NMS-uQ7-BKLT v1 ds-en

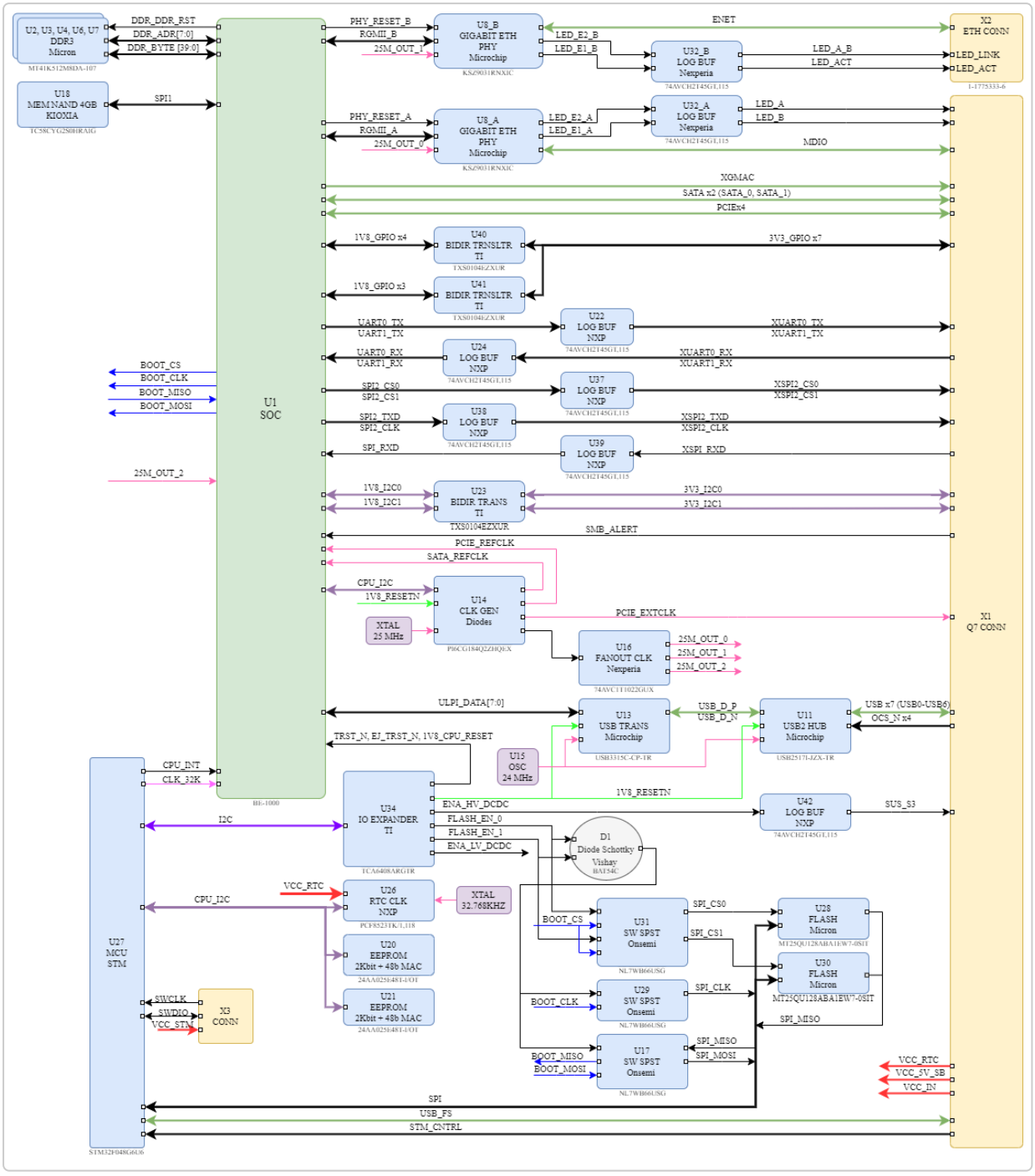
System on Module Q7_BFK is based on the Baikal-T1 (BE-T1000)applications processor. BE-T1000 is a russian system on a chip based on the MIPS Warrior P-class P5600 architecture by the «Baikal Electronics»

