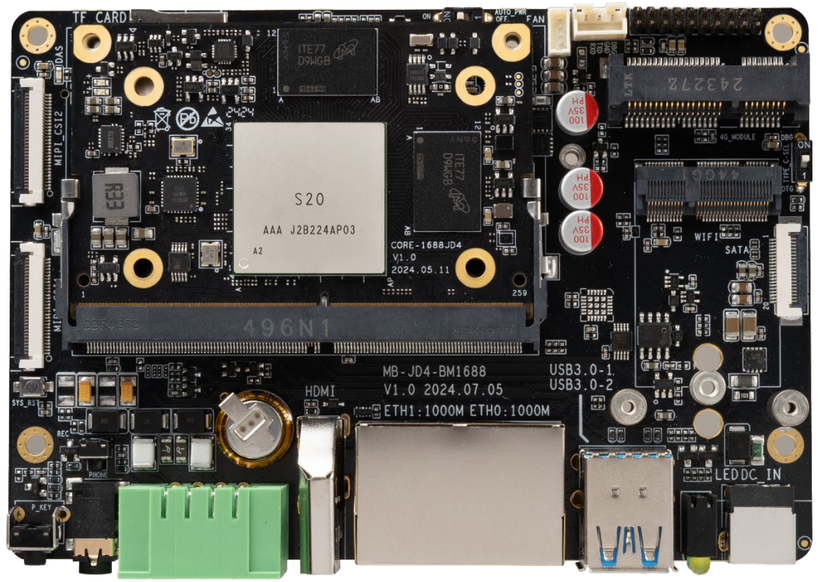
AIO-1688JD4

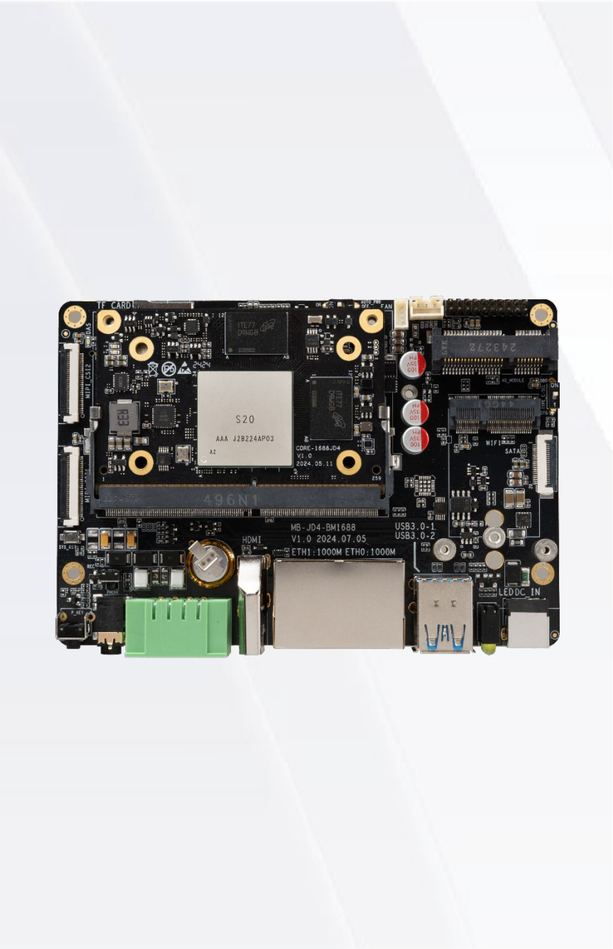
16T Computing power AI Mainboard



V1.0 2025-12-10

FIREFLY TECHNOLOGY

Product features



Computing power up to 16TOPS

Adopt SOPHON AI processor BM1688
32T@INT4 peak computing power, 16T@INT8 peak computing power, 4T@FP16/BF16 computing power, and 0.5T@FP32 computing power.

AI processing performance for multi-channel video

It supports 16 channels of H.265/H.264 1080P@30fps video decoding and 10 channels of H.265/H.264 1080P@30fps video encoding,1080P@480fps JPEG codec.

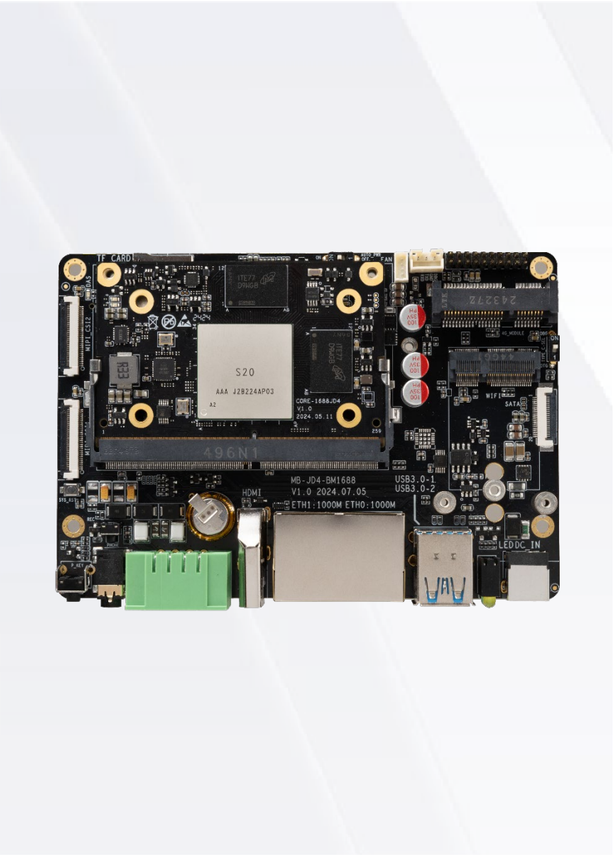
Powerful ISP image processing performance

It supports 6-channel sensor input video, and supports image processing functions such as wide dynamic range, shadow correction, lens distortion correction, purple edge correction, Bayer noise reduction, 3D noise reduction, 3A, dehaze, dynamic contrast enhancement, etc.

