# Hi3531 H.264 Codec Processor

## Key Specifications

### Processor
- ARM Cortex A9 dual cores
  - Up to 930 MHz
  - 32 KB I-cache and 32 KB D-cache
  - 256 KB L2 cache

### Video Encoding
- H.264 baseline profile level 5.0
- H.264 main profile level 5.0
- H.264 high profile level 5.0
- MJPEG/JPEG baseline

### Video Decoding
- H.264 baseline profile level 5.0
- H.264 main profile level 5.0
- H.264 high profile level 5.0
- MJPEG/JPEG baseline

### Video Codec
- H.264/JPEG performance:
  - 16D1@30 fps+16CIF@30 fps encoding+4D1@30 fps decoding+JPEG snapshot D1@16 fps
  - 4x1080pg@30 fps+4x(960x540)@15 fps encoding+1x1080pg@30 fps decoding+JPEG snapshot 1080pg@4 fps
  - 4x1080pg@15 fps+4x(960x540)@15 fps encoding+4x1080pg@15 fps decoding+JPEG snapshot 1080pg@4 fps
  - 4x720pg@30 fps+4xQVGA@30 fps encoding+4x720pg@30 fps decoding+JPEG snapshot 720pg@8 fps
  - 161D1g30 fps decoding
  - 16x960Hg30 fps decoding
  - 8x720pg@30 fps decoding
  - 4x1080pg@30 fps decoding
  - CBR, VBR, and ABR, ranging from 16 kbit/s to 40 Mbit/s
  - Encoding frame rate, ranging from 1/16 fps to 60 fps
  - ROI
  - Color-to-gray

### Intelligent Video Analysis
- Integrated intelligent analysis acceleration engine, supporting motion detection, boundary security, and video diagnosis

### Video and Graphic Processing
- 3D de-interlacing, image enhancement, edge enhancement, and 3D denoise
  - Anti-flicker
  - 1/16x to 8x video scaling
  - 1/2x to 2x graphic scaling
  - OSD overlay of eight regions
  - Alpha blending of the video layer and graphics layers

### Audio Codec
- ADPCM, G.711, and G.726 encoding

### Security Engine
- AES, DES, and 3DES encryption and decryption engine
- Digital watermark

### Video Interfaces
- Video input
  - 4xBT656@108 MHz/144 MHz for 16D1/960H, 8xBT656@54 MHz/72MHz for 16D1/960H, or 8xBT656@27 MHz/36 MHz for 8D1/960H
  - 4xBT1120@148.5 MHz for 4-channel 1080p@30 fps or 4-channels 720p@60 fps. One BT1120 can be configured as a BT1120@148.5 MHz output, and one BT1120 can be configured as video cascade for Hi3531s and Hi3532s
  - 8x multiplexed BT656@148.5 MHz for 8-channel 720pg@30 fps
- Video output
  - HDMI1.3x1, VGA/YPbPrx1 and CVBSx2
  - 8xBT656@27 MHz
  - 1xBT1120@148.5MHz, configured as the same output of HDMI or VGA
  - Maximum 1080p@60 fps for the HDMI
  - Maximum 2560x1600@60 fps for the VGA
  - Five graphics layers, RGB1555 or RGB8888, with a maximum resolution of 2560x1600
  - Two cursor layers, RGB1555 or RGB8888, with a maximum resolution of 128x128
  - One independent PIP layer

### Audio Interface
- I2Sx5
  - Four for input
  - One for input and output
  - Maximum of 16-channel 16-bit audio inputs for each interface

### Ethernet Ports
- GMACs2
  - RMII mode and MII mode
  - 10/100 Mbit/s full-duplex or half-duplex mode
  - 1000 Mbit/s full-duplex mode
  - TOE engine

### Peripherals
- PCIe 1.1x2
  - x1 mode
  - EP
  - RC
  - SATA 2.6x2
  - PM
  - eSATA
  - UARTs4
  - SPIx1, eight CsS
  - IxRx1, I2Cx1, and GPOIs
  - SDIO2.0x1, USB2.0 hostx2

### External Memory Interfaces
- 32-bit DDR2 or DDR3 SDRAMx2
  - Up to 620 MHz
  - DDT
  - Maximum 1 GB capacity for each
  - Automatic power control
  - SPI NOR flash
  - 1-, 2-, or 4-bit SPI and NOR flash
  - Two CsS
  - Maximum 32 MB capacity for each
  - NAND flash
  - 8-bit
  - SLC and MLC NAND flash
  - 1-, 4-, or 24-bit ECC
  - Embedded 2 KB bootrom and 10 KB SRAM

### Boot Modes
- Bootrom
- SPI NOR flash
- PCIe
- NAND flash

### SDK
- SDK based on Linux 2.6.38 SMP
- High-performance H.264 PC decoding library

### Physical Specifications
- Power consumption
  - About 5 W
  - Multi-level power control
- Operating voltage
  - 1.0 V core voltage
  - 3.3 V I/O and 5 V tolerance voltage
  - 1.5 V or 1.8 V DDR2/DDR3 SDRAM interface voltage
  - Operating temperature ranging from -20°C (~–4°F) to +70°C (+158°F)
- Package
  - RoHS, 817-pin EHS FCBGA
  - 0.65 mm ball pitch
  - 25 mm x25 body size

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The Hi3531 is a professional high-performance SoC designed for multi-channel D1 and HD DVR and NVR. With the embedded high-performance dual-core A9 processor, H264 codec engine (supporting a maximum of 5-channel 1080p real-time codec complying with multiple protocols), and dedicated TOE network acceleration module, the Hi3531 meets the rising demand for HD and network applications. The Hi3531 also provides outstanding video pre-processing and post-processing features, various codec algorithms, and multi-channel HD output capability. These features guarantee users a high-quality image experience. In addition, the Hi3531 supports multiple integrated peripheral interfaces to meet customer requirements for functionality, features, and image quality, while reducing the cost. By using the dedicated video cascade technology, Hi3531s and Hi3532s can be cascaded to provide superior encoding and decoding capabilities.

DVRs with a Single Hi3531

- 16D1+16CIF Encoding+4D1 Decoding DVR
  - 16D1+16CIF dual streams real-time encoding +16 fps D1 JPEG snapshot+4D1 real-time decoding

- 8D1 Simultaneous Encoding and Decoding DVR
  - 16D1+16CIF dual streams real-time encoding +16 fps D1 JPEG snapshot+4D1 real-time decoding

- 4-Channel HD Simultaneous Encoding and Decoding DVR
  - 4x720p+4xQVGA dual streams real-time encoding +4 fps 720p JPEG snapshot+4x720p real-time decoding

NVR with Hi3531s

- 16D1, 8x720p, or 4x1080p real-time decoding by using a single Hi3531
- 16Nx1D1, 8Nx720p, or 4Nx1080p real-time decoding with N cascaded Hi3531s

DVRs with the Hi3531 and Hi3532

- 16D1 Simultaneous Encoding and Decoding DVR
  - 16D1+16CIF dual streams real-time encoding +16 fps D1 JPEG snapshot+16D1 real-time decoding

- 8-Channel 720p Simultaneous Encoding and Decoding DVR
  - 8x720p+8xQVGA dual streams real-time encoding +8 fps 720p JPEG snapshot+8x720p real-time decoding

- 4-Channel 1080p Simultaneous Encoding and Decoding DVR
  - 4x1080p real-time+4x(960x540)@15 fps dual streams encoding +4 fps 1080p JPEG snapshot+ 4x1080p real-time decoding