Tronlong®

TL3576-EVM

Specification

Revision History

Draft Date	Revision No.	Description
2025/04/03	V1.0	1. Initial version.

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1 Evaluation Mainboard Introduction

The TL3576-EVM, designed by Tronlong, is a Quad-core ARM Cortex-A72 + Quad-core ARM Cortex-A53 + Single core ARM Cortex-M0 industrial Evaluation Mainboard based on the high-performance processor RK3576J/RK3576 from Rockchip. The Cortex-A72 core has a maximum clock frequency up to 2.2GHz, while the Cortex-A53 core has a maximum clock frequency up to 2.0GHz. The TL3576-EVM consists of a System on Module and an Evaluation Carrier Board. All the components of the SOM, such as CPU, ROM, RAM, power supply, crystal, and connectors are industrial-grade solutions. At the same time, most of the components on the Evaluation Carrier Board also adopt industrial-grade solutions. The SOM has professional PCB Layout and has passed high and low temperature test from -40℃ to 85℃. Due to its stable and reliable quality, which can meet the requirements of various industrial application environments.

The TL3576-EVM offers a wide range of interfaces, including 4-channel Ethernet, 3-channel USB3.2, 2-channel CAN-FD, 2-channel RS485, PCIe 2.1, and other communication interfaces. It also provides MIPI CSI, LVDS OUT, MIPI DSI, DP(DisplayPort), HDMI OUT, MIC IN, HP OUT, LINE IN for audio, video and multimedia applications. The TL3576-EVM supports three-screen different displays, 4K@60fps H.265/H.264 video encoding and 8K@30fps H.265/4K@60fps H.264 video decoding. It is equipped with an on-board WiFi/Bluetooth 2-in-1 module, and supports optional 4G/5G module, NVMe SSD, PLP power outage protection module. It supports optional enclosure and can be directly applied to the industrial field, facilitating users to quickly conduct the product program evaluation and technology pre-study.