Technical Specifications

Main technical specifications

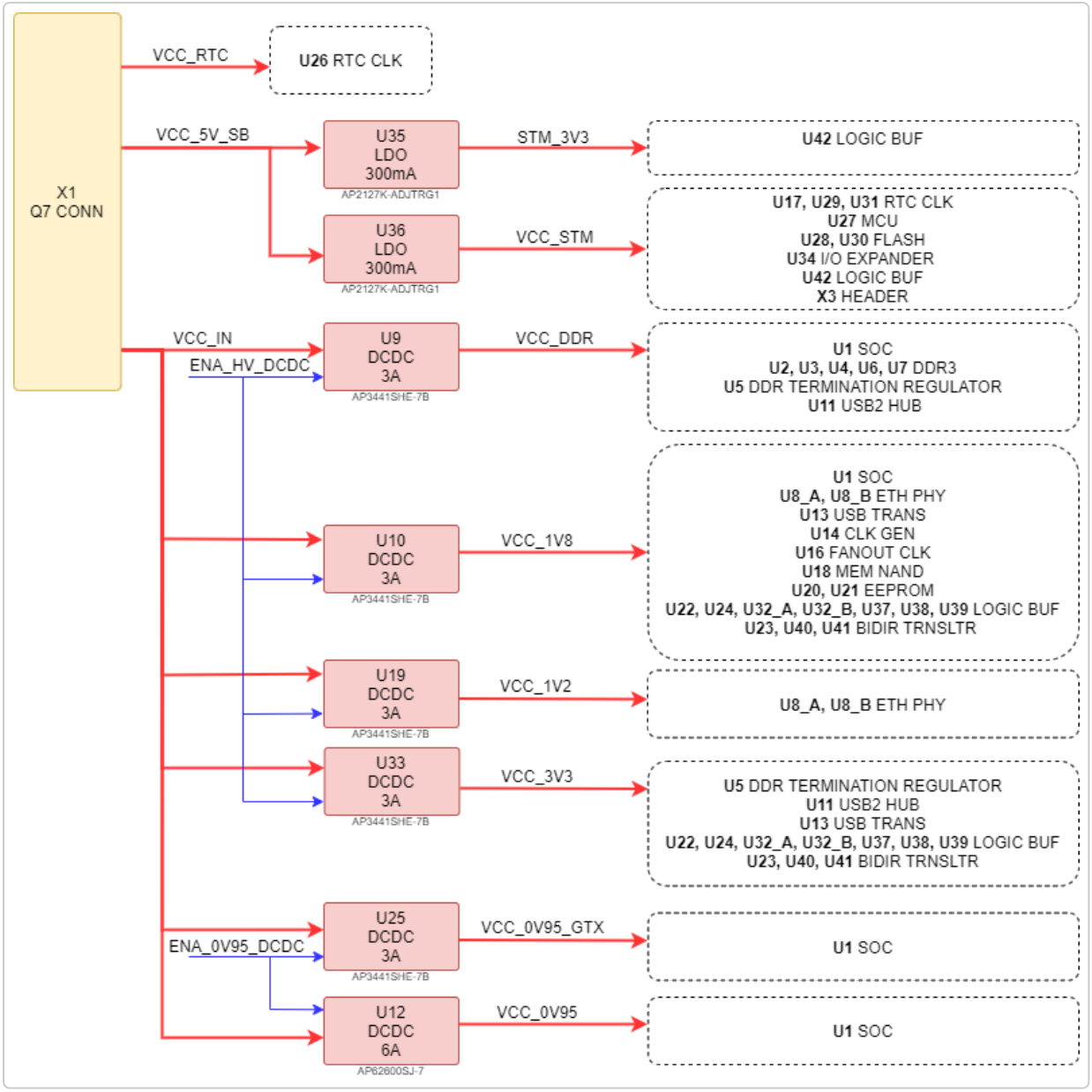
Form factor	Qseven
CPU	Baikal-T1 (BE-T1000))
	Cores: 2 x P5600 MIPS 32 r5 1,2 GHz
	L2 Cache: 1 MB
	Operating Frequency [Max]: 1.2 GHz
	ECC DDR3 4 Gb, interface 40-bit, 5 x 512 M x 8 (MT41K512M8DA-107)
RAM	NAND FLASH 4 Mb, SPI interface (TC58CYG2S0HRAIG)
	NOR FLASH 128 Mb, SPI interface (MT25QU128ABA1EW7)
EEPROM	2 Kb, I2C interface, Unique ID 48-bit (24AA025)
Power management IC	RTC (PCF8523TK)
	Ethernet PHY (KSZ9031)
	DDR Termination Regulator (TPS51200)
	PCIe Gen 4 Clock Generator (PI6CG184Q2)
	USB 2.0 7-Port High Speed Hub Controller (USB2517I)
	Hi-Speed USB Transceiver (USB3315C)
	ARM-based Cortex-M0 32-bit MCU (STM32F048G6U6)
Interfaces	4x PCIe
	2x UART
	2x SPI + BOOTSPI
	2x SATA
	7x USB 2.0
	2x Gigabit Ethernet (PHY)
	1x 10 Gigabit Ethernet
	2x I2C
	7x GPIO
Power supply voltage	+5V
Power consumption	**TBD**
Dimensions	70 x 40 mm

