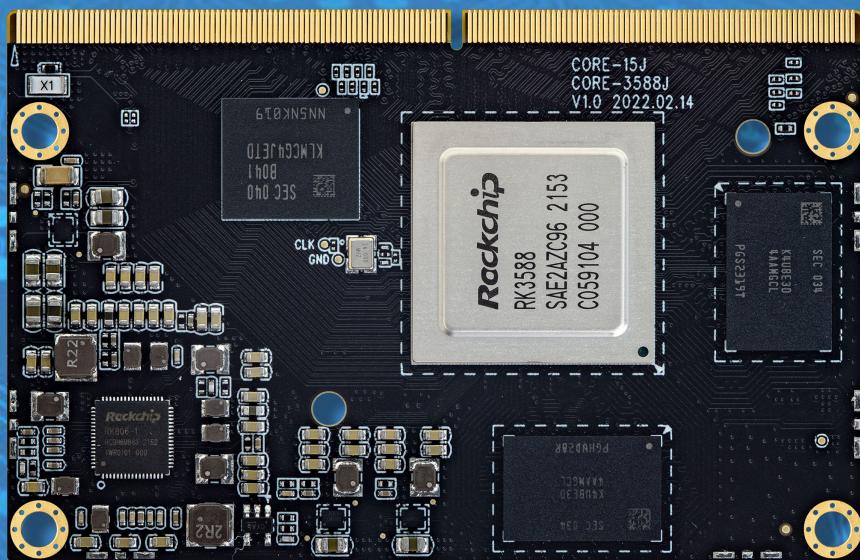


Core-3588J

8K AI Core Board

V1.0



T-CHIP INTELLIGENCE TECHNOLOGY CO., LTD.
www.t-firefly.com

Update history

Version	Date	Details
V1.0	2022-03-22	initial version

| Directory

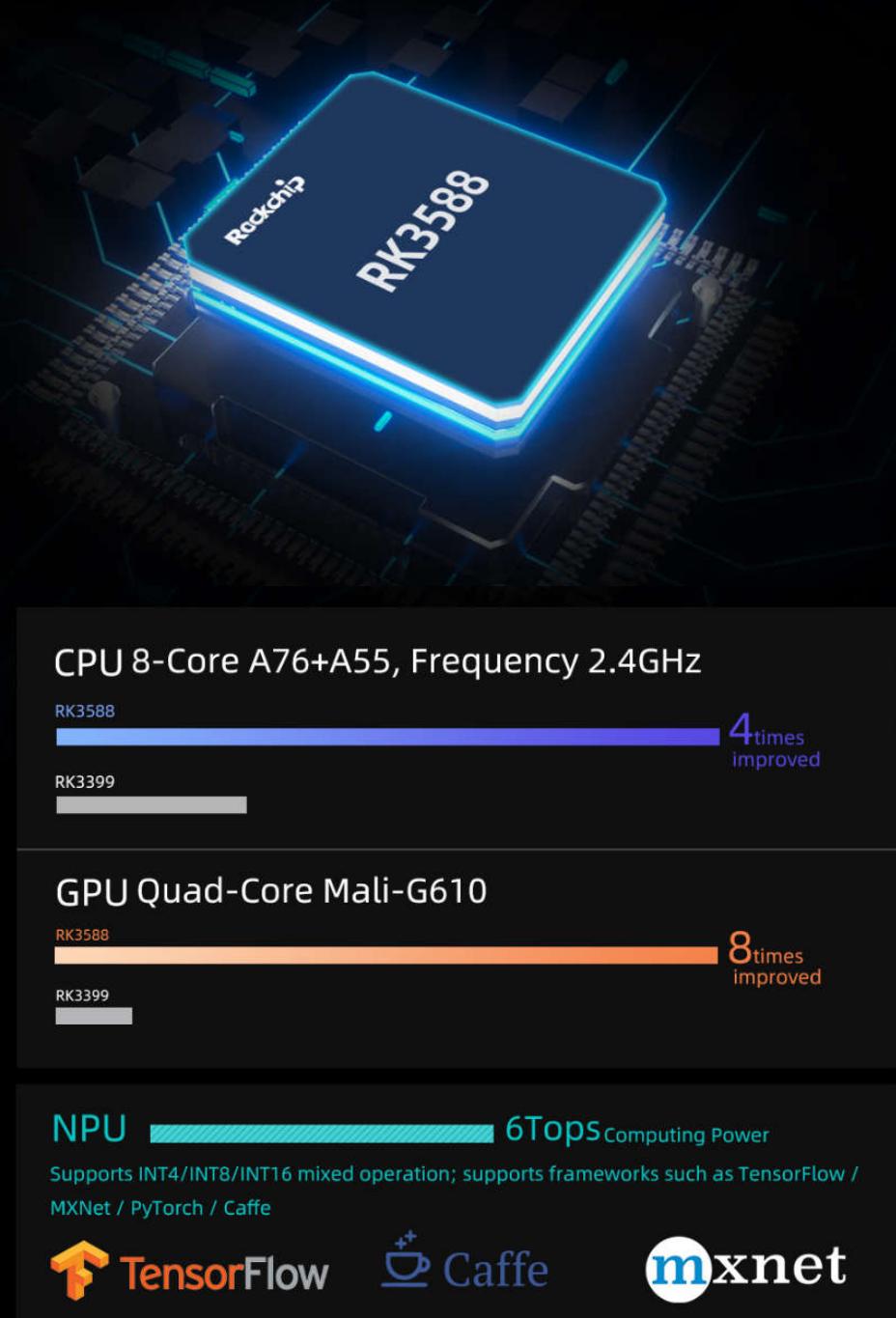
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Overview

Powered by Rockchip RK3588 new-gen 8-core 64-bit processor, the core board can be configured with up to 32GB RAM. Capable of 8K video encoding and decoding, it provides abundant interfaces supporting multiple hard disks, Gigabit Ethernet, WiFi6, 5G/4G expansion and a variety of video input and output. It also supports various operating systems. This core board can be used in ARM PC, edge computing, cloud server, smart NVR and other fields.