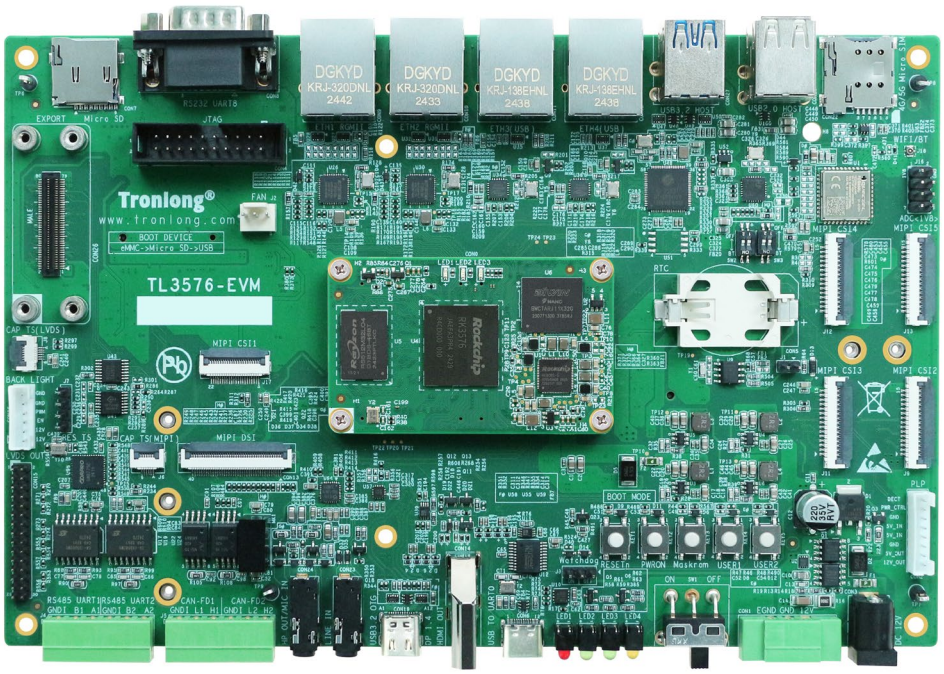

Figure 1 Top View of the Evaluation Mainboard

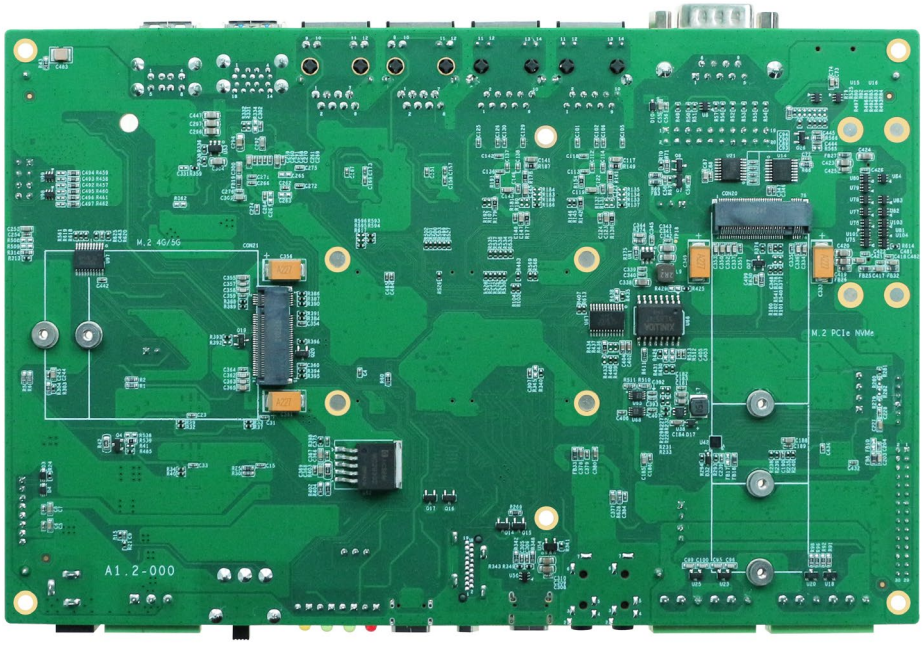

Figure 2 Bottom View of the Evaluation Mainboard

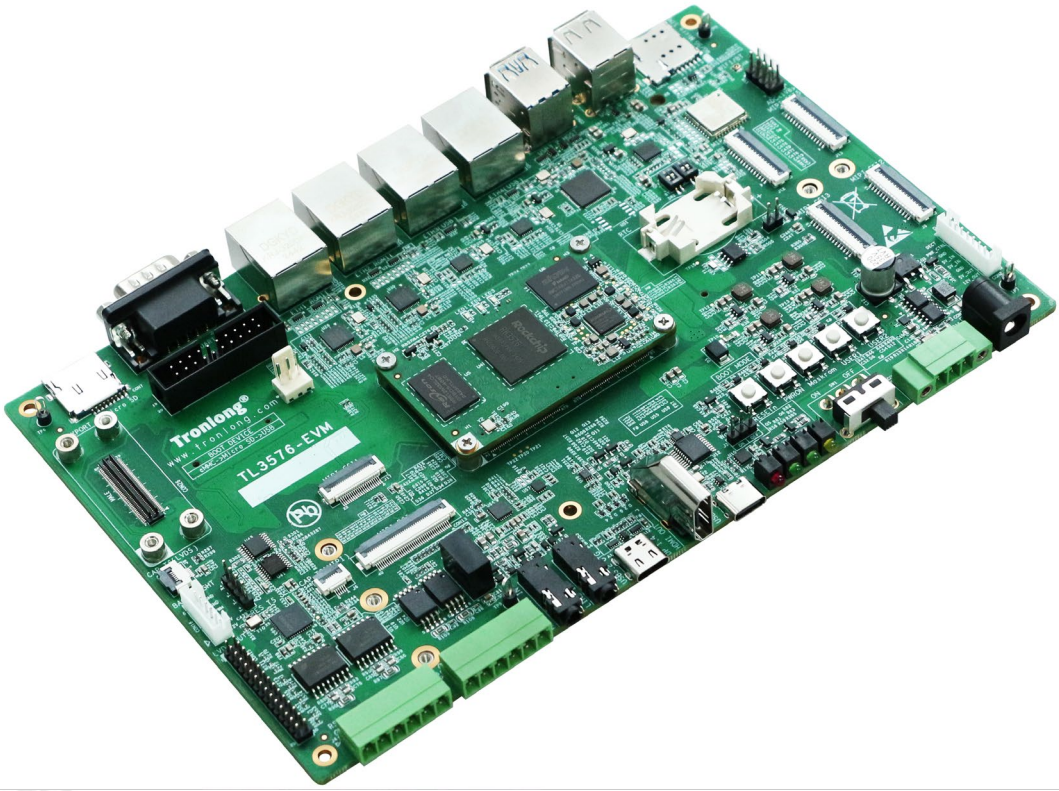

Figure 3 Oblique View of the Evaluation Mainboard

Figure 4 Front View of the Evaluation Mainboard 1

Figure 5 Front View of the Evaluation Mainboard 2

Figure 6 Front View of the Evaluation Mainboard 3

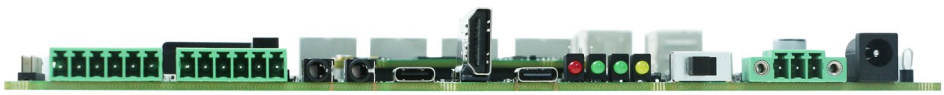

Figure 7 Front View of the Evaluation Mainboard 4

2 Typical Applications

- ✓ Advanced Industrial PLC
- ✓ Motion Controllers
- ✓ Industrial Computer
- ✓ Agricultural Drones
- ✓ Power Monitoring Devices
- ✓ 4K Medical Endoscopes

