Introduction

Hi3559 V200 is a high-performance and low-power 4K ultra-HD mobile camera SoC that is designed for action cameras and streaming media rear-view mirror cameras. Hi3559 V200 supports H.265/H.264 encoding and decoding, with performance up to 4K@P30/1080@P120. Integrated with the HiSilicon fourth-generation ISP, Hi3559 V200 provides WDR, multi-level NR, 6-DoF DIS, and multiple image enhancement and correction algorithms, allowing customers to capture images of professional quality. With the advanced low-power process and architecture design, Hi3559 V200 provides customers with a long-lasting battery life.

With the hardware-based 6-DoF DIS, Hi3559 V200 has reduced its dependence on the mechanical head during 4K@P30 video recording.

Backed by the dual-core Cortex-A7 CPU, Hi3559 V200 offers the dual-system solution, enabling fast startup, real-time performance, and connections with rich peripheral drives.

Hi3559 V200 supports the product miniaturization design because it uses the advanced 28 nm low-power process and miniaturization package and supports DDR3(L)/DDR4/LPDDR3 SDRAMs.

With the stable and easy-to-use SDK design, Hi3559V 200 can assist customers in rapid product mass production.

Key Specifications

- **Low Power Consumption**
  Typical power consumption in the 3840 x 2160@30 fps H.265 encoding scenario: 1.1 W

- **Advanced Gyro Image Stabilization 2.0 Algorithm**
  Hardware acceleration stabilization algorithm with up to 4K@30 fps performance

- **4K30 Encoding**
  3840 x 2160@30 fps or 1080p@120 fps H.265/H.264 encoding

- **Highest 0.4T neural network computing capability; supported intelligent functions such as face detection and scenario identification**

- **Dual-Sensor Access**
  Dual-channel input applications, such as streaming media rear-view mirror cameras.

- **Fast Startup**
Major Specifications

Processor Core
- ARM Cortex A7 MP2 @900 MHz, 32 KB I-cache, 32 KB D-cache, and 256 KB L2 cache
- Neon acceleration and integrated FPU

Video Encoding and Decoding
- H.265 Main Profile, level 5.1
- H.264 Baseline/Main/High Profile, level 5.1
- I-/P-slice supported in H.265/H.264 encoding and decoding
- Baseline JPEG

Video Encoding and Decoding Performance
- Maximum resolution for H.265/H.264 encoding and decoding: 3840 x 2160
- Maximum resolution for JPEG encoding and decoding: 8192 x 8192
- Maximum JPEG encoding and decoding performance: 16 MP (4608 x 3456)@10 fps
- Multiple bit rate control modes such as CBR, VBR, and FIXQP
- Maximum bit rate for H.265/H.264 encoding output: 100 Mbit/s
- Encoding of eight ROIs

VI
- 4-lane image sensor serial input, and MIPI, sub-LVDS, and HiSPI interfaces
- Division of the 4-lane MIPI sensor input into two groups of 2-lane MIPI input
- Maximum resolution of the first input: 4608 x 3456; maximum resolution of the second input: 2048 x 1536
- 10-/12-/14-bit Bayer RGB DC timing VI
- BT.656 and BT.1120 video input in YUV format
- One YUV input through the MIPI

ISP and Image Processing
- Multi-channel TDM for processing 2-channel sensor video input
- Adjustable 3A functions (AE, AWB, and AF)
- FPN removal
- 2-frame WDR exposure, local tone mapping, strong light suppression, and backlight compensation
- Defect pixel correction and LSC
- Multi-level 3DNR, which removes motion smearing and chroma noise and provides excellent image effects in low illumination
- 3D-LUT color adjustment
- Image dynamic contrast enhancement and edge enhancement
- CAC and purple fringe removal
- Dehaze
- 6-DoF image stabilization (based on video or gyro information) and rolling-shutter correction
- Lens GDC
- Image rotation by 90° or 270°
- Image mirror and flip
- Multi-channel 1/15.5x–16x scaling for output
- OSD overlaying of up to eight regions before encoding
- ISP adjustment tool on the PC

Graphics Processing
- 2D graphics acceleration
- Maximum output resolution: 1920 x 1080.