Block Diagram



Block Diagram

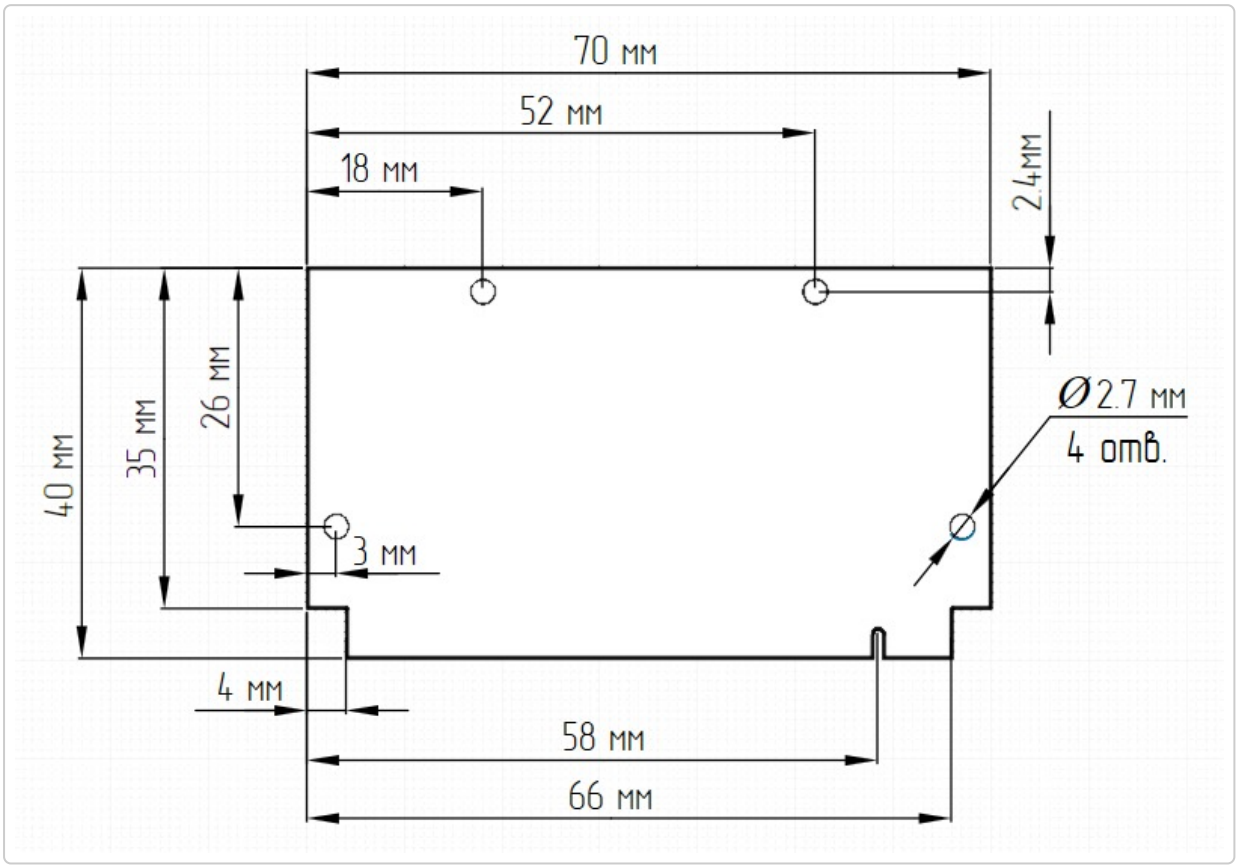
Power tree



Power tree

Mechanical Specifications

Board dimensions are: 70 x 40 mm.
Printed circuit of the board is made of 10 layers, some of them are ground planes, for disturbance rejection.



Module mechanical dimensions

Main Hardware Components

Component Location

Top view

Component Location. Top View

Component description on the board (Top side)

Designator	P/N	Description
U1	BAIKAL-T1	CPU
U2, U3, U6	MT41K512M8DA-107	DDR3 RAM
U5	TPS51200DRCT	DDR Termination Regulator
U8_A, U8_B	KSZ9031RN	Ethernet PHY
U9, U10, U25	AP3441SHE-7B	Step-down DC-DC Converters 3A
U11	USB2517I-JZX-TR	7-Port USB 2.0 Hub Controller
U12	AP62600SJ-7	6A DC-DC Switching Synchronous Bu Regulator
U13	USB3315C-CP-TR	USB-Transceiver
U14	PI6CG184Q2ZHQEX	PCIe Gen 4 Clock Generator
U17, U29	NL7WB66USG	SPST Analogue Switch
U22, U24	74AVCH2T45GT,115	Dual-bit, dual-supply voltage level translator/transceiver