3 EVM Specifications

Hardware Block Diagram

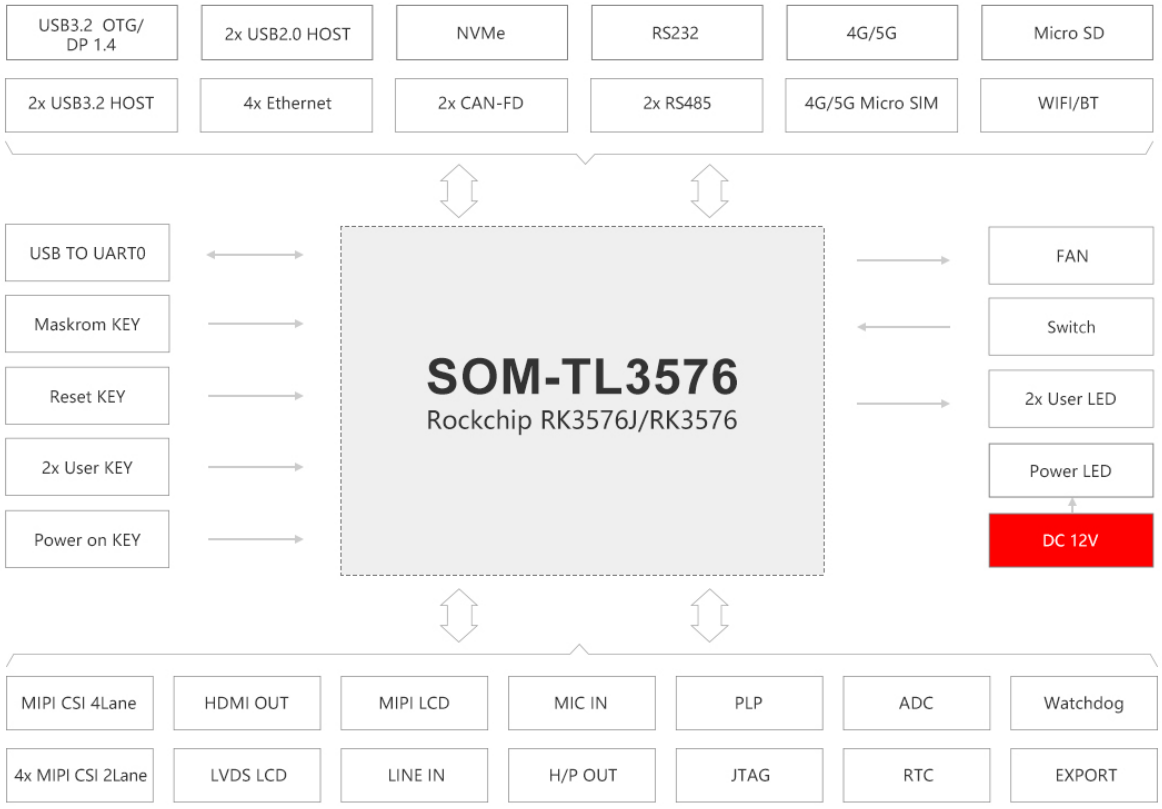

Figure 8 Evaluation Mainboard Hardware Block Diagram

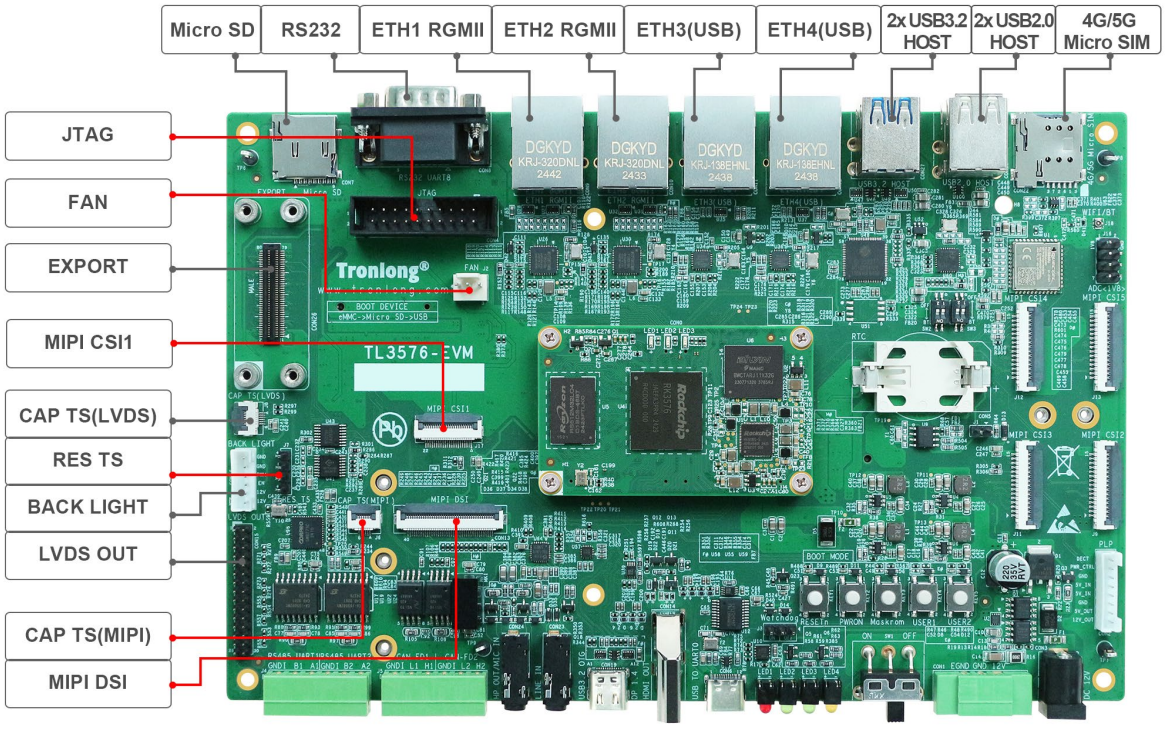

Figure 9 Evaluation Mainboard Hardware Resources Diagram 1

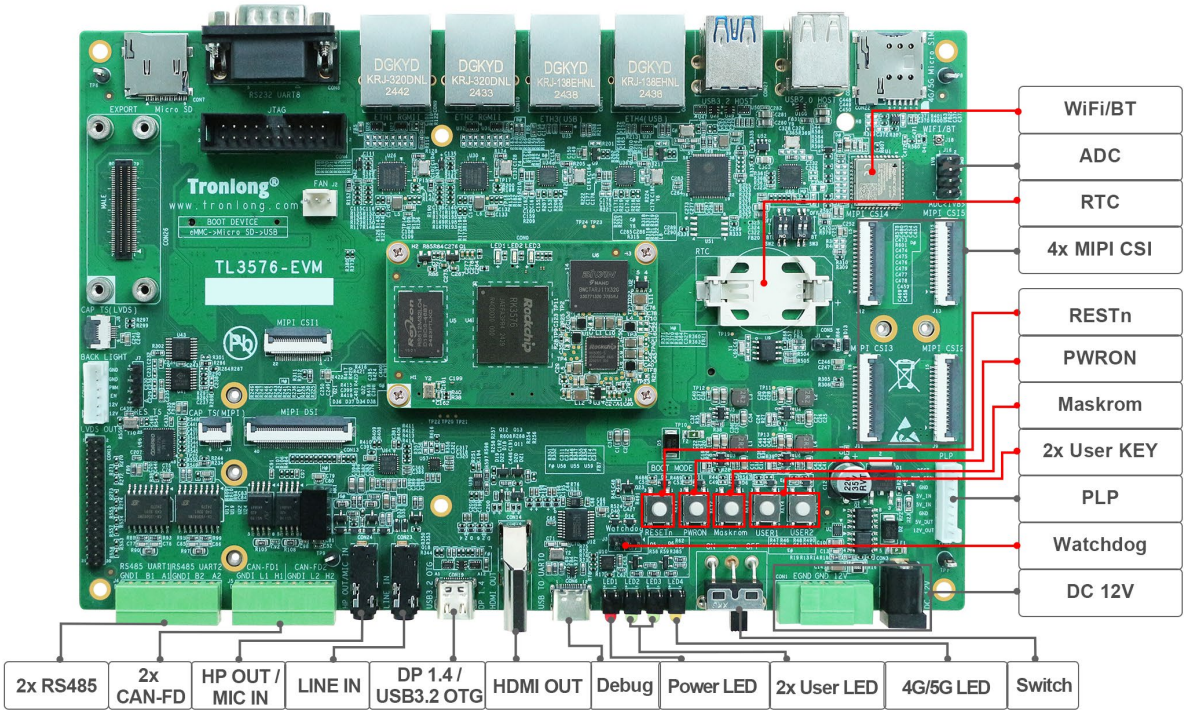

Figure 10 Evaluation Mainboard Hardware Resources Diagram 2

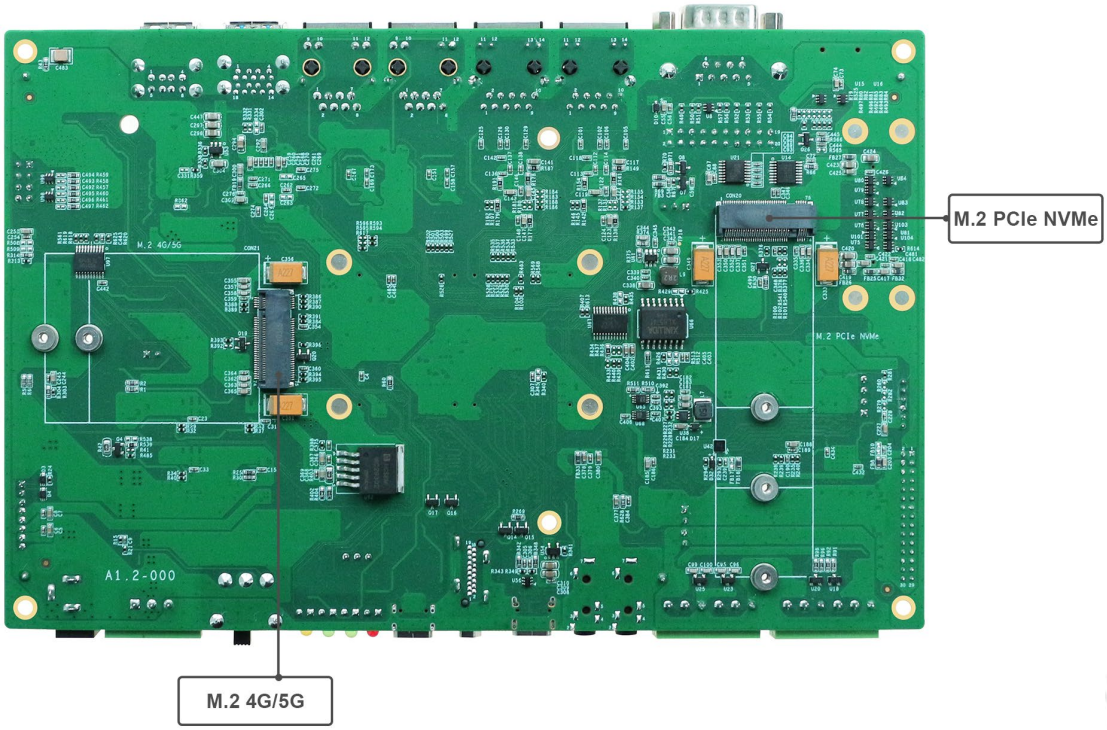

Figure 11 Evaluation Mainboard Hardware Resources Diagram 3

Hardware Specifications

Table 1

CPU	Rockchip RK3576J/RK3576, 64bit, 8nm
	4x ARM Cortex-A72 RK3576J main frequency: normal mode 1.6GHz, overdrive mode 2.1GHz RK3576 main frequency: 2.2GHz Note: To ensure the lifespan of the processor and meet the requirements of more industrial application scenarios, our company has set the default maximum clock frequency of the Cortex-A72 core of the RK3576J/RK3576 processor to 1.6GHz. If you need to adjust to a higher frequency, please refer to the user manual for operation.
	4x ARM Cortex-A53 RK3576J main frequency: normal mode 1.4GHz, overdrive mode 1.9GHz RK3576 main frequency: 2.0GHz Note: To ensure the lifespan of the processor and meet the requirements of more industrial