The private deployment of large language models

Support the private deployment of ultra-large-scale parameter models under the Transformer architecture, including large language models such as Gemma-2B, LlaMa2-7B, Qwen1.5-1.8B, ChatGLM3-6B. Support Docker container management technology.

Product features



Multiple deep learning frameworks

Support traditional network architectures such as CNN, RNN, and LSTM;
a variety of deep learning frameworks, including TensorFlow, Pytorch, PaddlePaddle, Caffe and ONNX, as well as custom operator development.

Abundant expansion interfaces

It has MIPI-CSI, MIPI-DSI, HDMI2.0, PCIe3.0, SATA3.0, USB3.0, USB2.0, SDIO, I2C, I2S, SPI, UART, CAN, PWM, ADC, GPIO and other expansion interfaces.

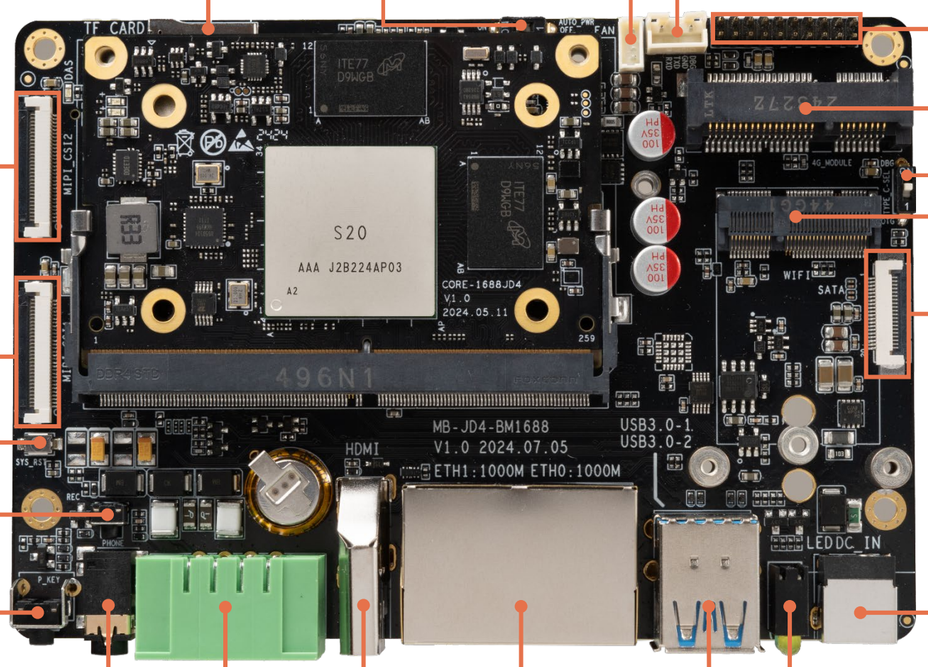
Wide range of application scenarios

Efficiently adapts to all AI algorithms on the market, and is widely used in: intelligent computing servers, edge intelligent computing boxes, industrial computers, professional intelligent network cameras, AIOT and other types of products, empowering AI for various industries.