U23	TXS0104EZXUR	4Bit Bidirectional Voltage-Level Shifter
U27	STM32F048G6U6	MCU
U34	TCA6408ARGTR	8-Bit I2C and SMBus I/O Expander
U36	AP2127K-ADJTRG1	CMOS LDO REGULATOR

Bottom View

Component Location. Bottom View

Component description on the board (Bottom side)

Designator	P/N	Description
U4, U7	MT41K512M8DA-107	DDR3 RAM
U16	74AVC1T1022GUX	1-to-4 fan-out buffer
U18	TC58CYG2S0HRAIG	NAND Flash memory
U19, U33	AP3441SHE-7B	Step-down DC-DC Converters 3A
U20, U21	24AA025E48T-I/OT	EEPROM
U26	PCF8523TK/1,118	RTC
U28, U30	MT25QU128ABA1EW7-0SIT	FLASH memory with SPI interface
U31	NL7WB66USG	SPST Analogue Switch
U32_A, U32_B, U37, U38, U39, U42	74AVCH2T45GT,115	Dual-bit, dual-supply voltage level translator/transceiver
U35	AP2127K-ADJTRG1	CMOS LDO REGULATOR
U40, U41	TXS0104EZXUR	4Bit Bidirectional Voltage-Level Shifte

Processor

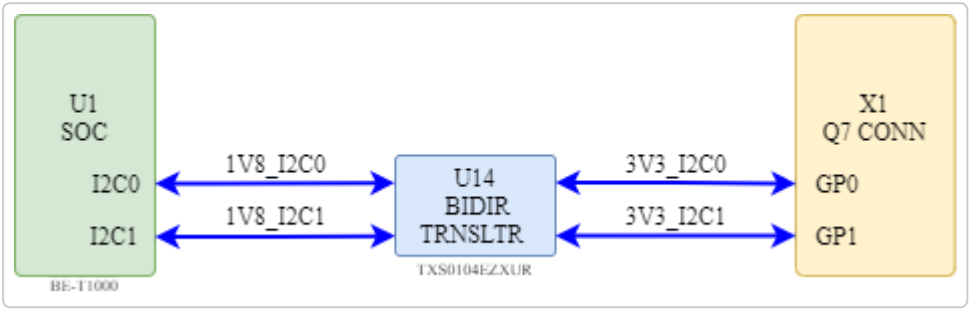
Figure 6 shows the functional modules in the Baikal-T1 processor system.

