

Tronlong®

SOM-TL3576

Specification

Revision History

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

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1 SOM Introduction

The SOM-TL3576, designed by Tronlong, is a quad-core ARM Cortex-A72 + quad-core ARM Cortex-A53 + single-core ARM Cortex-M0 industrial System on Module (SOM) 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. All components of the SOM, such as CPU, ROM, RAM, power supply, crystal, and connectors, are industrial-grade solutions.

The SOM provides 2x GMAC, 2x USB3.2, 2x SATA 3.1, 2x PCIe 2.1, 2x SDMMC, 2x CAN-FD, 5x MIPI CSI, MIPI DSI, HDMI/eDP OUT, DP Display, RGB Display and other interfaces through the industrial-grade B2B connector, with built-in 6TOPS NPU, Mali-G52 MC3 GPU, 16M ISP, and supports three-screen different display, 4K@60fps H.265/H.264 video encoding and 8K@30fps H.265/4K@60fps H.264 video decoding, and supports UFS high-capacity storage devices. The SOM has professional PCB Layout and has been passed high and low temperature test from -40°C to 85°C . Due to its stable and reliable quality, the SOM can meet the requirements of various industrial environments.

Tronlong provides a comprehensive and rich open source software system and reference design development kit, enabling users to quickly design and develop products based on the SOM. This can reduce the difficulty of development, shorten the product development cycle, and lower research and development costs, thereby achieving rapid product market entry.

