

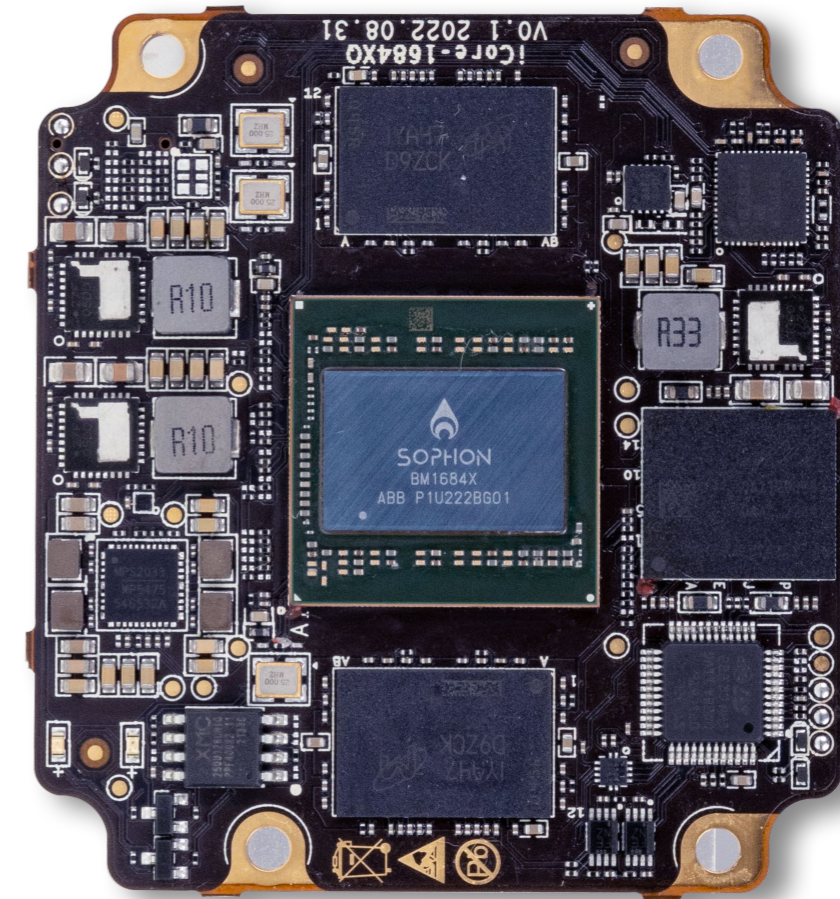


iCore-1684XQ

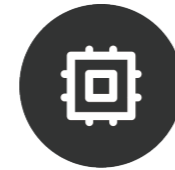
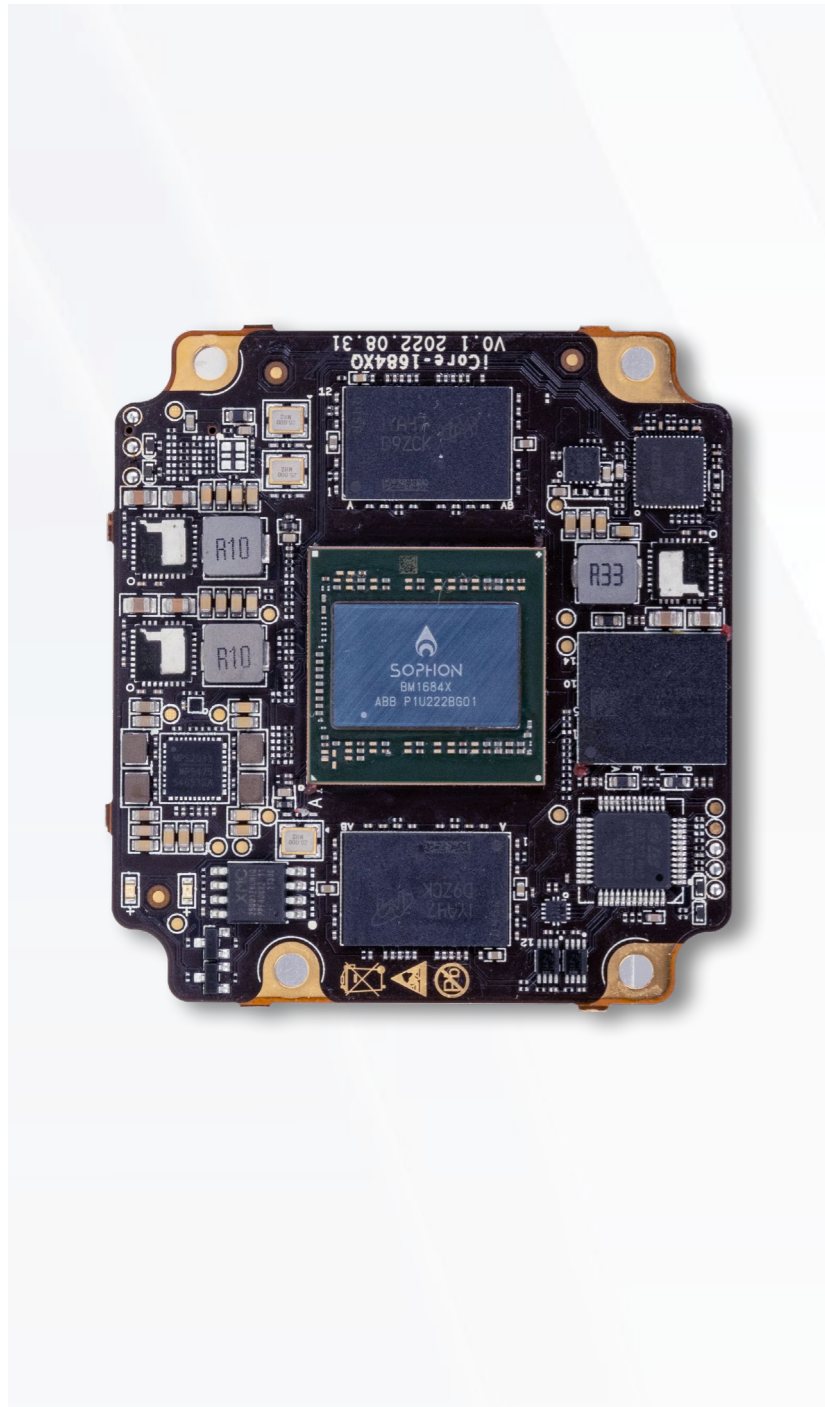
Octa-Core High Computing Power AI Core Board

V0.1 2024-3-19

T-CHIP INTELLIGENCE TECHNOLOGY



Product features



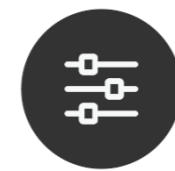
New-gen Octa-core AI processor BM1684X

This core board is powered by SOPHON AI processor BM1684X, which features octa-core ARM Cortex-A53, frequency of up to 2.3GHz and 12nm lithography process. With up to 32Tops (INT8) computing power, or 16TFLOPS (FP16/BF16) computing power, or 2Tops (FP32) high-precision computing power, it supports mainstream programming frameworks.



Powerful multi-channel video AI performance

The core board supports up to 32-channel 1080P H.264/H.265 video decoding. It is able to simultaneously process and analyze over 16-channel HD video, making it ideal for various AI applications such as face detection and license plate recognition on video streaming.