Baikal-T1 function modules

External connectors

I2C

Two I2C interfaces are available on Q7_BFK.



I2C interfaces

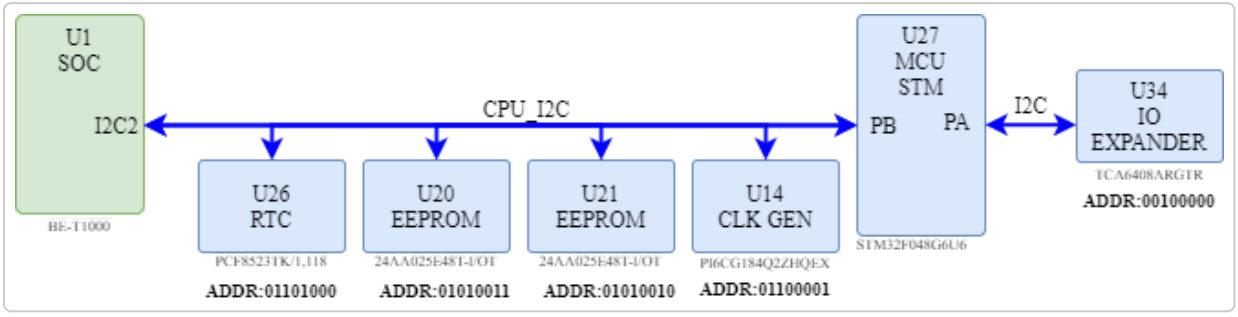
Q7 I2C signals

Signal Name	Pin(s)	Direction	Voltage standard	Description	
I2C0_SCL	66	in/out	3.3 1.8	General purpose I2C Bus clock line.	U1.AD5
I2C0_SDA	68	in/out	3.3 1.8	General purpose I2C Bus data line.	U1.AD4
I2C1_SCL	60	in/out	3.3 1.8	General purpose I2C Bus clock line.	U1.K7
I2C1_SDA	62	in/out	3.3 1.8	General purpose I2C Bus data line.	U1.K6

Debugging/development interfaces

I2C

One I2C interface (for communication between processor and peripherals) is available on Q7_BFK.



I2C interface

I2C Address Mapping

Device	Address
RTC	0x1101000
EEPROM1	0x1010011
EEPROM2	0x1010010
8-Bit I2C and SMBus I/O Expander	0x0100000
PCIe Gen 4 Clock Generator	0x1100001

BE-T1000 I2C signals

Signal Name	Pin(s)	Direction	Voltage standard	Description	Comments
I2C2_SDA	K1	in/out	1.8 PU 2.2 kΩ	I2C Bus data line	
I2C2_SCL	J1	in/out	1.8 PU 2.2 kΩ	I2C Bus clock line	

