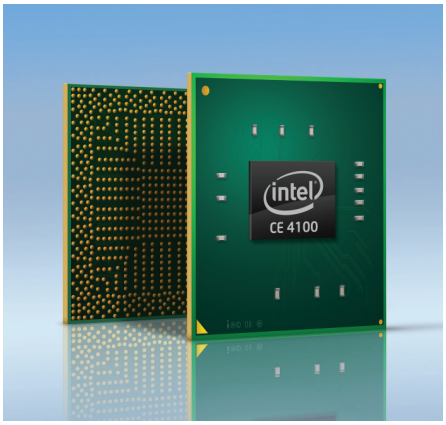
PRODUCT BRIEF
Intel® Atom™
Processor CE4100
Consumer Electronics

Intel® Atom™ Processor CE4100

Bring Internet media and services to TV with outstanding video and audio quality.



Product Overview

The Internet is largely built and optimized on platforms based on Intel® architecture. Intel® media processors have become important assets for developers of consumer electronics products as the industry adopts Internet-based media and services for the TV. The Intel® Atom™ processor CE4100 series is Intel's second generation of Intel architecture-based system-on-a-chip (SoC) devices, designed to enhance the delivery of the Internet to the TV with support for Adobe* Flash* Player.

The media processors include devices specifically designed to meet the requirements of IPTV/hybrid set top boxes and connected audio/video products.

These highly integrated SoCs built on Intel's 45nm process technology deliver the processing performance of a low-power Intel® Atom™ processor core, Intel® Precision View Technology for outstanding picture quality and Intel® Media Play Technology for seamless delivery of audio and video from both Internet and broadcast sources. The media processors also include functional units for robust 2D/3D graphics, flexible I/O, security and a unified high-speed memory subsystem for optimal responsiveness with Internet applications.

The Intel Atom processor CE4100 series delivers Intel® architecture software compatibility in highly integrated SoCs that reduce chip count to help support aggressive CE price points. The use of Intel architecture accelerates product time-to-market by providing access to a library of code familiar to programmers for more than 20 years, including tools, compilers and re-usable Internet applications.