application scenarios, our company has set the default maximum clock frequency of the Cortex-A53 core of the RK3576J/RK3576 processor to 1.4GHz. If you need to adjust to a higher frequency, please refer to the user manual for operation.
	1x ARM Cortex-M0, main frequency: 400MHz
	NPU: 6TOPS Supports INT4/INT8/INT16/FP16/BF16/TF32

	Supports for TensorFlow/PyTorch/Caffe/MXNet deep learning frameworks
	GPU: Mali-G52 MC3, supports OpenGL ES 1.1/2.0/3.2, OpenCL 2.0, Vulkan 1.1
	ISP: supports 16M ISP, supports HDR, 3A, CAC, 3DNR, 2DNR, etc
	Decoder: supports 8K@30fps/4K@120fps H.265, 4K@60fps H.264
	Encoder: supports 4K@60fps H.265/H.264
ROM	16/32/64GByte eMMC
	128GByte UFS (default empty post)
RAM	2/4/8GByte LPDDR4X
B2B Connector	System on Module: 2x 80pin plug B2B connectors, 2x 80pin receptacle B2B connectors; Evaluation Carrier Board: 2x 80pin plug B2B connectors, 2x 80pin receptacle B2B connectors; Total 320pins, pitch 0.5mm, total height 4.0mm
LED	2x Power LED(one for SOM, one for Evaluation Carrier Board)
	4x User LED(two for SOM, two for Evaluation Carrier Board)
	1x 4G/5G module LED(Evaluation Carrier Board)
KEY	1x PWRON Key
	1x CPU RESET Key