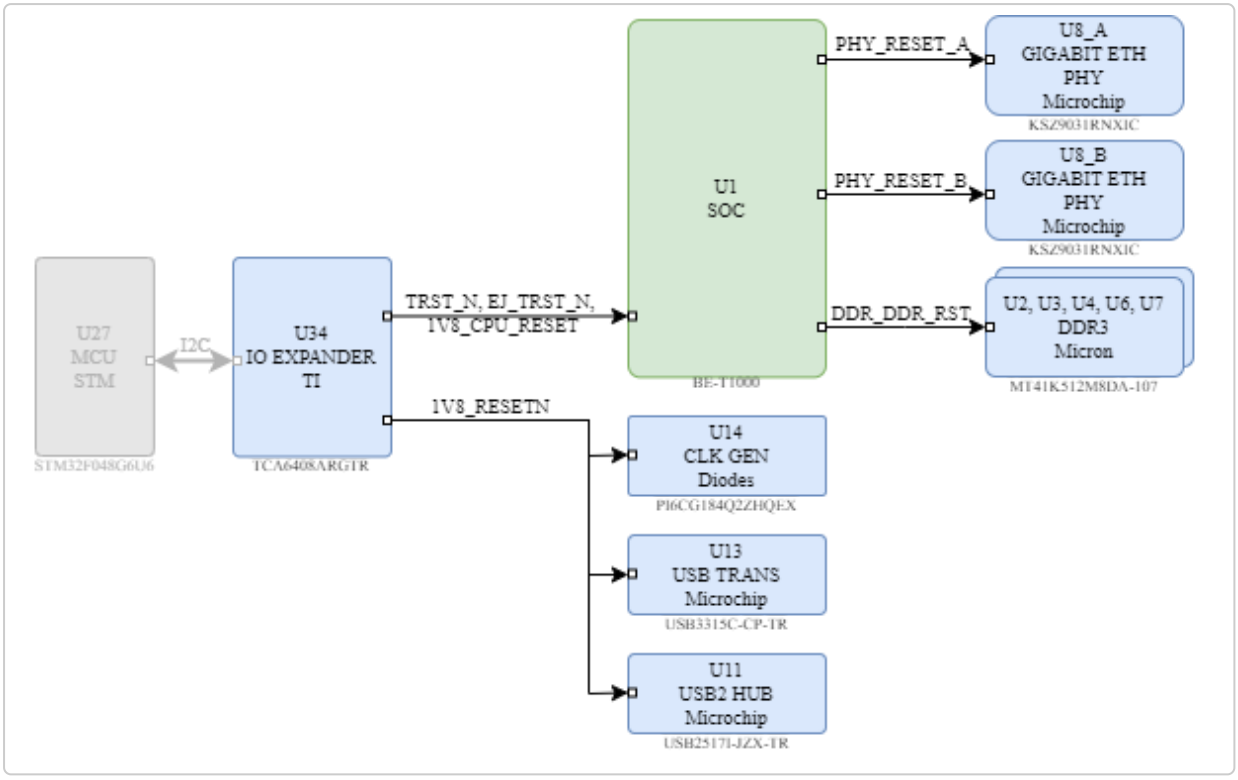
where PU - pull-up resistor, PD -pull-down resistor.

STM32 I2C signals

Signal Name	Pin(s)	Direction	Voltage standard	Description	Comments
I2C_SDA	6	in/out	3.3	I2C Bus data line.	
I2C_SCL	7	in/out	3.3	I2C Bus clock line.	
CPU_I2C_SCL	27	in/out	3.3	I2C Bus data line.	
CPU_I2C_SDA	28	in/out	3.3	I2C Bus clock line	

where PU - pull-up resistor, PD -pull-down resistor.

RESET



Reset signals

Reset signals

Signal Name	Pin(s)	Voltage standard	Description	Connection	Comments
G0_GP_OUT	N7	1.8 PU 10 kΩ	PHY_RESET_A	U8_A.42	
G1_GP_OUT	Y2	1.8 PU 10 kΩ	PHY_RESET_B	U8_B.42	
GPIO[8]	A5	1.8	CPU_INT	U27.9	
DDR_RAM_RST	T19	1.5 PD 10 kΩ	DDR_DDR_RST	U2.N2, U3.N2, U4.N2, U6.N2, U7.N2,	

where PU - pull-up resistor, PD -pull-down resistor.