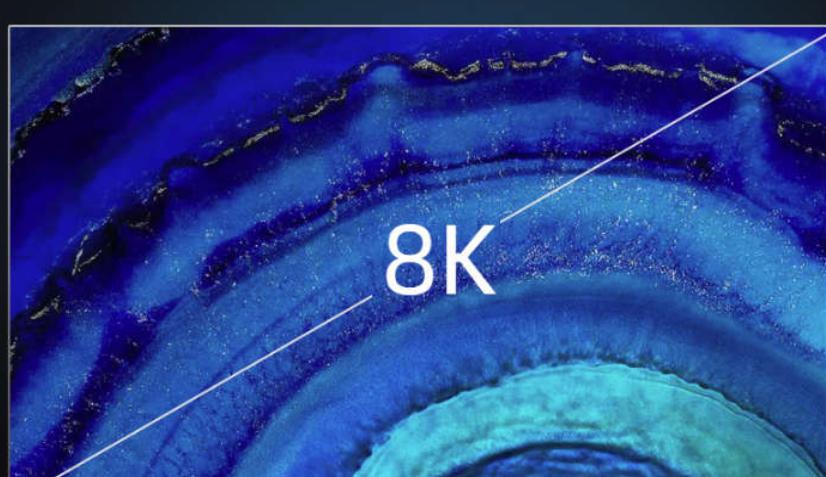
New-gen AIoT SoC RK3588

RK3588 is Rockchip's new-gen flagship AIoT SoC with 8nm lithography process. Equipped with 8-core 64-bit CPU, it has frequency up to 2.4GHz. Integrated with ARM Mali-G610 MP4 quad-core GPU and built-in AI acceleration NPU, it provides 6Tops computing power and supports mainstream deep learning frameworks. The powerful RK3588 can deliver more optimized performance in various AI application scenarios.



8K video encoding and decoding

The core board supports 8K@60fps H.265/VP9 video decoding and 8K@30fps H.265/H.264 video encoding, and also supports encoding and decoding simultaneously — achieves up to 32-channel 1080P@30fps decoding and 16-channel 1080P@30fps encoding. The strong video encoding and decoding capability makes 8K HD display and delicate picture quality available.



Super-large 32GB RAM

Up to 32GB of super-large RAM can be configured, which exceeds the limit of the previous RAM and delivers a faster response speed. It can meet the application requirements of products with large RAM and large storage.



Multi-channel input and output

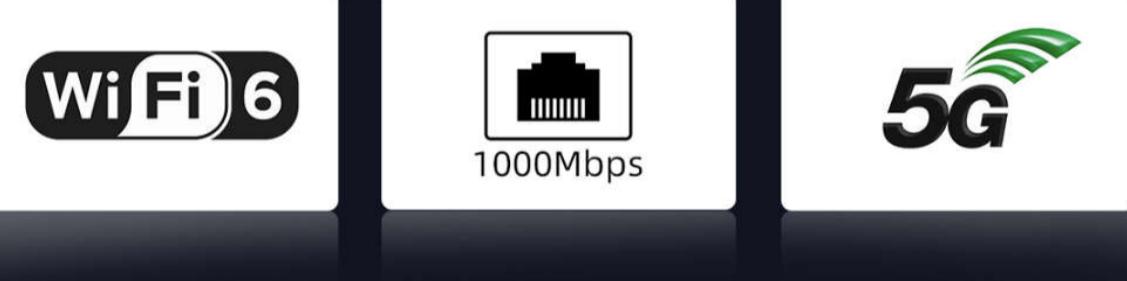
With HDMI 2.1/eDP1.3/MIPI-DSI/DP1.4/BT.1120 multi-channel video output and HDMI RX2.0/MIPI-CSI/DVP video input interfaces, it supports multi-channel 8K video output and 4K video input — up to seven-screen output with different displays can be achieved.

The integrated 48MP ISP with HDR&3DNR supports dual MIPI-CSI camera input.



Strong network communication capability

Integrated with PCIe3.0/GMAC/SDIO3.0/USB3.0, it can be extended to multi-channel Gigabit Ethernet, WiFi 6/Bluetooth, 5G/4G LTE, enabling network communication have a higher speed.



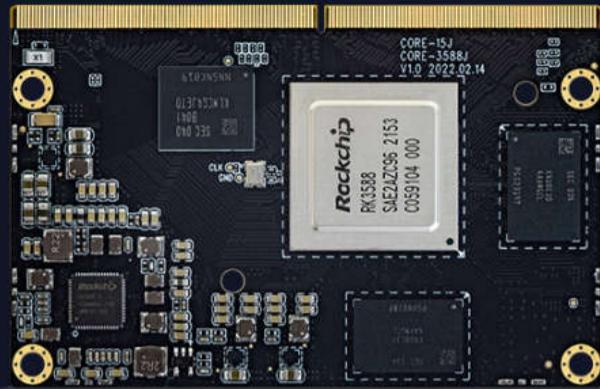
Multiple hard disks, Massive capacity

It supports expansion of multiple PCIe3.0/SATA3.0 SSD/HDD mass storage devices at the same time, making it a reality that the device can be easily expanded with TB storage capacity.



More interfaces for more possibilities

It's equipped with PCIE3.0, SATA3.0, I2S, I2C, CAN, UART, SPDIF, SDIO3.0, MIPI-CSI, MIPI-DSI, USB3.0, USB2.0, SPI, GPIO and other expansion interfaces.