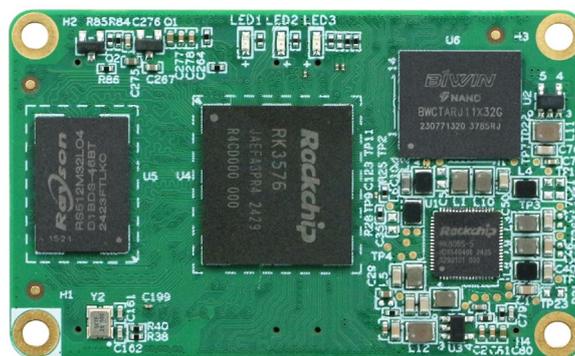


Figure 1 Top View of the SOM



Figure 2 Bottom View of the SOM



Figure 3 Oblique View of the SOM



Figure 4 Front View of the SOM

2 Typical Applications

- ✓ Advanced Industrial PLC
- ✓ Motion Controllers
- ✓ Industrial Computer

- ✓ Agricultural Drones
- ✓ Power Monitoring Devices
- ✓ 4K Medical Endoscopes

3 SOM Specifications

Hardware Block Diagram

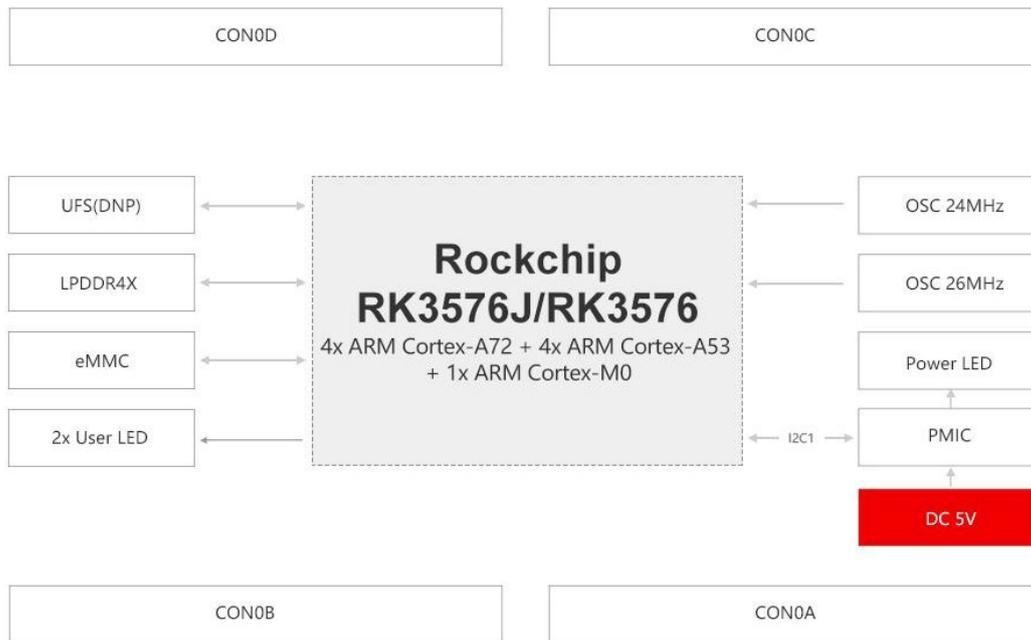


Figure 5 Hardware Block Diagram of the SOM

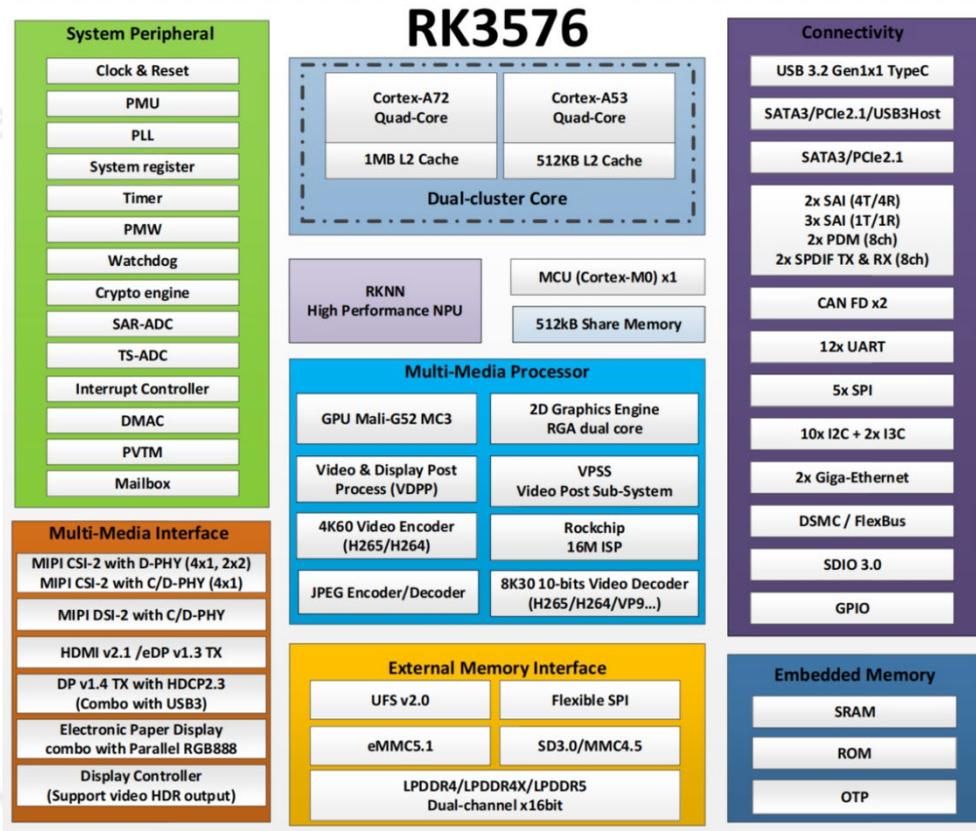


Figure 6 Processor Functional Block Diagram

Hardware Specifications

Table 1

| | |
|------------|--|
| CPU | Rockchip RK3576J/RK3576, 64bit, 8nm |
| | <p>4x ARM Cortex-A72</p> <p>RK3576J main frequency: normal mode 1.6GHz, overdrive mode 2.1GHz</p> <p>RK3576 main frequency: 2.2GHz</p> <p>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.</p> |
| | <p>4x ARM Cortex-A53</p> <p>RK3576J main frequency:normal mode 1.4GHz,overdrive mode 1.9GHz</p> <p>RK3576 main frequency:2.0GHz</p> <p>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</p> |

