

Mobile786EBX Low Power Pentium-class EBX Computer



General Description

AMPs **Mobile786EBX** is a highly integrated, cost-effective and ACPI compliant low power Pentium-class computer conforming to the EBX standard. The Mobile786EBX series are 100% compatible with MSDOS, Windows 3.x, Windows95/98/NT/CE, Linux and a wide range of RTOS such as PharLap, QNX, pSOS, etc. The **Mobile786EBX** features Fast Ethernet plus an advanced 3D AGP Graphics Display Accelerator able to drive a wide range of Flat Panels and CRT and direct Composite Video output for TV. The Graphics Accelerator supports display of two independent images on CRT, Flat Panel or TV and option for live PAL/NTSC video overlay on Flat Panel or CRT. For diskless operation, the Mobile786EBX provides support for up to 144Mbytes of Disk-on-chip Flash Disk. The **Mobile786EBX** provides extensive power management support in compliance with the ACPI specifications.

Features

- 100% PC-AT compatible
- Pentium-class processors to 450MHz
- 100MHz bus speed
- 32 - 128 MBytes SDRAM
- 4 - 144 MBytes Disk-on-Chip Flash Disk
- 10/100MBit Ethernet
- 3D AGP Graphics to Monitor, LCD, TV
- Floppy, EIDE and dual USB ports
- AC97 Sound
- Low Power ACPI compliant
- PC/104+ and PC/104 Expansion
- Available in Extended Temperature

Applications

- Medical Instrumentation
- Display System for Avionics
- Mobile Entertainment Systems
- Point-of-sale and Kiosk Applications
- Portable Test Equipment
- Rugged Harsh Environment Applications
- Industrial Automation
- Thin Server/Client Applications
- Embedded Internet/Intranet Appliance

Rev A.02 Pre-production Release

Mobile786EBX Low Power Pentium-class EBX Computer

Processors Pentium and MMX-class CPUs at up to 450MHz
Host Bus speeds up to 100MHz
3.3V and Low Power 2.5V Host Bus Operation

Memory SDRAM 32 - 128MBytes SDRAM
FlashDisk 4 - 144MBytes Disk-On-Chip
L2 Cache 512KBytes

Standard Peripherals

Display AGP 3D Graphics Accelerator with 8MBytes DRAM
Two Independent Images on CRT, Flat Panel or TV
Flat Panel Output 800x600 to 1024x768 by 24-bits
VGA CRT Output 640x480 to 1280x1024
MPEG/DVD Playback
PAL or NTSC Output to TV (option)

Serial Ports 4 RS232/422/485 ports with FIFO at 230KBaud
1 dedicated IR port

Parallel Port IEEE-1284 compliant with EPP, ECP modes

Disk/CD-ROM Supports 2 Floppy drives
Supports Ultra-DMA-33 Hard Disk and CDROM drive
Supports up to 144MBytes Disk-on-Chip

KeyB/Mouse Supports PC Keyboard and PS2 Mouse

Extended Peripherals

Network 10/100MBit PCI Ethernet Controller

Sound SoundBlaster Pro and AC97 Sound Port (option)
Live Video PAL/NTSC Analogue Video Input (option)
PAL/NTSC Output to TV (option)
Live video on LCD (option)
MPEG Decoder Plug-in (option)

USB 2 on-board USB ports
PCI bus-mastering USB Hub Controller
Fully compliant with OpenHCI standard

Enhanced Power Management

ACPI compliant
Dynamic Clock Stop
Power On Suspend

Expansion

PC/104 Standard 16-bit stackable PC/104 bus
PC/104 Plus 32-bit stackable embedded PCI bus
132MBytes/sec data bandwidth

Physical

Size 8.00 x 5.75 x 1.2in (203 x 146 x 30mm)
Temperature 0 to 60degC operating (-40 to 85degC option)
-40 to 95degC storage

Rel. Humidity 5% to 95% non-condensing (optional conformal coating)

Power Less than 7W with 166MHz CPU+16MBytes DRAM

Optional Retention Straps for DIMMs



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This section provides additional details on the Multimedia enhancements of the Mobile786EBX Computer.

