

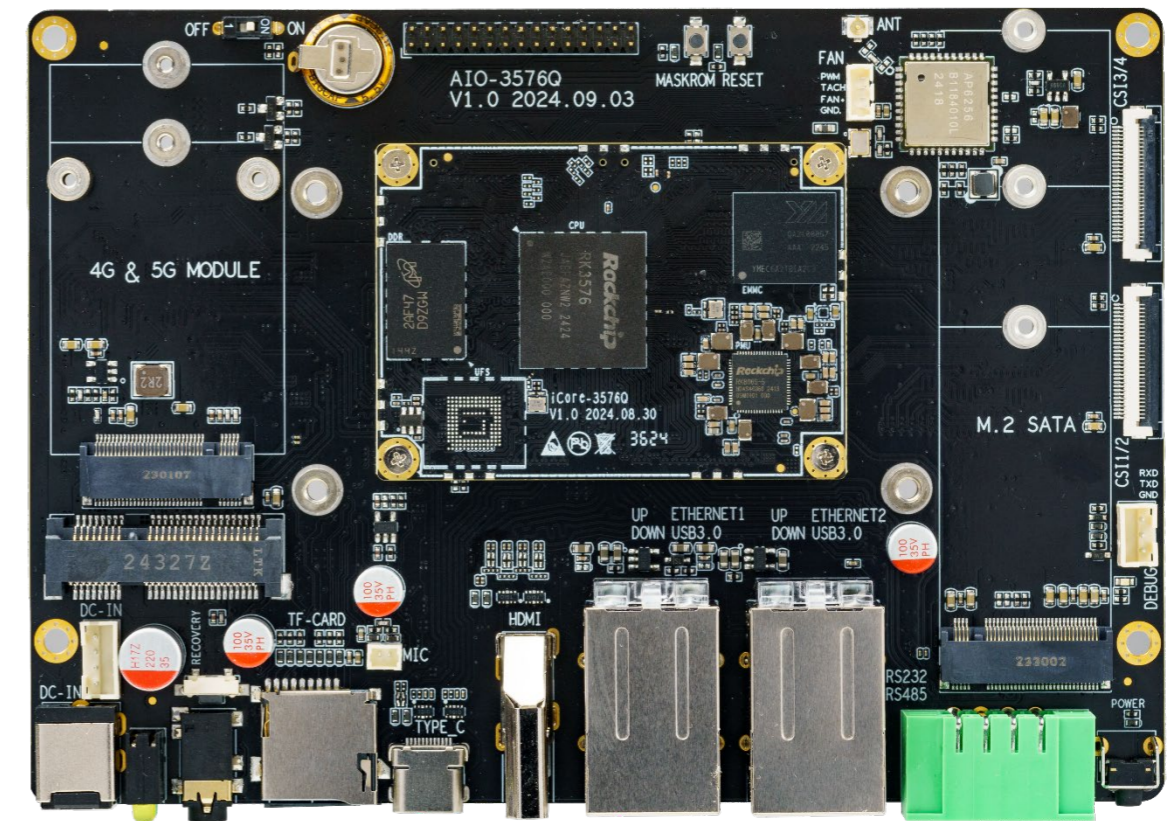


# Low-power Industrial AIOT Mainboard

- AIO-3576Q(Commercial)
- AIO-3576JQ(Industrial)

V1.0 2024-12-13

T-CHIP INTELLIGENCE TECHNOLOGY



# Product features



## Octa-core 64-bit AIoT processor RK3576

It adopts Rockchip's new generation of high-performance AIoT chip RK3576 series, octa-core 64-bit, large and small core architecture (4xA72 +4xA53), advanced process, and the main frequency is up to 2.2GHz.



## Built-in 6TOPS computing power NPU

NPU computing power up to 6TOPS, support INT4/INT8 and other operations, support dual-core collaborative or independent work, support multi-tasking, multi-scenario parallelism; Support the privatization and deployment of YOLO and large language models.



## 4K@120fps high frame rate video decoding

Support 8K@30fps/4K@120fps decode (H.265/HEVC, VP9, AVS2, AV1) , 4K@60fps encode (H.265/HEVC, H.264/AVC). It supports HDMI/eDP, MIPI DSI, DP and other display interfaces, and supports three-screen different display and 4K@120Hz ultra-clear display to meet the diverse display needs of multiple scenes.



## Powerful ISP image processing capabilities

Built-in 16 million pixel ISP, support low-light noise reduction, support RGB-IR sensor, support up to 120dB HDR, AI-ISP to improve low-noise image effect. Support 3 MIPI-CSI D-PHY inputs.



# Product features



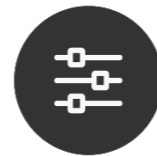
## Supports RTLinux and multiple operating systems

Supports RTLinux kernel with excellent real-time performance; Supports Android 14, Linux OS, and Buildroot operating systems, providing a secure and stable system environment for product development and production.



## New industrial features to meet the needs of industrial applications

It has new industrial features such as real-time network, Flexbus, hardware resource isolation, and DSMC to meet the needs of different industrial applications.



## Abundant expansion interfaces

Equipped with MIPI-DSI, MIPI-CSI, HDMI2.1, Mini PCIe, M.2, USB3.0, MIC and other expansion interfaces to meet the peripheral expansion needs of different scenarios.



## A wide range of applications

It is widely used in: edge computing, large model localization, smart commercial display, cloud terminal products, industrial control host, automotive electronics and other industries.

