Key Specifications

Key Features
- High-performance multi-core Cortex 64-bit CPU
- High-performance multi-core GPU
- High-performance multi-standard demodulation
- Dynamic multi-standard HDR processing
- 4K x 2K 10-bit@60 Hz decoding
- Security processing feature
- TCON connection to the screen
- 4K screen capturing
- CI Plus 1.4

High-Performance CPU
- Big.LITTLE architecture of the multi-core Cortex-A73
- Smooth intelligent applications
- Independent I-cache, D-cache, and L2 cache
- Integrated multimedia acceleration engine NEON
- Integrated hardware floating-point coprocessor

Video Decoding
- AVS2 Baseline 10-bit Profile@Level 8.2.60, 4Kx2K@60 fps capability
- ITU-T H.265 Main 10 Profile@Level 5.1 high-tier (and lower levels), 4K x 2K@60 fps capability
- H.264 Baseline Profile/Main Profile/High Profile@Level 5.0, 4K x 2K@30 fps capability
- MVC, 1080p@60 fps capability
- MPEG1, 1080p@60 fps capability
- MPEG2 Simple Profile@Main Level, Main Profile@High Level, 1080p@60 fps capability
- MPEG4 Simple Profile@Levels 0–3, ASP@Levels 0–5, GMC, 1080p@60 fps capability
- MPEG4 short header format (H.263 Baseline), 1080p@60 fps capability
- AVS Baseline Profile@Level 6.0, AVS+(AVS-P16), 1080p@60 fps capability
- VC-1 Simple Profile@Main Level, Main Profile@High Level, and Advanced Profile@Levels 0–3, 1080p@60 fps capability
- VP6/8, 1080p@60 fps capability
- Low-latency decoding
- Maximum 1 x UHD decoding performance

Image Decoding
- JPEG hardware decoding, supporting maximum 64 megapixels
- Supported formats: 400, 420, 411, 422, 422T, and 444
- MJPEG Baseline decoding
- PNG hardware decoding, supporting maximum 64 megapixels
- Supported formats: gray-scale image, true-color image, indexed-color image, gray-scale image with alpha channel data, and true-color image with alpha channel data

Video and Image Encoding
- H.264 Baseline Profile/Main Profile@Level 4.2 video encoding, 1-channel 1080p@30 fps encoding
- 1/4 pixel motion estimation, CABAC
- Low-latency decoding
- Multi-ROI encoding
- VBR and CBR modes

2D Graphics Acceleration
- Hardware acceleration engine, supporting efficient 2D processing
- ARGB, CLUT, and AYCbCr data formats
- Copying, filling, pattern filling, resizing, clipping, alpha blending, color keying, and clip masking
- ROP
- Anti-flicker, gamma correction, and luminance/contrast adjustment
- Programmable scanning mode
- Linked-list operation mode

3D GPU
- Integrated multi-core high-performance GPU
- UHD graphics rendering
- OpenGL ES 3.2/2.0/1.1/1.0
- OpenCL 2.0
- Vulkan 1.0

IF Demodulation of the Analog TV
- All analog TV standards, including M/N, B/G/H, D/K, I, L, and L'
- Low IF tuner inputs and configurable IF
- External SAW not required
- Group delay compensation and equalization filtering

Digital Demodulation
- Low IF tuner inputs
- Built-in 12-bit ADC, ensuring the sampling precision
- One embedded DVB-C QAM demodulator
  - ITU-T J.83 Annex A/B/C
  - Symbol rate: 1–7 Mbaud/s
  - Carrier frequency offset range: ±700 kHz
  - Superior anti-pulse-interference performance
  - Superior Gaussian reception performance
- One embedded DTMB demodulator
  - All the 330 standard DTMB (GB20600-2006) modes
  - 6 MHz, 7 MHz, and 8 MHz input signal bandwidths
  - Low IF (4–11 MHz) and high IF (36–37 MHz)
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- Compliance with the access test standards GB/T 26683-2011 and GB/T 26686-2011
- Superior Gaussian, multi-path, and mobile reception performance
- Superior anti-phase-noise performance
- Superior anti-pulse-interference performance
- Superior anti-interference (at the same frequency) performance
- Adaptive spectrum inversion recognition
- Frequency error capturing range broader than ±1.5 MHz