External connectors

Top view

Connectors Location. Top View

Designator	P/N	Description
X1	CONN-uQ7-EDGE	uQ7 format connector for connecting to the motherboard
X2	1-1775333-6	Gigabit Ethernet connector ZIF FFC/FPC

Bottom view

Connectors Location. Buttom View

Designator	P/N	Description
X3	59453-041110ECHLF	ZIF FFC/FPC connector for debugging/development

Appendix 1

X1 Q7_BFK connectors

Pin	Signal name(Top view)	Signal group	Type	Comments	Pin	Signa
1	GND		Power		2	
3	GBE_MDI3-	GBE	in/out		4	
5	GBE_MDI3+	GBE	in/out		6	
7	GBE_LINK100#	GBE	out	Unused	8	
9	GBE_MDI1-	GBE	in/out		10	
11	GBE_MDI1+	GBE	in/out		12	
13	GBE_LINK#	GBE	out		14	
15	GBE_CTREF	GBE	out	Unused	16	
17	WAKE#	PWR_MGMT	in	Unused	18	
19	GPO0(SUS_STAT#)	PWR_MGMT	out	Unused	20	
21	SLP_BTN#/GPII1	PWR_MGMT	in	Unused	22	
23	GND		Power		24	
25	GND		Power		26	
27	BATLOW#/GPII2	PWR_MGMT	in	Unused	28	
29	SATA0_TX+	SATA	out		30	
31	SATA0_TX-	SATA	out		32	
33	SATA_ACT#	SATA	out	Unused	34	
35	SATA0_RX+	SATA	in		36	
37	SATA0_RX-	SATA	in		38	
39	GND		Power		40	
41	BIOS_DIS#/BOOT_ALT#	BOOT	in		42	
43	SDIO_CD#	SDIO	in/out	Unused	44	res
45	SDIO_CMD	SDIO	in/out	Unused	46	
47	SDIO_PWR#	SDIO	out	Unused	48	
49	SDIO_DAT0	SDIO	in/out	Unused	50	
51	SDIO_DAT2	SDIO	in/out	Unused	52	res
53	reserved (SDIO_DAT4)				54	res
55	reserved (SDIO_DAT6)				56	USE
57	GND		Power		58	
59	HDA_SYNC/I2S_WS	AUDIO	out	Unused	60	SME

Pin	Signal name(Top view)	Signal group	Type	Comments	Pin	Signa
61	HDA_RST#/I2S_RST#	AUDIO	out	Unused	62	SME
63	HDA_BITCLK/I2S_CLK	AUDIO	out	Unused	64	
65	HDA_SDI/I2S_SDI	AUDIO	in	Unused	66	GP0
67	HDA_SDO/I2S_SDO	AUDIO	out	Unused	68	GP0
69	THRM#	MISC	in	Unused	70	
71	THRMTRIP#	MISC	out	Unused	72	
73	GND		Power		74	
75	USB_P7-/USB_SSTX0-	USB	in/out		76	USI
77	USB_P7+/USB_SSTX0+	USB	in/out		78	USE
79	USB_6_7_OC#	USB	in		80	
81	USB_P5-/USB_SSTX2-	USB	in/out		82	USI
83	USB_P5+/USB_SSTX2+	USB	in/out		84	USE
85	USB_2_3_OC#	USB	in		86	
87	USB_P3-	USB	in/out		88	
89	USB_P3+	USB	in/out		90	
91	USB_VBUS (USB_CC)	USB	in		92	
93	USB_P1-	USB	in/out		94	
95	USB_P1+	USB	in/out		96	
97	GND		Power		98	
99	eDP0_TX0+/LVDS_A0+	LVDS/eDP	out	Unused	100	eDI
101	eDP0_TX0-/LVDS_A0-	LVDS/eDP	out	Unused	102	eD
103	eDP0_TX1+/LVDS_A1+	LVDS/eDP	out	Unused	104	eDI
105	eDP0_TX1-/LVDS_A1-	LVDS/eDP	out	Unused	106	eD
107	eDP0_TX2+/LVDS_A2+	LVDS/eDP	out	Unused	108	eDI
109	eDP0_TX2-/LVDS_A2-	LVDS/eDP	out	Unused	110	eD
111	LVDS_PPEN	LVDS/eDP	out	Unused	112	
113	eDP0_TX3+/LVDS_A3+	LVDS/eDP	out	Unused	114	eDI
115	eDP0_TX3-/LVDS_A3-	LVDS/eDP	out	Unused	116	eD
117	GND		Power		118	
119	eDP0_AUX+/LVDS_A_CLK+	LVDS/eDP	out	Unused	120	eDP1_
121	eDP0_AUX-/LVDS_A_CLK-	LVDS/eDP	out	Unused	122	eDP1
123	LVDS_BLT_CTRL/GP_PWM_OUT0	LVDS/GP	out	Unused	124	GP_1
125	LVDS_DID_DAT/GP_I2C_DAT	LVDS/GP	in/out	Unused	126	eDP0_