VO
- Overlay of two layers (video layer and graphics layer)
- HDMI 1.4 interface, with the maximum output of 3840 x 2160@30 fps
- 4-lane MIPI DSI output
- 6-/8-/16-/18-/24-bit digital LCD interface
- BT.656/BT.1120 interface

Intelligent Analysis
- Facial recognition, target detection and tracking, and scenario identification
- Neural network acceleration engine with processing performance up to 0.4 TOPS

Audio Interface
- Integrated audio codec, supporting 16-bit audio input and output
- Single-end dual-channel input and stereo output
- I'S interface for connecting to external audio codec
- HDMI audio output

Audio Encoding and Decoding
- Voice encoding/decoding complying with multiple protocols by using software
- Audio encoding formats such as AAC/G.711/G.726/
- Audio VQE processing

Security Engine
- AES, DES, and 3DES encryption and decryption algorithms implemented by using hardware
- RSA 1024/2048/4096 signature verification algorithms implemented by using hardware
- HASH-SHA1/224/256/384/512 and
Hi3559 V200 4K Mobile Camera SoC

HMAC_SHA1/224/256/384/512 tamper-proofing algorithms implemented by using hardware
- Built-in 8-kb OTP storage space
- Built-in hardware true random number generator

Peripheral Interfaces
- Two SDIO 3.0 interfaces. One can be connected to the SD3.0 card.
- One USB 2.0 port, supporting the configurable host or device mode
- Output of the internal POR signal
- Independent battery for the built-in RTC
- Integrated 2-channel LSADC
- Multiple I²C interfaces, SPI, and UART interfaces
- One IR interface
- Three PWM interfaces

External Memory Interfaces
- 32-bit DDR3(L)/DDR4/LPDDR3 SDRAM interface
  - Maximum frequency of the DDR3(L)/DDR4 SDRAM interface: 900 MHz
  - Maximum frequency of the LPDDR3 SDRAM interface: 800 MHz
- SPI NOR flash interface
  - 1-/2-/4-line mode
  - 3-/4-byte address mode
  - Maximum capacity: 256 MB
- SPI NAND flash interface
  - Up to 24 bit/1 KB ECC performance
  - Maximum capacity: 1 GB
- eMMC 4.5 interface
  - 4-bit data width

Boot
- Booting from the SPI NOR flash memory, SPI NAND flash memory, or eMMC

Image Burning Mode
- Image burning over UART 0
- Image burning over the SD card
- Image burning over the USB device

SDK
- Linux+Huawei LiteOS dual-system solution
- High-performance H.265 iOS/Android decoding library

Physical Specifications
- Power consumption
  - Typical power consumption in the 3840 x 2160@30 fps H.265 encoding scenario: 1.1 W
- Operating voltages
  - 0.9 V core voltage
  - 1.8 V/3.3 V I/O voltage
  - 1.5 (1.35) V/1.2 V/1.2 V voltage for the DDR3(L)/DDR4/LPDDR3 SDRAM interface
- Package
  - Body size of 14 mm x 14 mm (0.55 in. x 0.55 in.), 0.65 mm (0.03 in.) ball pitch, TFBGA RoHS package with 367 pins
Functional Block Diagram

- **CPU Subsystem**
  - Cortex-A7 MP2 @900MHz (32K I/32K D/256K L2)
  - AES/DES/3DES/HASH

- **Image Subsystem**
  - VPSS+VGS
  - GDC
  - ISP (3A/WDR)
  - MIPI/LVDS/HiSPI/BDT.1120

- **Video Subsystem**
  - H.264/H.265/MJPEG Codec
  - AMBA3.0 BUS

- **Audio CODEC**
  - I2S

- **Video Subsystem**
  - VPSS+VGS
  - GDC
  - ISP (3A/WDR)

- **RTC**

- **I2Cx8**

- **SPIx3**

- **GP1Os**

- **IR**

- **UARTx5**

- **PWMx3**

- **LSADCx2**

- **32bit DDR3(L)/4 LPDDR3**

- **SD/eMMC**
  - SDIO3.0
  - Flash I/F

- **USB 2.0 Host/Device**
  - USB 2.0
  - Audio CODEC
  - I2S

- **SPI Flash**

- **USB**

- **Video Subsystem**
  - BT.1120/RGB565/888/MIPI DSI/HDMI1.4
  - SDIO3.0

- **Audio CODEC**
  - I2S

- **DDRC**

- **Cortex-A7 MP2 @900MHz (32K I/32K D/256K L2)**

- **AMBA3.0 BUS**

- **Hi3559 V200**

- **Hi3559 V200 4K Mobile Camera SoC**

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Hi3559 V200 Action Camera Solution