- One embedded ATSC demodulator
  - Standard-version A.53/2011
  - Low IF and high IF (36 MHz)
  - Adaptive spectrum inversion recognition
  - Frequency error detection range broader than ±600 kHz
  - Compliance with the A74:2010 test specifications

- One embedded ISDB-T demodulator
  - Compliance with the ARIB STD-B31v2_2-E1 test standard
  - Low IF and high IF (36 MHz)
  - 6 MHz, 7 MHz, and 8 MHz input signal bandwidths
  - Compliance with the ARIB STD-B21v5_4-E1 test standard
  - ISDB-T 13-SEG mode
  - Superior Gaussian, multi-path, and mobile reception capability
  - Superior anti-pulse-interference and anti-interference (at the same frequency) capabilities
  - Adaptive spectrum inversion recognition
  - Frequency error detection range broader than ±500 kHz

- One embedded DVB-T demodulator
  - Compliance with the ETSI EN300744-V1.6.1 standard
  - Low IF and high IF (36 MHz)
  - 6 MHz, 7 MHz, and 8 MHz input signal bandwidths
  - Compliance with the NorDig Unified Test Specification V2.4 and DTG 8.0 test standard
  - 2K, 8K FFT mode, 1/32 to 1/4 guard interval
  - Superior Gaussian, multi-path, and mobile reception capability
  - Superior anti-pulse-interference and anti-interference (at the same frequency) capabilities
  - Adaptive spectrum inversion recognition
  - Frequency error detection range broader than ±500 kHz

- One embedded DVB-T2 demodulator
  - T2-Base and T2-Lite modes in the ETSI EN302755-V1.3.1 standard
  - Low IF and high IF (36 MHz) signal inputs
  - 1.7 MHz, 5 MHz, 6 MHz, 7 MHz, and 8 MHz input signal bandwidths
  - Single PLP and multi-PLP services as well as SISO and MISO transfer
  - Compliance with the NorDig Unified Test Specification V2.4 and DTG 8.0 test standard
  - Superior Gaussian, multi-path, and mobile reception capability
  - Superior anti-pulse-interference and anti-interference (at the same frequency) capabilities
  - Superior guard interval exceeding performance
  - Adaptive spectrum inversion recognition
  - Frequency error detection range broader than ±500 kHz

- One embedded DVB-T2 Lite demodulator
  - T2-Base and T2-Lite modes in the ETSI EN302755-V1.3.1 standard
  - Low IF and high IF (36 MHz) signal inputs
  - 1.7 MHz, 5 MHz, 6 MHz, 7 MHz, and 8 MHz input signal bandwidths
  - Single PLP and multi-PLP services as well as SISO and MISO transfer
  - Compliance with the NorDig Unified Test Specification V2.4 and DTG 8.0 test standard
  - Superior Gaussian, multi-path, and mobile reception capability

- Superior anti-pulse-interference and anti-interference (at the same frequency) capabilities
- Superior guard interval exceeding performance
- Adaptive spectrum inversion recognition
- Frequency error detection range broader than ±500 kHz

- External TS inputs

NTSC/PAL/SEAC Video Demodulation
- NTSC (NTSC-M, NTSC-J, NTSC-4.43), PAL (B, D, G, H, M, N, I, Nc), and SECAM standards
- Automatic standard detection
- Motion-adaptive 3D comb filter
- Cross-luma and cross-color suppression
- One CVBS input

Multi-Format Audio Demodulation
- SIF demodulation
- NICAM, A2, EIA-A, BTSC, FM, and AM demodulation
- BTSC, mono, stereo, and SAP modes in the EIAJ standard
- Mono, stereo, and dual modes in the NICAM and A2 standards
- Sound standard and automatic mode detection