Pin	Signal name(Top view)	Signal group	Type	Comments	Pin	Signa
127	LVDS_DID_CLK/GP_I2C_CLK	LVDS/GP	in/out	Unused	128	eDP1_
129	CAN0_TX	CAN	out	Unused	130	
131	DP_LANE3+/TMDS_CLK+ (SDVO_BCLK+)	HDMI/DP	out	Unused	132	USB_
133	DP_LANE3-/TMDS_CLK- (SDVO_BCLK-)	HDMI/DP	out	Unused	134	USB_
135	GND		Power		136	
137	DP_LANE1+/TMDS_LANE1+ (SDVO_GREEN+)	HDMI/DP	out	Unused	138	(S
139	DP_LANE1-/TMDS_LANE1- (SDVO_GREEN-)	HDMI/DP	out	Unused	140	(S
141	GND		Power		142	
143	DP_LANE2+/TMDS_LANE0+ (SDVO_BLUE+)	HDMI/DP	out	Unused	144	(S
145	DP_LANE2-/TMDS_LANE0- (SDVO_BLUE-)	HDMI/DP	out	Unused	146	(S
147	GND		Power		148	
149	DP_LANE0+/TMDS_LANE2+ (SDVO_RED+)	HDMI/DP	out	Unused	150	H (S
151	DP_LANE0-/TMDS_LANE2- (SDVO_RED-)	HDMI/DP	out	Unused	152	H (S
153	HDMI_HPD#	HDMI/DP	in	Unused	154	
155	PCIE_CLK_REF+	PCIE	out		156	
157	PCIE_CLK_REF-	PCIE	out		158	
159	GND		Power		160	
161	PCIE3_TX+	PCIE	out		162	
163	PCIE3_TX-	PCIE	out		164	
165	GND		Power		166	
167	PCIE2_TX+	PCIE	out		168	
169	PCIE2_TX-	PCIE	out		170	
171	UART0_TX (EXCD0_PERST#)	UART	out		172	(
173	PCIE1_TX+	PCIE	out		174	
175	PCIE1_TX-	PCIE	out		176	
177	UART0_RX (EXCD0_CPPE#)	UART	in		178	

Pin	Signal name(Top view)	Signal group	Type	Comments	Pin	Signa
179	PCIE0_TX+	PCIE	out		180	
181	PCIE0_TX-	PCIE	out		182	
183	GND		Power		184	
185	LPC_AD0/GPIO0	GPIO	in/out		186	
187	LPC_AD2/GPIO2	GPIO	in/out		188	
189	LPC_CLK/GPIO4	GPIO	in/out		190	LP
191	SERIRQ/GPIO6	GPIO	in/out		192	LI
193	VCC_RTC		in		194	SPI
195	FAN_T_IN/GP_TIMER_IN	MISC	in	Unused	196	FAN_
197	GND		Power		198	
199	SPI_MOSI	SPI	out		200	
201	SPI_MISO	SPI	in		202	
203	SPI_SCK	SPI	out		204	
205	VCC_5V_SB		in		206	
207	MFG_NC0	MFG	in	Unused	208	
209	MFG_NC1	MFG	out		210	
211	NC (VCC)			Unused	212	
213	NC (VCC)			Unused	214	
215	NC (VCC)			Unused	216	
217	NC (VCC)			Unused	218	
219	VCC		Power		220	
221	VCC		Power		222	
223	VCC		Power		224	
225	VCC		Power		226	
227	VCC		Power		228	
229	VCC		Power		230	