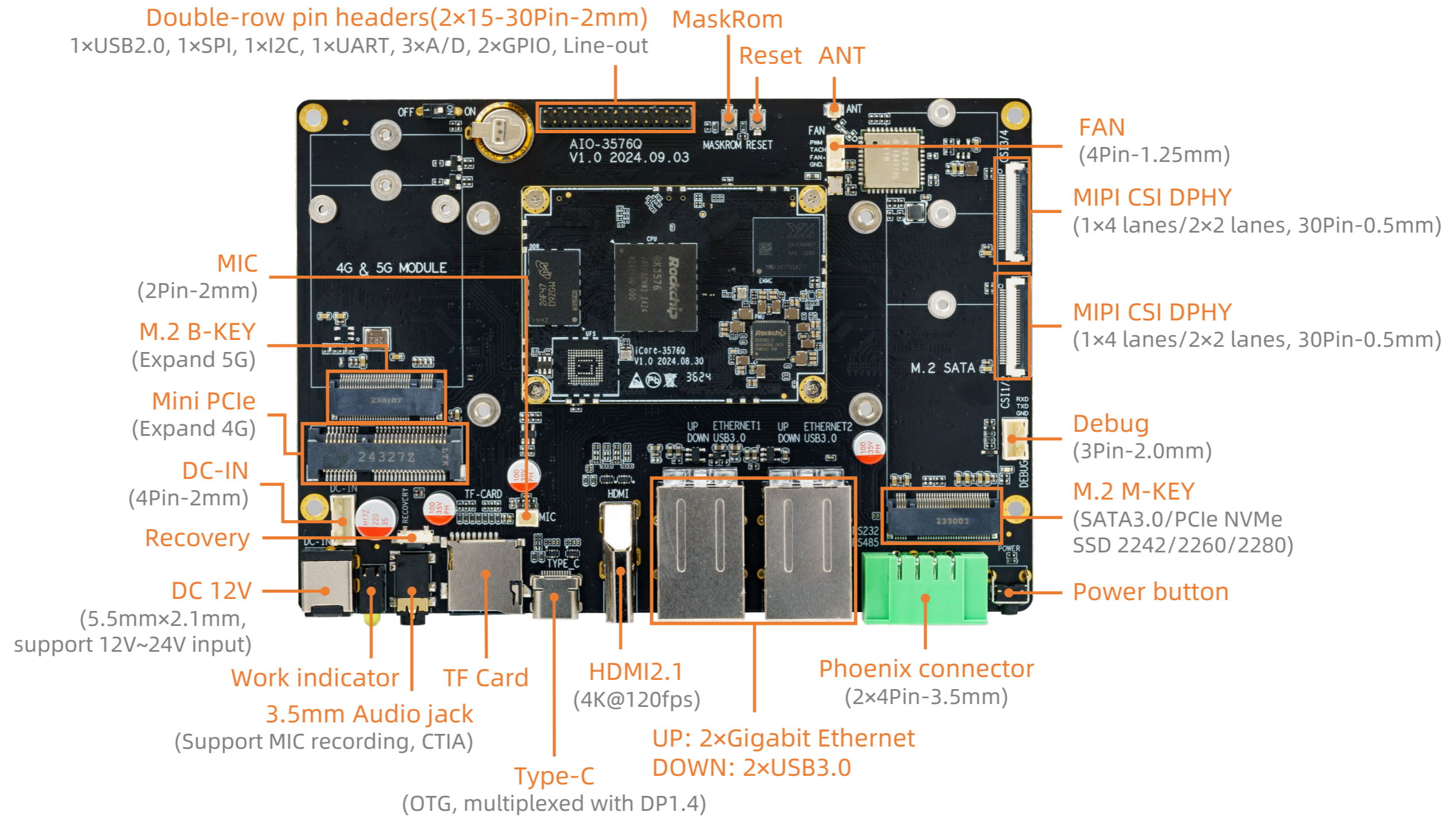
# Specifications



		AIO-3576Q(Commercial)	AIO-3576JQ(Industrial)
Basic Specifications	SOC	Rockchip RK3576	Rockchip RK3576J
	CPU	Octa-core 64-bit processor (4xA72 + 4xA53) with a maximum frequency of 2.2GHz	Octa-core 64-bit processor (4xA72 + 4xA53) with a maximum frequency of 1.6GHz
	GPU	G52 MC3 @ 1GHz, supports OpenGL ES 1.1/2.0/3.2, OpenCL 2.0, Vulkan 1.1, embedded high-performance 2D acceleration hardware	
	NPU	6 TOPS computing power NPU, support INT4/INT8/INT16/FP16/BF16/TF32 operation, support dual-core collaborative or independent work, support multi-task, multi-scenario parallelism	
	ISP	Built-in 16 million pixel ISP, support low-light noise reduction, support RGB-IR sensor, support up to 120dB HDR, AI-ISP to improve low-noise image effect	
	Codecs	Decode: 8K@30fps/4K@120fps (H.265/HEVC, VP9, AVS2, AV1), 4K@60fps (H.264/AVC) Encode:4K@60fps (H.265/HEVC, H.264/AVC)	
	RAM	LPDDR4/LPDDR4x (4GB/8GB/16GB Optional)	
	Storage	eMMC (16GB/32GB/64GB/128GB/256GB Optional), UFS2.0 (Optional)	
	Storage Expansion	1 × M.2 M-KEY (Scalable SATA3.0/PCIe NVMe SSD, support 2242/2260/2280), 1 × TF Card	
	Power	DC 12V (5.5mm × 2.1mm, support 12V~24V wide voltage input)	
	Power consumption	Max: 6W(12V/500mA), Normal: 1.8W(12V/150mA), Min: 0.624W(12V/52mA)	
	OS	It supports RTLinux kernel and has excellent real-time performance, which is widely used in industrial application scenarios. Support Android14, Linux OS, Buildroot, domestic operating system, provide a safe and stable system environment for product research and production. It has new industrial features such as real-time network, Flexbus, hardware resource isolation, and DSMC to meet the needs of different industrial applications.	
