	-	-	-
S26	SDMMC_D0	-	-	-	-	-	-	-
S27	SDMMC_D1	-	-	-	-	-	-	-
S28	SDMMC_D2	-	-	-	-	-	-	-
S29	SDMMC_D3	-	-	-	-	-	-	-
S30	SDMMC_D4	-	-	-	-	-	-	-
S31	SDMMC_D5	-	-	-	-	-	-	-
S32	SDMMC_D6	-	-	-	-	-	-	-
S33	SDMMC_D7	-	-	-	-	-	-	-
S34	GND_S34	-	-	-	-	-	-	-
S35	SDMMC_CK	-	-	-	-	-	-	-
S36	SDMMC_CMD	-	-	-	-	-	-	-
S37	SDMMC_RST#	-	-	-	-	-	-	-
S38	AUDIO_MCK	-	-	-	-	-	-	-
S39	I2S0_LRCK	-	-	-	-	-	-	-
S40	I2S0_SDOUT	-	-	-	-	-	-	-
S41	I2S0_SDIN	-	-	-	-	-	-	-
S42	I2S0_CK	-	-	-	-	-	-	-
S43	I2S1_LRCK	-	-	-	-	-	-	-
S44	I2S1_SDOUT	-	-	-	-	-	-	-
S45	I2S1_SDIN	-	-	-	-	-	-	-
S46	I2S1_CK	-	-	-	-	-	-	-
S47	GND_S47	-	-	-	-	-	-	-
S48	I2C_GP_CK	Out	PU-2k2	CMOS 1.8V	PCA9518 / LEVEL SHIFTER	SCL3	12C	V_1V8_S0
S49	I2C_GP_DAT	Bi-Dir	PU-2k2	CMOS 1.8V	PCA9518 / LEVEL SHIFTER	SCL3	12C	V_1V8_S0
S50	I2S2_LRCK	-	-	-	-	-	-	-
S51	I2S2_SDOUT	-	-	-	-	-	-	-
S52	I2S2_SDIN	-	-	-	-	-	-	-
S53	I2S2_CK	-	-	-	-	-	-	-
S54	SATA_ACT#	-	-	-	-	-	-	-
S55	MBE1_LINK_ACT#	Out / OD	-	-	DP83848K / CPLD	-	RMII	-
S56	AFB9_PTIO	-	-	-	-	-	-	-
S57	PCAM_ON_CSI0#	-	-	-	-	-	-	-
S58	PCAM_ON_CSI1#	-	-	-	-	-	-	-
S59	SPDIF_OUT	-	-	-	-	-	-	-
S60	SPDIF_IN	-	-	-	-	-	-	-
S61	GND_S61	-	-	-	-	-	-	-
S62	MBE1_MDIO_D_+	Bi-Dir	PU-49R9	-	DP83848K	TD +	RMII	V_3V3_S0
S63	MBE1_MDIO_D_-	Bi-Dir	PU-49R9	-	DP83848K	TD -	RMII	V_3V3_S0