| | |
|----------------------|---|
| | 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: 16M, 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 | 2x 80pin Plug B2B connectors, 2x 80pin receptacle B2B connectors, 320pin total, 0.5mm pitch, 4.0mm total height |
| LED | 1x Power LED |
| | 2x User LED |
| Video IN | 1x MIPI CSI (DCPHY) Supports MIPI CSI DPHY V2.0 specification, contains 4 Lane data channels, up to 4.5Gbps per Lane Supports MIPI CSI CPHY V1.1 specification, contains 3 Lane data channels, up to 2.5Gbps per Lane |
| | 4x MIPI CSI (DPHY) Supports MIPI CSI DPHY V1.2 specification, each MIPI CSI contains 2Lane data channels, up to 2.5Gbps per Lane, supports 4x 2Lane, 2x 4Lane mode |
| | 1x DVP (Digital Video Port, same as CIF), 8/10/12/16bit, supports BT.601, BT.656, BT.1120 |
| Video OUT | 1x HDMI/eDP OUT HDMI OUT supports HDMI2.1 specification, up to 4K@120fps resolution eDP OUT supports eDP1.3 specification, up to 4K@60fps resolution Note: HDMI OUT is multiplexed with eDP OUT |
| | 1x DP(DisplayPort) TX, supports DP 1.4a specification up to 4K@120fps resolution Note: DP TX is multiplexed with USB3 OTG0 |
| | 1x MIPI DSI (DCPHY), supports MIPI DPHY V2.0 or MIPI CPHY V1.1 specification, up to 2560x1600@60fps resolution |
| | 1x LCDC (Parallel Interface) Supports 24bit RGB mode, up to 1080P@60fps resolution |

| | |
|---------------------------------|--|
| | <p>Supports 16bit BT.1120 mode, up to 1080P@60fps resolution</p> <p>Supports 8bit BT.656 mode, up to 720x576@60fps resolution</p> |
| | <p>1x EBC (E-ink Electronic Paper Display), supports up to 2560x1920@85fps resolution</p> |
| Audio | <p>5x SAI (Serial Audio Interface), SAI0~SAI4, supports I2S/PCM/TDM modes, 16bit~32bit resolution, sampling frequency up to 192KHz</p> |
| | <p>2x SPDIF_TX, 2x SPDIF_RX, supports linear PCM mode</p> |
| | <p>2x PDM (PDM0/PDM1), 8 channels, 16bit~24bit resolution, sampling frequency up to 192KHz</p> |
| Other hardware resources | <p>2x SDMMC/SDIO, supports SD3.0, MMC4.51 protocol, 4bit data bus bit width</p> |
| | <p>1x UFS, supports UFS V2.0 specification, 2 Lane data channel, rate up to 5.8Gbps per Lane</p> <p>Note: Inside the SOM is already using the UFS function internally and is not pinned out to the B2B connector.</p> |
| | <p>2x PCIe 2.1, only supports Root Complex (RC) mode, 1 Lane of data per PCIe 2.1, up to 5Gbps per Lane</p> <p>Note: PCIe0 is multiplexed with SATA0, PCIe1 is multiplexed with SATA1 and USB3 OTG1</p> |
| | <p>2x SATA 3.1 with eSATA support at up to 6Gbps</p> <p>Note: SATA0 is multiplexed with PCIe0, SATA1 is multiplexed with PCIe1 and USB3 OTG1</p> |
| | <p>2x USB3.2, Gen1 x1, with OTG support up to 5Gbps</p> <p>Note: USB3 OTG0 is multiplexed with DP TX, USB3 OTG1 is multiplexed with PCIe1 and SATA1</p> |
| | <p>2x GMAC, supports RMII/RGMII interfaces, 10/100/1000Mbps adaptive</p> |
| | <p>1x FSPI(FSPI1), supports SDR mode, supports 2 chip selects, supports single/dual/quad wire mode</p> <p>Note: FSPI0 is multiplexed with the eMMC interface and is not pinned out to the B2B connector</p> |
| | <p>1x DSMC(Double Data Rate Serial Memory Controller), supports 4 chip selects, 8/16bit serial transfer mode, clock rate up to 100MHz</p> |
| | <p>2x FlexBus, supports 2/4/8/16bit parallel transfers with clock rate up to 100MHz</p> <p>Note: FlexBus is multiplexed with DSMC; FlexBus0 supports sending and receiving, FlexBus1 supports receiving only</p> |
| | <p>2x CAN-FD, supports CAN standard and extended frames</p> |
| | <p>5x SPI(SPI0~SPI4), support master and slave mode, each SPI supports 2 chip selects</p> |
| | <p>12x UART(UART0~UART11), supports flow control mode(except UART0), baud rate up to 8Mbps</p> |
| | <p>2x I3C (I3C0/I3C1), supports 7bit and 10bit address mode, supports I3C bus master mode(up to 12.5Mbps), compatible with I2C bus master mode(up to</p> |