	AI performance	Support the privatization deployment of ultra-large-scale parametric models under the Transformer architecture, such as Gemma-2B, ChatGLM3-6B, Qwen-1.8B, Phi-3-3.8B and other large language models. It supports traditional network architectures such as CNN, RNN, and LSTM, and supports the import and export of RKNN models; Support a variety of deep learning frameworks, including TensorFlow, TensorFlow Lite, PyTorch, Caffe, ONNX and Darknet. It also supports the development of custom operators. Support Docker container management technology.	
		It supports the real-time object detection algorithm YOLO (You Only Look Once), which is fast and real-time compared with traditional object detection methods, and can accurately identify and locate multiple target objects in images or videos, powering AI applications.	
	Size	145.9mm × 104.11mm × 26.38mm	
Weight	≈149g		
Environment	Operating Temperature: -20°C ~ 60°C Storage Humidity: 10% ~ 90%RH (non-condensing)	Operating Temperature: -40°C ~ 85°C Storage Humidity: 10% ~ 90%RH (non-condensing)	
Interface Specifications	Internet	2 × Gigabit Ethernet (RJ45/1000Mbps), supports 2.4GHz/5GHz dual band WiFi (802.11a/b/g/n/ac), Bluetooth 5.0, expandable 4G LTE (Mini PCIe), 5G (M.2 B-KEY)	
	Video input	2 × MIPI-CSI DPHY (1×4Lanes or 2×2Lanes, 30Pin-0.5mm) 1 × MIPI-CSI D/CPHY (DPHY(1×4 Lanes/2×2 Lanes) or CPHY(3Lanes), 24Pin-0.5mm)	
	Video output	1 × MIPI-DSI D/CPHY (30Pin-0.5mm, 2560×1600@60Hz) 1 × HDMI2.1 (4K@120fps)	
	Audio	1 × MIC (2Pin-1.25mm), 1 × 3.5mm Audio jack (Support MIC recording, American Standard CTIA)	
	USB	2 × USB3.0 (HOST, Max: 1.2A)	
	Button	1 × MaskRom, 1 × Reset, 1 × Recovery	
	Other interfaces	1 × SIM Card, 1 × Type-C (USB3.0 OTG, multiplexed with DP1.4), 1 × FAN (4Pin-1.25mm), 1 × Debug (3Pin-2mm), 1 × DC-IN (4Pin-2mm), 1 × Phoenix connector (2×4Pin-3.5mm): 1 × RS485, 1 × RS232, 1 × CAN 2.0 1 × Double-row pin headers (2×15-30Pin-2mm): 1×USB2.0, 1×SPI, 1×I2C, 1×UART, 3×A/D, 2×GPIO, Line-out	