S64	GND_S64	-	-	-	-	-	-	-
S65	MBE1_MDI1_D_+	Bi-Dir	PU-49R9	-	DP83848K	RD +	RMII	V_3V3_S0
S66	MBE1_MDI1_D_-	Bi-Dir	PU-49R9	-	DP83848K	RD -	RMII	V_3V3_S0
S67	GND_S67	-	-	-	-	-	-	-
S68	AFB_DIFF2+	-	-	-	-	-	-	-
S69	AFB_DIFF2-	-	-	-	-	-	-	-
S70	GND_S70	-	-	-	-	-	-	-
S71	AFB_DIFF3+	-	-	-	-	-	-	-
S72	AFB_DIFF3-	-	-	-	-	-	-	-
S73	GND_S73	-	-	-	-	-	-	-
S74	AFB_DIFF4+	-	-	-	-	-	-	-
S75	AFB_DIFF4-	-	-	-	-	-	-	-
S76	PCIE_B_RST#	-	-	-	-	-	-	-
S77	PCIE_C_RST#	-	-	-	-	-	-	-
S78	PCIE_C_RX+	-	-	-	-	-	-	-
S79	PCIE_C_RX-	-	-	-	-	-	-	-
S80	GND_S80	-	-	-	-	-	-	-
S81	PCIE_C_TX+	-	-	-	-	-	-	-
S82	PCIE_C_TX-	-	-	-	-	-	-	-
S83	GND_S83	-	-	-	-	-	-	-
S84	PCIE_B_REFCK+	Out	Serial 0R	PCIe	QUARK	REF1_OUTCLK_P	CPU / PLL	V_1V0_S0
S85	PCIE_B_REFCK-	Out	Serial 0R	PCIe	QUARK	REF1_OUTCLK_N	CPU / PLL	V_1V0_S0
S86	GND_S86	-	-	-	-	-	-	-
S87	PCIE_B_RX+	In	-	PCIe	QUARK	PCIE_PERP_1	PCIe	-
S88	PCIE_B_RX-	In	-	PCIe	QUARK	PCIE_PERN_1	PCIe	-
S89	GND_S89	-	-	-	-	-	-	-
S90	PCIE_B_TX+	Out	Serial 100n	PCIe	QUARK	PCIE_PETP_1	PCIe	-
S91	PCIE_B_TX-	Out	Serial 100n	PCIe	QUARK	PCIE_PETN_1	PCIe	-
S92	GND_S92	-	-	-	-	-	-	-
S93	LCD_D0	-	-	-	-	-	-	-
S94	LCD_D1	-	-	-	-	-	-	-
S95	LCD_D2	-	-	-	-	-	-	-
S96	LCD_D3	-	-	-	-	-	-	-
S97	LCD_D4	-	-	-	-	-	-	-
S98	LCD_D5	-	-	-	-	-	-	-
S99	LCD_D6	-	-	-	-	-	-	-
S100	LCD_D7	-	-	-	-	-	-	-
S101	GND_S101	-	-	-	-	-	-	-
S102	LCD_D8	-	-	-	-	-	-	-
S103	LCD_D9	-	-	-	-	-	-	-
S104	LCD_D10	-	-	-	-	-	-	-
S105	LCD_D11	-	-	-	-	-	-	-
S106	LCD_D12	-	-	-	-	-	-	-
S107	LCD_D13	-	-	-	-	-	-	-
S108	LCD_D14	-	-	-	-	-	-	-
S109	LCD_D15	-	-	-	-	-	-	-
S110	GND_S110	-	-	-	-	-	-	-
S111	LCD_D16	-	-	-	-	-	-	-
S112	LCD_D17	-	-	-	-	-	-	-
S113	LCD_D18	-	-	-	-	-	-	-
S114	LCD_D19	-	-	-	-	-	-	-
S115	LCD_D20	-	-	-	-	-	-	-
S116	LCD_D21	-	-	-	-	-	-	-
S117	LCD_D22	-	-	-	-	-	-	-
S118	LCD_D23	-	-	-	-	-	-	-
S119	GND_S119	-	-	-	-	-	-	-
S120	LCD_DE	-	-	-	-	-	-	-
S121	LCD_VS	-	-	-	-	-	-	-
S122	LCD_HS	-	-	-	-	-	-	-
S123	LCD_PCK	-	-	-	-	-	-	-
S124	GND_S124	-	-	-	-	-	-	-
S125	LVDS0+	-	-	-	-	-	-	-
S126	LVDS0-	-	-	-	-	-	-	-
S127	LCD_BKLT_EN	-	-	-	-	-	-	-
S128	LVDS1+	-	-	-	-	-	-	-
S129	LVDS1-	-	-	-	-	-	-	-
S130	GND_S130	-	-	-	-	-	-	-
S131	LVDS2+	-	-	-	-	-	-	-