PCIE 3.0

SATA 3.0

UART

CAN

SPDIF

SDIO 3.0

GPIO

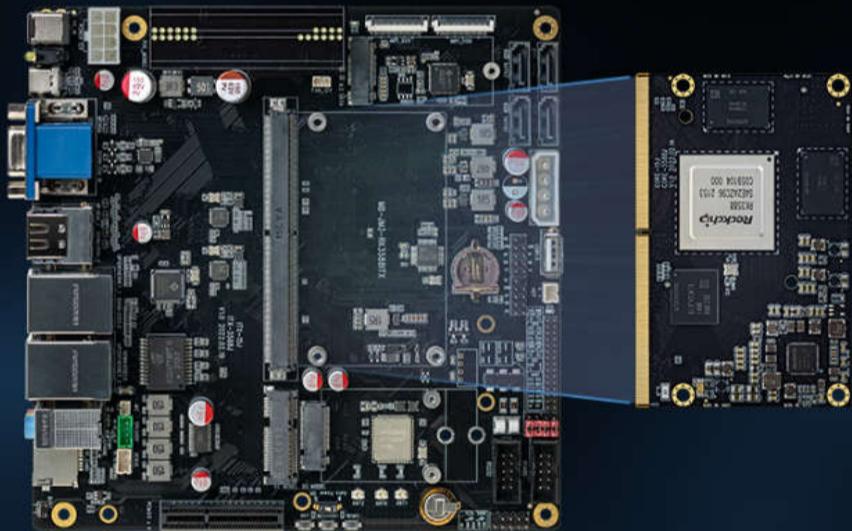
MIPI-DSI

MIPI-CSI

USB 3.0

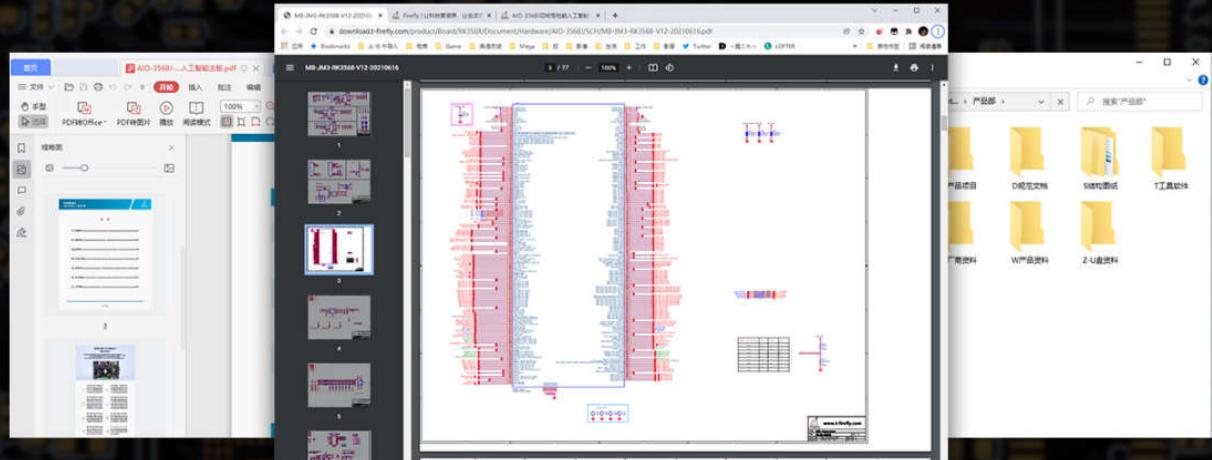
High-performance ITX mainboard

The core board, with standard MXM3.0-314P interface, which is small in size, can be combined with a backplane to form a complete high-performance ITX mainboard with richer expansion interfaces, which can be directly applied to various smart products to accelerate the product development process.



Backplane reference design is provided

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



Supports various operating systems

Android 12.0, Ubuntu Desktop version and Server version, Debian11, Buildroot, Kylin and UOS are supported. And it supports RTLinux, delivering excellent real-time performance. Also, UEFI Boot is available. The stable and reliable operation provides a safe and stable system environment for product research and production.



Abundant resources

SDK, tutorials, tech docs and dev tools are provided, making development simpler and more convenient.



A wide range of applications

The core board can be used in edge computing, cloud server, ARM PC, smart NVR, intelligent cockpit, smart video wall, AR/VR, high-end tablet, multi-lens camera, smart car and other fields. The core board can be used in edge computing, cloud server, ARM PC, smart NVR, intelligent cockpit, smart video wall, AR/VR, high-end tablet, multi-lens camera, smart car and other fields.



Technical parameters

Basic Specifications

SOC	RockChip RK3588
CPU	Octa-core 64-bit (4×Cortex-A76+4×Cortex-A55) , 8nm lithography process, frequency up to 2.4GHz
GPU	ARM Mali-G610 MP4 quad-core GPU Supports OpenGL ES3.2 / OpenCL 2.2 / Vulkan1.1, 450 GFLOPS
NPU	NPU computing power is up to 6 TOPS, Supports INT4/INT8/INT16 mixed operation, Supports framework switching of TensorFlow / MXNet / PyTorch / Caffe / etc.
ISP	Integrated 48MP ISP with HDR&3DNR
VPU	Video decoding: 8K@60fps H.265/VP9/AVS2 8K@30fps H.264 AVC/MVC 4K@60fps AV1 1080P@60fps MPEG-2/-1/VC-1/VP8 Video encoding: 8K@30fps H.265/H.264 * Achieves up to 32-channel 1080P@30fps decoding and 16-channel 1080P@30fps encoding
RAM	4GB/8GB/16GB 64-bit LPDDR4/LPDDR4x (Up to 32GB optional)
Storage	16GB/32GB/64GB/128GB eMMC

Hardware Specifications

Network	Integrated with PCIe3.0/GMAC/SDIO3.0/USB3.0, it can be extended to multi-channel Gigabit Ethernet, WiFi 6/Bluetooth, 5G/4G LTE
Display	Video output: 2 × HDMI2.1 (8K@60fps or 4K@120fps, Combo with eDP (4K@60fps)) 2 × MIPI-DSI (4K@60fps) 2 × DP1.4 (8K@30fps, Combo with USB 3.0) 1 × BT.1120 (1080P@60fps) Video input: 1 × HDMI-IN (4K@60fps) , supports HDCP 2.3 1 × MIPI CSI (4 lanes) or 2 × MIPI CSI (2 lanes) 2 × MIPI DC (4-lane DPHY v2.0 or 3-lane CPHY V1.1) 1 × DVP camera (up to 150MHz input data) * Supports multi-channel 8K video output and 4K video input, up to seven-screen output with different displays
Audio	2 × 8-channel I2S 2 × 2-channel I2S 2 × SPdif 2 × 8-channel PDM (supports multi-MIC array) 1 × Dual-channel digital audio codec (16-bit DAC) 1 × VAD
PCIE	1 × PCIe3.0 (2×2 lanes/1×4 lanes/4×1Lane/1×2lanes+2×1lane) 3 × PCIe2.1 (1 lane, Multiplexed with SATA3.0)
SATA	3 × SATA3.0 (Multiplexed with PCIe2.1)
USB	USB3.1(Gen1) OTG × 2 USB3.1(Gen1) HOST × 1 USB2.0 HOST × 4 USB2.0 OTG × 2
Power	4V (voltage tolerance±5%)
Other Interfaces	9 × I2C, 10 × UART, 5 × SPI, 7 × ADC, 16 × PWM, 1 × SDMMC, GPIOs