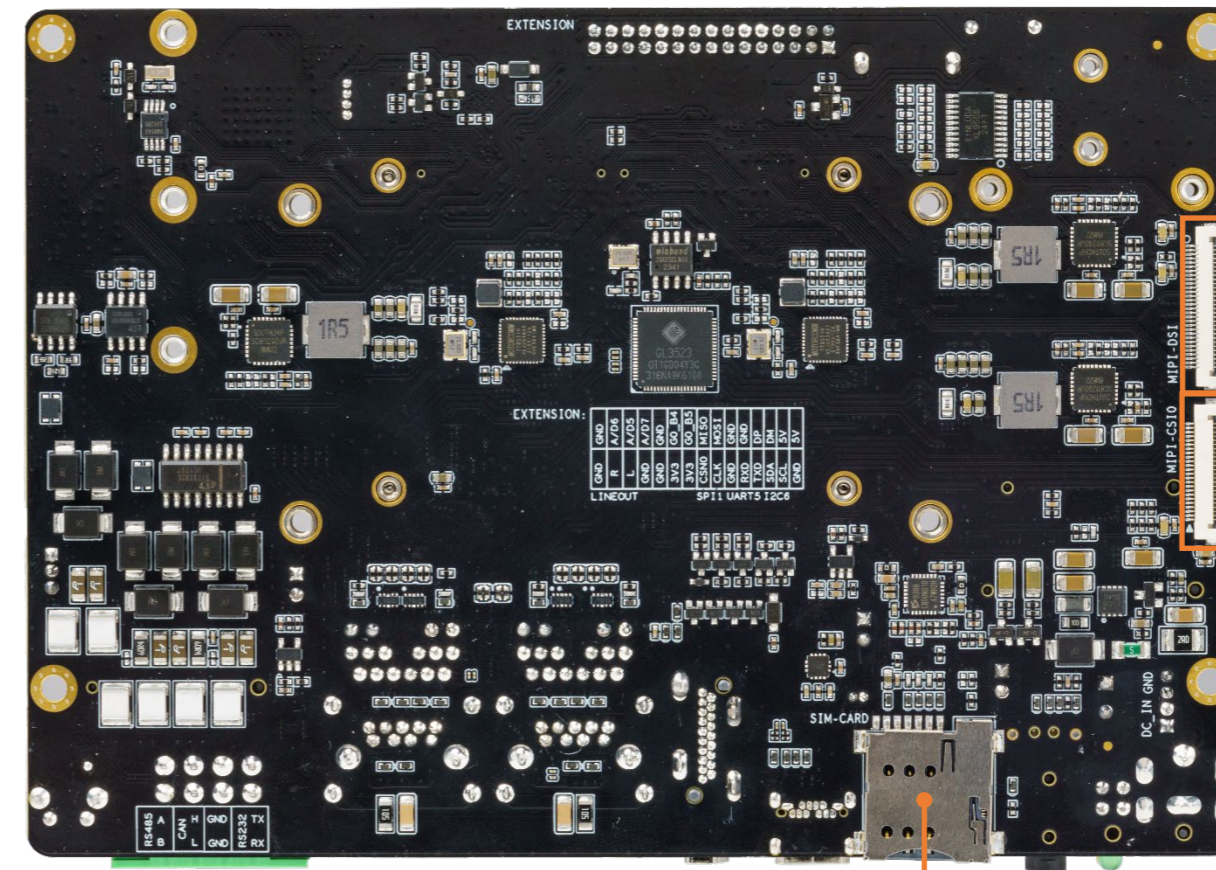
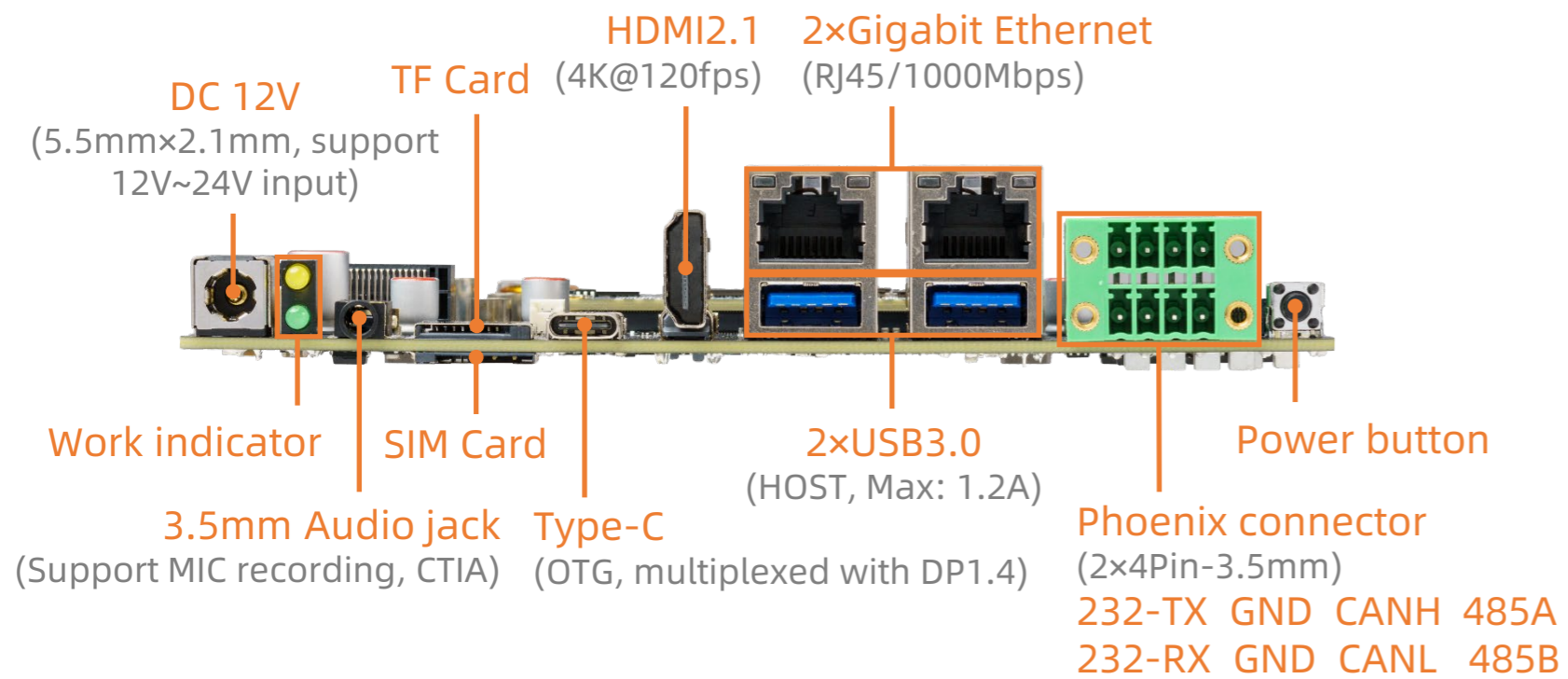
# Interface description