| | |
|--|---|
| | 400Kbps) |
| | 10x I2C(I2C0~I2C9), supports 7bit and 10bit address mode, supports standard mode(100Kbps), fast mode(400Kbps) Note: Inside the SOM, the I2C1 bus have been connected to the PMIC(address 0x23) and also pinned out to the B2B connector |
| | 16x PWM, supports input capture mode, PWM0 supports 2 channels, PWM1 supports 6 channels, PWM2 supports 8 channels |
| | 30x Timer, 64bit, supports Timer Interrupt |
| | 6x Watchdog, 32-bit Watchdog Counter |
| | 1x SARADC, 8-channel single-ended input, 12-bit resolution, sampling rate up to 1MSPS |

Note: Some pin resources have a multiplexing relationship.

Software Specifications

Table 2

| | | |
|---------------------------------|--|-----------------------|
| Operating Systems | 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 components program and shorten the 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
- Android OS application
- 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) AMP Development Example
- Demonstration of Docker container technology and MQTT communication protocol
- 4G/5G/WiFi/Bluetooth/B Code Timing application

- IgH EtherCAT,USB Network Port Expansion application
- Cortex-A72/A53 and Cortex-M0 Inter-core Communication application
- ARM + FPGA communication application 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 |
|---|---------|---------|---------|
| Operating Temperature (Industrial-grade) | -40°C | / | 85°C |
| Operating Temperature (Wide Temperature Range) | 0°C | / | 80°C |
| Supply voltage | / | 5.0V | / |

Power Consumption Testing

Table 4

| Operating State | Typical Voltage | Typical Current | Typical Power Consumption |
|-----------------|-----------------|-----------------|---------------------------|
| State 1 | 5.0V | 0.08A | 0.40W |
| State 2 | 5.0V | 0.51A | 2.55W |

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 no program is executed.

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 run, the resource utilization rate of the 4 ARM Cortex-A72 and 4 ARM Cortex-A53 cores is about 100%.

6 Mechanical Dimensions

Table 5

| | |
|--|-----------|
| PCB Dimensions | 38mm*62mm |
| PCB Layers | 10 layers |
| PCB Thickness | 2.0mm |
| Number of Mounting Holes | 4 |
| Combined Height of B2B Connector | 4.0mm |
| Maximum Component Height on the Top | 1.4mm |
| SOM Height | 7.4mm |
| SOM Weight | 16.2g |

Note:

- (1) Maximum component height on the top: The difference in height between the level of the highest component on the SOM and the level of the top side of the PCB. The highest component of the SOM is the power supply chips(U2).
- (2) SOM Height = B2B Connector Combined Height + PCB Thickness + Highest Component Height on Top Level.