Mobile786EBX Graphics and Video capabilities

· General Graphic Capabilities

- 64-bit Single Cycle 2D/3D Graphics Engine
- Supports 2 to 8 Mbytes of Frame Buffer located in System Memory
- Real Time DVD MPEG-2 and AC-3 Playback
- Video Processor
- Extended Screen Resolutions up to 1600x1200
- Extended Text Modes 80 or 132 columns by 25/30/43/60 rows
- DirectX 6 and OpenGL ICD API
- 1/16 sub-pixel positioning

Rendering Engine

- High performance single pass execution
- Diffused and specula lighting
- Gouraud and flat shading
- Anti-aliasing including edge, scene, and super-sampling
- OpenGL compliant blending for fog and depth-cueing
- 16-bit Z-buffer
- 8/16/32 bit per pixel colour formats

Texturing Engine- Multiple buffering and page flipping

Setup Engine

- 32-bit IEEE floating point input data
- High Performance rCADE3D™ Accelerator
- 32 entry command queue, 32 entry data queue
- 4Kbyte texture cache with over 90% hit rates
- Pipelined Setup/Texturing/Rendering Engines
- DirectDraw™ acceleration
- Slope and vertex calculations
- Back facing triangle culling

- D3D compressed texture formats DXT1 and DXT2
- Anisotropic texture filtering
- 1/2/4/8-bits per pixel compact palletized textures
- 16/32-bits per pixel quality non-palletized textures
- Pallet formats in ARGB 565, 1555, or 444
- Tri-linear, bi-linear, and point-sampled filtering
- Mip-mapping with multiple (Level-of-Detail) LOD calculation and perspective correction
- Colour keying for translucency





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2D GUI Engine

- 8/15/16/24/32-bits per pixel colour formats
- 256 Raster Operations (ROPs)
- Accelerated drawing: BitBLTs, lines, polygons, fills, patterns, clipping, bit masking
- Panning, scrolling, clipping, colour expansion, sprites
- 32x32 and 64x64 Hardware Cursor
- DOS graphics and text modes

· DVD

- Hardware-Assisted MPEG-2 Architecture for DVD with AC-3
- Simultaneous motion compensation and front-end processing (decryption and decode)
- Supports full DVD 1.0, VCD 2.0 and CD-Karaoke
- Microsoft DirectShow 2.x native support, backward compatible to MCI
- No additional frame buffer requirements
- Dynamic frame and field de-interlace filtering for high quality playback on VGA monitors
- Tamper-proof software CSS implementation
- Freeze, Fast-Forward, Slow Motion, Reverse
- Pan-and-Scan support for 16:9 sequence

· Video Processor

- On-chip Colour Space Converter (CSC)
- Anti-tearing via two frame buffer based capture surfaces
- Minifier for video stream compression and filtering
- Horizontal/vertical interpolation with edge recovery
- Dual frame buffer apertures for independent memory access for graphics and video
- Live Video input from PAL/NTSC source
- Capture / ZV Port for MPEG playback
- Vertical Blank Interval for Intercast™
- Overlay differing video and graphic colour depths
- Display two simultaneous video streams from both AGP and Video/MPEG Capture port
- Two scalers and Colour Space Converters (CSC) for independent windows

· Digital Flat Panel (DFP) Interface

- 85MHz DFP interface supports wide range of Flat Panels
- Both STN and TFT technologies at up to 1024x768 panels
- Allows external TMDS transmitter for advanced panel interfaces





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Mobile786EBX Graphics Controller Overview

The Mobile786EBX on-board Graphics Controller is a highly integrated display control device that incorporates a 64-bit 3D/2D graphic engine and video accelerator with advanced DVD video and optional TV output capability. It provides a flexible and high performance solution for graphics and video playback acceleration for various colour depth and resolution modes.

The Mobile786EBX Graphics Controller supports a video capture port to import captured live MPEG 1 or MPEG 2 video streams, or DVD decompressed video streams. An optional facility for live video capture from an analogue PAL/NTSC source is provided. Live video from the capture port can be re-sized, cropped and re-positioned and then overlaid with a graphics stream from the Graphics accelerator for display on CRT and Flat Panel and optionally output as PAL/NTSC to drive a TV Monitor.

The Mobile786EBX supports dual live video streams providing independent dual video windows ready for videoconferencing and telephony.

This unprecedented level of video integration and high performance graphics capability make the Mobile786EBX computer a very cost-effective solution for embedded multimedia and mobile entertainment applications.

Capability Overview

The Mobile786EBX on-board Graphics Controller is a fully integrated CRT and TV 64-bit 2D/3D Accelerator. The high performance graphics engine offers high speed 3D image processing in full compliance and compatibility with IBM® VGA and VESA™ extended VGA.

As an integrated controller, it allows unprecedented cost and performance advantages by eliminating the need for an external frame buffer while at the same time gaining local access to a larger amount of memory.

