



Hi3531A H.264 CODEC Processor

Brief Data Sheet

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Key Specifications

Processor Core

- Dual-core ARM Cortex A9@1.1 GHz
 - 32 KB L1 I-cache, 32 KB L1 D-cache
 - 256 KB L2 cache
 - NEON and FPU

Video Encoding/Decoding Protocols

- H.264 baseline/main/high profile L4.2
- MJPEG/JPEG baseline

Video Encoding/Decoding

- H.264&JPEG multi-stream encoding and decoding
 - 8x1080p@30 fps H.264 encoding+8xCIF@30 fps H.264 encoding+4x1080p@30 fps H.264 decoding+8x1080p@2 fps JPEG encoding
 - 16x720p@30 fps H.264 encoding+16xCIF@30 fps H.264 encoding+8x720p@30 fps H.264 decoding+16x720p@2 fps JPEG encoding
 - 32x960H@30 fps H.264 encoding+32xCIF@30 fps H.264 encoding+8x960H@30 fps H.264 decoding+32x960H@2 fps JPEG encoding
 - 32xD1@30 fps H.264 encoding+32xCIF@30 fps H.264 encoding+16xD1@30 fps H.264 decoding+32xD1@2 fps JPEG encoding
- Constant bit rate (CBR) mode, variable bit rate (VBR) mode, FixQp mode, and adaptive variable bit rate (AVBR) mode, with the bit rate ranging from 16 kbit/s to 40 Mbit/s
- Fixed QP
- Encoding frame rate ranging from 1/16 fps to full frame rate
- ROI encoding
- Color-to-gray encoding

Intelligent Video Analysis

- Integrated IVE, supporting various intelligent analysis applications such as motion detection, perimeter defense, and video diagnosis

Video and Graphics Processing

- Video pre- and post-processing, including deinterlacing, sharpening, 3D denoising, DCI, and demosaic
- Anti-flicker for output videos and graphics
- 1/15x to 16x video scaling
- 1/2x to 2x graphics scaling
- Four Cover regions
- OSD overlaying of eight regions

Audio Encoding/Decoding

- ADPCM, G.711, and G.726 hardware audio encoding
- Software audio encoding and decoding complying with multiple protocols

Security Engine

- AES, DES, and 3DES algorithms implemented by using hardware

Video Interfaces

- VI interfaces
 - Eight 8-bit interfaces and one 16-bit video cascade interface
 - Two 8-bit interfaces that can form a 16-bit interface
 - 108 MHz/144 MHz 4xD1/960H TDM inputs for each 8-bit interface (32xD1/32x960H real-time video inputs in total)
 - 144 MHz/148.5 MHz 2x720p TDM inputs for each 8-bit interface (16x720p@30 fps real-time video inputs in total)
 - 4x720p TDM inputs through 148.5 MHz dual-edge sampling or 297 MHz single-edge sampling for each 8-bit interface (32x720p@30 fps real-time video inputs in total)
 - 148.5 MHz BT.1120 inputs in Y/C interleaved mode for each 8-bit interface (8x1080p@30 fps real-time video inputs in total)
 - 2x1080p TDM inputs through 148.5 MHz dual-edge sampling or 297 MHz single-edge sampling for each 8-bit interface (16x1080p@30 fps real-time video inputs in total)
 - 148.5 MHz BT.1120 standard mode for the 16-bit interface (4x1080p@60 fps real-time video inputs in total)
 - One 3840 x 2160@30 fps input through 148.5 MHz dual-edge sampling or 297 MHz single-edge sampling for the 16-bit video cascade input interface
- VO interfaces
 - One HDMI 1.4 output interface with the maximum output of 3840 x 2160@30 fps
 - One VGA HD output interface with the maximum output of 2560 x 1600@60 fps
 - One BT.1120 HD output interface with the maximum output of 1080p@60 fps
 - One BT.1120 video cascade output interface with the maximum output of 3840 x 2160@30 fps
 - Two independent HD output channels (DHD0 and DHD1), output over any HD interface (HDMI, VGA, or BT.1120/ Cascade Interface)
 - 64-picture output for DHD0, maximum output of 3840 x 2160@30 fps
 - 64-picture output for DHD1, maximum output of 1080p@60 fps
 - One CVBS SD output interface
 - Three full-screen GUI graphics layers in ARGB1555 or ARGB8888 format for two HD channels and one SD channel
 - Two hardware cursor layers in ARGB1555 or ARGB8888 format (configurable) with the maximum resolution of 256 x 256

Audio Interfaces

- Five unidirectional I²S/PCM interfaces
 - Three input interfaces, supporting 20 multiplexed inputs



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- Two output interfaces, supporting the dual-channel output
- 16-bit audio inputs and outputs