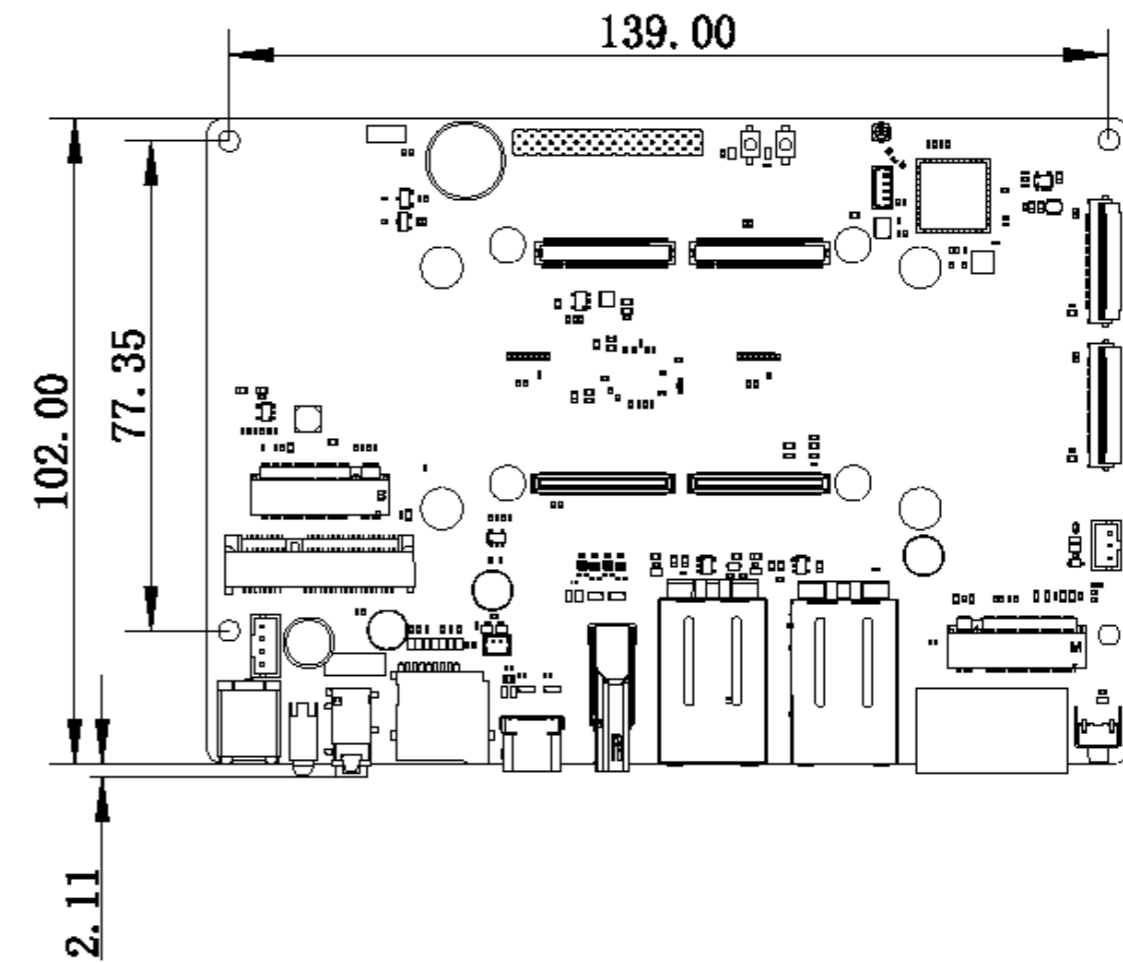
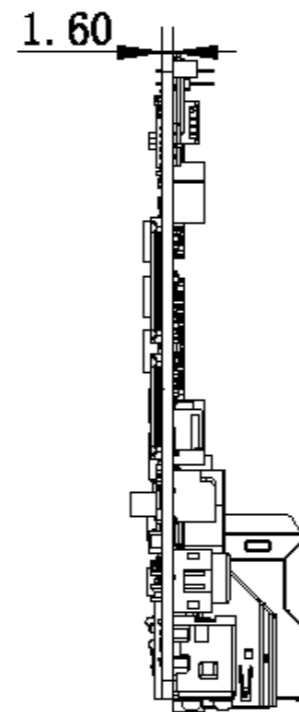
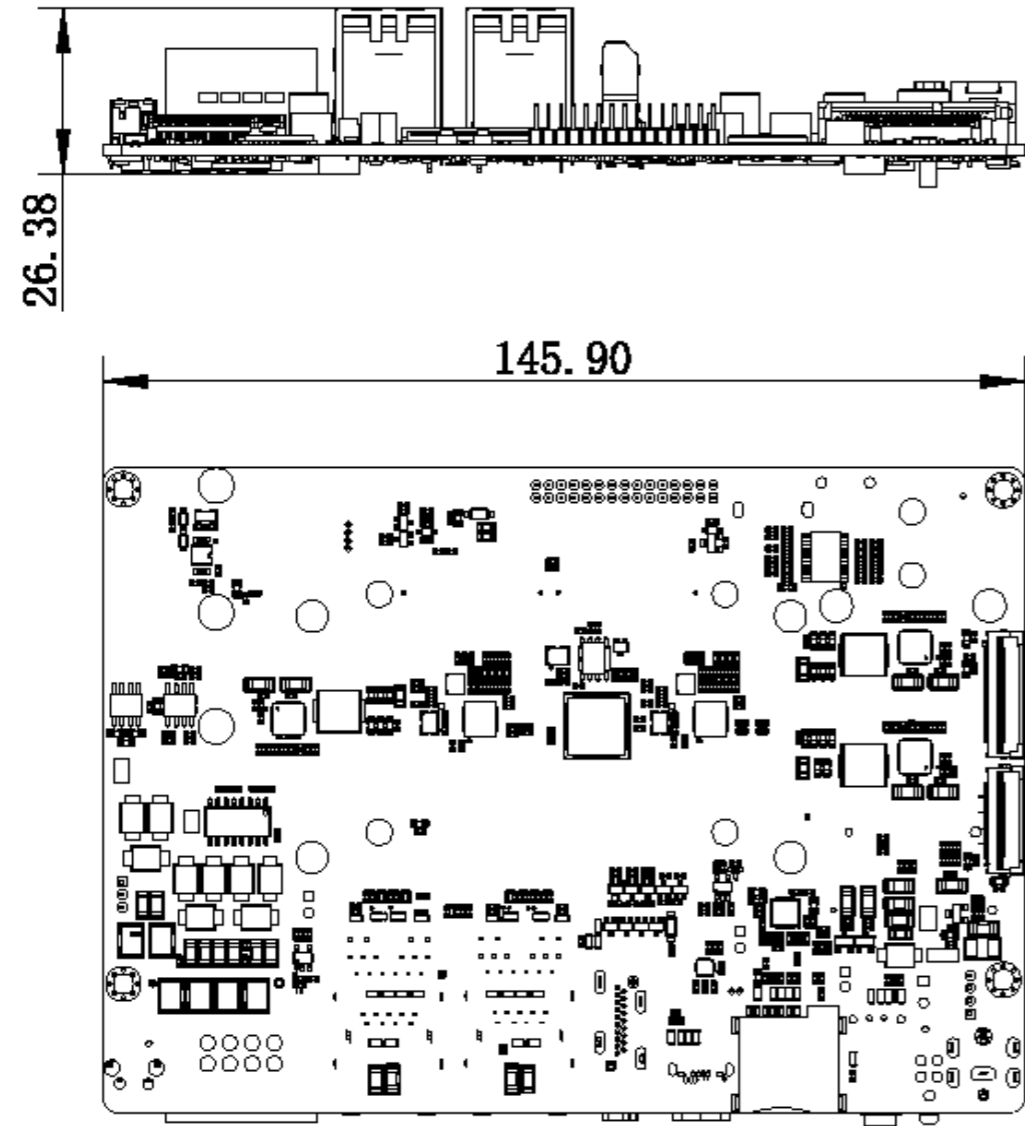