Specifications

Specification		
Basic Specifications	SOC	SOPHON BM1688
	CPU	Octa-core 64-bit ARM Cortex-A53 @ 1.6GHz
	TPU	Built-in SOPHGO neural network acceleration engine TPU, 32T@INT4 peak computing power, 16T@INT8 peak computing power, 4T@FP16/BF16 computing power, 0.5T@FP32 computing power
	ISP	Time-sharing multiplexing for up to 6 sensor input videos, with maximum widths of 4608 (non-tile mode) and 8192 (tile mode) Supports Sensor self-band dynamic and 2-frame wide dynamic range, and the maximum performance supports: 12M@30 HDR or 8K@15 SDR or 16M@30 SDR Support RGB-IR, AI ISP interface, 3A (AE/AWB/AF, 3A control user adjustable) Support fixed mode noise removal, dead pixel correction, shadow correction, lens distortion correction, purple edge correction, Bayer noise reduction, 3D denoising, image edge enhancement, dehazing, dynamic contrast enhancement, image video Mirror, Flip and other functions
	VPU	Video decoding: H.265/H.264 decoding (maximum performance: 1920×1080@480fps or 8192×4320@30fps) Video encoding: H.265/H.264 encoding (maximum performance: 1920×1080@300fps or 8192×4320@15fps) Image codec: Support JPEG/MJPEG Baseline codec (JPEG codec: 1080P@480fps, maximum resolution 32768×32768)
	RAM	8GB LPDDR4 (4GB/8GB/16GB optional)
	Storage	32GB eMMC (32GB/64GB/128GB/256GB optional)
	Expand storage	1 × TF Card, 1 × SATA3.0 (expandable SATA3.0 SSD), 1 × M.2 (expandable SATA3.0/PCIe NVMe SSD, support 2242/2260/2280)
	OS	Linux OS (Ubuntu)
	Software Support	· The private deployment of ultra-large-scale parameter models under the Transformer architecture, including large language models such as Gemma-2B, LlaMa2-7B, ChatGLM3-6B, Qwen1.5-1.8B. · Traditional network architectures such as CNN, RNN, and LSTM; a variety of deep learning frameworks, including TensorFlow, Pytorch, PaddlePaddle, Caffe and ONNX, as well as custom operator development · Docker container management technology
	Power	DC 12V (5.5mm × 2.1mm, support 9V~24V wide voltage input)
	Power consumption	Normal: 8.4W (12V/700mA), Max: 30W (12V/2500mA)
	Size	122.89mm × 85.04mm × 22.7mm
	Weight	≈120g
	Environment	Operating Temperature: -20℃ ~ 60℃ , Storage temperature: -20℃~70℃, Storage Humidity: 10% ~ 90%RH(non-condensing)
Interface Specifications	Internet	Ethernet: 2 × RJ45 (1000Mbps) WiFi: Extend WiFi/Bluetooth module via M.2 E-KEY (2230) , supports 2.4GHz/5GHz dual band WiFi 6 (802.11a/b/g/n/ac/ax) and Bluetooth 5.2 4G: Extend 4G LTE via Mini PCIe (Reused with 5G) 5G: Extend 5G via M.2 B-KEY (Reused with 4G and USB3.0(1), not populated by default)
	Video input	3 × MIPI CSI DPHY (1×4lanes or 2×2lanes, 30Pin-0.5mm)
	Video output	1 × HDMI2.0 (4K@60fps) 1 × MIPI DSI DPHY (1×4lanes, 30Pin-0.5mm)
	Audio output	1 × 3.5mm Audio jack (support MIC recording, American standard CTIA)
	SATA	1 × SATA3.0 (expandable SATA3.0 SSD)
	USB	2 × USB3.0 (Max: 1A; UP: USB3.0(1), reused with 5G; DOWN: USB3.0(2))
	Other interfaces	1 × Type-C (USB2.0/DEBUG), 1 × FAN (4Pin-1.25mm), 1 × SIM Card 1 × Double-row pin headers (2×10Pin-2.0mm): USB2.0, SPI, 2×I2C, Line in, Line out, GPIO 1 × Phoenix connector (2×4Pin-3.5mm): 1 × RS485, 1 × RS232, 1 × CAN 2.0

Interface description



Auto Power-on DIP Switch
(ON: Power on immediately after inserting power;
1: Power on by short-pressing the Power button after inserting power)

TF Card

FAN (4Pin-1.25mm)

Debug (3Pin-2.0mm)

Double-row pin headers
(2×10-20PIN-2.0mm)

Mini PCIe
(4G/3G)

Type-C function selection
(ON: Debug; 1: Flash/OTG)

M.2 E-KEY
(Extended WiFi/Bluetooth Module)

SATA
SATA SSD

MIPI CSI DPHY
(1×4lanes/2×2lanes, 30Pin-0.5mm)

MIPI CSI DPHY
(1×4lanes/2×2lanes, 30Pin-0.5mm)

Reset

Recovery

Power button

DC 12V
(5.5mm×2.1mm, support 9V~24V wide voltage input)

3.5mm Audio jack
(Support Mic recording)

Phoenix connector
(2×4Pin, 3.5mm Pitch)

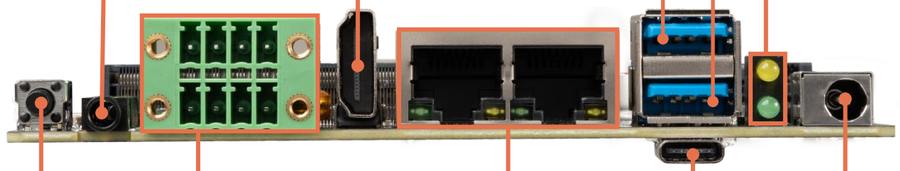
HDMI2.0
(4K@60fps)

2×Gigabit Ethernet
(RJ45/1000Mbps)

2×USB3.0

Work indicator

Interface description



3.5mm Audio jack
(Support Mic recording, CTIA)

HDMI2.0
(4K@60fps)

USB3.0(1)
(Multiplexing with 5G)

USB3.0(2)
(Max: 1A)

Work indicator

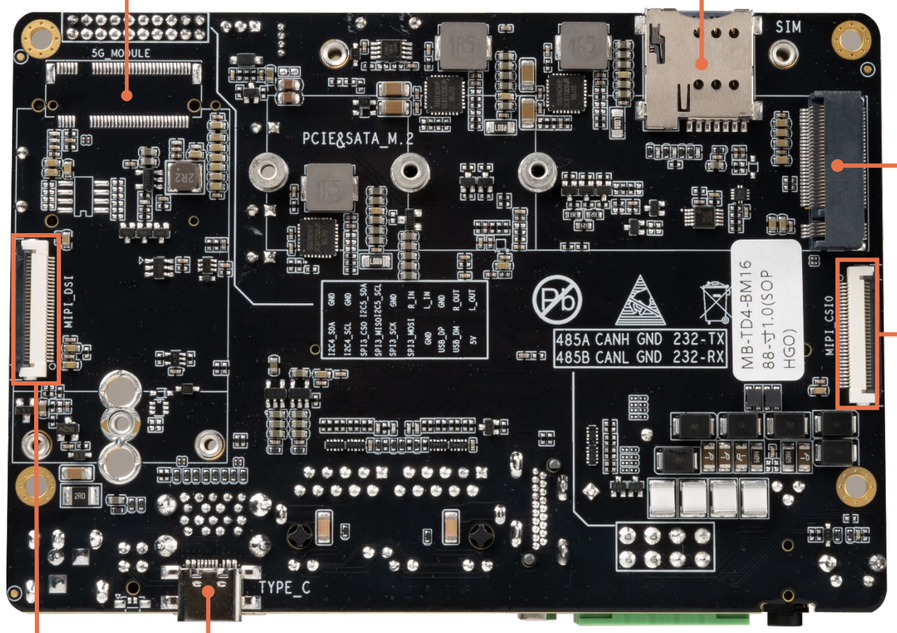
Power button

2×Gigabit Ethernet
(RJ45/1000Mbps)