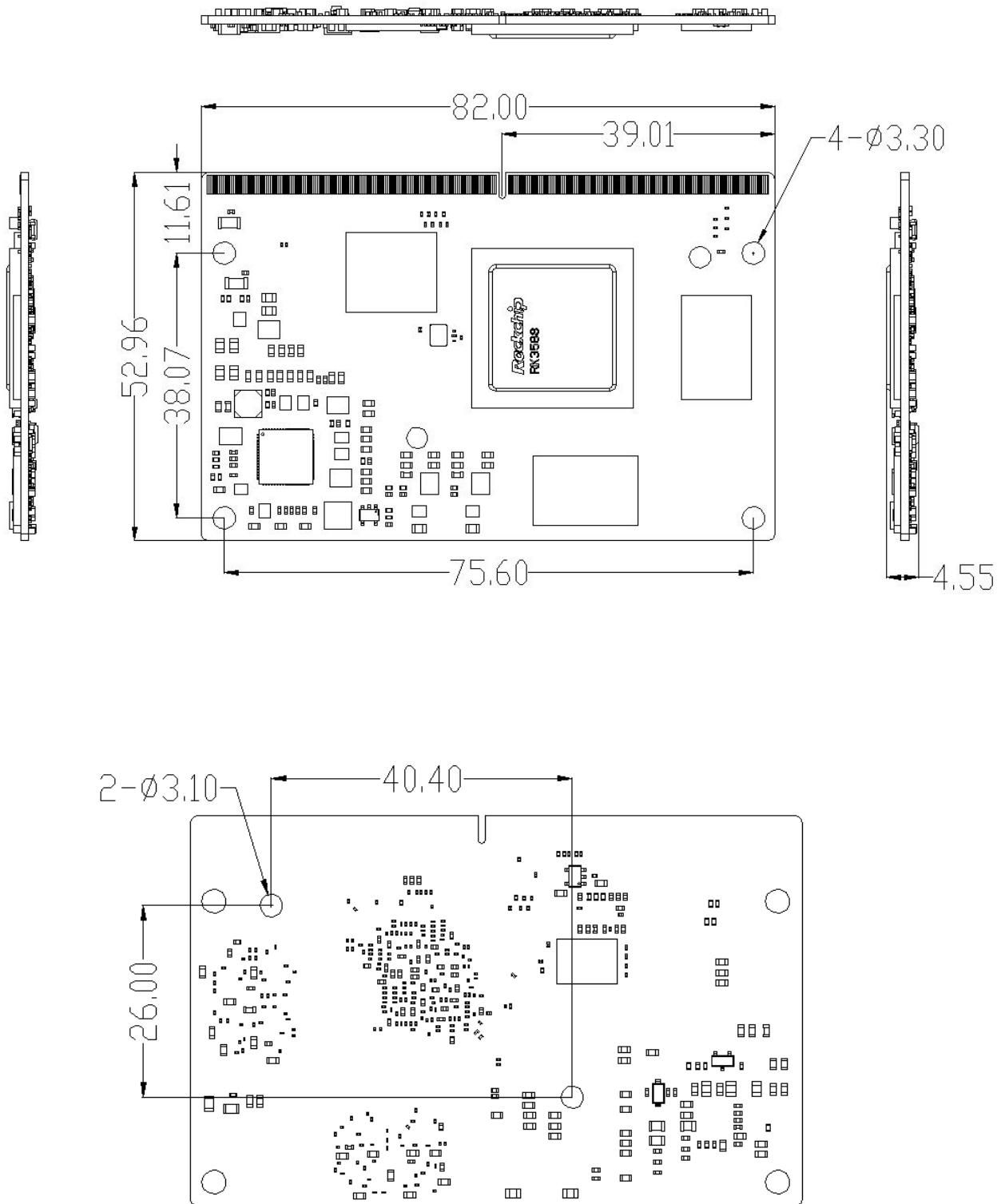
OS/Software

OS	Android: Android 12.0 Linux: Ubuntu Desktop, Ubuntu Server, Debian11, Buildroot, RTLinux, Kylin Linux, UOS. Supports UEFI Boot
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General

Size	82 mm × 53 mm
Interface Type	MXM3.0 (314 PIN, 0.5mm pitch)
PCB	10-layer design, immersion gold technology
Heat Dissipation	Heat sink installation hole pitch: 45mm
Power Consumption	Min: ≈1.35W (4V/338mA) Normal: ≈4.8W (4V/1200mA) Max: ≈20W (4V/5000mA)
Environment	Operating Temperature: -20°C~60°C Storage Temperature: -20°C~70°C Storage Humidity: 10%~90%RH(non-condensing)