Ethernet Ports

- One gigabit Ethernet port
 - RGMII, RMII, and MII modes
 - 10/100 Mbit/s half-duplex or full-duplex
 - 1000 Mbit/s full-duplex
 - TSO for reducing the CPU usage

Peripheral Interfaces

- Four SATA 3.0/PCIe 2.0/USB 3.0 multiplexed interfaces
 - Configurable four SATA interfaces, two 2-lane PCIe interfaces, two SATA interfaces+two 1-lane PCIe interfaces, or one USB 3.0 interface+two SATA interfaces+one 1-lane PCIe interface
 - RC and EP supported as the PCIe 2.0 interface
 - eSATA and PM supported as the SATA 3.0 interface
 - USB host and hub supported as the USB 3.0 interface
- Two USB 2.0 host interfaces, supporting the hub
- Four UART interfaces (including two 4-wire interfaces)
- One SPI, supporting four CSs
- One IR interface
- Two I²C interface
- Multiple GPIO interfaces

Memory Interfaces

- Two 32-bit DDR3/DDR3L SDRAM interfaces
 - Maximum frequency of 866 MHz
 - Dual channels
 - ODT
 - Maximum capacity of 3 GB
- NAND flash interface
 - 8-bit NAND flash
 - Two CSs
 - SLC or MLC
 - 8-/24-/40-/64-bit ECC (based on 1 KB data block)
- SPI NOR/NAND flash interface
 - 1-/2-/4-bit SPI NOR/NAND flash
 - Two CSs, connected to different types of flash

memories

- Maximum capacity of 32 MB for each CS (only for the NOR flash)
- Maximum capacity of 512 MB for each CS (only for the SPI NAND flash)
- 2 KB/4 KB page size (only for the SPI NAND flash)
- 8-bit/1 KB or 24-bit/1 KB ECC (only for the SPI NAND flash)
- Embedded 4 KB BOOTROM and 64 KB SRAM

RTC with an Independent Power Supply

- Independent battery for supplying power to the RTC

Configurable Boot Modes

- Booting from the BOOTROM
- Booting from the SPI NOR flash
- Booting from the SPI NAND flash
- Booting from the NAND flash
- Booting the slave chip over the PCIe interface

SDK

- Linux 3.10-based SDK
- Audio encoding and decoding libraries complying with multiple protocols
 - High-performance H.264 PC decoding library