- Video recording mode: 3840 x 2160@30 fps encoding for SD card storage + 720p@30 fps sub-stream encoding for Wi-Fi VOD or preview
- 3840 x 2160@30 fps/1080p@60 fps 6-DoF digital image stabilization based on the gyro.
- Photographing mode: 16 MP (4608 x 3456)@10 fps/12 MP @15 fps burst mode
- Playback mode: 3840 x 2160@30 fps decoding + HDMI 3840 x 2160@30 fps for TV display
- Two 16-bit 1866 Mbit/s DDR3L SDRAMs or one 32-bit 1600 Mbit/s LPDDR3 SDRAM
- Dual MICs and advanced dual-MIC NR algorithm
Hi3559 V200 Streaming Media Rear-View Mirror Camera Solution

- MIPI interface input (4M WDR + 2M WDR) or (5M linear + 2M WDR)
- MIPI interface and BT.656 input (5M WDR + 2M YUV)
- (5M + 2M) @ 30 fps H.265/H.264 encoding
- Interconnection with the 1080p screen through the MIPI-DSI interface for low-delay preview
- Two 16-bit 1866 Mbit/s DDR3 SDRAMs or one 32-bit 1600 Mbit/s LPDDR3 SDRAM
**Acronyms and Abbreviations**

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>3DNR</td>
<td>three-dimensional noise reduction</td>
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<tr>
<td>6-DoF</td>
<td>six degrees of freedom</td>
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<tr>
<td>AAC</td>
<td>advanced audio coding</td>
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<tr>
<td>AE</td>
<td>automatic exposure</td>
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<tr>
<td>AES</td>
<td>advanced encryption standard</td>
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<td>AF</td>
<td>auto focus</td>
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<td>AWB</td>
<td>automatic white balance</td>
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<td>CAC</td>
<td>chromatic aberration correction</td>
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<td>CBR</td>
<td>constant bit rate</td>
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<tr>
<td>CPU</td>
<td>central processing unit</td>
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<tr>
<td>DDR</td>
<td>double data rate</td>
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<tr>
<td>DES</td>
<td>data encryption standard</td>
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<td>DIS</td>
<td>digital image stabilization</td>
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<tr>
<td>DSI</td>
<td>display serial interface</td>
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<td>ECC</td>
<td>error checking and correction</td>
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<td>eMMC</td>
<td>embedded multimedia card</td>
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<tr>
<td>GDC</td>
<td>geometric distortion correction</td>
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<td>HD</td>
<td>high definition</td>
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<td>HDMI</td>
<td>high definition multimedia interface</td>
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<td>HiSPI</td>
<td>high-speed serial pixel interface</td>
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<td>IR</td>
<td>infrared spectrum</td>
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<tr>
<td>ISP</td>
<td>image signal processor</td>
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<tr>
<td>LSADC</td>
<td>low-speed analog-to-digital converter</td>
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<td>LSC</td>
<td>lens shading correction</td>
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<td>LVDS</td>
<td>low-voltage differential signaling</td>
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<td>MIC</td>
<td>microphone</td>
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<tr>
<td>MIPI</td>
<td>mobile industry processor interface</td>
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<td>NR</td>
<td>noise reduction</td>
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<td>OSD</td>
<td>on-screen display</td>
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<tr>
<td>OTP</td>
<td>one-time programmable</td>
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<td>POR</td>
<td>power-on reset</td>
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<td>PWM</td>
<td>pulse-width modulation</td>
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<tr>
<td>RoHS</td>
<td>restriction of hazardous substances</td>
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<td>ROI</td>
<td>region of interest</td>
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<tr>
<td>RSA</td>
<td>Rivest-Shamir-Adleman</td>
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<tr>
<td>RTC</td>
<td>real-time clock</td>
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<tr>
<td>SDIO</td>
<td>secure digital input output</td>
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<td>SDK</td>
<td>software development kit</td>
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<td>SDRAM</td>
<td>synchronous dynamic random access memory</td>
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<td>SoC</td>
<td>system on a chip</td>
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<tr>
<td>TFBGA</td>
<td>thin &amp; fine ball grid array</td>
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<td>UART</td>
<td>universal asynchronous receiver transmitter</td>
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<td>VBR</td>
<td>variable bit rate</td>
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<td>VI</td>
<td>video input</td>
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<td>VO</td>
<td>video output</td>
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<td>VOD</td>
<td>video on demand</td>
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<td>VQE</td>
<td>voice quality enhancement</td>
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<td>WDR</td>
<td>wide dynamic range</td>
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<tr>
<td>YUV</td>
<td>luminance-bandwidth-chrominance</td>
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