# Interface description

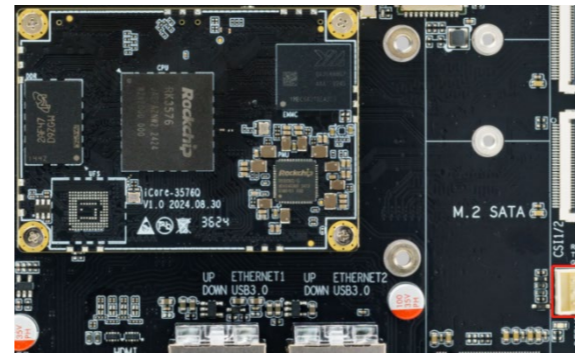


# Dimension



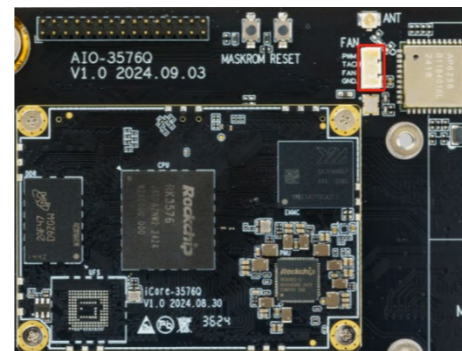
# Interface definition

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



NO.	Definition	Power/V	NO.	Definition	Power/V
1	UART0_RXD_Debug	3.3	3	GND	
2	UART0_TXD_Debug	3.3			

## 2. (J18)FAN: 4PIN 1.25mm pitch wafer seat



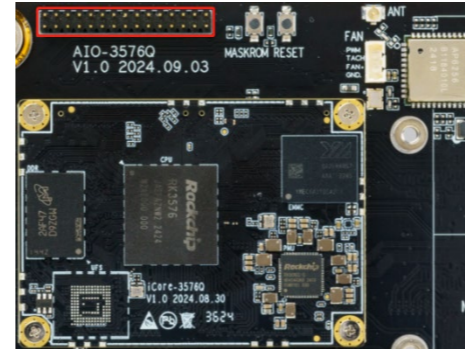
NO.	Definition	Power/V	NO.	Definition	Power/V
1	GND		2	FAN+ (5V Output)	5
3	FG Input 【PWM0_CH0_M3】	3.3	4	PWM1 Output 【PWM0_CH1_M0】	3.3



# Interface definition



## 3. (J21) Double-row pin headers EXTENSION INTERFACE 2\*15PIN

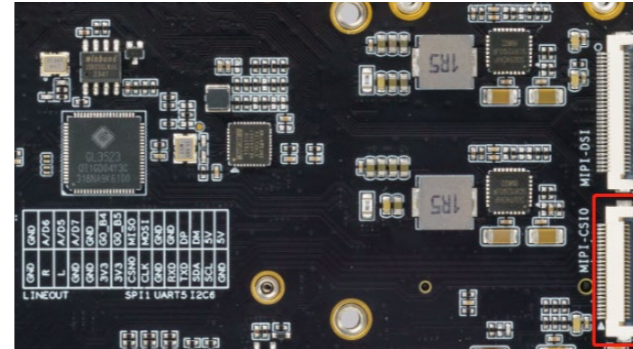


NO.	Definition	Power/V	NO.	Definition	Power/V
1	GND		2	VCC5V0_SYS (5.0V OUTPUT)	5.0V(MAX:500mA)
3	I2C6_SCL_M3/(GPIO4_C6_d)	-	4	VCC5V0_SYS (5.0V OUTPUT)	
5	I2C6_SDA_M3/(GPIO4_C7_d)	-	6	HUB_USB1_DM	-
7	UART5_TX_M1/(GPIO4_B0_d)		8	HUB_USB1_DP	-
9	UART5_RX_M1 /(GPIO4_B1_d)	1.8	10	GND	
11	GND		12	GND	
13	SPI1_CLK_M2 /(GPIO3_C7_d)	1.8	14	SPI1_MOSI_M2 /(GPIO3_C6_d)	1.8
15	SPI1_CSNO_M2 /(GPIO3_D0_d)	1.8	16	SPI1_MISO_M2 /(GPIO3_C5_d)	1.8
17	VCC3V3_SYS (3.3V Output)	3.3V (MAX:500mA)	18	GPIO0_B5_d	3.3
19	VCC3V3_SYS (3.3V Output)		20	GPIO0_B4_d	3.3
21	GND		22	GND	
23	GND		24	ADC7_Input	1.8
25	AUD_LINEOUT_L (40mW from ES8388)	3.3	26	ADC5_Input	1.8
27	AUD_LINEOUT_R (40mW from ES8388)	3.3	28	ADC6_Input	1.8
29	GND		30	GND	

# Interface definition



## 4. (J15) MIPI CSI0 24PIN 0.5mm pitch

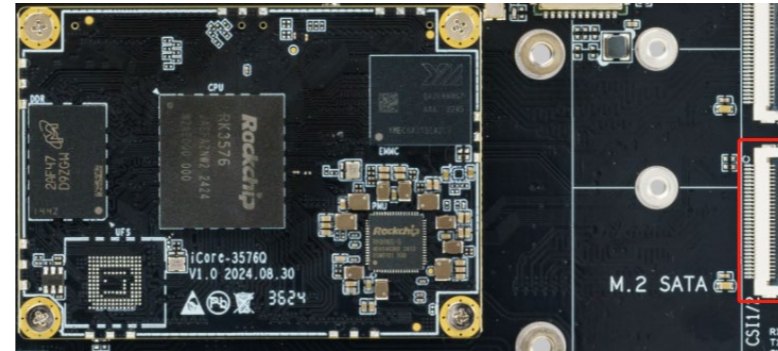


NO.	Definition	Power/V	NO.	Definition	Power/V
1	VCC5V0_SYS (5.0V OUTPUT)	5.0V, MAX:500mA	16	GND	
2	VCC5V0_SYS (5.0V OUTPUT)		17	CSI0_CLK_P	-
3	VCC5V0_SYS (5.0V OUTPUT)		18	CSI0_CLK_N	-
4	I2C7_SDA_M2 【GPIO4_A1_d】 Pull-up resistor 2.2K	1.8	19	GND	
5	I2C7_SCL_M2 【GPIO4_A0_d】 Pull-up resistor 2.2K	1.8	20	CSI0_D1_P	-
6	CAM0_RESET 【Expand IO】	1.8	21	CSI0_D1_N	-
7	CAM0_PDN 【Expand IO】	1.8	22	GND	
8	CAM0_PWR 【Expand IO】	1.8	23	CSI0_D0_P	-
9	CAM0_MCLK 【GPIO3_D7_d】	1.8	24	CSI0_D0_N	-
10	GND				
11	CSI0_D3_P	-			
12	CSI0_D3_N	-			
13	GND				
14	CSI0_D2_P	-			
15	CSI0_D2_N	-			