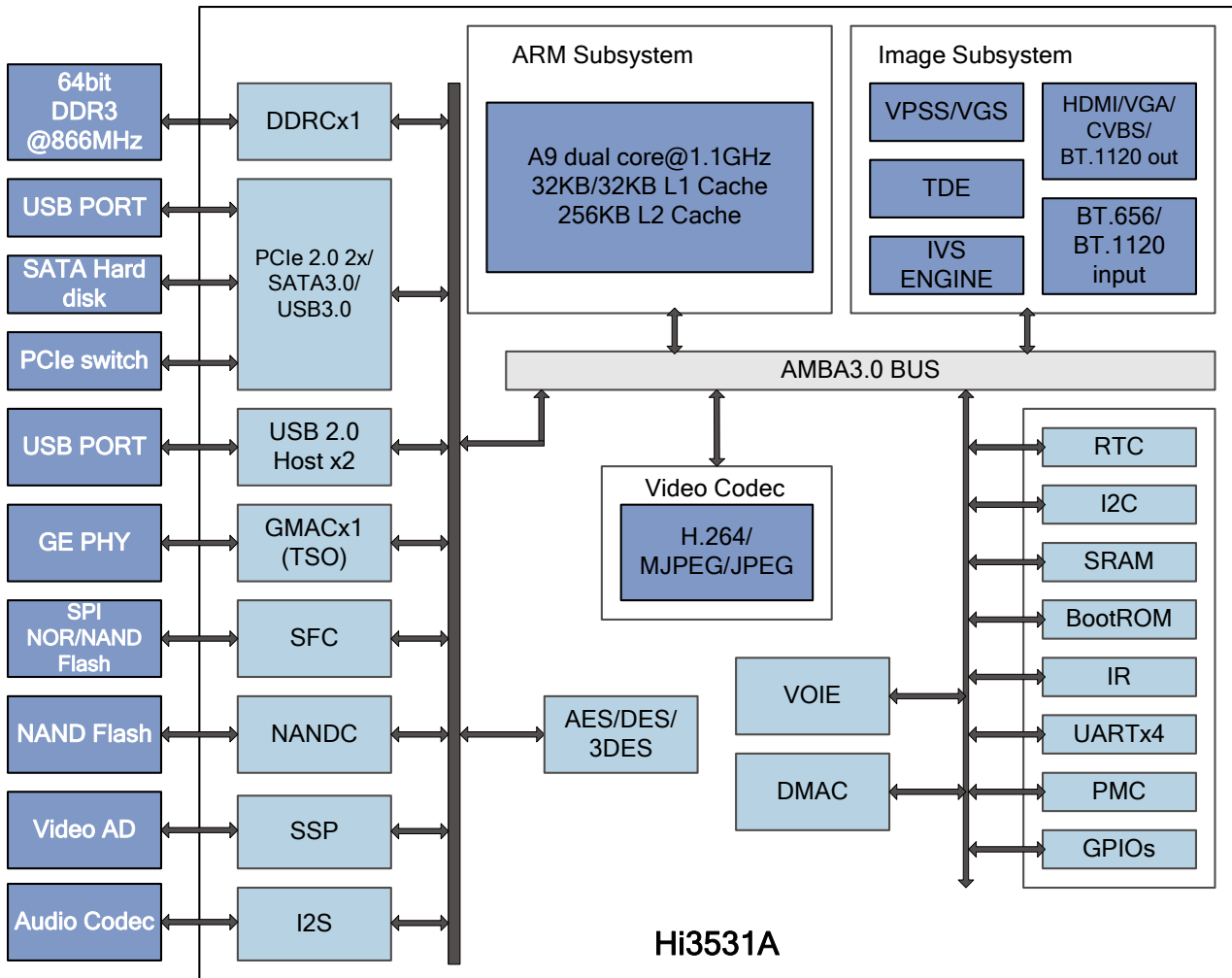
Physical Specifications

- Power consumption
 - Typical power consumption of 5 W
 - Multi-level power consumption control
- Operating voltages
 - 1.1 V core voltage
 - 1.2 V CPU voltage
 - 3.3 V I/O voltage
 - 1.5 V DDR3 SDRAM interface voltage
- Package
 - RoHS, EDHS-PBGA
 - Ball pitch of 0.8 mm (0.03 in.)
 - Body size of 27 mm x 27 mm (1.06 in. x 1.06 in.)
- Operating temperature ranging from 0°C (32°F) to 70°C (158°F)



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Functional Block Diagram



The Hi3531A is a professional SoC targeted for multi-channel HD (1080p/720p) or SD (D1/960H) DVRs. The Hi3531A provides an embedded dual-core ARM A9 processor, a high-performance H.264 video encoding/decoding engine, a high-performance video/graphics processing engine integrated with various complicated graphics processing algorithms, HDMI/VGA HD outputs, and various peripheral interfaces. These features enable the Hi3531A to provide high-performance, high-picture-quality, and low-cost analog HD/SDI solutions for customers' products while greatly reducing the eBOM cost.

DVRs (Each with a Hi3531A)

8x1080p DVR

- 8x1080p@30 fps H.264 encoding+8xCIF@30 fps H.264 encoding+4x1080p@30 fps H.264 decoding+8x1080p@2 fps JPEG encoding
- HDMI 4K x 2K@30 fps output

16x720p DVR

- 16x720p@30 fps H.264 encoding+16xCIF@30 fps H.264 encoding+8x720p@30 fps H.264 decoding+16x720p@2 fps JPEG encoding