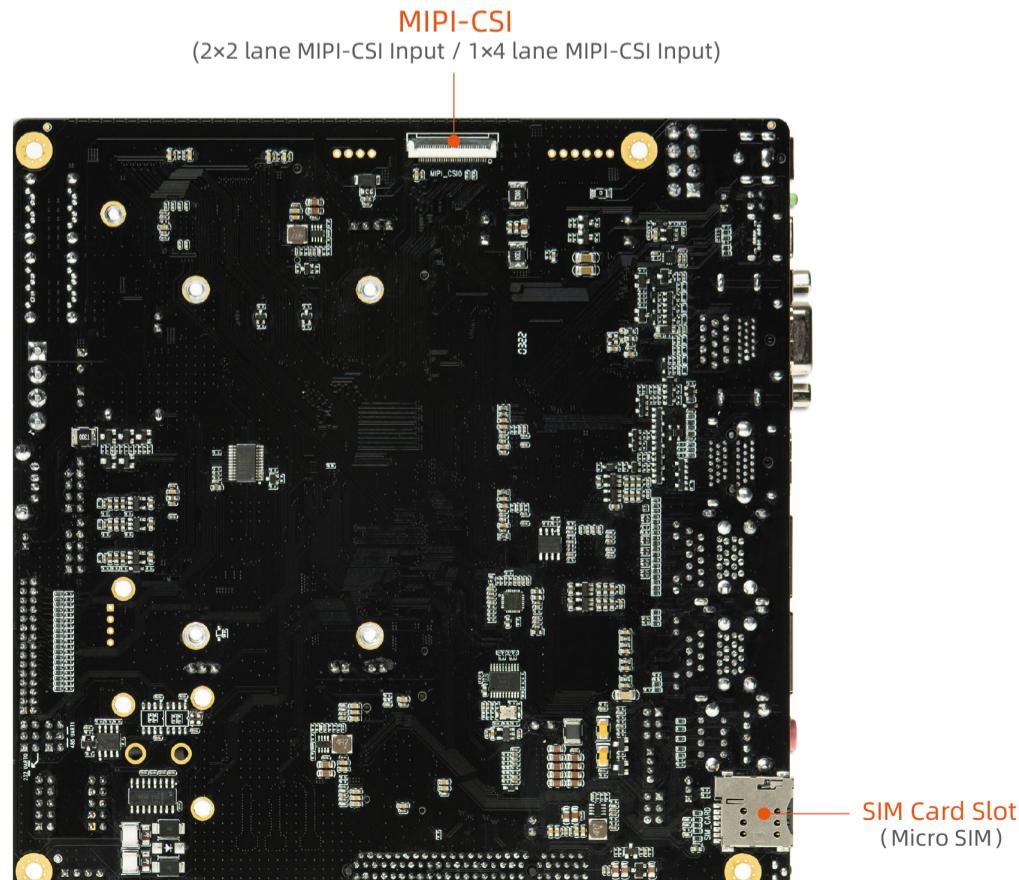
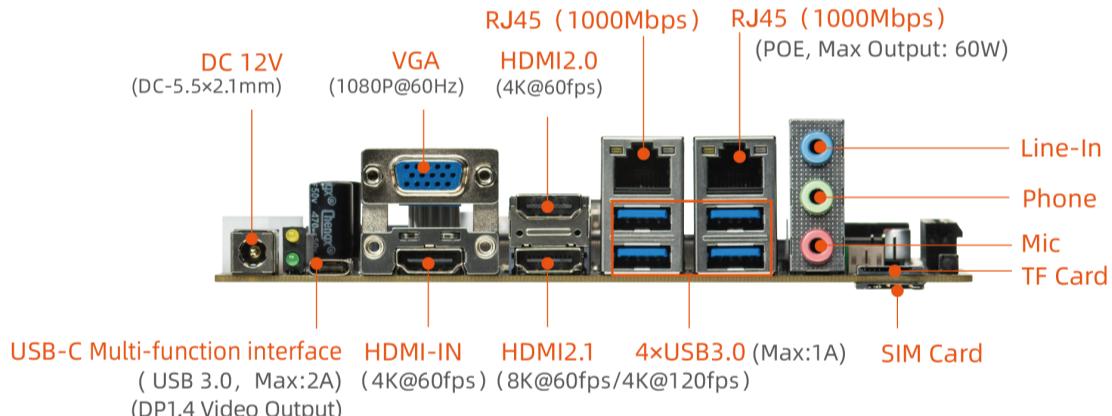
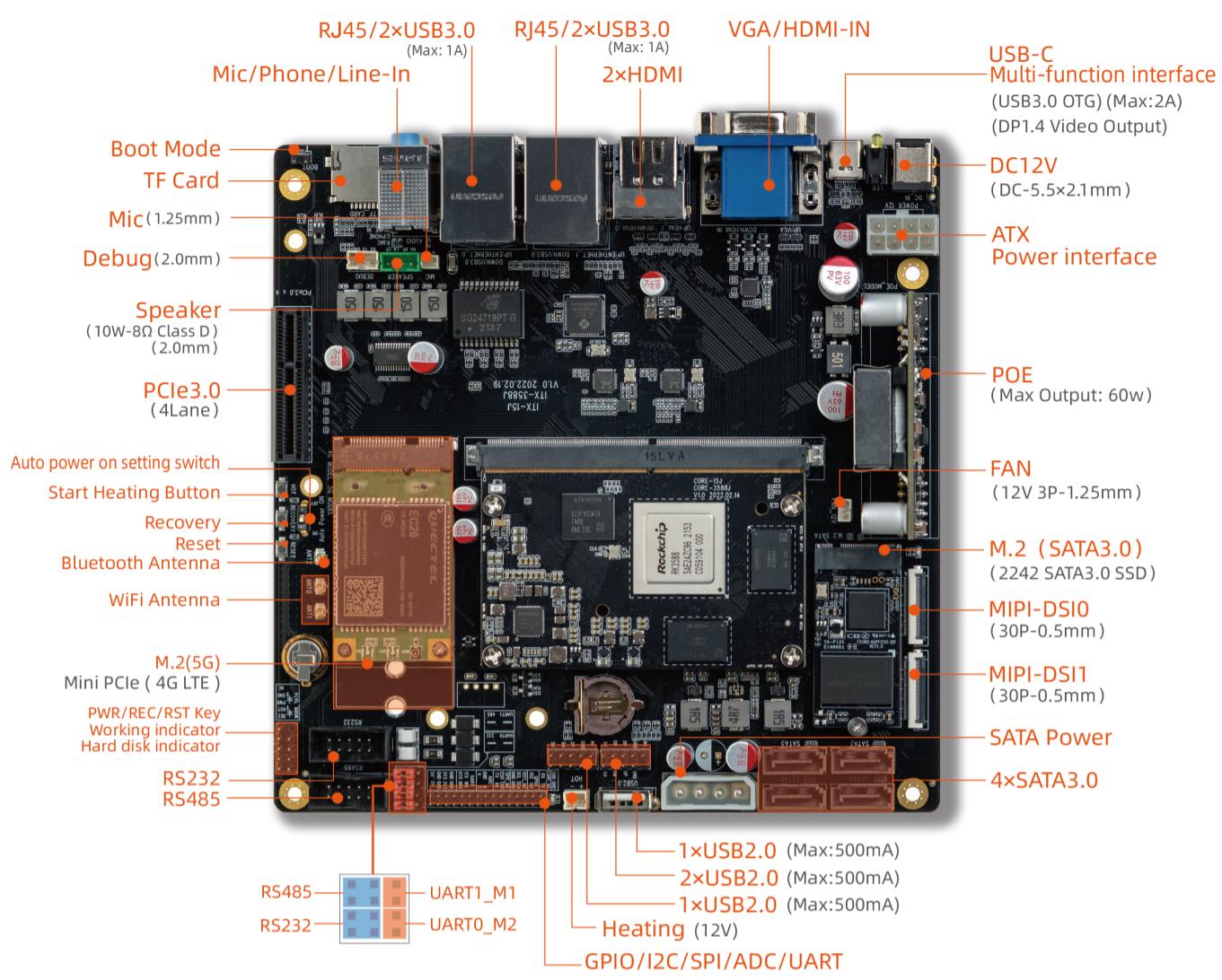
Dimensions



