



IP Digital Set Top Box

Scalable Platform for Video-on-Demand with TV-Out

Application Description

The IP-Digital Set Top Box (IP-DSTB) enables the implementation of “triple-play” data, voice and video services in the home including the sharing of photos, music, data, voice and video with networked consumer electronics devices, entertainment PCs and mobile devices. This platform plays a key role in emerging business models, such as the delivery of IP-TV and video-on-demand (VoD) over broadband which is made possible by emerging advanced codecs implemented in software. The platform also supports the deployment of other services which can generate recurring revenue streams, such as online gaming subscriptions.



The IP-DSTB is designed to function as a DSL or Ethernet-based digital set top device with TV-out that can be easily configured with hardware options and software to fit many emerging IP-based service models. It provides a cost-effective platform that minimizes capital cost, while providing the expandability options needed to meet the requirements of a variety of service provider deployment and consumer electronics usage models, including personal video recorder (PVR) applications.

General platform features include:

- Software-based advanced compression codecs for flexible support of emerging standards.
- Processing headroom for emerging consumer electronics applications such as personal video recording and online gaming, residential gateway functionality, remote device management and more.
- Platform flexibility and expandability to accommodate emerging business and service delivery models without the need to change-out the set top box.

This document provides an overview of the platform, including hardware and software building blocks and available development tools.