A variety of interfaces

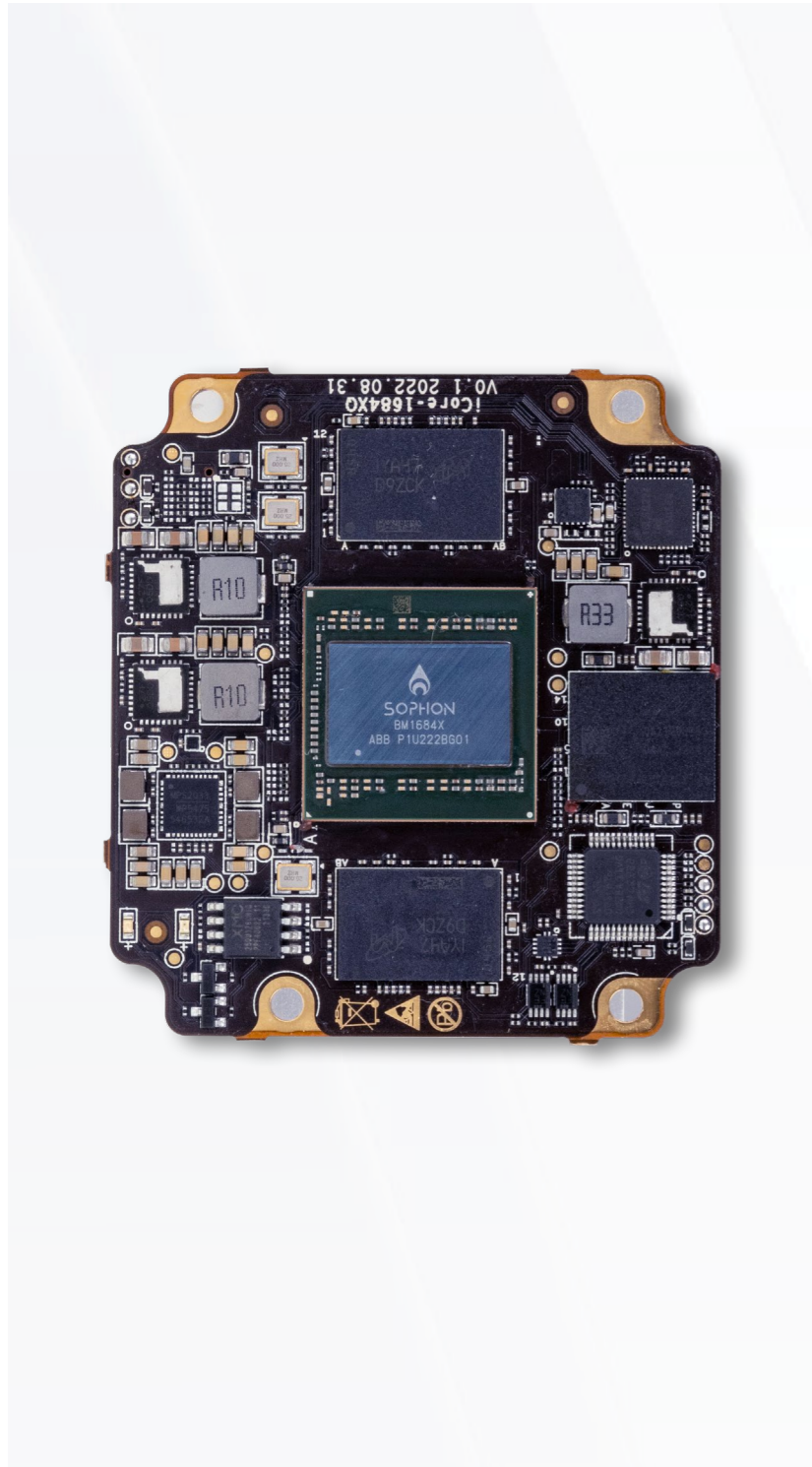
With PCIe3.0, GMAC, SDIO3.0, I2C, PWM, UART, and GPIO, it is easy to integrate into various edge embedded products, and accelerate product development.



Firm and tight BTB interface

The core board is equipped with high-speed industrial-grade connector, with high reliability and stability. The BTB interface provides a tight and firm connection, allowing the core board to be combined with a backplane to form a complete high-performance industrial mainboard.

Product features



Complete software and hardware

With complete software and hardware, artificial intelligence inference for cloud and edge applications can be easily achieved. All of them accelerate the development of edge applications, such as face recognition, video structuring, abnormal alarm, equipment inspection, and situation prediction, etc.



Abundant algorithms

It supports multiple algorithms porting such as "person/vehicle/object" recognition, video structuring, and trajectory behavior, with high security and reliability. It can be flexibly applied to various product development.



Provide backplane reference design

Backplane reference design and complete technical information are provided, so users can efficiently proceed with secondary development to quickly create independent and controllable products.