Audio and Sound Effect Processing
- Conversion of the audio sampling rate
- Volume, equalization, and mute control
- Virtual stereo/surround and bass enhancement
- Dialog enhancement and intelligent volume
- DTS and DBX-TV total technology audio enhancement
- HiSilicon's unique SWS 3D advanced audio post-processing technology

Audio Encoding and Decoding
- Multi-format audio decoding
  - Dolby Digital\textsuperscript{option}, Dolby Digital Plus\textsuperscript{option}, and Dolby TrueHD\textsuperscript{option}
  - DTS\textsuperscript{option}, DTS-HD\textsuperscript{option}, and DTS-M\textsuperscript{option}
  - MS12 D\textsuperscript{option}
  - MPEG L1/L2
  - MP3
  - AAC-LC, HE-AAC, and HE\_AAC v2
  - LPCM
  - APE
  - FLAC
  - Ogg Vorbis
  - AMR-NB
  - AMR-WB
  - -G.711(u/a)

- Audio encoding in a unified format of AAC

Professional HiSilicon Graphics Engines (Hi-Imprex VII Engines)
- Hi-HDR IV processing engine
  - HDR10 processing
  - SL\textsuperscript{option} processing
  - HLG\textsuperscript{option} processing

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Issue: 03

www.hisilicon.com
Date: 2019-05-07
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- Technicolor PS\textsuperscript{option} processing
- Dolby Vision\textsuperscript{option} processing
- ST.2094 processing

Hi-Imprex VII scaling engine
- High-order multi-phase filtering with programmable coefficients
- Various scaling modes, including the non-linear scaling mode
- De-ringing
- De-jagging

Hi-Imprex VII video processing engine
- Full-MC IPC
- Automatic detection and restoration in 3:2, 2:2, or M: N film mode
- Full-MC NR for various video contents, including network videos
- MPEG NR, de-blocking, and mosquito NR
- Global motion detection and scene change detection

Hi-Imprex VII video processing engine
- Adaptive sharpening for the 4K × 2K content
- Enhancement and shoot control for different directions and frequencies
- LTI and CTI
- 3D adaptive color management, supporting enhancement of specific colors and automatic color copying
- Wide color gamut processing
- Blue level extension

Hi-SuperClear VII processing
- Thin edge, improving the edge effect
- Edge smoothing and enhancement

12-bit programmable gamma LUT

Automatic 3D format detection

2D-to-3D processing

0D/1D/2D local dimming processing

Ambilight processing\textsuperscript{option}

Video rotation

4K screen capturing

Professional HiSilicon MEMC Engine (Hi-Motion IV Engine)
- 4K@60 Hz processing
- Enhanced halo free processing
- Enhanced deblur & dejudder processing
- Enhanced small object processing
  - Football tracking technology
  - Small object protection
- Enhanced OSD
  - Scrolling caption tracking technology
  - OSD region protection

Content protection for USB devices
Downloadable CA\textsuperscript{option}

Audio and Video Interfaces
- Audio interface
  - Two F/S inputs or outputs and one S/PDIF output
  - One HDMI ARC
  - Two stereo inputs
  - One stereo output and one headphone output
- YPbPr/RGB interface
  - Two analog channels, supporting maximum 1080p resolution
  - SoG
  - Automatic format and mode detection
  - Position and phase adjustment of the RGB channel
  - Online cable detection for analog video channels
- HDMI
  - Three HDMI 2.0 input interfaces (One interface supports MHL 2.0 and one supports ARC.)
  - 4K × 2K@60 Hz inputs
  - CEC
  - HDCP 2.2/1.4/1.3/1.1
- 8-lane VBO outputs
- 4K@60 Hz screen
- P2P interface output required by each screen factory
  - 4K@60 Hz screen
  - OD processing
  - RGBA processing
  - Dimura processing
- One CVBS output