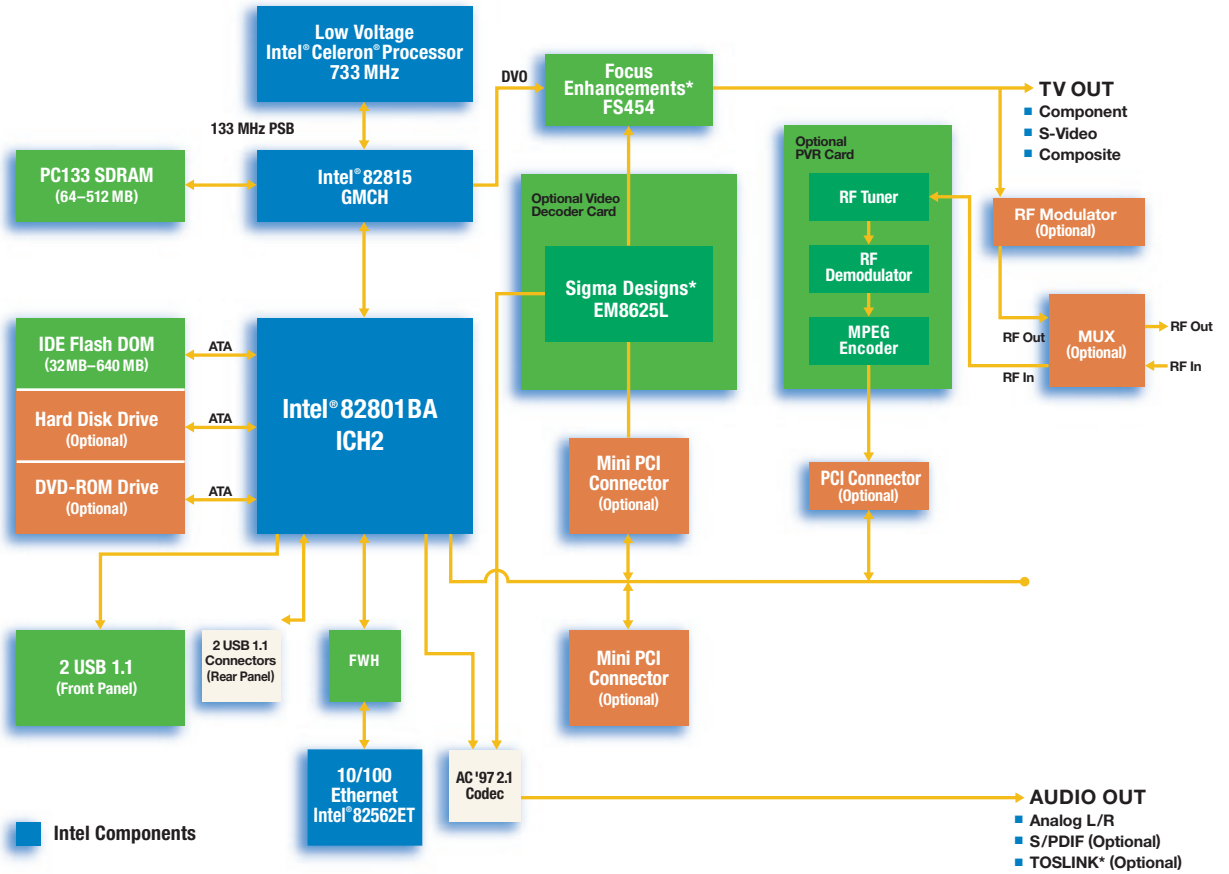


Figure 1. Intel® IP-Digital Set Top Box Block Diagram

The Intel IP-DSTB platform showcases the convergence of computing, communications and consumer electronics. It provides the computing horsepower to run software codecs for Windows Media* Video 9 in addition to MPEG-1,* MPEG-2* and MPEG-4* compression formats. The design includes the Low Voltage Intel® Celeron® processor or the Ultra Low Voltage Intel® Celeron® processor, the Intel® 815 chipset, and an Intel® Ethernet controller providing integrated network connectivity, in addition to video, audio and connectivity components from third-party suppliers. Intel's flexible design enables manufacturers to tailor their own set top boxes to meet the needs of service providers and consumers.

- The Low Voltage Intel Celeron processor at 733 MHz provides the performance needed for software-based codecs. For higher processing requirements, the design supports Intel Celeron processors up to 1.26 GHz.
- The compact main board provides expandability through PCI* and mini-PCI connectors.
- The Intel® 82801BA I/O controller (ICH2) for integrated LAN and ATA/100 provides design flexibility in a full-featured IP-DSTB solution. The chipset also supports up to 512 MB of PC133 SDRAM in addition to a 16MB – 640MB IDE Flash Disk-on-Module for storage of BIOS and operating system. Peripheral expansion includes 2 front USB 1.1 ports for consumer interface devices including a front-panel LCD. The platform also includes two rear USB 1.1 ports for video cameras, microphones and other accessories, one RJ-45 10/100 Ethernet port, an optional low-profile PCI slot with rear-panel I/O access and 2 optional mini-PCI slots. The design includes an infrared receiver for a remote control/keyboard in addition to a RF pass-through MUX, a smart card reader and Wi-Fi* connectivity for home networks using one of the mini-PCI slots.
- The design provides the foundation for a fanless thermal solution using a heat pipe and a chassis-mounted heat exchanger.
- The IP-DSTB design can be implemented in multiple form factors based on the same main board, including a STB-type small form factor (approx. 12"W x 8"D x 2"H), and a CE-type full size form factor (approx. 17"W x 11"D x 3"H) that can accommodate hard disk drives (HDD) and DVD-ROM or DVD+/-R/RW drives.

Featured Intel Products

The IP-DSTB design supports the Low Voltage Intel Celeron processor or the Ultra Low Voltage Intel® Celeron processor, the Intel 815 chipset, and an Intel® Ethernet controller providing integrated networking and hard drive connectivity.

Low Voltage Intel Celeron Processor

The Low Voltage Intel® Celeron® processor at 733 and 866 MHz and the Ultra Low Voltage Intel® Celeron® processor at 650, 733 and 800 MHz deliver a scalable processing solution for digital set-top-box applications. Built on Intel's state-of-the-art manufacturing technology, this processor combines the solid performance needed to run software-based video/audio codecs, soft DVD MPEG-2 playback, rich user interfaces and a variety of consumer electronics applications, while maintaining exceptional value.

Intel 815 Chipsets

The Intel® 815E chipset, including the I/O Controller Hub2 (ICH2) and Graphics Memory Controller Hub (GMCH) provides increased I/O bus bandwidth through the use of Intel® Hub Architecture, providing the enhanced concurrency needed for next-generation IP-DSTB designs. The chipset supports up to 512 MB of 133 MHz SDRAM. It includes Intel® 3D integrated graphics with Direct AGP expandability for vivid 2D and 3D graphics, and is upgradeable to AGP4X to increase graphics bandwidth for even higher levels of graphics performance. The integrated AC '97 Controller provides outstanding audio quality, and the chipset supports Digital Video Output compatible with the DVI* specification, enabling the set top box to connect to a variety of displays including traditional TVs and digital flat-panel designs.

