

## Highlights

- browsing, and data broadcasting. The newest members of the IBM family of STB products, these advanced controllers incorporate the IBM STB architecture, advanced 0.15-micron process technology, and design flexibility. These controllers deliver high DMIPS performance and robust functionality geared to today's diverse and increasingly large bandwidth requirements.



High performance and support for multiple transport inputs and memory streaming enable solutions such as dual tuners and HDD applications. The solution is designed to enable middleware environments, such as MediaHighway, which facilitate STB services, including live broadcasts and storing and receiving video and audio.

The IBM PowerPC Architecture™ provides a clear software migration path to high-performance processors for more demanding applications. In addition, IBM's enabling tools can help STB manufacturers improve their time-to-market.

The STB04xxx and STBx5xxx design allows base audio and video decoding activities to execute with minimal host processing, thereby making more DMIPS available to enable high-end functions performed concurrently with audio/video programming and entertainment.

STB04xxx and STBx5xxx controllers include five subsystems: processor, memory, digital audio/video, 2-D graphics, and peripheral interface. Third-generation single-chip devices, STB04xxx and STBx5xxx controllers demonstrate IBM's commitment to satisfying emerging STB requirements through a range of advanced features.

#### **Design flexibility supports diverse applications**

STB04xxx and STBx5xxx controllers can offer the flexibility to satisfy manufacturers' individual application requirements. STB manufacturers can choose from controllers featuring either a 175-DMIPS or a 350-DMIPS embedded PowerPC 405. For applications requiring even more

performance, the controllers integrate a glueless integrated external processor interface that enables dual-processor solutions.

To support NDS conditional access (VideoGuard) and XTV applications, IBM offers controllers that comply with these NDS services (STB15xxx).

Additionally, customers can select a controller with Macrovision copy protection support, Dolby® Digital audio support, or both. A broad spectrum of peripheral interfaces and support for a range of industry-standard memory further extend design flexibility.

#### **PowerPC 405 delivers high performance**

The PowerPC 405 processor, the heart of the *processor subsystem*, features high-speed operation at 126 MHz or 252 MHz, 16-KB instruction cache, and 16-KB data cache to maximize application performance. With this processing capability, STB manufacturers can design products to support:

- PVR
- Internet gaming
- Interactive TV
- Web browsing
- E-commerce applications
- Personal TV services (NDS XTV)

#### **Advanced digital audio and video features support next-generation and multi-stream applications**

The *digital audio and video subsystem* delivers high-quality video and sound, enabling state-of-the-art features for consumer applications. An advanced MPEG-2 transport demultiplexer function, including three demultiplexers and multistreaming capabilities, supports simultaneous dual-stream recording and single-stream playback.

Capabilities include playing a video stream from an HDD, live streaming of video, and variable video scaling. In STB15xxx controllers, the transport function also supports NDS conditional access and XTV Services. The digital audio and video subsystem operates with minimal processor intervention, making more DMIPS available for custom application functions.

The STB04xxx and STBx5xxx digital audio and video subsystem incorporates:

- MPEG-2 video decoder; decodes MPEG-2 Main Profile at Main Level (MP@ML) video
- Three MPEG-2 transport demultiplexers/DVB descramblers (DES encode and decode in STB05xxx and STB15xxx controllers)
- Digital encoders, including NTSC, PAL, and SECAM analog conversion, and six concurrent analog video outputs
- MPEG-2 audio decoder; decodes MPEG-2 Layer I & Layer II
- MPEG-2 Layer III (MP3) audio decoder
- Dolby Digital-compliant decoding\* (STB04x1x and STBx5x1x controllers only; Dolby Digital license is required)
- Macrovision copy protection support (STB04xx1 and STBx5xx1 controllers only; a Macrovision license is required)
- Support for NDS VideoGuard and NDS XTV (STB15xxx controllers only; an NDS license is required)

### Graphics subsystem enables full 2-D capabilities

The 2-D *graphics subsystem* incorporates a 2-D bitBLT engine supporting up to 32 bits per pixel, graphic scaler, command list controller, and display engine to enable creation of brilliant graphics and animation. This capability allows service providers to offer graphically rich user interfaces for next-generation interactive applications.

The graphic scaler can perform independent horizontal and vertical scaling, using arbitrary scaling factors, to provide zooming capabilities. The command list controller executes a command list from memory to control the operations of the BLT engine and graphic scaler, without processor intervention. The display unit supports up to five physical layers, including background, image (still), video, graphic, and cursor. In addition, it can support many logical layers based on the system memory available. The 2-D graphics subsystem features:

- Support for frame-based, enhanced color depth
- Programmable background color behind the background layer
- Multilevel blending
- Graphic control output for the external multiplexer (picture-in-picture)
- Square pixel filter for the graphic and cursor layers
- Automatic RGB/YCbCr conversion for the graphic plane
- Anti-flicker filter