Type-C
(USB2.0/DEBUG)

DC 12V
(5.5mm×2.1mm, support 9V~24V wide voltage input)

Phoenix connector(2×4Pin, 3.5mm Pitch)
232-TX GND CANH 485A
232-RX GND CANL 485B



M.2 B-KEY
(Expand 5G, not populated by default, reused with 4G and USB3.0(1))

SIM Card

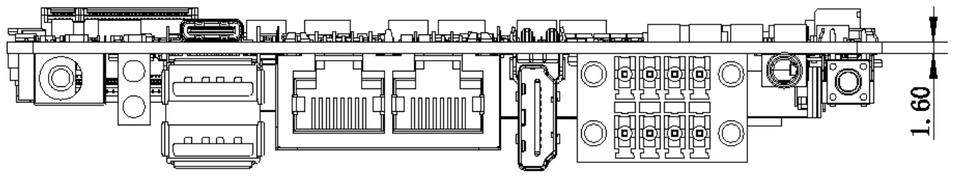
M.2
(SATA3.0/PCIe NVMe SSD 2242/2260/2280)

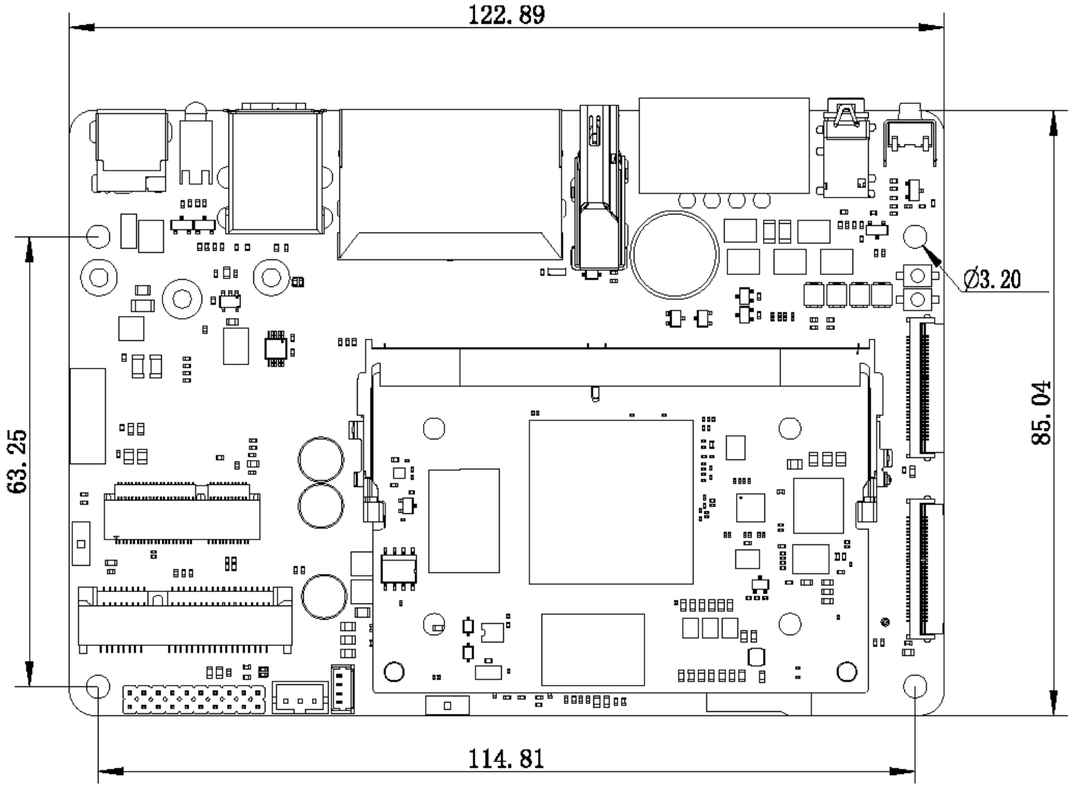
MIPI CSI DPHY
(1×4lanes/2×2lanes, 30Pin-0.5mm)

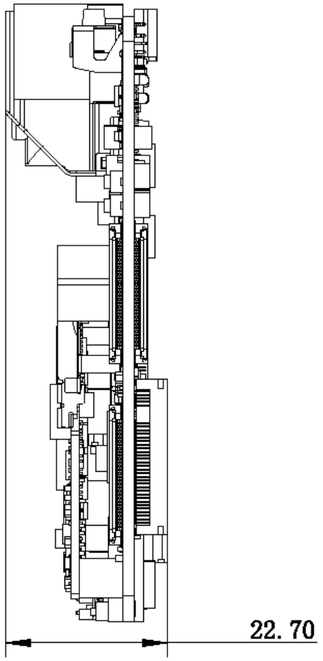
MIPI DSI DPHY
(1×4lanes, 30Pin-0.5mm)