# Interface definition



## 5. (J16) MIPI CSI1/2 30PIN 0.5mm pitch



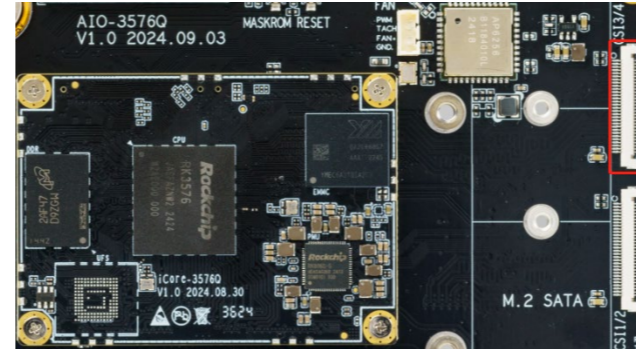
NO.	Definition	Power/V	NO.	Definition	Power/V
1	I2C5_SDA_M3 【GPIO3_C1_d】 Pull-up resistor 2.2K	1.8	16	GND	
2	I2C5_SCL_M3 【GPIO3_C4_d】 Pull-up resistor 2.2K	1.8	17	CSI2_CLK_P	-
3	CAM1_PWDN 【GPIO3_D5_d】	1.8	18	CSI2_CLK_N	-
4	CAM1_RESET 【GPIO3_D6_d】	1.8	19	GND	
5	GND		20	CSI3_D0_P	-
6	CAM1_MCLK 【GPIO2_D6_d】	1.8	21	CSI3_D0_N	-
7	CAM2_PWDN 【GPIO3_D4_d】	1.8	22	GND	
8	CAM2_RESET 【GPIO3_A4_d】	1.8	23	CSI3_D1_P	-
9	CAM1_MCLK 【GPIO2_D6_d】	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



# Interface definition



## 6. (J14) MIPI CSI3/4 30PIN 0.5mm pitch

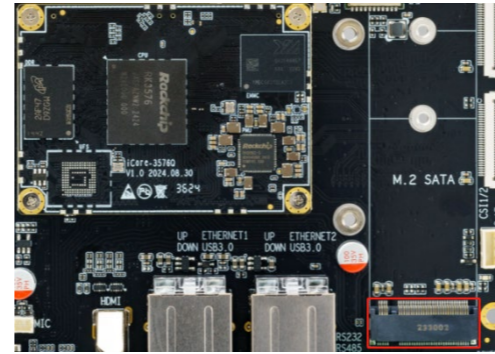


NO.	Definition	Power/V	NO.	Definition	Power/V
1	I2C4_SDA_M3 【GPIO3_B7_d】 Pull-up resistor 2.2K	1.8	16	GND	
2	I2C4_SCL_M3 【GPIO3_C0_d】 Pull-up resistor 2.2K	1.8	17	CSI3_CLK_P	-
3	CAM3_PWDN 【GPIO2_B3_d】	1.8	18	CSI3_CLK_N	-
4	CAM3_RESET 【GPIO1_D5_d】	1.8	19	GND	
5	GND		20	CSI4_D0_P	-
6	CAM2_MCLK 【GPIO2_D7_d】	1.8	21	CSI4_D0_N	-
7	CAM4_PWDN 【GPIO2_A7_d】	1.8	22	GND	
8	CAM4_RESET 【GPIO3_A1_d】	1.8	23	CSI4_D1_P	-
9	CAM2_MCLK 【GPIO2_D7_d】	1.8	24	CSI4_D1_N	-
10	GND		25	GND	
11	CSI3_D0_P	-	26	CSI4_CLK_P	-
12	CSI3_D0_N	-	27	CSI4_CLK_N	-
13	GND		28	GND	
14	CSI3_D1_P	-	29	VCC5V0_SYS (5.0V OUTPUT)	5.0
15	CSI3_D1_N	-	30	VCC5V0_SYS (5.0V OUTPUT)	5.0

# Interface definition



## 7. (U29) M.2 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	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	
29	NC		30	NC	

# Interface definition



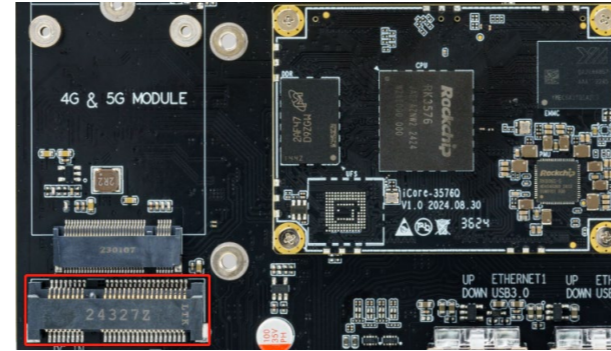
31	NC		32	NC	
33	GND		34	NC	
35	NC		36	NC	
37	NC		38	DEVSLP 【Expand IO】	3.3
39	GND		40	NC	
41	PCIE0_RXP / SATA0_RXP	-	42	NC	
43	PCIE0_RXN /SATA0_RXN	-	44	NC	
45	GND		46	NC	
47	PCIE0_TXN/SATA0_TXN(Series capacitor 100nF)	-	48	NC	
49	PCIE0_TXP/SATA0_TXP(Series capacitor 100nF)	-	50	PCIE0_RST(GPIO4_A7_d)	3.3
51	GND		52	PCIE0_CLKREQN_M2(GPIO4_B5_d)	3.3
53	PCIE0_REFCLKN	-	54	PCIE0_WAKEN_M2 (GPIO4_B2_d)	3.3
55	PCIE0_REFCLKP	-	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