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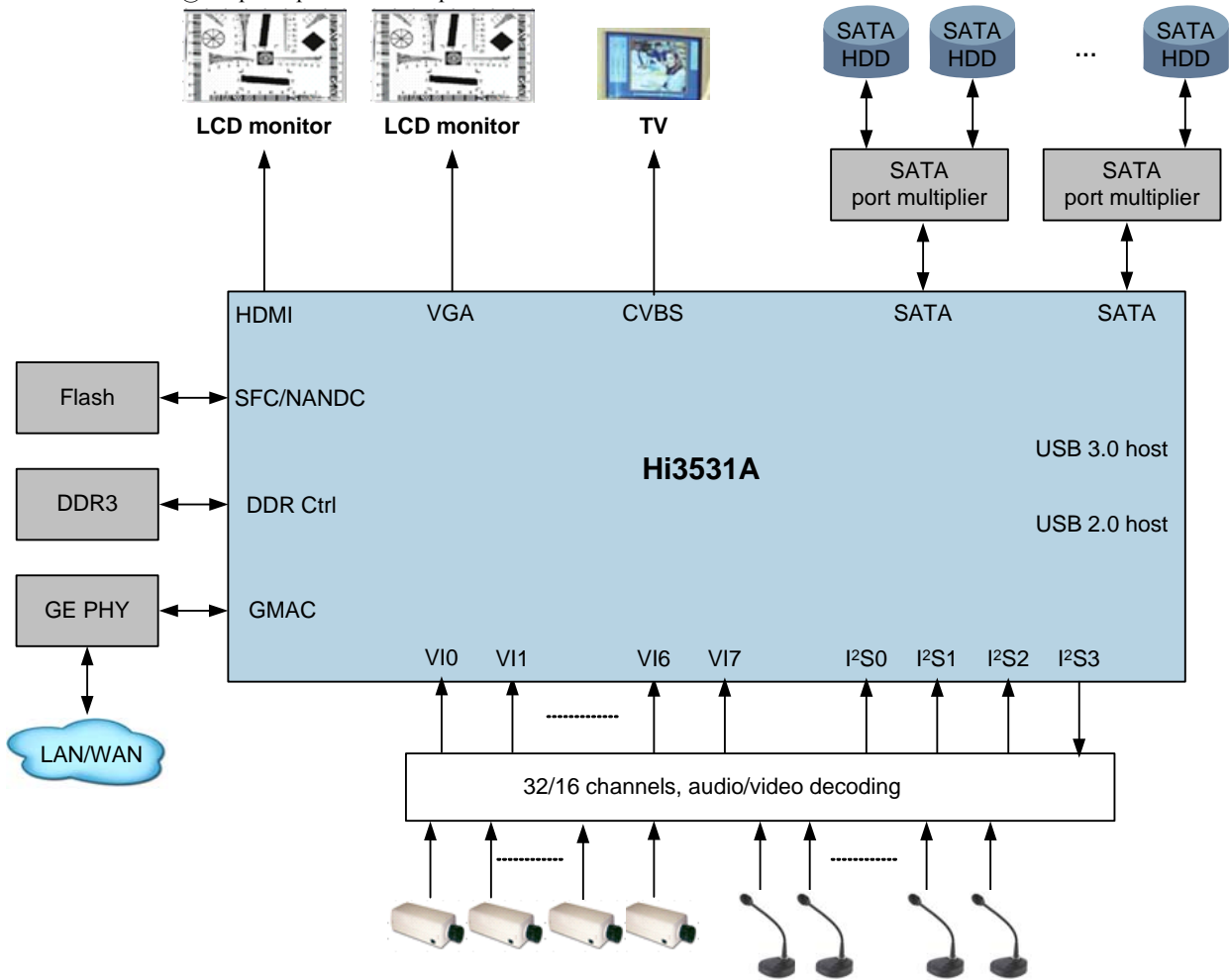
- HDMI 4K x 2K@30 fps output

32x960H DVR

- 32x960H@30 fps H.264 encoding+32xCIF@30 fps H.264 encoding+8x960H@30 fps H.264 decoding+32x960H@2 fps JPEG encoding
- HDMI 4K x 2K@30 fps output+CVBS output

32xD1 DVR

- 32xD1@30 fps H.264 encoding+32xCIF@30 fps H.264 encoding+16xD1@30 fps H.264 decoding+32xD1@2 fps JPEG encoding
- HDMI 4K x 2K@30 fps output+CVBS output





Acronyms and Abbreviations

3DES	triple data encryption standard
ADPCM	adaptive differential pulse code modulation
AES	advanced encryption standard
CBR	constant bit rate
CODEC	coder/decoder
CS	chip select
CVBS	composite video broadcast signal
DCI	dynamic contrast improvement
DDR	double data rate
DES	data encryption standard
DVR	digital video recorder
eBOM	engineering bill of materials
ECC	error correcting code
EDHS-PBGA	exposed drop-in heat sink plastic ball grid array
EP	end point
eSATA	external serial advanced technology attachment
GPIO	general-purpose input/output
GUI	graphical user interface
HD	high definition
HDMI	high definition multimedia interface
I ² C	inter-integrated circuit
I ² S	inter-IC sound
IR	infrared
IVE	intelligent video engine
MII	media independent interface
MLC	multi-level cell
ODT	on-die termination
OSD	on-screen display
PCIe	peripheral component interconnect express
PCM	pulse code modulation
PM	port multiplexer
QP	quantization parameter
RC	root complex
RGMI	reduced gigabit media independent interface
RMII	reduced media independent interface
RoHS	Restriction of Hazardous Substances
ROI	region of interest
RTC	real-time clock
SATA	serial advanced technology attachment
SD	standard definition
SDI	serial digital interface
SDK	software development kit
SDR	single data rate
SDRAM	synchronous dynamic random access memory
SLC	single-level cell
SoC	system-on-chip
SPI	serial peripheral interface
SRAM	static random access memory
TDM	time division multiplexing
TSO	TCP segmentation offload
UART	universal asynchronous receiver transmitter



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VBR	variable bit rate
VGA	video graphics array
VI	video input
VO	video output