Memory Control Interfaces
- DDR3/DDR4 interface
  - Maximum 4 GB capacity
  - Maximum 64-bit interface
  - Up to 2.133 Gbit/s frequency
- eMMC V5.1 flash interface

Peripheral Interfaces
- Three USB 2.0 host ports
- One USB 3.0 host port
- One PCIe interface
- One SDIO interface, supporting 3.3 V components
- One 10 Mbit/s or 100 Mbit/s adaptive network port
- One CI/C+ interface\textsuperscript{option}
- One IR receiver
- Four keypad interfaces
- Multiple FC interfaces
- Two UART interfaces
- Multiple groups of GPIO interfaces
- Multiple PWM interfaces
- Integrated POR module

Others
- 2-layer double-sided PCB and 4-layer single-sided PCB
- PBGA 27 x 27
- Boot program download and execution over a serial port or
Acronyms and Abbreviations

3DES                 Triple Data Encryption Standard
AAC                 Advanced Audio Coding
AAC-LC            Advanced Audio Coding Low Complexity
ADC                analog-to-digital converter
AES                Advanced Encryption Standard
AM                  amplitude modulation
AMR-NB         adaptive multi-rate narrowband
AMR-WB          adaptive multi-rate wideband
APE                Monkey’s Audio
ARC               audio return channel
ARIB             Association of Radio Industries and Businesses
ASP                audio signal processing
ATSC              Advanced Television Systems Committee
AVS                Audio Video Standard
AVS              adaptive voltage scaling
BTSC            Broadcast Television Systems Committee
CA                conditional access
CABAC        context-adaptive binary arithmetic coding
CBR                constant bit rate
CEC                consumer electronics control
CI                common interface
CLUT              color look-up table
CPU                central processing unit
CTI            chroma transient improvement
CVBS            Composite Video Broadcast Signal
DCI            dynamic contrast improvement
DDR               double data rate
DES                Data Encryption Standard
DRM                digital rights management
DTG                Digital TV Group
DTMB             Digital Terrestrial Multimedia Broadcast
DTS                Digital Theater Systems
DVB-C                Digital Video Broadcasting-Cable
DVB-T                Digital Video Broadcasting-Terrestrial
DVB-T2            Digital Video Broadcasting-Terrestrial-Second Generation
DVFS            dynamic voltage and frequency scaling
EI/J              Electronic Industries Association of Japan
eMMC             embedded multimedia card
ETSI               European Telecommunications Standards Institute
FFT                fast Fourier transformation
FLAC             Free Lossless Audio Codec
FM                frequency modulation
GMC            global motion compensation
GPIO          general-purpose input/output
GPU            graphics processing unit
HDCP            High-bandwidth Digital Content Protection
HDMI            high definition multimedia interface
HDR             high dynamic range
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HE-AAC</td>
<td>High-Efficiency Advanced Audio Coding</td>
</tr>
<tr>
<td>HE-AAC v2</td>
<td>High-Efficiency Advanced Audio Coding version 2</td>
</tr>
<tr>
<td>HLG</td>
<td>Hybrid Log-Gamma</td>
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<tr>
<td>IF</td>
<td>intermediate frequency</td>
</tr>
<tr>
<td>fC</td>
<td>inter-integrated circuit</td>
</tr>
<tr>
<td>IR</td>
<td>infrared</td>
</tr>
<tr>
<td>FS</td>
<td>inter-IC sound</td>
</tr>
<tr>
<td>IPC</td>
<td>interlaced-to-progressive conversion</td>
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<tr>
<td>ISDB-T</td>
<td>Integrated Service Digital Broadcasting-Terrestrial</td>
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<tr>
<td>ITU-T</td>
<td>International Telecommunication Union Telecommunication Standardization Sector</td>