### IBM STB04xxx and STBx5xxx Digital Set-Top Box Integrated Controllers

<b>Processor Subsystem</b>	PowerPC 405 @ 175/350 DMIPS (126/252 MHz) 16-KB I-Cache, 16-KB D-Cache	
<b>Memory Subsystem</b>	2 DMA controllers External bus interface unit Intelligent crossbar switch	2 SDRAM controllers External processor interface
<b>Audio/Video Subsystem</b>	MPEG-2 MP @ ML video decoder 3 MPEG-2 transport demultiplexers/DVB descramblers Digital encoders with NTSC/PAL/SECAM analog conversion MPEG-2 Layer I and Layer II audio decoder Dolby Digital decoding (license required) Macrovision copy protection (license required) NDS Conditional Access (license required) XTV Services (license required)	
<b>2-D Graphics Subsystem</b>	2-D bitBLT engine Graphic scaler with arbitrary scaling factors Command list controller Display unit support for background, image, video, graphics, cursor, and anti-flicker filter	
<b>Peripheral Interface Subsystem</b>	General-purpose timers IDE ATA-5 interface 1394 interface port 2 I <sup>2</sup> C interfaces Serial control port Synchronous serial interface	Pulse width modulation USB 1.1 host controller 2 smart cards Three UART serial ports GPIO controllers
<b>Physical Specifications</b>	0.15-micron CMOS technology 3.3 V/2.5 V/1.8 V operating voltage 2.0 W (max.) power dissipation 0°C - 70°C ambient temperature range 35-mm 420-ball EPBGA package	

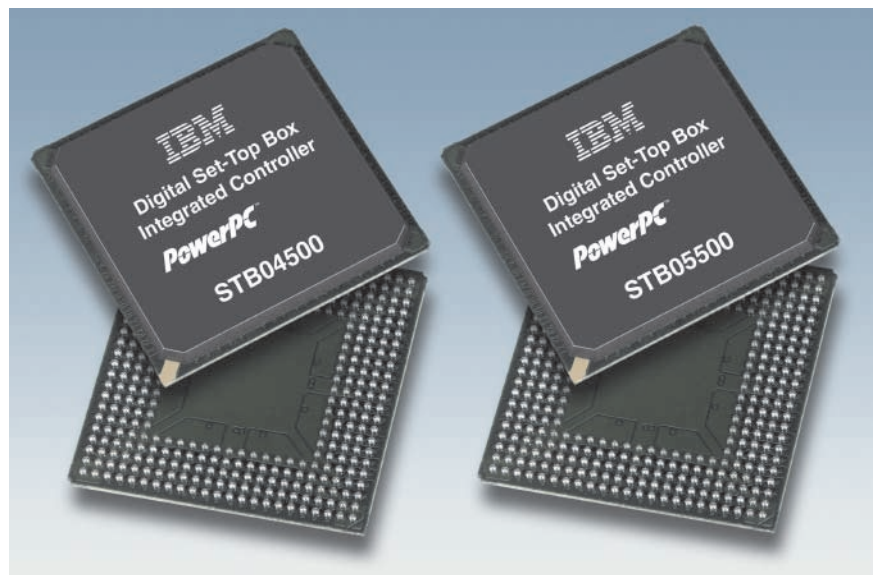


Figure 2: STB04xxx and STBx5xxx controllers integrate advanced features to satisfy emerging high-end applications.

## Choose from a wide range of peripheral and memory interfaces

The *peripheral interface subsystem* provides a variety of interfaces, including:

- General-purpose timers, pulse width modulation (GPT, PWM)
- IDE interface (ATA-5)
- Universal Serial Bus (USB) 1.1 host controller
- Seamless 1394 interface to TSB42AA4
- Two smart card interfaces (SCIs)
- Two inter-integrated circuit (I<sup>2</sup>C) interfaces
- Three UART serial communications ports
- Serial control port
- General-purpose input/output (GPIO) controllers
- Synchronous serial interface/digital audio input

The *memory subsystem* incorporates two DMA controllers, providing a total of 8 channels supporting up to 256 MB of SDRAM; two SDRAM controllers; an external bus interface unit (EBIU) supporting up to 256 MB of RAM, ROM, or Flash memory; an intelligent crossbar switch (ICBS); and an external processor interface (EPI) to a PowerPC processor. The ICBS is designed to support the audio, video, and processor subsystems simultaneously while the EPI and EBIU enable high-end applications, such as those requiring multiple CPUs. The subsystem's two DMA controllers increase application performance by allowing more concurrent data transfer between memory and peripherals.

## Highly productive development tools help reduce time-to-market

Evaluation kits, including device drivers, a circuit board, and Microsoft Windows® 98-hosted development tools, such as a C/C++ compiler and RISCWatch™ debugger for non-invasive RTOS-aware debug, are available to help manufacturers improve their time-to-market. In addition, the PowerPC 405 processor's widely adopted architecture is supported by the IBM PowerPC Embedded Tools Program, giving designers access to third-party tools to meet a range of development needs.



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Printed in the United States of America 05-02

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