	1x Maskrom Key, supports entering Maskrom mode for system firmware update
	2x User Input Keys Note: KEY4(USER1) button can be used as Recovery function at the same time
Video IN	5x MIPI CSI, including 1x MIPI CSI (4Lane) and 4x MIPI CSI(2Lane) MIPI CSI(4Lane): MIPI DPHY V2.0 specification, supports up to 4.5Gbps per Lane, 22pin FFC connector interface, 0.5mm pitch MIPI CSI(2Lane): MIPI DPHY V1.2 specification, supports up to 2.5Gbps per Lane, 15pin FFC connector interface, 1.0mm pitch Note: MIPI CSI4 and MIPI CSI5 interfaces have a multiplexed relationship for the I2C1 signal pin
Video OUT	1x HDMI OUT, HDMI receptacle, supports 4K@120fps resolution
	1x DP(DisplayPort) 1.4, supports 4K@120fps resolution, Type-C connector Note: DP 1.4 and USB3.2 OTG share a Type-C port
	1x MIPI DSI, supports 2560x1600@60fps resolution, supports capacitive touch screen; 40pin(display) + 6pin(capacitive touch) FFC connector with 0.5mm pitch
	1x LVDS OUT, supports 1920x1080@60fps resolution, supports capacitive touch screen and resistive touch screen; 2x 15pin (display) + 6pin (backlight) header pins, 2.0mm pitch; 4pin (resistive touch) header pins, 2.54mm pitch; 6pin (capacitive