Type-C
(USB2.0/DEBUG)

Dimension

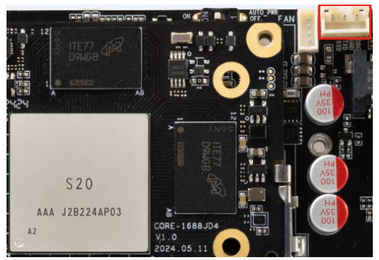






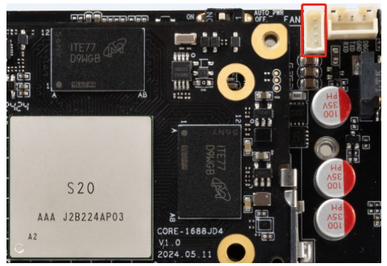
Interface definition

1. (J19) DEBUG: 3 PIN 2.0mm pitch wafer



NO.	Definition	Power/V	NO.	Definition	Power/V
1	UART0_RXD	3.3	3	GND	
2	UART0_TXD	3.3			

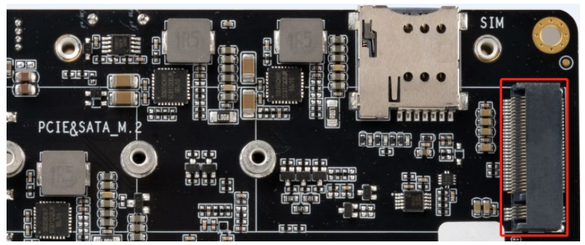
2. (J6)FAN: 4PIN 1.25mm pitch wafer



NO.	Definition	Power/V	NO.	Definition	Power/V
1	GND		2	FAN+ (5V Output)	5
3	FG Input 【PWR_GPIO1】	3.3	4	PWM11 Output 【GPIO114】	3.3

Interface definition

3. (U4)M.2 PCIE/SATA M-KEY



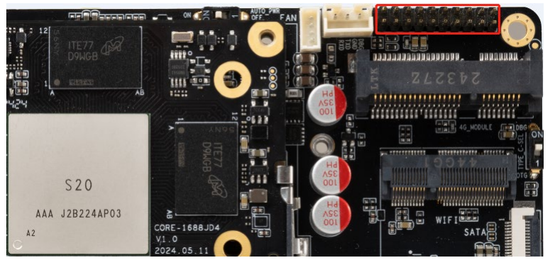
NO.	Definition	Power/V	NO.	Definition	Power/V
1	GND		2	VCC3V3_PCIE (3.3V Output)	3.3
3	GND		4	VCC3V3_PCIE (3.3V Output)	3.3
5	NC		6	NC	
7	NC		8	NC	
9	GND		10	DAS/DSS [pull up resistor10K]	3.3
11	NC		12	VCC3V3_PCIE (3.3V Output)	3.3
13	NC		14	VCC3V3_PCIE (3.3V Output)	3.3
15	NC		16	VCC3V3_PCIE (3.3V Output)	3.3
17	NC		18	VCC3V3_PCIE (3.3V Output)	3.3
19	NC		20	NC	
21	GND		22	NC	
23	NC		24	NC	
25	NC		26	NC	
27	GND		28	NC	

Interface definition

29	NC		30	NC	
31	NC		32	NC	
33	GND		34	NC	
35	NC		36	NC	
37	NC		38	DEVSLP [pull up resistor10K]	3.3
39	GND		40	NC	
41	PCIE0_RX0_P / SATA_RX0_P	-	42	NC	
43	PCIE0_RX0_N / SATA_RX0_N	-	44	NC	
45	GND		46	NC	
47	PCIE0_TX0_N / SATA_TX0_N (Series capacitor 100nF)	-	48	NC	
49	PCIE0_TX0_P / SATA_TX0_P (Series capacitor 100nF)	-	50	PCIE0_RST* (GPIO40)	3.3
51	GND		52	PCIE0_CLKREQ* (GPIO42)	3.3
53	PCIE0_EP_CLK_N	-	54	PCIE_WAKE*(GPIO41)	3.3
55	PCIE0_EP_CLK_P	-	56	NC	
57	GND		58	NC	
67	NC		68	NC	
69	GND		70	VCC3V3_PCIE (3.3V Output)	3.3
71	GND		72	VCC3V3_PCIE (3.3V Output)	3.3
73	GND		74	VCC3V3_PCIE (3.3V Output)	3.3
75	GND				

Interface definition

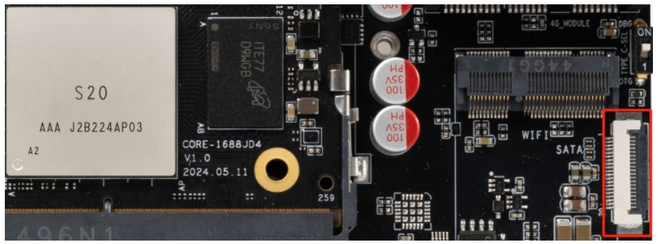
4. (J15) Double-row pin headers Extension Interface 2*10PIN