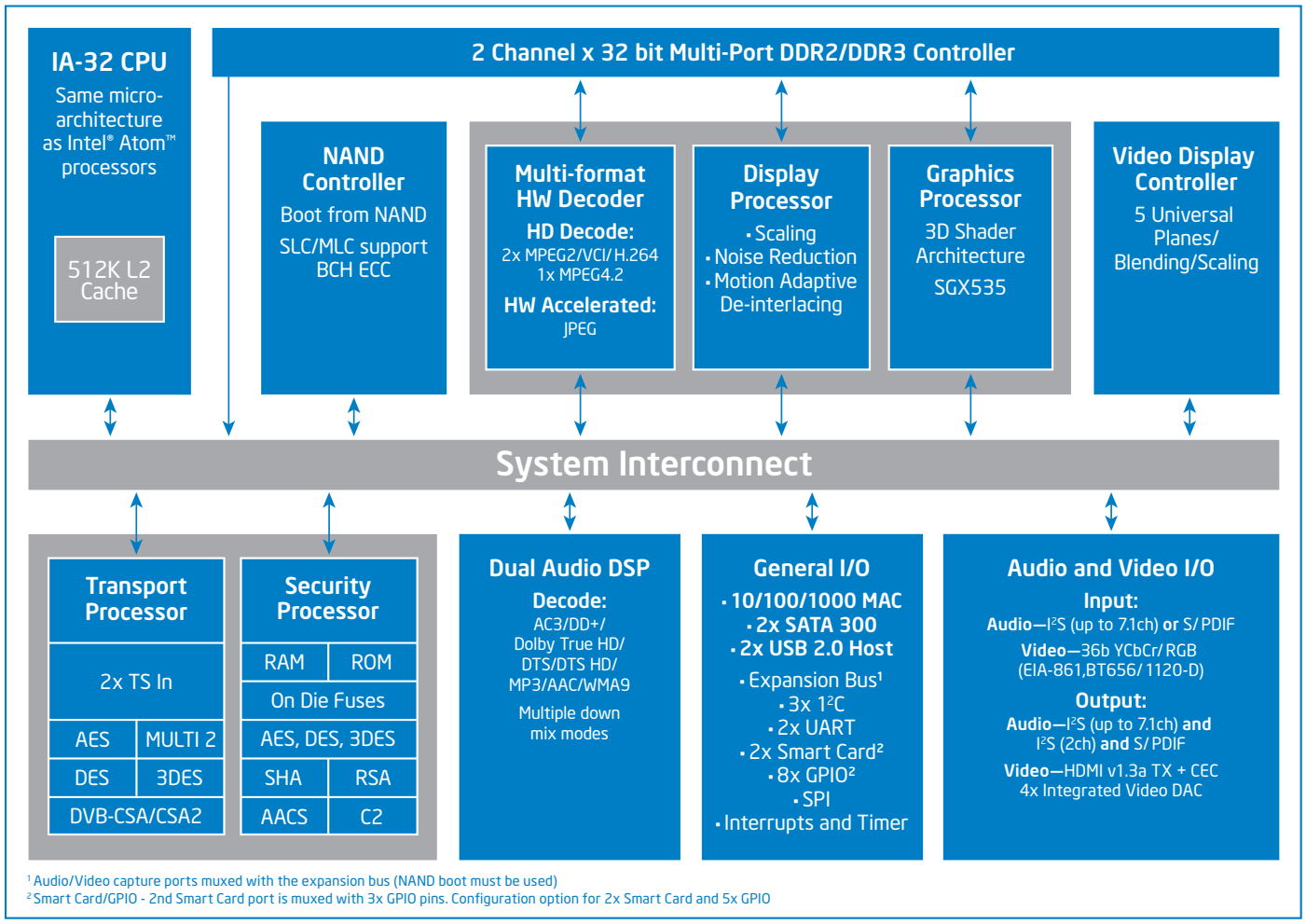


Figure 1 – Intel® Atom™ Processor CE4100 Block Diagram

In addition to the 45nm Intel® Atom™ processor core at up to 1.2GHz, the SoC includes enhanced functional units including a 512K L2 cache, a NAND flash controller with secure boot and code/data storage, a multi-format hardware decoder supporting dual HD decode (MPEG2, VC1, and H.264) single HD decode support for MPEG 4.2 ASP and JPEG decode hardware acceleration. Other functional blocks include a display processor, graphics processor, video display controller, transport processor, dedicated security processor with support for secure data path, general I/O including SATA-300, USB 2.0, Gigabit Ethernet, and audio/video I/O with 36b YCbCr/RGB video input and I²S or S/PDIF audio input.

Target Markets

- Connected AV products including digital TVs and Blu-ray* players
- IPTV/Hybrid set top boxes

Video Decoding Support

- Dual MPEG-2 MP@HL/MP@ML
- Dual VC1/WM9*—AP@L1-L3
- 2x H.264—HP@L4.1
- Single MPEG-4.2 ASP
- Ready for DivX* Home Theater 3.0 certification
- Hardware accelerated JPEG decode

Video Output Support

- Simultaneous video on every output
- Support for NTSC/PAL
- HDMI/DVI 1.3a + CEC
  - 1080P@60 fps with deep color in RGB/YUV
  - 1080P@24 fps film format
- 4 integrated 10-bit 150MHz video DACs can be configured in various combinations:
  - Component
  - Composite
  - S-Video
  - SCART

Video Input Support

- 36b YCbCr/RGB
  - EIA-861, BT656/1120-D
  - 4:4:4 deep color via HDMI receiver

Intel® Precision View Technology

- SoC includes 250MHz embedded controller

- Configurable multi-stream 10-bit precision pipeline
- Single 1080p@60fps input
- Single 1080p@60fps output
- Chroma up-sampling
- Temporal noise reduction
- Film mode detection for 3:2/2:2 pull-down detection
- Advanced 4-field/pixel motion adaptive de-interlacing
- Motion history
- Low angle diagonal interpolation
- Independent horizontal and vertical scaling (9-tap 128-phase polyphase filter)