	touch)FFC connector, 0.5mm pitch Note: LVDS OUT is multiplexed with the MIPI DSI capacitive touch signal pins
Audio	1x HP OUT/MIC IN, 3.5mm audio socket
	1x LINE IN, 3.5mm Audio socket
USB	2x USB3.2 HOST, dual-layer Type-A connectors Note: The USB3 OTG1 bus is expanded by four signals through the first-class USB3.2 HUB, with two of the expansions leading out of the USB3.2 HOST
	2x USB2.0 HOST, dual-layer Type-A connectors Note: The USB3 OTG1 bus is expanded by four signals through the secondary USB2.0 HUB, with two of the expansions leading out to the USB2.0 HOST
	1x USB3.2 OTG from USB3 OTG0 bus, Type-C connector
SD	1x Micro SD, Micro SD card slot
Ethernet	2x RGMII ETH, 10/100/1000Mbps Adaptive, RJ45 connector
	2x USB ETH, 10/100Mbps Adaptive, RJ45 connector Note: The USB3 OTG1 bus is expanded by four signals through a secondary USB2.0 HUB, with two of the expansions leading out of the USB ETH
4G/5G	1x M.2 4G/5G module(optional), M.2 B Key slot Note: USB3 OTG1 bus through the first-class USB3.2 HUB for 4 channels signal expansion, with one of the extended leading out to the 4G/5G module
	1x Micro SIM
NVMe	1x M.2 NVMe hard disk(optional), leading out of PCIe 2.1(PCIe0), M.2 M Key slot
WiFi/BT	1x WiFi/Bluetooth 2-in-1 module, connected via SDMMC1/SAI2/UART4, supports WiFi5, Bluetooth 5.0
CAN-FD	2x CAN-FD, 1x 6pin green connector, 3.81mm pitch
UART	1x Debug UART, pin out from UART0, Type-C connector
	2x RS485 UART, leading out of UART1, UART2, 1x 6pin green connector, 3.81mm pitch
	1x RS232 UART, leading out of UART8, DB9 interface
Watchdog	1×3-pin header configuration interface, with a 2.54mm pitch, using an external chip solution.
RTC	1× RTC holder, compatible with ML2032 (3V rechargeable) and CR2032 (3V non-rechargeable) coin cell batteries.
ADC	1x ADC, 6-channel, 2x 4pin Header, 2.54mm Pitch
EXPORT	1x EXPORT expansion connector with DSMC, FlexBus, FSPI, SPI, GPIO and other signals leading out of 80pin plug B2B connector, pitch 0.5mm, total height 4.0mm
JTAG	1x ARM JTAG interface, 2x 10pin horn connector, 2.54mm pitch

FAN	1x FAN, 12V Power Supply, 3pin header, 2.54mm pitch
Switch	1x Power Toggle Switch
PLP	1x Power Loss Protection module(optional), 8pin white terminal, 2.0mm pitch
Power	1x 12V DC input DC-005 power connector for power plugs with OD of 5.5mm and ID of 2.1mm
	1x 12V DC input, 3pin green connector, 3.81mm pitch

Note: Some hardware interface resources have a multiplexing relationship.

Software Specifications

Table 2

Operating System	Buildroot-2024.02 (Linux-6.1.75, Linux-RT-6.1.75) Buildroot-2024.02(Linux-6.1.115、Linux-RT-6.1.115) Android 14	
Qt Version	Qt-5.15.11	
Software Development Kit	rk3576_linux6.1_release_v1.0.0_20240620 rk3576_linux6.1_release_v1.1.0_20241220 RK3576_Android14.0_SDK_Release	
Support Driver	eMMC	LPDDR4X
	UFS	SD
	LED	KEY
	MIPI DSI	HDMI OUT
	DP	LVDS OUT
	MIPI CSI	HP OUT/MIC IN/LINE IN
	Ethernet	PCIe NVMe
	RS232	USB3.2/2.0
	RS485	CAN-FD
	UART	WiFi
	Bluetooth	USB 4G/5G
	RTC	ADC

	DSMC	Watchdog
	FlexBus	FAN

4 Development Resources

（1）Provide SOM pin definition, SOM 3D model files, EVM schematic, EVM PCB and chips Datasheet to assist in the selection of component program and shorten hardware design cycle;

（2）Provide system curing image, Bootloader source code, Kernel driver source and rich Demo programs;

（3）Provide complete platform development kits and getting started tutorials to save time on software organization and make application development simpler;

（4）Provide detailed ARM + FPGA heterogeneous multi-core architecture communication tutorials to solve development bottlenecks of ARM + FPGA heterogeneous multi-core systems.