## 8. (U24)MINI PCIe 4G



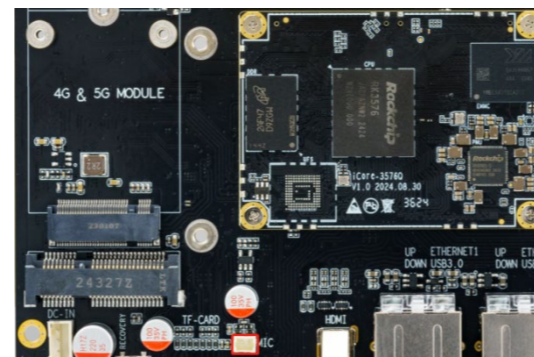
NO.	Definition	Power/V	NO.	Definition	Power/V
1	NC		2	VCC3V8_4G (3.5V Output)	3.5
3	NC		4	GND	
5	NC		6	NC	
7	NC		8	UIM_PWR	1.8
9	GND		10	UIM_DAT	1.8
11	NC		12	UIM_CLK	1.8
13	NC		14	UIM_RST	1.8
15	GND		16	NC	
17	NC		18	GND	
19	NC		20	NC	
21	GND		22	4G_RESET	3.5
23	NC		24	NC	
25	NC		26	GND	
27	GND		28	NC	
29	GND		30	NC	



# Interface definition

31	NC		32	NC	
33	NC		34	GND	
35	GND		36	HUB_USB2_DM	-
37	GND		38	HUB_USB2_DP	-
39	VCC3V8_4G (3.5V Output)	3.5	40	GND	
41	VCC3V8_4G (3.5V Output)	3.5	42	NC	
43	GND		44	SIM_DET	1.8
45	NC		46	NC	
47	NC		48	NC	
49	NC		50	GND	
51	NC		52	VCC3V8_4G (3.5V Output)	3.5

## 9. (J12)MIC\_IN 2PIN 1.25mm pitch wafer seat (white)

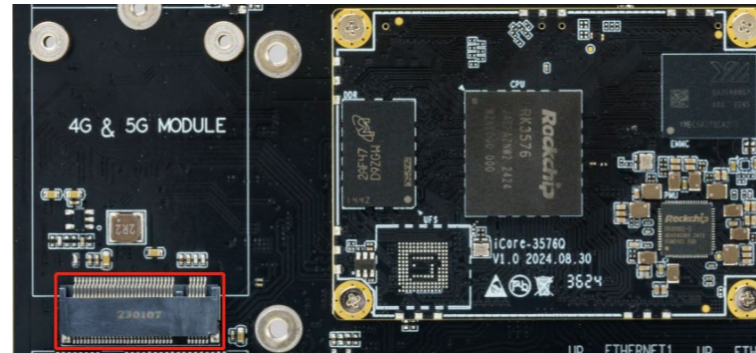


NO.	Definition	Power/V	NO.	Definition	Power/V
1	MIC2-P	3.3	2	MIC2-N	3.3

# Interface definition



## 10. (U23)5G NGFF-M.2-B-KEY



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	HUB_USB2_DP	-	8	NC	
9	HUB_USB2_DM	-	10	NC	
11	GND		20	NC	
21	NC		22	NC	
23	NC		24	NC	
25	NC		26	NC	
27	GND		28	NC	
29	HUB_USB2_SSRXN	-	30	UIM_RST	1.8
31	HUB_USB2_SSRXP	-	32	UIM_CLK	1.8
33	GND		34	UIM_DAT	1.8
35	HUB_USB2_SSTXN (Series capacitor 100nF)	-	36	UIM_PWR	1.8
37	HUB_USB2_SSTXP (Series capacitor 100nF)	-	38	NC	



# Interface definition

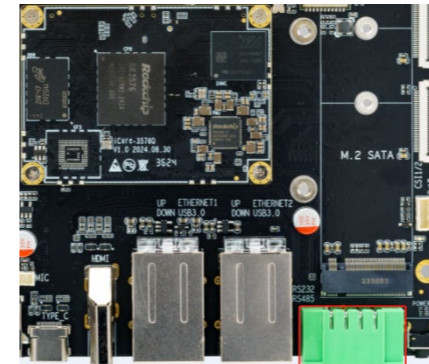


39	GND		40	NC	
41	NC		42	NC	
43	NC		44	NC	
45	GND		46	NC	
47	NC		48	NC	
49	NC		50	NC	
51	GND		52	NC	
53	NC		54	NC	
55	NC		56	NC	
57	GND		58	NC	
59	NC		60	NC	
61	NC		62	NC	
63	GND		64	NC	
65	NC		66	SIM_DET	1.8
67	4G_RESET	3.5	68	NC	
69	NC		70	VCC3V8_4G (3.5V Output)	3.5
71	GND		72	VCC3V8_4G (3.5V Output)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



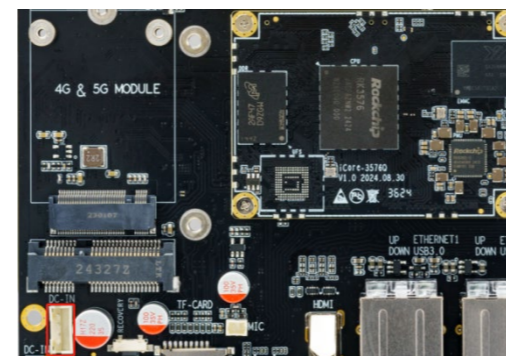
# Interface definition

## 11. (J20)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 UART8)	-	8	RS232_RX (from UART8)	-

## 12. (J25)POWER\_IN 4PIN 2.0mm pitch wafer seat (white)



NO.	Definition	Power/V	NO.	Definition	Power/V
1	12V_IN	12	3	GND	
2	12V_IN	12	4	GND	



## T-CHIP INTELLIGENCE TECHNOLOGY

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