Compatibility with Internet Applications

Tomorrow's Internet innovations will be created on Intel architecture. With its Intel Atom processor core, the Intel Atom processor CE4100 series supports multiple Internet video and audio formats for optimum compatibility with a broad range of applications and services, including infotainment, social networking and 3D gaming. The Intel® Atom™ CE4100 media processors also provide excellent performance for multiple software development and application frameworks, such as the Widget Channel and the Adobe Flash Player. These are full-featured software frameworks that allow TV viewers to enjoy rich Internet applications while watching their favorite programs.

Intel® Precision View Technology

Picture quality is an important issue with consumers. Intel is committed to developing and delivering industry-leading display processing technology that optimizes visual quality for standard definition (SD) to high definition (HD) video from Internet and broadcast sources. Intel Atom processor CE4100 SoCs include Intel® Precision View Technology, a dedicated display processor that performs noise reduction, motion adaptive de-interlacing and scaling.

When evaluated against competitive products with dedicated display processors using the Hollywood Quality Video* (HQV) benchmarks, Intel® media processors outperformed in tests of SD to HD up-scaling and HD rendition, without relying on an external chip[3]. OEMs can deliver the outstanding picture quality that consumers want, while minimizing chip count.

Intel® Media Play Technology

The Intel Atom processor CE4100 series makes Internet-based video content a seamless part of the TV viewing experience by decoding video from both broadcast and Internet sources. When you watch a broadcast channel or stored content, video is encoded in a standard format such as H.264. Streaming media drivers in the media processor route the video to the on-chip multi-format hardware decoder.

The decoder performs multi-stream decode and display up to 1920x1080p at 60 frames per second and single-stream decode and display at twice that rate. New in the Intel Atom processor CE4100 series is HD decode support for MPEG-4.2 and hardware JPEG decode acceleration.

When you switch to an Internet channel, software automatically routes video and audio to a software codec running on the Intel architecture processor core. The ability to decode a broad array of video and audio formats in software gives CE devices the flexibility they need to seamlessly adapt to constantly evolving Internet standards.

Product Highlights Intel® Atom™ Processor CE4100

- Processor
  - Intel Atom processor (45nm)
  - 512K 2-way set-associative L2 cache
- Memory Controller
  - Two 32-bit DDR2 and DDR3 memory channels
  - Up to 800MT/s DDR2; 1333MT/s DDR3
- Graphics Core
  - Programmable 2D/3D Intel® Graphics Media Accelerator 500 (based on the POWERVR* SGX535 from Imagination Technologies*)
  - Dual universal scalable shader engines with up to 16 threads per core providing pixel and vertex shader functionality
  - Enables 2D, 3D processing in a single pipeline
  - Accelerated 2D operations—BLT, alpha-blend BLTs
  - Industry-standard API support—OpenGL ES 1.1, OpenGL ES 2.0 and OpenVG 1.0
- Video Decoding Support
  - Multi-stream and simultaneous decode for VC1/WM9, H.264 and MPEG2 up to 2HD

CE4100 Family Table

	CE4100	CE4130	CE4150
Power	7–9W	7–9W	7–9W
AV Input		▪	▪
Performance Graphics (200MHz)	▪	▪	
Extreme Graphics (400MHz)			▪
Core Frequency	1.2GHz	1.2GHz	1.2GHz

Figure 2 – Intel® Atom™ Processor CE4100

The Intel® Atom™ processor CE4100 series includes three processor variants. Each provides integrated features designed to meet the requirements of a specific consumer electronics product segment.