Intel® 82562ET 10/100 Ethernet Controller

The Intel® 82562 family of controllers are highly integrated platform LAN connection (ICH2/3/4) devices that combine 10BASE-T and 100BASE-TX physical layer capabilities and provide a core building block for integrated networking connectivity in ICH2-based platforms.

Functional Description

The platform includes an IDE Flash Disk-on-Module. Storage of the operating system on this module reduces the bill-of-materials costs and enables the device to boot rapidly for enhanced ease-of-use in the CE environment. The Intel IP-DSTB is a multi-function platform that is designed to enable flexible implementation of a variety of video, voice and data applications and services:

Video

The emergence of software-based advanced codecs enables the delivery of compressed video over DSL local loops in addition to other broadband sources. Compressed video enters the system through the 10/100 Ethernet interface in the form of IP packets, which are routed from the controller hub (ICH2) to the graphics memory controller hub (GMCH) and then to the processor. The program channel is de-multiplexed from the transport stream, and the packets are examined for Digital Rights Management (DRM) encapsulation. Following DRM verification, the video packets are decoded by the processor, using the PC133 SDRAM for frame buffering. The decoded video is routed to the GMCH where graphics can be overlaid on top of the video. This is important for displaying enhanced program guide (EPG) content and other, on-screen graphical content while users watch video programming. Video and overlaid graphics are then output via the DVO port to the TV encoder for output to a television through composite, S-video or component video connectors.

Voice over IP/Video Phone

The addition of Voice over IP (VoIP) capability enables service providers to support traditional IP-based telephony applications and video-phone services. Incoming packets are routed into the platform through the ICH and GMCH to the processor, which runs the call-processing application. To permit two-way voice functionality, the platform must be configured with a microphone or USB-connected wireless headset for audio capture with a supporting module for re-encoding the data into a packetized audio stream. The addition of a camera enables the platform to support video-phone applications, which can be further enhanced by graphical data for services including call-waiting and caller-ID.

Online Gaming

The IP-DSTB platform also supports online gaming applications. Game input data is received through the Ethernet controller and routed through the ICH and GMCH to the processor. Players can also communicate with each other while a game is in progress using the platform's VoIP capability.

Software Considerations

The Intel® IP-DSTB Reference Design supports the following software components:

Operating Systems

Intel provides matching BSPs/PSPs for the latest released versions of supported operating systems:

- Board Support Package (BSP) for Windows CE* 4.2
- Board Support Package (BSP) for Windows XP* Embedded
- Platform Support Package (PSP) for Red Hat* Linux v.8.0

Core Middleware Building Blocks

The following middleware building blocks are provided by third-party vendors:

- Software-based codecs for emerging advanced compression technologies (including MPEG-4 Part 10 (H.264/MPEG-4 AVC), Windows Media* Video 9, in addition to MPEG-1 and MPEG-2 compression formats) provide the flexibility to implement multiple emerging and existing standards and formats. The use of advanced compression encoding for digital video requires roughly half the bandwidth required for MPEG-2, enabling service providers to distribute video-on-demand and other services over DSL telephone lines.
- Middleware conformant to Intel Network Media Processing Requirements (Intel® NMPPR) to ensure interoperability
- Digital Rights Management software

Interoperability

Intel NMPR is a comprehensive set of specifications for network media interoperability at the protocol level. Intel NMPR-conformant and validated middleware ensures baseline functionality utilizing existing industry standards, while providing the freedom to add higher-level functionality needed for product differentiation.

Intel NMPR specifications are designed to comprehend interoperability specifications developed by the Digital Home Working Group* (DHWG).

Applications

When combined with a direct broadband connection between the viewer and service provider, the Intel IP-Digital Set Top Box design supports a rich menu of triple-play voice, data and video services:

- Video-on-demand (VoD)
- Pay-per-view (PPV) video programming
- “Internet video phone” voice+video communication via the Internet
- Voice over IP (VoIP) communications
- Streaming video and audio content
- Online shopping
- Interactive online games
- Web browsing
- E-mail and text messaging

Third-Party Software Support

Intel works with multiple independent hardware and software vendors to help enable quick implementation of designs based on the Intel® 815 DSTB Reference Design.