Development demos mainly include:

- Linux,Linux-RT and Qt application
- Demonstration of Android OS
- NPU application
- Multi-screen Different Display, OpenCV, video hardware codec application
- Multi-channel MIPI video capture, ISP image processing application
- Linux + Baremetal/RT-Thread (RTOS) Asymmetric AMP application
- Demonstration of Docker container technology and MQTT communication protocol
- 4G/5G/WiFi/Bluetooth/B Code Timing application
- IgH EtherCAT, expansion of USB Ethernet port application
- Application of Cortex-A72/A53 and Cortex-M0 Inter-core Communication

➢ Application of ARM + FPGA communication based on DSMC, FlexBus, PCIe

Note: Some demos may not be released at this stage, please consult our sales staff for details.

5 Electrical Characteristics

Operating Conditions

Table 3

Environmental Parameter	Minimum	Typical	Maximum
SOM Operating Temperature (Industrial-grade)	-40°C	/	85°C
SOM Operating Temperature (Wide Temperature Range)	0°C	/	80°C
SOM Operating Voltage	/	5.0V	/
EVM Operating Voltage	/	12.0V	/

Power Consumption Testing

Table 4

Category	Operating State	Typical Voltage	Typical Current	Typical Power Consumption
SOM	**State 1**	5.0V	0.08A	0.40W
	State 2	5.0V	0.51A	2.55W
EVM	**State 1**	12.0V	0.23A	2.76W
	State 2	12.0V	0.42A	5.04W

Note: Power consumption is measured based on the TL3576-EVM Evaluation Mainboard(with a CPU of RK3576J,featuring an ARM Cortex-A72 running at 1.6GHz and an ARM Cortex-A53 running at 1.4GHz) running the Buildroot system under natural cooling conditions. The test data is related to specific application scenarios and is for reference only.

State 1: The system is booted, the Evaluation Mainboard is not connected to other external modules and does not execute the program.

State 2: The system is booted, the Evaluation Mainboard is not connected to other external modules,Weston desktop is closed,and the test command "stress-ng --cpu 8 --vm 8 --vm-bytes 64M --timeout 86400s &" is running,and the resource utilization rate of the 4 ARM Cortex-A72 and 4 ARM Cortex-A53 cores is about 100%.

6 Mechanical Dimensions

Table 5

	System on Module	Evaluation Carrier Board
PCB Dimensions	38mm*62mm	135mm*208mm
PCB Layers	10 layers	6 layers
PCB Thickness	2.0mm	2.0mm
Number of Mounting Holes	4	6