- Single-stream decode of MPEG4.2
- Trick-mode support
- MPEG-2 MP@HL or MP@ML, VC1—DAP@L1-L3, H.264—HP@L4.1
- Hardware JPEG decode acceleration

▪ Display Composition

- Dual pipeline with independent timing control
- 5 universal pixel planes supporting both video and graphics pixels
- Two 8-bit indexed-pixel/alpha planes
- Flexible blenders allowing sideband, global and per-pixel alpha blending per plane
- Simultaneous HD and SD display

▪ Video Output Support

- HDMI/DVI 1.3a (CEC) compliant output with support for 1080P@60 with deep color in RGB/YUV, 1080P@24 film format
- 4 Integrated 10-bit 150MHz video DACs

▪ Video Input Support

- 36b YCbCr/RGB (EIA-861, BT656/1120-D)

▪ Audio Processing Support

- Dual DSP Core with special audio instructions
- Audio decode (MPEG1/3, AC3, Dolby Digital Plus,* DTS-HD/Master Audio & High Res,* Dolby True HD/MLP,* DTS LBR,* AAC plus V2, WMA)
- Audio encode (AC3, DTS)
- Audio effects, resampling, mixing
- 24-bit 192KHz audio support

▪ Audio Interface Support

- HDMI audio support including high-bit rate (HBR) audio
- One stereo and one 7.1 channel output
- One S/PDIF output
- Simultaneous audio on each output
- One audio input up to 7.1 channels or S/PDIF

▪ Transport Processing

- Programmable transport demux
- 2 serial transport stream interfaces

▪ Security Features Support

- 2 smart card (ISO 7816) interfaces
- HDCP content protection for HDMI
- ROVI*[4] (v7.1.L1) and CGMS-A protection on analog video
- DES, 3DES, AES, MULTI2 and DVB-CSA transport stream descrambling
- Dedicated security processor with hardware acceleration
- Support for security access schemes
- Secure boot

▪ Peripheral Support

- 2 USB 2.0 host ports
- Ethernet 802.3 10/100/1000 MAC
- Single-port or dual-port SATA-300 for drive connectivity
- NAND/NOR flash including boot

▪ 425 signal pins in a 27mm^2 lead-free FCBGA (951 ball) package

For more information, visit the Intel Consumer Electronics home page at: **http://www.intelconsumerelectronics.com**

[1] Audio/Video capture ports muxed with the expansion bus (NAND boot must be used)

[2] Smart Card/GPIO - 2nd Smart Card port is muxed with 3x GPIO pins. Configuration option for 2x Smart Card and 5x GPIO

[3] Source: Intel Corporation. HQV* benchmark is an image quality testing tool for Plasma, LCD, RPTV or Front Projector HDTV. It's designed to reveal the device's ability to upconvert standard definition footage to high definition. HQV benchmark uses video clips provided on a DVD with 10 test patterns that stress the video processor and evaluate a variety of interlaced video signal processing tasks including decoding, de-interlacing, motion correction, noise reduction, film cadence detection and detail enhancement. Unlike standard technology benchmark test suites which are typically based on software programs that produce a score, HQV and HD HQV tests rely on human visual perception to correctly identify picture artifacts and properly score the resulting images. The HQV test process describes the picture artifacts to look for and how to score the resulting images. THE INTEL EMPLOYEES THAT PERFORMED THE TESTS ARE CONSIDERED BY INTEL TO BE EXPERTS IN THE FIELD OF VIDEO QUALITY. Performance tests and ratings are measured using specific systems and/or components and reflect the approximate performance of products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance.

[4] This device is protected by U.S. patent numbers 5,315,448 and 6,516,132, and other intellectual property rights. The use of ROVI's copy protection technology in the device must be authorized by ROVI and is intended for home and other limited pay-per-view uses only, unless otherwise authorized in writing by ROVI. Devices incorporating ROVI's copy protection technology can only be sold or distributed to companies appearing on ROVI's list of "Authorized Buyers" at: www.rovicorp.com. Reverse engineering or disassembly is prohibited.

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