NO.	Definition	Power/V	NO.	Definition	Power/V
1	VCC5V0_SYS (5.0V OUTPUT)	5.0 (MAX:500mA)	2	Left output 2 (40mW from ES8388)	3.3
3	USB_HOST0_DM	-	4	Right output 2 (40mW from ES8388)	3.3
5	USB_HOST0_DP	-	6	GND	
7	GND		8	Right channel input 1 (to ES8388)	3.3
9	SPI3_SDO (IIC5_SDA / KEY_ROW2 / GPIO103 / UART6_TX)	1.8	10	Left channel input 1 (to ES8388)	3.3
11	SPI3_SCK (IIC5_SCL / KEY_ROW3 / GPIO104 / UART6_RX)	1.8	12	GND	
13	SPI3_SDI (IIC4_SCL / KEY_ROW1 / GPIO102 / UART5_RX)	1.8	14	I2C5_SCL (PWM18 / GPIO65 / UART7_TX) (Pull-up resistor 4.7K)	3.3
15	SPI3_CS0 (IIC4_SDA / KEY_ROW0 / GPIO101 / UART5_TX)	1.8	16	I2C5_SDA (PWM17 / GPIO64) (Pull-up resistor 4.7K)	3.3
17	I2C4_SCL (PWM16 / GPIO63) (Pull-up resistor 4.7K)	3.3	18	GND	
19	I2C4_SDA (PWM15 / GPIO62) (Pull-up resistor 4.7K)	3.3	20	GND	

Interface definition

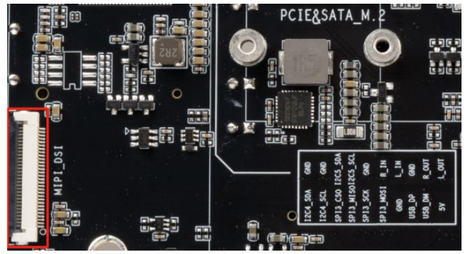
5. (J12)SATA 20pin 0.5mm pitch



NO.	Definition	Power/V	NO.	Definition	Power/V
1	GND		11	VCC5V0_SYS (5.0V OUTPUT)	5.0
2	SATA_TX1_P (Series capacitor 10nF)	-	12	VCC5V0_SYS (5.0V OUTPUT)	5.0
3	SATA_TX1_N (Series capacitor 10nF)	-	13	VCC5V0_SYS (5.0V OUTPUT)	5.0
4	GND		14	VCC5V0_SYS (5.0V OUTPUT)	5.0
5	SATA_RX1_N (Series capacitor 10nF)	-	15	GND	
6	SATA_RX1_P (Series capacitor 10nF)	-	16	GND	
7	GND		17	GND	
8	SATA_LED (GPIO112)	3.3	18	VSYS_12V (12.0V OUTPUT)	12.0
9	GND		19	VSYS_12V (12.0V OUTPUT)	12.0
10	GND		20	VSYS_12V (12.0V OUTPUT)	12.0

Interface definition

6. (J11) MIPI DSI 30PIN 0.5mm pitch

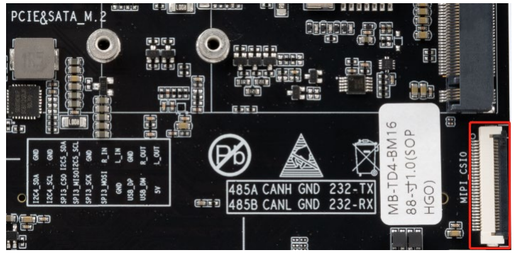


NO.	Definition	Power/V	NO.	Definition	Power/V
1	VCC5V0_SYS (5.0V OUTPUT)	5.0	16	DSI_D0_P	-
2	VCC5V0_SYS (5.0V OUTPUT)	5.0	17	DSI_D0_N	-
3	VCC5V0_SYS (5.0V OUTPUT)	5.0	18	GND	
4	GND		19	DSI_D1_P	-
5	NC		20	DSI_D1_N	-
6	VCC3V3_SYS (3.3V OUTPUT)	3.3	21	GND	
7	I2C4_SDA【GPIO62】 Pull-up resistor 10K	3.3	22	DSI_CLK_P	-
8	I2C4_SCL 【GPIO63】 Pull-up resistor 10K	3.3	23	DSI_CLK_N	-
9	LCD_EN【Extended IO】	3.3	24	GND	
10	TP_INT【GPIO75】	3.3	25	DSI_D2_P	-
11	BL_EN【GPIO68】	3.3	26	DSI_D2_N	-
12	BL_PWM1【GPIO76】	3.3	27	GND	
13	LCD_RESET【Extended IO】	3.3	28	DSI_D3_P	-

Interface definition

14	TP_RESET【Extended IO】	3.3	29	DSI_D3_N	-
15	GND		30	GND	

7. (J7) MIPI CSI0 30PIN 0.5mm pitch



NO.	Definition	Power/V	NO.	Definition	Power/V
1	I2C0_SDA 【GPIO184】 Pull-up resistor 10K (switch: GPIO80->H)	1.8	16	GND	
2	I2C0_SCL 【GPIO128】 Pull-up resistor 10K (switch: GPIO80->H)	1.8	17	CSI0_CLK_P	-
3	CAM0_PWDN【GPIO69】	1.8	18	CSI0_CLK_N	-
4	CAM0_RESET_H【Extended IO】	1.8	19	GND	
5	GND		20	CSI1_D0_P	-
6	CAM0_MCLK【GPIO46】	1.8	21	CSI1_D0_N	-
7	CAM3_PWDN 【PWR_GPIO4】	1.8	22	GND	
8	CAM0_RESET_H【Extended IO】	1.8	23	CSI1_D1_P	-
9	CAM0_MCLK【GPIO46】	1.8	24	CSI1_D1_N	-
10	GND		25	GND	