</tr>
<tr>
<td>LPCM</td>
<td>linear pulse-code modulation</td>
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<tr>
<td>LTI</td>
<td>luma transient improvement</td>
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<tr>
<td>LUT</td>
<td>lookup table</td>
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<tr>
<td>MC</td>
<td>motion compensation</td>
</tr>
<tr>
<td>MEMC</td>
<td>Motion Estimation/Motion Compensation</td>
</tr>
<tr>
<td>MHL</td>
<td>Mobile High-Definition Link</td>
</tr>
<tr>
<td>MISO</td>
<td>multiple-input single-output</td>
</tr>
<tr>
<td>MVC</td>
<td>multiview video coding</td>
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<tr>
<td>NICAM</td>
<td>Near Instantaneous Companded Audio Multiplex</td>
</tr>
<tr>
<td>NR</td>
<td>noise reduction</td>
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<tr>
<td>NTSC</td>
<td>National Television System Committee</td>
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<tr>
<td>OD</td>
<td>on demand</td>
</tr>
<tr>
<td>OSD</td>
<td>on-screen display</td>
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<tr>
<td>PAL</td>
<td>Phase Alternating Line</td>
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<tr>
<td>PBGA</td>
<td>plastic ball grid array</td>
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<tr>
<td>PCB</td>
<td>printed circuit board</td>
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<tr>
<td>PCIe</td>
<td>Peripheral Component Interconnect Express</td>
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<tr>
<td>PID</td>
<td>packet identifier</td>
</tr>
<tr>
<td>PLP</td>
<td>physical layer pipe</td>
</tr>
<tr>
<td>PNG</td>
<td>Portable Network Graphics</td>
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<tr>
<td>POR</td>
<td>power-on reset</td>
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<tr>
<td>PS</td>
<td>Prime Single</td>
</tr>
<tr>
<td>P2P</td>
<td>point-to-point</td>
</tr>
<tr>
<td>PVR</td>
<td>personal video recording</td>
</tr>
<tr>
<td>PWM</td>
<td>pulse-width modulation</td>
</tr>
<tr>
<td>QAM</td>
<td>quadrature amplitude modulation</td>
</tr>
<tr>
<td>ROI</td>
<td>region of interest</td>
</tr>
<tr>
<td>ROP</td>
<td>raster operation</td>
</tr>
<tr>
<td>RSA</td>
<td>Rivest-Shamir-Adleman</td>
</tr>
<tr>
<td>SAP</td>
<td>secondary audio programming</td>
</tr>
<tr>
<td>SAW</td>
<td>surface acoustic wave</td>
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<tr>
<td>SDIO</td>
<td>Secure Digital Input Output</td>
</tr>
<tr>
<td>SECAM</td>
<td>sequential color with memory</td>
</tr>
<tr>
<td>SEG</td>
<td>Similar Exposure Group</td>
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<tr>
<td>SIF</td>
<td>sound intermediate frequency</td>
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<tr>
<td>SISO</td>
<td>single-input single-output</td>
</tr>
<tr>
<td>SLF</td>
<td>scene luminance fidelity</td>
</tr>
<tr>
<td>SoG</td>
<td>sync on green</td>
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<tr>
<td>SPDIF</td>
<td>Sony/Philips Digital Interface Format</td>
</tr>
<tr>
<td>SRS</td>
<td>Sound Retrieval System</td>
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<tr>
<td>SVP</td>
<td>secure video path</td>
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<tr>
<td>SWS</td>
<td>super wide sound</td>
</tr>
<tr>
<td>TCON</td>
<td>timing controller</td>
</tr>
<tr>
<td>TEE</td>
<td>Trusted Execution Environment</td>
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<tr>
<td>TS</td>
<td>transport stream</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>UART</td>
<td>universal asynchronous receiver transmitter</td>
</tr>
<tr>
<td>UHD</td>
<td>ultra high definition</td>
</tr>
<tr>
<td>VBO</td>
<td>V-by-One</td>
</tr>
<tr>
<td>VBR</td>
<td>variable bit rate</td>
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</table>