A wide range of applications

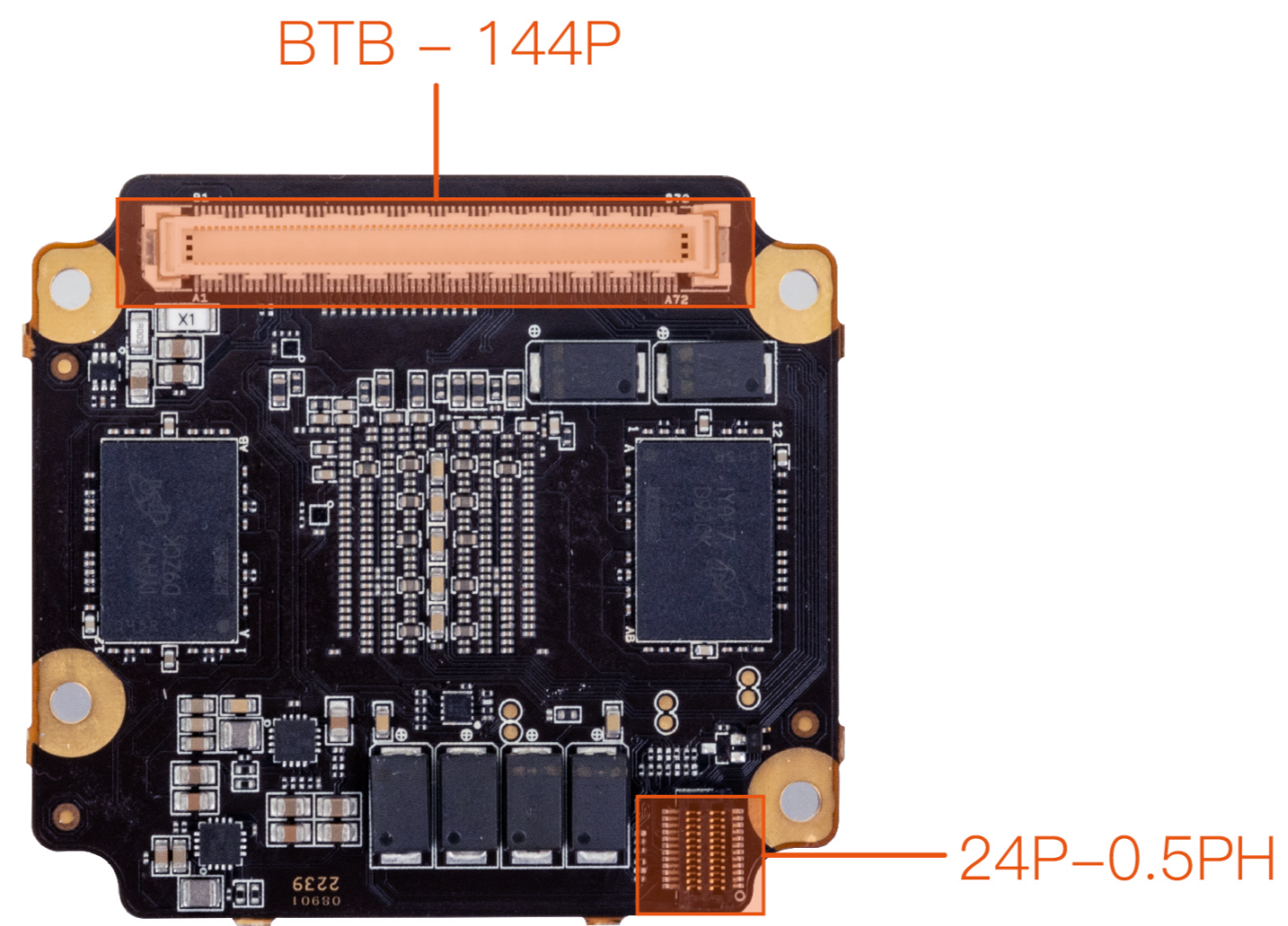
The core board supports flexible deployment in multiple fields and scenarios, such as intelligent security, intelligent transportation, smart park, smart retail, intelligent finance, smart city, smart industry, and smart energy.