S132	LVDS2-	-	-	-	-	-	-	-
S133	LCD_VDD_EN	-	-	-	-	-	-	-
S134	LVDS_CK+	-	-	-	-	-	-	-
S135	LVDS_CK-	-	-	-	-	-	-	-
S136	GND_S136	-	-	-	-	-	-	-
S137	LVDS3+	-	-	-	-	-	-	-
S138	LVDS3-	-	-	-	-	-	-	-
S139	I2C_LCD_CK	-	-	-	-	-	-	-
S140	I2C_LCD_DAT	-	-	-	-	-	-	-
S141	LCD_BKLT_PWM	-	-	-	-	-	-	-
S142	LCD_DUAL_PCK	-	-	-	-	-	-	-
S143	GND_S143	-	-	-	-	-	-	-
S144	RSVD/EDP_HPD	-	-	-	-	-	-	-
S145	WDT_TIME_OUT#	Out	-	CMOS 1.8V	QUARK / CPLD	-	-	V_1V8_S0
S146	PCIE_WAKE#	In	PU_20k	CMOS 3.3V	QUARK	WAKE_B	PWRMGMT	V_3V3_S3
S147	VDD_RTC	-	-	PWR	-	-	-	-
S148	LID#	In	W_PU	CMOS 1.8V	QUARK / CPLD	-	-	V_1V8_S0
S149	SLEEP#	In	W_PU	CMOS 1.8V	QUARK / CPLD	-	-	V_1V8_S0
S150	VIN_PWR_BAD#	In	W_PU	CMOS 1.8V	CPLD	-	-	V_1V8_S5
S151	CHARGING#	In	W_PU	CMOS 1.8V	QUARK / CPLD	-	-	V_1V8_S0
S152	CHARGER_PRSNT#	In	W_PU	CMOS 1.8V	QUARK / CPLD	-	-	V_1V8_S0
S153	CARRIER_STBY#	Out	-	CMOS 1.8V	CPLD	-	-	V_1V8_S0
S154	CARRIER_PWR_ON	Out	-	CMOS 1.8V	CPLD	-	-	V_1V8_S5
S155	FORCE_RECOV#	In	W_PU	CMOS 1.8V	CPLD	-	-	V_1V8_S0
S156	BATLOW#	In	W_PU	CMOS 1.8V	QUARK / CPLD	-	-	V_1V8_S0
S157	TEST#	In	-	CMOS 1.8V	CPLD	-	-	V_1V8_S5
S158	VDD_IO_SEL#	-	-	-	-	-	-	-

4.3 Bootloader (Grub 0.97) description

Briefly, a boot loader is the first software program that runs when a computer starts. It is responsible for loading and transferring control to an operating system kernel software (such as Linux or GNU Mach). The kernel, in turn, initializes the rest of the operating system (e.g. a GNU system). GNU GRUB is a very powerful boot loader, which can load a wide variety of free operating systems, as well as proprietary operating systems with chain-loading1. GRUB is designed to address the complexity of booting a personal computer; both the program and this manual are tightly bound to that computer platform, although porting to other platforms may be addressed in the future. One of the important features in GRUB is flexibility; GRUB understands filesystems and kernel executable formats, so you can load an arbitrary operating system the way you like, without recording the physical position of your kernel on the disk. Thus you can load the kernel just by specifying its file name and the drive and partition where the kernel resides. When booting with GRUB, you can use either a command-line interface , or a menu interface . Using the command-line interface, you type the drive specification and file name of the kernel manually. In the menu interface, you just select an OS using the arrow keys. The menu is based on a configuration file which you prepare beforehand . While in the menu, you can switch to the command-line mode, and vice-versa. You can even edit menu entries before using them. Besides the GRUB boot loader itself, there is a grub shell grub which can be run when you are in your operating system. It emulates the boot loader and can be used for installing the boot loader.

4.3.1 How to boot from different sources

The kernel and root file system (bzImage and image-nnnn.gz, respectively) can be copied onto a USB stick or SD card and booted from grub. Also, the file grub.conf must be located in the /boot/grub/ directory of the USB stick or SD card.

it is relatively easy to boot GNU/Linux from GRUB, because it somewhat resembles to boot a Multiboot-compliant OS.

Set GRUB's root device to the same drive as GNU/Linux's. Probably the command find /vmlinuz or similar can help you (see find). Load the kernel:

```
<code>grub> kernel /vmlinuz root=/dev/hda1</code>
```

If you need to specify some kernel parameters, just append them to the command. For example, to set vga to `ext', do this:

```
<code>grub> kernel /vmlinuz root=/dev/hda1 vga=ext</code>
```

See the documentation in the Linux source tree for complete information on the available options.

If you use an initrd, execute the command initrd (see initrd) after kernel:

```
<code>grub> initrd /initrd</code>
```

Finally, run the command boot (see boot). Caution: If you use an initrd and specify the `mem=' option to the kernel to let it use less than actual memory size, you will also have to specify the same memory size to GRUB. To let GRUB know the size, run the command uppermem before loading the kernel. See uppermem, for more information.

4.3.2 How to update the bootloader

```
grub-install --root-directory=/mnt/sdb1 /dev/sdb
# echo -e ' title Wind River Intelligent Device Platform
root (hd0,0)
kernel /boot/bzImage
root=/dev/sda1 rw,noatime rootwait reboot=bios' > /mnt/
sdb1/boot/grub/menu.lst
```