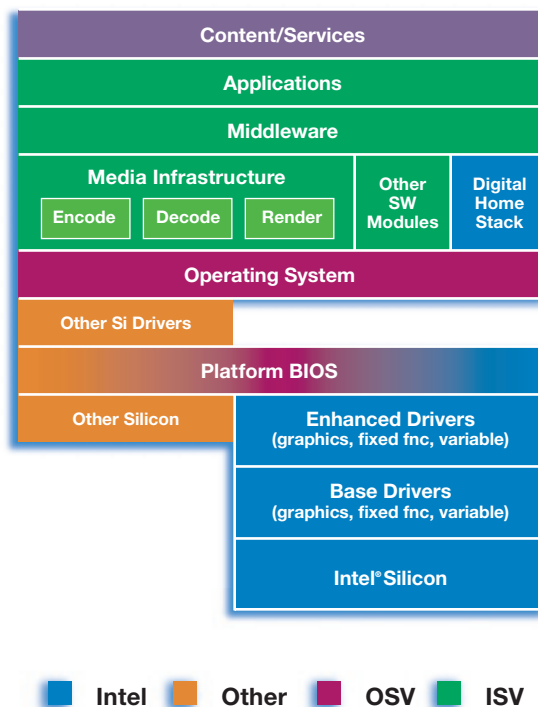


Figure 2. Intel provides drivers, tools, a board support package and core middleware building blocks to speed software development.

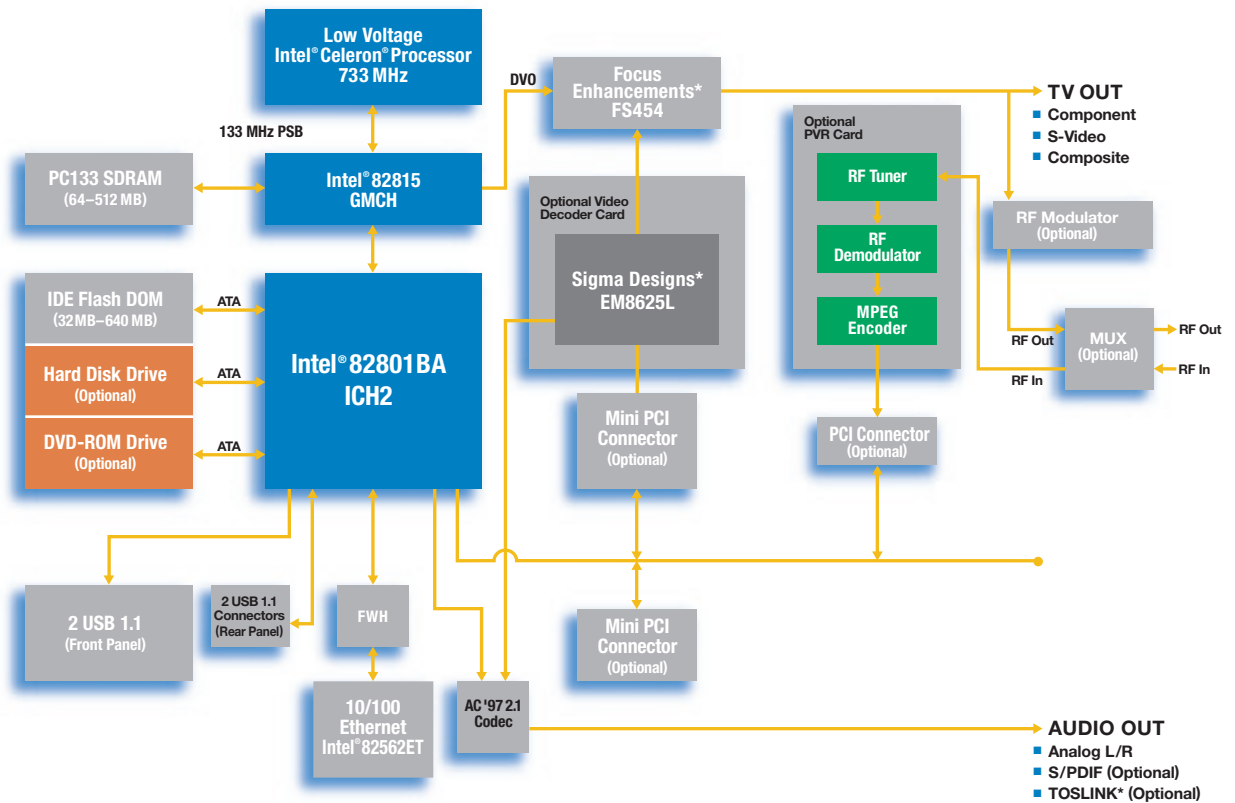


Figure 3. The flexible IP-Digital Set Top Box design can be configured as a PVR, by adding an optional PVR card and hard disk drives or optical drives.