Interface Definition

Part A	PIN	CORE-358J pin definition	RK3588 Pin No.	Pad type	IO Pull	Function for Main BOARD(MB-JM3-RK3588)	Defualt function description	IO Power domain
1	VCCAV0_SYS			P		VCCAV0_CORE	Input Voltage 4.0V	4.0V
3				P				4.0V
5				P				4.0V
7				P				4.0V
9				P				4.0V
11				P				4.0V
13	GND			G		GND	GND	GND
15				G				GND
17	VCC_3V3_S3			G				GND
21	VCC_3V3_S3			G				GND
23	VCC_3V3_S3			P		VCC_3V3_S3	3.3V Output (Pin23/24 Total Max:800mA)	3.3V
25	VCC_1V8_S3			P		VCC_1V8_S3	1.8V Output (Pin25/26 Total Max:400mA)	1.8V
27	VCC_1V8_S3			P		VCC_1V8_S3	1.8V Output Max:200mA	1.8V
29	NPFOR		M31	I	UP	RESET_L	System reset input, Active L	1.8V
31	I2S0_SD0/250_SD2/IDP01_SD0/2I2C1_SCL/M4/UART4_RX_TX_M0/PW		F28	I/O	DOWN	SP1_CLK_M2/UART4_RX_M0/I2C1_SCL_M4	SP1_CLK_M2/UART4_RX_M0/I2C1_SCL_M4	1.8V
32	MD1/SP1_CLK_M2/IDP01_D2_d		G26	I/O	DOWN	HDIMII_RX_D	HDIMII_RX_DETECT_Active_L	1.8V
33	PD0_M/IDP01_C51_M2/GPI01_D5_d		K29	I/O	UP	WIFI_WAKE_HOST_H	WIFI_WAKE_HOST_Active_H	1.8V
35	CL32K_INICL32K_OUT/GPIO1_B2_u		P30	I/O	UP	HOST_WAKE_BT_H	HOST WAKE BT, Active H	1.8V
37	W2M_M/IDP01_C51_M2/GPI01_C5_u		P33	I/O	DOWN	BT_WAKE_HOST_H	BT WAKE HOST, Active H	1.8V
38	RTSN/CLKREGN_M0/GPI01_C5_u		T29	I/O	UP	BT_REG_ON_H	BT_EN_Active_H	1.8V
41	I2S1_SD0/1I2C1_SD1/AVS1_I2C1_SD0/IDP01_M1/SPI_CLK_M0/PCE30_X4_C5LCLKREGN_M0/SDA1/CPD/GPI01_M1		V28	I/O	UP	I2C1_SDA_M2_MP	I2C1_SDA for TP Core board pull up resistance 2.2K	1.8V
43	SDA1_SD0/1I2C1_SD1/AVS1_I2C1_SD0/IDP01_M1/SPI_CLK_M0/PCE30_X4_C5LCLKREGN_M0/SDA1/CPD/GPI01_M1		V29	I/O	UP	I2C1_SCL_M2_MP	I2C1_SCL for TP Core board pull up resistance 2.2K	1.8V
45	SDA1_SD0/1I2C1_SD1/AVS1_I2C1_SD0/IDP01_M1/SPI_CLK_M0/PCE30_X4_C5LCLKREGN_M0/SDA1/CPD/GPI01_M1		R30	I/O	DOWN	WIFI_REG_ON_H	WIFI_REG_ON_Active_H	1.8V
47	LTCPI_AVIS/P18_P19_CLK_M2/IDP00_D3_u		U33	I/O	UP	CC_INT_L	TYPEC_CC_INT_Active_L	1.8V
51	PCIE30X1_0_WAKEN_M1/CLKREGN_M0/GPI01_D4_u		A24	I/O	DOWN	UART6_RX_M1_BT	UART6_RX_M1 for BT	1.8V
53	PCIE30X1_0_WAKEN_M1/CLKREGN_M0/GPI01_D4_u		A25	I/O	DOWN	UART6_TX_M1_BT	UART6_TX_M1 for BT	1.8V
55	HDIMI_UART4_RX_M1/SP1_M2/GPI01_A1_d		B26	I/O	DOWN	HDIMITX0_HPDIN_M0	HDIMITX0_HPDIN_Active_H	1.8V
57	VOP_POT_EMPTY/2C4_SD0_M3/UART1_M1/PWPM0_M2/SP1_CL_K2/GPI01_A2_d		A26	I/O	DOWN	UART6_RTSN_M1_BT	UART6_RTSN_M1 for BT	1.8V
59	PCIE30X1_0_WAKEN_M1/CLKREGN_M0/GPI01_D4_u		D27	I/O	DOWN	PCIEX1_0_WAKEN_M1_L/GPI01_B3	WORK_LED	1.8V
61	HDIMI_TX1_SD0/2I2C1_SD1/AVS1_I2C1_SD0/IDP01_M1/SPI_CLK_M0/PCE30_X4_C5LCLKREGN_M0/SDA1/CPD/GPI01_A3_d		A27	I/O	DOWN	UART6_CTSN_M1_BT	UART6_CTSN_M1 for BT	1.8V
63	PC1M1_CLK0/1I2C1_SD0/1I2C1_SD1/PERSTN_M2/UART7_RX_M2/SP10_C50_M2/GPI01_B4_u		E24	I/O	UP	PCIEX1_0_PERSTN_M1_L	PCIEX1_0_PERSTN_M1_Active_L	1.8V
65	PC1M1_SD0/1I2C1_SD0/1I2C1_SD1/PERSTN_M2/UART7_RX_M2/SP10_C50_M2/GPI01_B4_u		E25	I/O	UP	MIP1_CAM3_PDN_L	MIP1_CAM3_PDN_Active_L	1.8V
67	HDIMI_UART4_RX_M1/SP1_M2/GPI01_D3_d		B25	I/O	DOWN	VGA_HPDIN_L	VGA_HPDIN_Active_L	1.8V
69	HDIMI_TX1_HPDIN_M0/GPI01_B4_u		C24	I/O	DOWN	HDIMITX1_HPDIN_M0	HDIMITX1_HPDIN_Active_H	1.8V
71	PCIE30X1_0_WAKEN_M1/CLKREGN_M0/GPI01_B5_u		E25	I/O	UP	PCIEX1_0_CLKREGN_M1_L	PCIEX1_0_CLKREGN_M1_Active_L	1.8V
73	PC1M1_SD0/1I2C1_SD1/IDP01_M1/CLKREGN_M0/GPI01_B1_d		D25	I/O	DOWN	MIP1_CAM4_PVREN_H	MIP1_CAM4_PVREN_Active_H	1.8V
75	PC1M1_SD0/1I2C1_SD1/IDP01_M1/CLKREGN_M0/GPI01_B2_d		D26	I/O	DOWN	MIP1_CAM4_PVREN_H	MIP1_CAM4_PVREN_Active_H	1.8V
77	I2S0_SD0/2I2C0_SD0/1I2C1_SD1/AVS1_I2C1_SD0/IDP01_M1/SP1_M2/GPI01_D4_d		E28	I/O	UP	SP1_CS0_M2/UART4_RX_M0/I2C1_SDA_M4	SP1_CS0_M2/UART4_RX_M0/I2C1_SDA_M4	1.8V