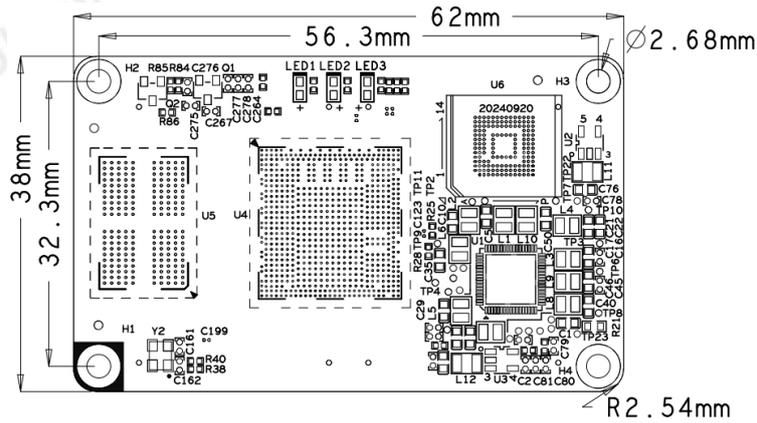


Figure 7 SOM Mechanical Dimensions Diagram

7 Product Ordering Part Number

Table 6

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

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

Parameter Explanation

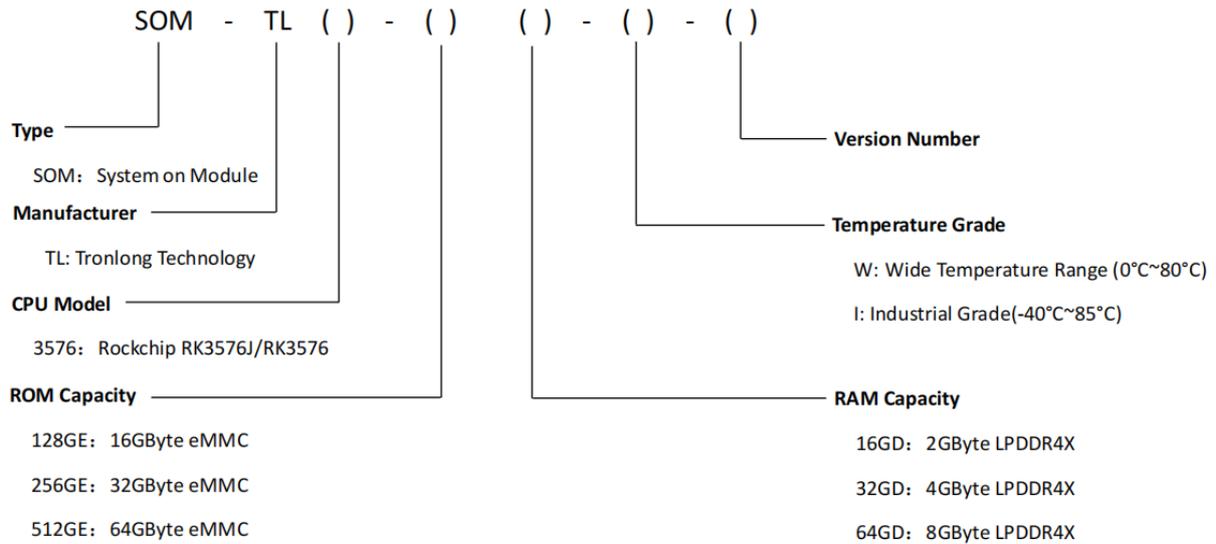


Figure 8

8 SOM Kit List

Table 7

| Name | Quantity | Note |
|-----------------------------|----------|------|
| SOM-TL3576 System on Module | 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 Service

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

Additional Information

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