Scalability and Migration Options

Intel's flexible IP-DSTB design enables manufacturers to tailor a variety of digital set-top-box solutions to meet the varied needs of service providers and consumers. In addition to supporting a range of Intel processors, the platform includes peripheral expansion capabilities, including standard and mini-PCI connectors and USB ports.

In addition to a basic digital set top box designed to receive streaming advanced-compression content, the base IP-DSTB design can be configured as a personal video recorder (PVR) capability through the addition of one or more hard drives. Manufacturers can expand their product options even more by adding tuners for broadcast TV, remote-control units, joysticks and game controllers, in addition to wired and wireless home networking options.

The addition of a hard disk drive and an optional tuner/encoder card, enables the IP-DSTB to support a variety of other usage models. With a hard drive, a 'trickle' video-on-demand model can be enabled where video and other content can be downloaded (non-real-time) based on end-user preferences. This allows service providers to offer recommendations of content that the end-user may be interested in. The hard drive also enables the IP-DSTB to be a personal video recorder (PVR) where end users can do PVR trick modes such as live-pause, live-rewind and skipping features on content delivered via DSL. With an optional tuner, the IP-DSTB can also receive local terrestrial broadcasts.

The Intel Low Voltage Celeron processor family provides product developers with a scalable path that helps preserve their hardware and software investments over multiple-product generations. The ability to use a single-system design that supports a wide range of price and performance options enables developers to rapidly add product features and functionality while minimizing their total system cost.

Recommended Development Tools

Intel provides building blocks that work together in specific configurations to support simple and fast development of applications designed for consumer electronics. These building blocks can also be used to provide the high levels of scalable performance and reliability required by today's demanding applications.

Recommended development tools include:

- Intel 815 Digital Set Top Box Reference Design
- Documentation
- Schematics

The IP-DSTB platform is based on open Intel® Architecture, which is familiar to a majority of programmers, and the wide range of Intel Architecture software-development and optimization tools provide developers with a significant time-to-market advantage. For a comprehensive list of Intel Architecture software-development tools, refer to the Intel Electronic Tools Catalog at <http://appzone.intel.com/toolcatalog/>.

Intel Design Advantage

Time-to-Market

Intel provides a comprehensive reference design that can dramatically accelerate time-to-market and works with independent hardware and software vendors to quickly enable the implementation of designs.

Cost-Effectiveness

An Intel-validated reference platform, including schematics and documentation, is available at no cost. Developers can cut costs even further by utilizing the substantial amount of platform engineering work already performed by Intel.

Performance with Flexibility

The Intel 815 DSTB Reference Design is ideally suited for the video-over-IP DSTB market segment and designed to meet low-cost, high-performance product targets. Support for multiple operating systems and a variety of expandability options are available to help developers meet customer requirements.

Scalability

The Intel product roadmap enables developers to meet the evolving processing requirements of digital set top boxes.

Quality

Intel's manufacturing capacity and quality requirements help ensure processor and chipset reliability for customer satisfaction.

Broad Application Support

The platform is based on open Intel Architecture, which is familiar to a majority of programmers. In addition, the platform is validated with the Microsoft Windows CE .NET operating system, providing developers who adopt the reference design a significant time-to-market advantage.

New Business Models

By providing the flexibility to implement multiple configurations using a single-base platform design, the Intel IP-DSTB platform can support a variety of emerging business models designed to take maximum advantage of the power of IP-based digital media. Service providers have the flexibility to evaluate new services, ranging from video-on-demand and integrated voice over IP, to gaming and interactive video services. The use of Intel silicon building blocks, the validated Intel® 815 Set Top Box Reference Design and software from a variety of third-party vendors enables fast time-to-market while minimizing development costs.

**For more information, visit the Intel Consumer Electronics home page at:
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