The Mobile786EBX Graphics Controller supports all key 3D rendering operations, including: Gouraud shading for smooth object surfaces, texture mapping for realistic object textures, 16-bit hardware Z-buffering for fast 3D depth calculations, and Alpha Blending for transparency effects.

The Mobile786EBX features a tightly-coupled full AGP implementation internally maintaining compatibility with existing software and programming models and at the same providing unprecedented 2D/3D graphics bandwidth and performance.

To meet the requirements of a PC98 graphics adapter in a multimedia PC, the Mobile786EBX Graphics Controller supports planar video format for MPEG-1, MPEG-2, and DVD-video playback. The dual video playback facility is capable of overlaying windows for videoconferencing and multimedia displays on CRT, TV and Flat Panel Display.

The Mobile786EBX provides advanced features such as colour space conversion, video scaling, dual video windows, dual-view display, analogue PAL/NTSC video capture and display, Vertical Blanking Interleave (VBI), a 24-bit True Colour DAC, and dual clock





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synthesizers to achieve peak performance levels.

By using an extended 16-bit capture / ZV port the Mobile786EBX Graphics Controller also supports DTV resolution.

The Mobile786EBX on-board Graphics Controller is capable of supporting three simultaneous displays:

CRT (analogue monitor), Flat Panel (digital monitor), and Video (standard television display), each with a different “window” or desktop.

Graphics Display System Capabilities

The Mobile786EBX Graphics Controller’s main system features include:

- High Performance single cycle GUI
- Highly Integrated RAMDAC™ and Triple Clock Synthesizer
- Full Feature High Performance 3D Graphics Engine
- High speed internal AGP Bus Mastering data bus supporting DVD video playback & 3D
- Hardware implementation of motion compensation
- Dual Video Windows for Videoconferencing
- TrueVideo Processor
- DirectDraw and DirectVideo Hardware Support
- Versatile Motion Video Capture/Overlay/Playback Support
- Flexible Frame Buffer Memory Interface
- Advanced Power Management Features
- PC98 Hardware Support

High Performance 64-bit 2D GUI

The 64-bit graphics engine of the Mobile786EBX Graphics Controller significantly improves graphics performance through specialized hardware that accelerates the most frequently used GUI operations and matches the high-speed requirements of CPUs.

Functions directly supported in hardware include: BitBLTs, image and text transfer, line draw, short stroke vector draw, rectangle fills, and clipping. The graphics engine supports 256 Raster Operations (ROPs) for up to 32-bit packed pixel graphic modes. The ROP3 Processor in the Mobile786EBX Graphics Controller is able to perform Boolean functions which allow many additional operations, including transparency, pattern masking, colour expansion alignment, and pattern enhancement.

Additionally, the graphics engine features linear display memory addressing (up to 4GB memory space), accelerated colour expansion modes for graphics text procession, and memory-mapped I/O registers on the graphics engine for faster access time.

Graphic functions are optimized by a 64-bit internal data bus and a four-colour hardware cursor/pop-up icon, operating up to a 128x128x2 pixel image, which offloads the CPU.

The hardware cursor mechanism can also be used to display patterns stored in the system memory. This pop-up icon is very useful to display user friendly information instantly through simple hot key operations. This advanced function combination allows significant performance increases over standard Super VGA designs and provides outstanding graphics acceleration on GUIs, such as Microsoft Windows 95 .





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Full Feature High Performance 3D Engine

The Mobile786EBX Graphics Controller is equipped with an advanced Graphics Drawing, Single Cycle 3D Graphics Engine that performs premium 3D functions at a high level of more than 1M triangles per second. The 3D engine supports Microsoft Direct3D.

The 3D Engine is set up to off-load the CPU from major 3D tasks including slope calculation, sub-pixel positioning, and Tri-striping. By balancing the 3D pipeline and reducing parameter passing, the Mobile786EBX Graphics Controller provides very high levels of performance. The 3D engine is integrated with a triangle set-up engine that sets up triangles according to vertex input data and accomplishes various functions for 3D rendering.

Gouraud shading provides smooth shading for colours across surfaces, perspective correction and texture mapping to correct texture data based on the perspective, bi-linear texture filtering for interpolating, alpha blending .

Other features include Z-buffering (16-bit/24-bit), video texturing to overlay 2D video play-back onto 3D images, fogging to simulate weather effects, palletized texture mapping (1-, 4-, or 8-bit) for memory and bandwidth reduction, and anti-aliasing to reduce or eliminate jaggies that may have resulted from alias rendering.