Specifications



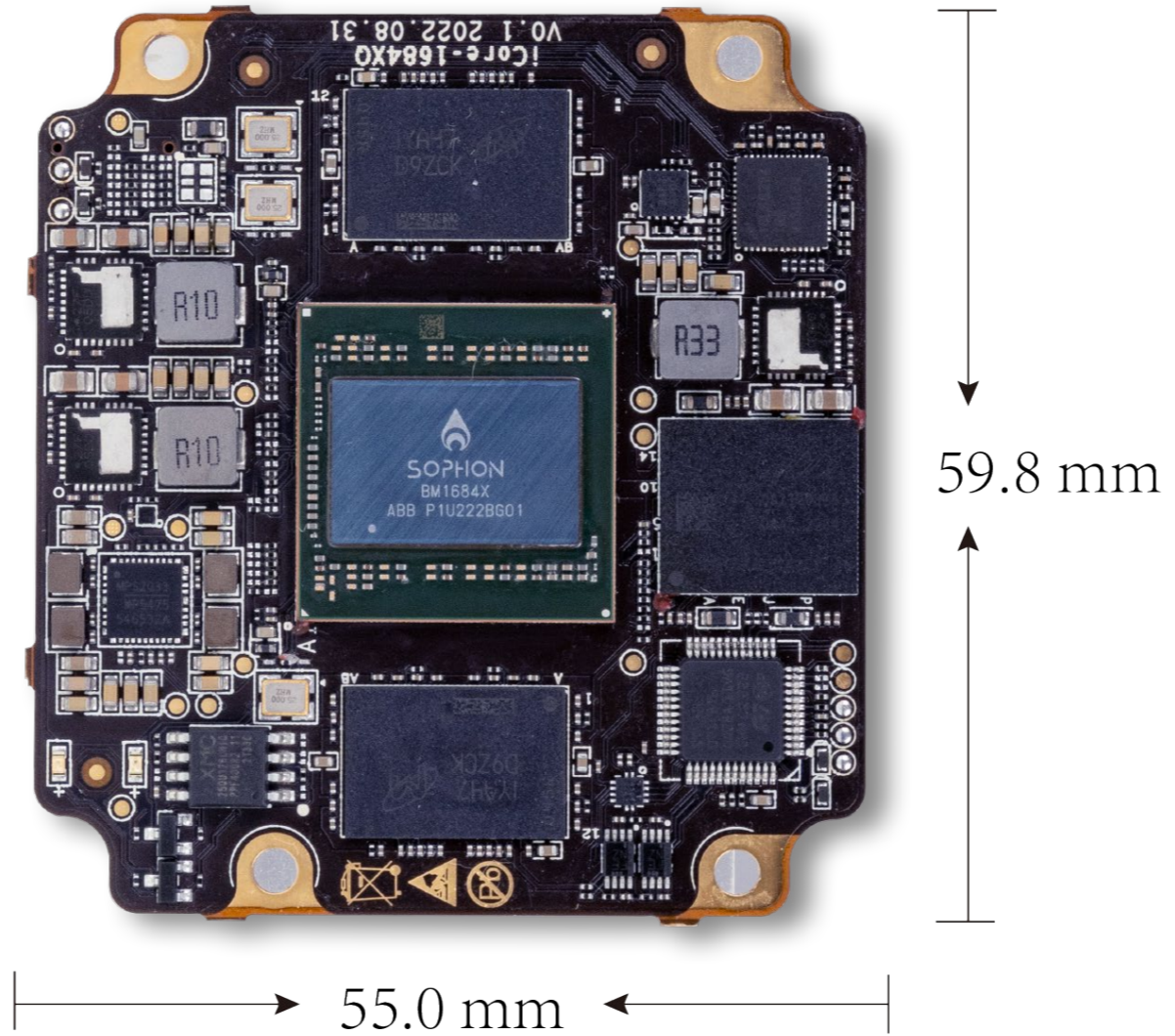
Specification	
SOC	SOPHON BM1684X
CPU	Integrated high-performance ARM A53, 12nm lithography process, clock speed up to 2.3GHz
TPU	Built-in tensor computing module TPU, computing power up to: 32TOPS (INT8), 16TFLOPS (FP16/BF16), 2TFLOPS (FP32) Support mainstream programming frameworks, such as TensorFlow / Caffe / PyTorch / Paddle / ONNX / MXNet / DarkNet
Encoding/Decoding	32-channel H.265/H.264 1080p@25fps video decoding, 32-channel 1080P@25fps HD video full process processing (decoding+AI analysis) 12 -channel H.265/H.264 1080p@25fps video encoding
RAM	16GB LPDDR4x
Storage	64GB eMMC, 128MB SPI Flash
Ethernet	Expandable dual 1000Mbps Ethernet via GMAC
Other interface	PCIe3.0 PHY (x4 RC+EP) , 2*I2C, 2*UART, 1*PWM, 1*SDMMC, GPIO
OS	Linux
Interface Type	BTB
Size	55mm * 59.8mm
Power	12V/3A
Power Consumption	Noraml:18W(12V/1.5A), Max:33.6W(12V/2.8A)
Environment	Operating Temperature: -20°C ~ 60°C, Storage Temperature: -20°C ~ 70°C, Storage humidity: 10% ~ 90%RH (non-condensing)

Interface description



- | | | |
|---------|-------|------|
| PCIe3.0 | SDMMC | I2C |
| PWM | UART | GPIO |

Dimension





Interface definition

Notes1:

① : Pad types: I = input, O = output, I/O = input/output (bidirectional), G= Ground ,
 P = power supply , DOWN = Internal pull down , UP = Internal pull UP L = Low Level H = High level”