Interface definition

11	CSI0_D0_P	-	26	CSI1_CLK_P	-
12	CSI0_D0_N	-	27	CSI1_CLK_N	-
13	GND		28	GND	
14	CSI0_D1_P	-	29	VCC5V0_SYS (5.0V OUTPUT)	5.0
15	CSI0_D1_N	-	30	VCC5V0_SYS (5.0V OUTPUT)	5.0

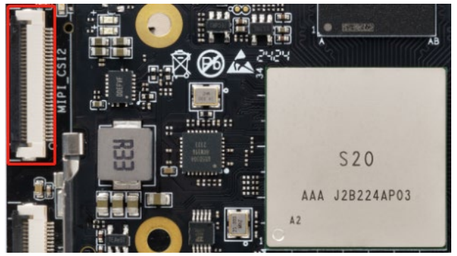
8. (J13) MIPI CSI1 30PIN 0.5mm pitch

NO.	Definition	Power/V	NO.	Definition	Power/V
1	I2C0_SDA 【GPIO184】 Pull-up resistor 10K (switch: GPIO80->L)	1.8	16	GND	
2	I2C0_SCL 【GPIO128】 Pull-up resistor 10K (switch: GPIO80->L)	1.8	17	CSI2_CLK_P	-
3	CAM1_PWDN【GPIO70】	1.8	18	CSI2_CLK_N	-
4	CAM1_RESET_H【Extended IO】	1.8	19	GND	
5	GND		20	CSI3_D0_P	-
6	CAM1_MCLK【GPIO47】	1.8	21	CSI3_D0_N	-
7	CAM4_PWDN 【PWR_GPIO4】	1.8	22	GND	

Interface definition

8	CAM1_RESET_H【Extended IO】	1.8	23	CSI3_D1_P	-
9	CAM1_MCLK【GPIO47】	1.8	24	CSI3_D1_N	-
10	GND		25	GND	
11	CSI2_D0_P	-	26	CSI3_CLK_P	-
12	CSI2_D0_N	-	27	CSI3_CLK_N	-
13	GND		28	GND	
14	CSI2_D1_P	-	29	VCC5V0_SYS (5.0V OUTPUT)	5.0
15	CSI2_D1_N	-	30	VCC5V0_SYS (5.0V OUTPUT)	5.0

9. (J16) MIPI CSI2 30PIN 0.5mm pitch



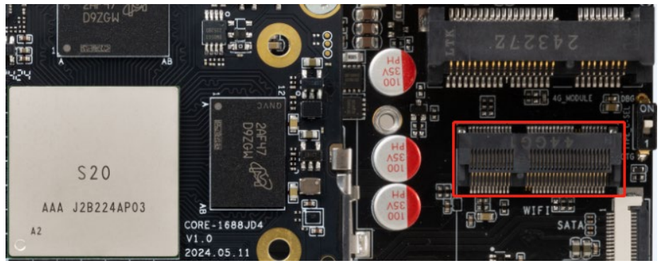
NO.	Definition	Power/V	NO.	Definition	Power/V
1	I2C4_SDA【GPIO62】 Pull-up resistor 10K	1.8	16	GND	
2	I2C4_SCL 【GPIO63】 Pull-up resistor 10K	1.8	17	CSI4_CLK_P	-
3	CAM2_PWDN【GPIO51】	1.8	18	CSI4_CLK_N	-
4	CAM2_RESET_H【Extended IO】	1.8	19	GND	

Interface definition

5	GND		20	CSI5_D0_P	-
6	CAM2_MCLK【GPIO50】	1.8	21	CSI5_D0_N	-
7	CAM5_PWDN【GPIO177】	1.8	22	GND	
8	CAM2_RESET_H【Extended IO】	1.8	23	CSI5_D1_P	-
9	CAM2_MCLK【GPIO50】	1.8	24	CSI5_D1_N	-
10	GND		25	GND	
11	CSI4_D0_P	-	26	CSI5_CLK_P	-
12	CSI4_D0_N	-	27	CSI5_CLK_N	-
13	GND		28	GND	
14	CSI4_D1_P	-	29	VCC5V0_SYS (5.0V OUTPUT)	5.0
15	CSI4_D1_N	-	30	VCC5V0_SYS (5.0V OUTPUT)	5.0

Interface definition

10. (U16) M.2 Module E-KEY



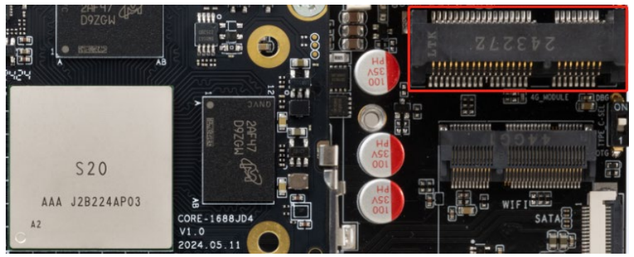
NO.	Definition	Power/V	NO.	Definition	Power/V
1	GND		2	WIFI_3V3 (3.3V Output)	3.3
3	HUB_HOST20_DP3	-	4	WIFI_3V3 (3.3V Output)	3.3
5	HUB_HOST20_DM3	-	6	NC	
7	GND		8	NC	
9	NC		10	NC	
11	NC		12	NC	
13	NC		14	NC	
15	NC		16	NC	
17	NC		18	GND	
19	NC		20	BT_M2_WAKE_AP (PWR_GPIO2)	3.3
21	NC		22	NC	
23	NC		32	NC	
33	GND		34	NC	
35	PCIE1_TX0_P(Series capacitor 100nF)	-	36	NC	