79	PC1M1_SD0/1I2C1_SD1/AVS1_I2C1_SD0/IDP01_M1/SP1_M2/GPI01_D4_d		C27	I/O	UP	RESET0_CAM	RESET0_CAM	1.8V
81	I2S0_SD0/2I2C1_SD1/IDP01_M1/CLKREGN_M0/GPI01_D0_d		F26	I/O	DOWN	SP1_MISO_M2/UART6_RX_M2/I2C2_SD0_M2/SP1_M2/GPI01_D0_d	SP1_MISO_M2/UART6_RX_M2/I2C2_SD0_M2/SP1_M2/GPI01_D0_d	1.8V
83	I2S0_SD0/2I2C1_SD1/IDP01_M1/CLKREGN_M0/GPI01_D0_d		F27	I/O	DOWN	A_M0	A_M0	1.8V
85	PC1M1_CLK0/1I2C4_SD0_M4/PWPM15_IR_M2/GPI01_C6_d		D29	I/O	DOWN	PWPM15_M2	PWPM15_M2	1.8V
87	PC1M1_CLK0/1I2C4_SD0_M4/PWPM15_IR_M2/GPI01_C5_d		D30	I/O	DOWN	I2S0_RXC_KTX	I2S0_RXC_KTX	1.8V
89	PC1M1_SD0/1I2C1_SD0/IDP01_M1/CLKREGN_M0/GPI01_D4_d		D28	I/O	DOWN	I2S0_SD10	I2S0_SD10	1.8V
91	PC1M1_SD0/1I2C1_SD0/IDP01_M1/CLKREGN_M0/GPI01_D4_d		E30	I/O	DOWN	HP_DET_L	HP_DET_L_Active_L	1.8V
93	I2S0_SD0/2I2C1_SD1/IDP01_M1/CLKREGN_M0/GPI01_C5_d		E31	I/O	DOWN	I2S0_SCLK_TX	I2S0_SCLK_TX	1.8V
95	I2S0_SD0/2I2C1_SD1/IDP01_M1/CLKREGN_M0/GPI01_C5_d		E29	I/O	DOWN	I2S0_SD00	I2S0_SD00	1.8V
97	O1_C2_d		F30	I/O	DOWN	I2S0_MCLK	I2S0_MCLK	1.8V
99	GND		G			GND	GND	1.8V
101	PCIE20_2_REFCLKP		G31	I/O	DOWN	PCIE20_2_REFCLKP	PCIE20_2_REFCLKP	1.8V
103	PCIE20_2_REFCLKLN		G30	I/O	DOWN	PCIE20_2_REFCLKLN	PCIE20_2_REFCLKLN	1.8V
105	PCIE20_2_TXP/SATA30_2_TXP/USB30_2_SSTXP		H30	I/O	DOWN	PCIE20_2_TXP/SATA30_2_TXP	PCIE20_2_TXP/SATA30_2_TXP	1.8V
107	PCIE20_2_TXN/SATA30_2_TXN/USB30_2_SSTXN		H29	I/O	DOWN	PCIE20_2_TXN/SATA30_2_TXN	PCIE20_2_TXN/SATA30_2_TXN	1.8V
109	PCIE20_2_TXP/SATA30_2_TXP/USB30_2_SSRXP		J31	I/O	DOWN	PCIE20_2_RXP/SATA30_2_RXP	PCIE20_2_RXP/SATA30_2_RXP	1.8V
111	PCIE20_2_RXN/SATA30_2_TRXN/USB30_2_SRRXN		J30	I/O	DOWN	PCIE20_2_RXN/SATA30_2_RXN	PCIE20_2_RXN/SATA30_2_RXN	1.8V
113	GND		GND			GND	GND	1.8V
115	SP1_M1/2I2C1_SD1/AVS1_I2C1_SD0/IDP01_M1/CLKREGN_M0/GPI01_D4_d		L30	I/O	Tri-State	RTC_INT_L	RTC_INT_Input_Active_L	1.8V
117	I2S1_SD1/CLK1_M1/CLKREGN_M0/GPI01_D4_d		P29	I/O	DOWN	UART2_TX_M0_DEBUG	UART2_TX_M0_DEBUG	1.8V
119	SCL1_SD1/CLK1_M1/CLKREGN_M0/GPI01_D4_d		R29	I/O	DOWN	UART2_RX_M0_DEBUG	UART2_RX_M0_DEBUG	1.8V
121	E23_1_0_PERSTN_M0/GPI01_B7_d		T28	I/O	DOWN	GMAC0_INT/PMEB_1V8	GMAC0_INT/PMEB_1V8	1.8V
123	PC1M1_CLK0/1I2C1_SD0/IDP01_M1/CLKREGN_M0/GPI01_D0_d		T31	I/O	DOWN	GMAC1_INT/PMEB_1V8	GMAC1_INT/PMEB_1V8	1.8V
125	I2S1_SD1/IDP01_M1/CLKREGN_M0/GPI01_D0_d		V31	I/O	DOWN	I2C6_SDA_M0	I2C6_SDA_M0	1.8V
127	I2S1_SD1/IDP01_M1/CLKREGN_M0/GPI01_D0_d		W31	I/O	DOWN	I2C6_SCL_M0	I2C6_SCL_M0	1.8V
129	GND		G			GND	GND	1.8V
131	GMAC0_RXD2/DS0/DO_M1/CLKREGN_M0/GPI01_A6_u		AC32	I/O	UP	GMAC0_RXD2	GMAC0_RXD2	1.8V
133	GMAC0_RXD2/DS0/DO_M1/CLKREGN_M0/GPI01_A7_u		AC31	I/O	UP	GMAC0_RXD3	GMAC0_RXD3	1.8V
135	GMAC0_RXD0/2I2C2_SD1/CLKREGN_M0/GPI01_A6_u		AD32	I/O	DOWN	GMAC0_RXD0	GMAC0_RXD0	1.8V
137	GMAC0_RXD0/2I2C2_SD1/CLKREGN_M0/GPI01_A7_u		AD31	I/O	DOWN	GMAC0_RXD1	GMAC0_RXD1	1.8V
139	GMAC0_RXD1/CLKREGN_M0/GPI01_D0_d		AE32	I/O	UP	GMAC0_RXD2	GMAC0_RXD2	1.8V
141	GMAC0_RXDV_C5M1/CLKREGN_M0/GPI01_D0_d		AE31	I/O	DOWN	GMAC0_RXDV_CRS	GMAC0_RXDV_CRS	1.8V
143	GMAC1_MDI0/MP1_C5M1/CLKREGN_M0/GPI01_D0_d		Y30	I/O	DOWN	GMAC1_MDI0	GMAC1_MDI0	1.8V
145	GMAC1_MDI0/MP1_C5M1/CLKREGN_M0/GPI01_C2_d		Y31	I/O	DOWN	GMAC1_MDC	GMAC1_MDC	1.8V
147	GMAC1_MDI0/MP1_C5M1/CLKREGN_M0/GPI01_A7_d		A28	I/O	DOWN	GMAC1_RSTN_L	GMAC1_RSTN_Active_L	1.8V
149	GMAC1_RXD2/DS0/DO_M1/CLKREGN_M0/GPI01_D0_d		AD30	I/O	DOWN	LC01_RST1_V8	MIPI_TX_RESET	1.8V
151	GMAC1_RXD2/DS0/DO_M1/CLKREGN_M0/GPI01_B6_d		A29	I/O	DOWN	GMAC1_MCLKINOUT	GMAC1_MCLKINOUT	1.8V
153	GMAC1_RXD2/DS0/DO_M1/CLKREGN_M0/GPI01_B6_d		A30	I/O	DOWN	GMAC1_RXD2	GMAC1_RXD2	1.8V
155	GMAC1_RXD2/DS0/DO_M1/CLKREGN_M0/GPI01_B6_d		A31	I/O	DOWN	GMAC1_RXD3	GMAC1_RXD3	1.8V
157	GMAC1_RXD2/DS0/DO_M1/CLKREGN_M0/GPI01_B							