PIN	iCORE-1684XQ pin definition	BM1684X Pin NO.	Pad type	IO Pull	Function for Main BOARD (SM7-SBASE-EN4)	Defual function description	IO Power domain
A1	PCIE_12V		P		PCIE_12V	Power Input: 12V +/-5%	12V
A2	PCIE_12V		P		PCIE_12V		12V
A3	PCIE_12V		P		PCIE_12V		12V
A4	PCIE_12V		P		PCIE_12V		12V
A5	PCIE_12V		P		PCIE_12V		12V
A6	PCIE_12V		P		PCIE_12V		12V
A7	PCIE_12V		P		PCIE_12V		12V
A8	GND		G		GND	GND	
A9	GND		G		GND	GND	
A10	GND		G		GND	GND	
A11	GND		G		GND	GND	
A12	B1_SYS_RST_MCU				RESET_KEY	System Reset Input, Active L	3.3V
A13	MCU_PB15		I/O		TCA6416_INT	TCA6416_INT Input, Active L	3.3V
A14	MCU_PB10/I2C2_SCL		I/O		TCA6416_SCL	TCA6416_SCL(core board pull up resistor 4.7K)	3.3V
A15	MCU_PB11/I2C2_SDA		I/O		TCA6416_SDA	TCA6416_SDA(core board pull up resistor 4.7K)	3.3V



Interface definition

A16	VDDIO33		P		PCIE_3.3V	3.3V Output (Max: 500mA)	3.3V
A17	UART1_TX/GPIO87	B29	I/O	Up	UART1_TX	UART1_TX (core board series resistance 33R)	1.8V
A18	UART1_RX/GPIO88	D30	I/O	Up	UART1_RX	UART1_RX	1.8V
A19	GND		G		GND	GND	
A20	B1_PCIE_TX0_N	BH13			NC	NC(core board series capacitance 220nF)	
A21	B1_PCIE_TX0_P	BG13			NC	NC(core board series capacitance 220nF)	
A22	GND		G		GND	GND	
A23	B1_PCIE_TX1_N	BH15			NC	NC(core board series capacitance 220nF)	
A24	B1_PCIE_TX1_P	BG15			NC	NC(core board series capacitance 220nF)	
A25	GND		G		GND	GND	
A26	B1_PCIE_TX2_N	BH17			NC	NC(core board series capacitance 220nF)	
A27	B1_PCIE_TX2_P	BG17			NC	NC(core board series capacitance 220nF)	
A28	GND		G		GND	GND	
A29	B1_PCIE_TX3_N	BH19			NC	NC(core board series capacitance 220nF)	
A30	B1_PCIE_TX3_P	BG19			NC	NC(core board series capacitance 220nF)	
A31	GND		G		GND	GND	
A32	RC_PCIE_TX3_N	BH39			NC	NC(core board series capacitance 220nF)	
A33	RC_PCIE_TX3_P	BG39			NC	NC(core board series capacitance 220nF)	



Interface definition

A34	GND		G		GND	GND	
A35	RC_PCIE_TX2_N	BH41			NC	NC(core board series capacitance 220nF)	
A36	RC_PCIE_TX2_P	BG41			NC	NC(core board series capacitance 220nF)	
A37	GND		G		GND	GND	
A38	RC_PCIE_TX1_N	BH43			RC_PCIE_TX1_N	RC_PCIE_TX1_N (core board series capacitance 220nF)	
A39	RC_PCIE_TX1_P	BG43			RC_PCIE_TX1_P	RC_PCIE_TX1_P (core board series capacitance 220nF)	
A40	GND		G		GND	GND	
A41	RC_PCIE_TX0_N	BH45			RC_PCIE_TX0_N	RC_PCIE_TX0_N (core board series capacitance 220nF)	
A42	RC_PCIE_TX0_P	BG45			RC_PCIE_TX0_P	RC_PCIE_TX0_P (core board series capacitance 220nF)	
A43	GND		G		GND	GND	
A44	PCIE_REFCLK0_P	BH29			PCIE_REFCLK0_P	PCIE_REFCLK0_P	
A45	PCIE_REFCLK0_M	BG29			PCIE_REFCLK0_N	PCIE_REFCLK0_N	
A46	GND		G		GND	GND	
A47	PCIE_REFCLK1_M	BJ36			PCIE_REFCLK1_N	PCIE_REFCLK1_N	
A48	PCIE_REFCLK1_P	BK36			PCIE_REFCLK1_P	PCIE_REFCLK1_P	
A49	GND		G		GND	GND	
A50	SDIO_DAT2	BJ8	I/O		SDIO_DAT2	SDIO_DAT2	3.3V