Interface definition

37	PCIE1_TX0_N(Series capacitor 100nF)	-	38	AP_M2_WAKE_BT(Extended IO)	3.3
39	GND		40	NC	
41	PCIE1_RX0_P	-	42	NC	
43	PCIE1_RX0_N	-	44	NC	
45	GND		46	NC	
47	PCIE1_EP_CLK_P	-	48	NC	
49	PCIE1_EP_CLK_N	-	50	32KOUT_WIFI (GPIO176)	3.3
51	GND		52	PCIE1_RST* (GPIO43)	3.3
53	PCIE1_CLKREQ* (GPIO45)		54	BT_DISABLE_L (GPIO61)	3.3
55	PCIE_WAKE* (GPIO41)		56	WIFI_DISABLE_L (GPIO79)	3.3
57	GND		58	NC	
59	NC		60	NC	
61	NC		62	NC	
63	GND		64	NC	
65	NC		66	NC	
67	NC		68	NC	
69	GND		70	NC	
71	NC		72	WIFI_3V3 (3.3V Output)	3.3
73	NC		74	WIFI_3V3 (3.3V Output)	3.3
75	GND				

Interface definition

11. (U21)MINI PCIe 4G



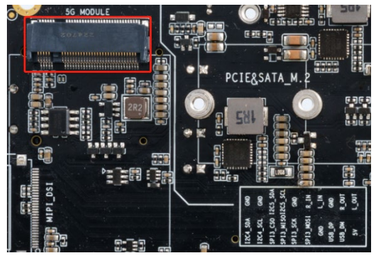
NO.	Definition	Power/V	NO.	Definition	Power/V
1	NC		2	VCC3V8_4G (3.8V Output)	3.8
3	NC		4	GND	
5	NC		6	NC	
7	NC		8	UIM_PWR	1.8
9	GND		10	UIM_DAT	1.8
11	NC		12	UIM_CLK	1.8
13	NC		14	UIM_RST	1.8
15	GND		16	NC	
17	NC		18	GND	
19	NC		20	NC	
21	GND		22	4G_RESET	3.8
23	NC		24	NC	
25	NC		26	GND	
27	GND		28	NC	

Interface definition

29	GND		30	NC	
31	NC		32	NC	
33	NC		34	GND	
35	GND		36	4G_HOST20_DM3	-
37	GND		38	4G_HOST20_DP3	-
39	VCC3V8_4G (3.8V Output)	3.8	40	GND	
41	VCC3V8_4G (3.8V Output)	3.8	42	NC	
43	GND		44	SIM_DET	1.8
45	NC		46	NC	
47	NC		48	NC	
49	GND		50	GND	
51	NC		52	VCC3V8_4G (3.8V Output)	3.8

Interface definition

12. (U26) 5G NGFF-M.2-B-KEY **(Defult:NC)**



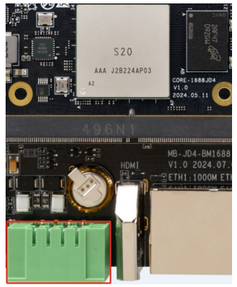
NO.	Definition	Power/V	NO.	Definition	Power/V
1	NC		2	VCC3V8_4G (3.5V Output)	3.5
3	GND		4	VCC3V8_4G (3.5V Output)	3.5
5	GND		6	FUL_CARD_POWER_OFF#	3.5
7	5G_HOST20_DP3	-	8	NC	
9	5G_HOST20_DM3	-	10	NC	
11	GND		20	NC	
21	NC		22	NC	
23	NC		24	NC	
25	NC		26	NC	
27	GND		28	NC	
29	5G_USB30_RX_N	-	30	UIM_RST	1.8
31	5G_USB30_RX_P	-	32	UIM_CLK	1.8
33	GND		34	UIM_DAT	1.8
35	5G_USB30_TX_N (Series capacitor 100nF)	-	36	UIM_PWR	1.8
37	5G_USB30_TX_P (Series capacitor 100nF)	-	38	NC	

Interface definition

39	GND		40	NC	
41	NC		42	NC	
43	NC		44	NC	
45	GND		46	NC	
47	NC		48	NC	
49	NC		50	NC	
51	GND		52	NC	
53	NC		54	NC	
55	NC		56	NC	
57	GND		58	NC	
59	NC		60	NC	
61	NC		62	NC	
63	GND		64	NC	
65	NC		66	SIM_DET	1.8
67	4G_RESET	3.5	68	NC	
69	NC		70	VCC3V8_4G (3.5V Output)	3.5
71	GND		72	VCC3V8_4G (3.5V Output)	3.5
73	GND		74	VCC3V8_4G (3.5V Output)	3.5
75	NC				

Interface definition

13. (J3)RS485/RS232/CAN 2*4PIN 3.5mm pitch seat（GREEN）



NO.	Definition	Power/V	NO.	Definition	Power/V
1	RS485_A		2	RS485_B	5.0
3	CAN_H	-	4	CAN_L	-
5	GND		6	GND	
7	RS232_TX (from UART6)	-	8	RS232_RX (from UART6)	-

FIREFLY TECHNOLOGY

Contact Us

(+86)18688117175

E-mail

global@t-firefly.com

Website

www.t-firefly.com

Address

Room 2101, Hongyu Building, #57 Zhongshan 4Rd, East District, Zhongshan, Guangdong, China.