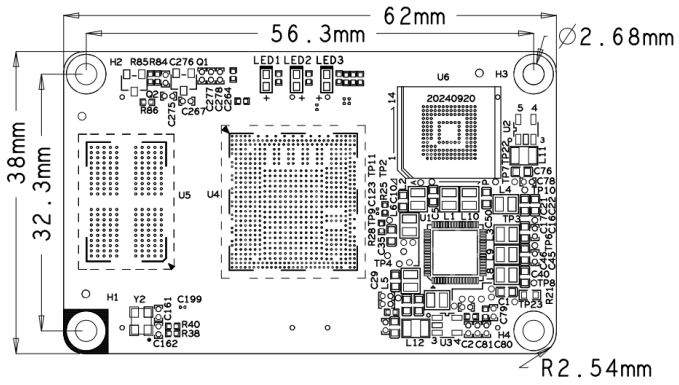

Figure 12 SOM Mechanical Dimensions Diagram

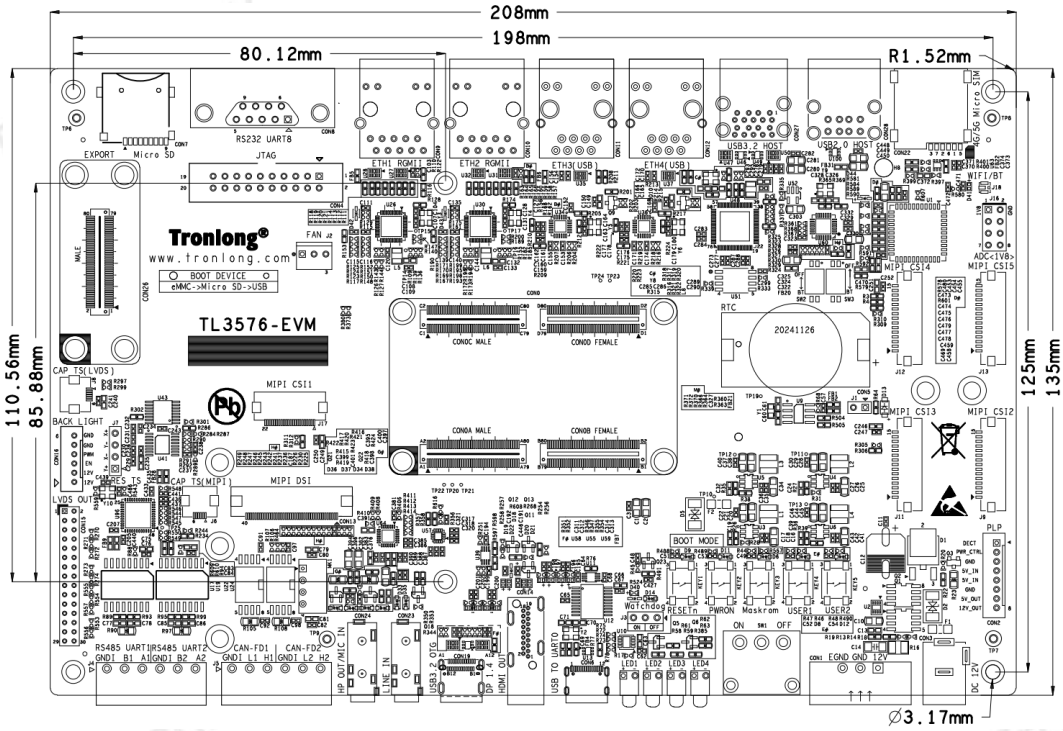

Figure 13 Evaluation Carrier Board Mechanical Dimensions Diagram

7 Product Ordering Part Number

Table 6

Configuration	Part Number	CPU	Main Frequency	eMMC	LPDDR4X
S (Standard)	TL3576-EVM-A1.2-128GE16GD-I-A1.0	RK3576J	2.1GHz	16GByte	2GByte
A	TL3576-EVM-A1.2-256GE32GD-I-A1.0	RK3576J	2.1GHz	32GByte	4GByte
B	TL3576-EVM-A1.2-512GE64GD-I-A1.0	RK3576J	2.1GHz	64GByte	8GByte
C	TL3576-EVM-A1.2-256GE16GD-W-A1.0	RK3576	2.2GHz	32GByte	2GByte
D	TL3576-EVM-A1.2-256GE32GD-W-A1.0	RK3576	2.2GHz	32GByte	4GByte
E	TL3576-EVM-A1.2-512GE64GD-W-A1.0	RK3576	2.2GHz	64GByte	8GByte

Note: The standard configuration is TL3576-EVM-A1.2-128GE16GD-I-A1.0,please contact the relevant sales staff for other models.

Explanation of model parameters

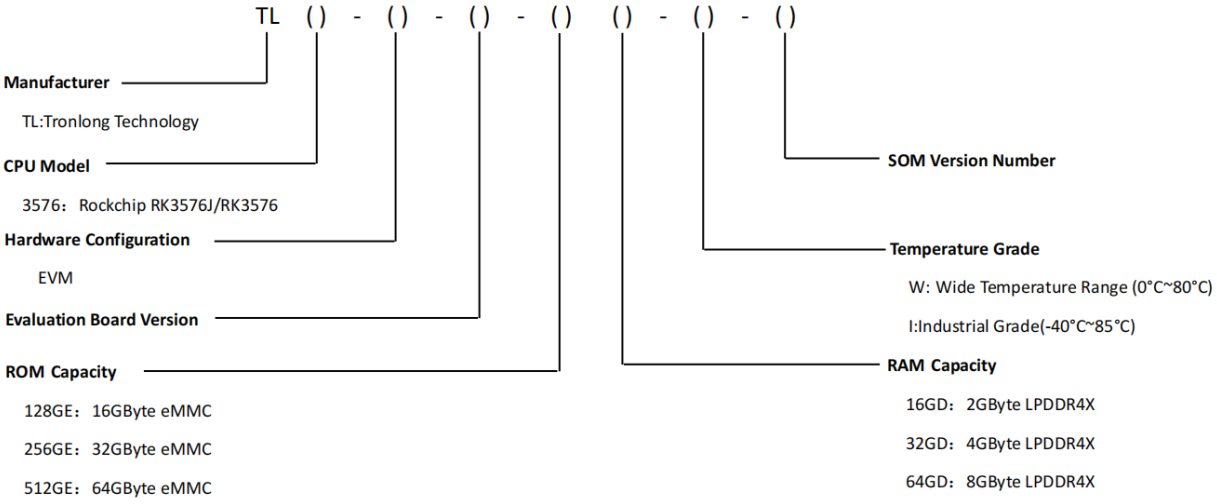

Figure 14

8 EVM Kit List

Table 7

Name	Quantity
TL3576-EVM Evaluation Mainboard	1
12V2A Power Adapter	1
Micro SD Card	1
Card Reader	1
HDMI Cable	1
Ethernet Cable	1
Type-C Cable	1
RS232 Crossover Serial Female-Female Cable	1
USB to RS232 Male Serial Cable	1
2.4G Antenna	1

9 Technical Services

（1）Assists in the design and testing of the carrier board to reduce errors in hardware design;

（2）Assist in resolving any abnormal issues that arise when following the user manual;

（3）Assist in product failure determination;

（4）Assist in correct compilation and operation of the provided source;

（5）Assist in the secondary development of the product;

（6）Provide long-term after-sales service.

10 Value-Added Services

- Customized Mainboard Design
- Customized SOM Design
- Embedded Software Development
- Project Collaboration Development
- Technical Training

Additional Information

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