Interface definition

A51	SDIO_DAT0	BH8	I/O		SDIO_DAT0	SDIO_DAT0	3.3V
A52	SDIO_DAT3	BJ7	I/O		SDIO_DAT3	SDIO_DAT3	3.3V
A53	SDIO_DAT1	BK8	I/O		SDIO_DAT1	SDIO_DAT1	3.3V
A54	SDIO_CD_X	BG6	I/O	Up	SDIO_CD_X	TF Card Det Input ,Active L	1.8V
A55	SDIO_PWR_EN/GPIO42	BH6	I/O	N.A	SDIO_PWR_EN	SDIO_Power_EN Output, Active H	3.3V
A56	SDIO_CMD	BK7	I/O		SDIO_CMD	SDIO_CMD	3.3V
A57	SDIO_CLK	BG8	I/O		SDIO_CLK	SDIO_CLK	3.3V
A58	PWM0/GPIO75	A44	I/O		FAN_PWM	FAN_PWM (PWM0 Output)	1.8V
A59	FAN0/GPIO77	A45	I/O		FAN_TACH	FAN_TACH Input, Active L	1.8V
A60	GND		G		GND	GND	
A61	RGMI11_IRQ/GPIO72	D17	I/O	Down	RGMI11_IRQ	RGMI11_INT Input, Active L	1.8V
A62	RGMI11_RXD0	A14	I/O		RGMI11_RXD0	RGMI11_RXD0	1.8V
A63	RGMI11_RXD2	A15	I/O		RGMI11_RXD2	RGMI11_RXD2	1.8V
A64	GND		G		GND	GND	
A65	RGMI11_TXC	C17	I/O		RGMI11_TXCLK	RGMI11_TXCLK	1.8V
A66	RGMI11_TXCTRL	E18	I/O		RGMI11_TXCTRL	RGMI11_TXCTRL	1.8V
A67	RGMI11_TXD1	B17	I/O		RGMI11_TXD1	RGMI11_TXD1	1.8V
A68	RGMI11_TXD0	B18	I/O		RGMI11_TXD0	RGMI11_TXD0	1.8V



Interface definition

A69	RGMI11_TXD2	A17	I/O		RGMI11_TXD2	RGMI11_TXD2	1.8V
A70	RGMI11_TXD3	C18	I/O		RGMI11_TXD3	RGMI11_TXD3	1.8V
A71	RGMI11_MDIO	E17	I/O		RGMI11_MDIO	RGMI11_MDIO	1.8V
A72	RGMI11_MDC	D15	I/O		RGMI11_MDC	RGMI11_MDC	1.8V
PIN	iCORE-1684XQ pin definition	BM1684X Pin NO.	Pad type	IO Pull	Function for Main BOARD (SM7-SBASE-EN4)	Defual function description	IO Power domain
B1	PCIE_12V		P		PCIE_12V	Power Input: 12V +/-5%	12V
B2	PCIE_12V		P		PCIE_12V		12V
B3	PCIE_12V		P		PCIE_12V		12V
B4	PCIE_12V		P		PCIE_12V		12V
B5	PCIE_12V		P		PCIE_12V		12V
B6	PCIE_12V		P		PCIE_12V		12V
B7	GND		G		GND	GND	
B8	GND		G		GND	GND	
B9	GND		G		GND	GND	
B10	GND		G		GND	GND	
B11	RGMI10_RXCTRL	D23	I/O		RGMI10_RXCTRL	RGMI10_RXDV_CRS	1.8V
B12	RGMI10_RXD0	C23	I/O		RGMI10_RXD0	RGMI10_RXD0	1.8V
B13	RGMI10_IRQ/GPIO56	A18	I/O	Down	RGMI10_IRQ	RGMI10_INT Input, Active L	1.8V



Interface definition

B14	RGMII0_RXC	C21	I/O		RGMII0_RXC	RGMII0_RXCLK	1.8V
B15	RGMII0_RXD2	B23	I/O		RGMII0_RXD2	RGMII0_RXD2	1.8V
B16	RGMII0_RXD1	A23	I/O		RGMII0_RXD1	RGMII0_RXD1	1.8V
B17	RGMII0_RXD3	B21	I/O		RGMII0_RXD3	RGMII0_RXD3	1.8V
B18	GND		G		GND	GND	
B19	RGMII0_TXC	A20	I/O		RGMII0_TXC	RGMII0_TXCLK	1.8V
B20	RGMII0_TXD0	D20	I/O		RGMII0_TXD0	RGMII0_TXD0	1.8V
B21	RGMII0_TXCTRL	B20	I/O		RGMII0_TXCTRL	RGMII0_TXCTRL	1.8V
B22	RGMII0_TXD2	C20	I/O		RGMII0_TXD2	RGMII0_TXD2	1.8V
B23	RGMII0_TXD1	A21	I/O		RGMII0_TXD1	RGMII0_TXD1	1.8V
B24	RGMII0_TXD3	D21	I/O		RGMII0_TXD3	RGMII0_TXD3	1.8V
B25	RGMII0_MDIO	E20	I/O		RGMII0_MDIO	RGMII0_MDIO	1.8V
B26	RGMII0_MDC	E23	I/O		RGMII0_MDC	RGMII0_MDC	1.8V
B27	RGMII0_RST/GPIO76	B44	I/O	Down	PHY_RST0	RGMII0_Reset Output,Active L	1.8V
B28	GND		G		GND	GND	
B29	B1_PCIE_RX0_N	BK12			NC	NC	
B30	B1_PCIE_RX0_P	BJ12			NC	NC	
B31	GND		G		GND	GND	