Interface Description



About us

T-Chip Intelligent Technology (Zhongshan) Co., Ltd. , established in 2005, has more than ten years of technological product research and development capabilities, and has nearly 100 patents and software copyrights. As a national high-tech enterprise, we focus on the research and development, production and sales of open source smart hardware, Internet of Things, and digital audio products, while also provide overall solutions with smart hardware products.

T-Chip is an IDH (Independent Design House) officially authorized by Rockchip in Fuzhou, and also a strategic partner of Rockchip, with a close cooperative relationship for more than 10 years.

Firefly is a brand established by T-Chip, with open source community and online store. Firefly products include core boards, mainboards, embedded computers, cluster servers, development kits and other products. Currently, we have more than 100,000 users, including more than 10,000 enterprise users such as Arm, Google, Baidu, Tencent and Alibaba.

Firefly team has more than 70 R&D members, with excellent research and development capabilities of schematic design, PCB layout, board mass production, embedded development, system development, application development and so on. We accelerate the research and development process for many technology entrepreneurs and start-ups, and provide professional technical services.

Make technology simpler, Make life smarter - is the idea of Firefly team. We hope that through Firefly's open source products and technical services, the research and development of various technological products will become efficient and simple, and intelligent technology can be integrated into life.

Firefly is committed to providing enterprise customers with long-term stable and reliable industrial products and services, and continuously creating value for customers.

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