Interface definition

B32	B1_PCIE_RX1_N	BK14			NC	NC	
B33	B1_PCIE_RX1_P	BJ14			NC	NC	
B34	GND		G		GND	GND	
B35	B1_PCIE_RX2_N	BK16			NC	NC	
B36	B1_PCIE_RX2_P	BJ16			NC	NC	
B37	GND		G		GND	GND	
B38	B1_PCIE_RX3_N	BK18			NC	NC	
B39	B1_PCIE_RX3_P	BJ18			NC	NC	
B40	GND		G		GND	GND	
B41	RC_PCIE_RX3_P	BJ38			NC	NC	
B42	RC_PCIE_RX3_N	BK38			NC	NC	
B43	GND		G		GND	GND	
B44	RC_PCIE_RX2_P	BJ40			NC	NC	
B45	RC_PCIE_RX2_N	BK40			NC	NC	
B46	GND		G		GND	GND	
B47	RC_PCIE_RX1_P	BJ42			RC_PCIE_RX1_P	RC_PCIE_RX1_P	
B48	RC_PCIE_RX1_N	BK42			RC_PCIE_RX1_N	RC_PCIE_RX1_N	
B49	GND		G		GND	GND	



Interface definition

B50	RC_PCIE_RX0_P	BJ44			RC_PCIE_RX0_P	RC_PCIE_RX0_P	
B51	RC_PCIE_RX0_N	BK44			RC_PCIE_RX0_N	RC_PCIE_RX0_N	
B52	GND		G		GND	GND	
B53	UART2_TX/GPIO89	C30	I/O	Up	UART2_TX	UART2_TX (core board series resistance 33R)	1.8V
B54	UART2_RX/GPIO90	E30	I/O	Up	UART2_RX	UART2_RX	1.8V
B55	I2C2_SCL/GPIO84	E41	I/O		I2C2_SCL	I2C2_SCL	1.8V
B56	I2C2_SDA/GPIO83	D41	I/O		I2C2_SDA	I2C2_SDA	1.8V
B57	PCIEE_RST_X	C26			PCIEE_RST_X	PCIEE_RST_X	3.3V
B58	PCIER_RST_X	C24			PCIER_RST_X	PCIER_Reset Output Active L (core board pull up resistance 4.7K)	3.3V
B59	GPIO7/IIC_ADDR2	B26	I/O		GPIO7	GPIO7	1.8V
B60	GND		G		GND	GND	
B61	RGMI11_RST/GPIO31	C27	I/O		RGMI11_RST	RGMI11_Reset Output, Active L	1.8V
B62	RGMI11_RXCTRL	B15	I/O		RGMI11_RXCTRL	RGMI11_RXCTRL	1.8V
B63	RGMI11_RXC	B14	I/O		RGMI11_RXC	RGMI11_RXC	1.8V
B64	RGMI11_RXD1	C15	I/O		RGMI11_RXD1	RGMI11_RXD1	1.8V
B65	RGMI11_RXD3	C14	I/O		RGMI11_RXD3	RGMI11_RXD3	1.8V
B66	GND		G		GND	GND	
B67	GPIO30/DBG_IIC_SDA	A36	I/O	N.A	GPIO30	GPIO30	1.8V



Interface definition

B68	GPIO29/DBG_IIC_SCL	D9	I/O	N.A	GPIO29	GPIO29	1.8V
B69	GPIO5/IIC_ADDR0	A26	I/O		GPIO5	GPIO5	1.8V
B70	GPIO6/IIC_ADDR1	B27	I/O		GPIO6	GPIO6	1.8V
B71	UART0_RX/GPIO86	C29	I/O	Up	UART0_RX	UART0_RX (System Debug)	1.8V
B72	UART0_TX/GPIO85	D29	I/O	Up	UART0_TX	UART0_TX (System Debug)	1.8V



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