The 3D engine also works with the APM system, conserving power while 3D operations are suspended.

Video Processor

Video processor features include: on-chip hardware Colour Space Conversion (CSC) for faster data conversion on the fly, Horizontal/Vertical (H/V) scaling with interpolation, edge recovery algorithm logic, gamma correction, and overlay control with different colour depths from graphics.

The Mobile786EBX Graphics Controller also includes a fully integrated GUI accelerator, read cache, and command FIFO that optimize memory bandwidth and maximize graphics performance.

The Mobile786EBX Graphics Controller, with an integrated Video Display and a Capture Engine, supports dual apertures on the PCI bus which enables independent graphic and video data to be transported simultaneously to and from different memory areas, a feature which greatly accelerates the performance of both DirectDraw™ and DirectVideo™

The Mobile786EBX Graphics Controller provides dual video windows that display different images from different video sources (from the PCI bus and from the Live Video/MPEG capture port) on the same screen.

The video image is stored in off-screen memory and is retrieved by the Video Display Processing block for video processing. With the help of DirectDraw™ acceleration for sprites, page flipping, double buffering, and colour keying, video processing is performed by utilizing a proprietary edge recovery algorithm for sharper line visibility, de-interlacing, anti-tearing,

multitap horizontal filtering, dithering, and scaling operations with bilinear interpolation in both horizontal and vertical directions.

Linear scaling permits zoom in/out to any size without any restrictions. In addition, the on-chip hardware Colour Space Conversion (CSC) accelerates conversion for 16 bit YUV pixels into linear true colour 24 bit RGB pixels on the fly. Additional X and Y minifiers are capable





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of shrinking video images to any linear fractions, which saves bus bandwidth and memory space.

The YUV planar logic of the Mobile786EBX Graphics Controller supports a YUV 420 format that can eliminate redundant video stream decoding operations. This can significantly reduce computing power required from the CPU when performing software MPEG or software video conferencing.

The colour and luminance control provided by the Mobile786EBX Graphics Controller offers colour compensations to prevent colour distortion for display devices such as a CRT or TV with Gamma correction and hue adjustment control.

The Video Conferencing feature allows remote and local video images to be displayed simultaneously on the same screen.

Video Capture and DVD

The Mobile786EBX computer has an optional live video decoder and capture port and advanced hardware interface logic allowing the system to accept analogue PAL/NTSC video from camera or other sources.

Provision has been made also for attachment of an optional plug-in MPEG decoder module on the mobile786EBX computer.

The Mobile786EBX computer features an integrated with a DVD video hardware block for motion compensation, which greatly enhances the ability to play DVD video in MPEG-2 format at high bandwidths with exceptionally good video quality.

A new industry standard is being set for transmission of non-video data over a TV broadcast signal during vertical blanking interval (VBI). This technology is referred to as Intericast. The Mobile786EBX Graphics Controller has the ability to take the entire video stream over the video port, sending the visible video stream to the display memory for display in a window, stripping the VBI data from the stream, and then sending this data to the CPU for processing using PCI Bus Mastering.

Versatile Frame Buffer Interface

The Mobile786EBX Graphics Controller features a versatile frame buffer interface aperture into main system memory.

Optimum performance is achieved with the single cycle memory bus interface using programmable SDRAM timing.

The internal display queue of the controller has been designed to reduce the frequency of memory bus requests, thereby optimizing memory bus efficiency for the graphic controller.

In the execute mode, the Mobile786EBX Graphics Controller is able to use both the dedicated graphics portion and the general portion of system memory for graphics operations. As a result, DVD and 3D rendering performance and quality are greatly enhanced.





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Hi-Resolution and Hi-Refresh Display Support

Mobile786EBX Graphics Controller display enhancements dramatically improve CRT resolution. These enhancements include support of non-interlaced 1280x1024x64K, 1024x768x16M, 800x600x16M, and 640x480x16M colours for “full spectrum” colour. Extended text modes of 80 or 132 columns by 25, 30, 43, or 60 rows provide an extended graphics area frequently used in many spreadsheet and database applications. Extended graphics and text modes are supported by software drivers that provide a “ready-to-go” solution, minimizing the need for additional driver development.

A virtual screen can be created with the Mobile786EBX Graphics Controller. When this function is enabled, a selected portion of a large image can be shown on a smaller display. The image can also be moved or scrolled and panned across the whole screen, either up or down.

Digital Flat Panel (DFP) Interface

The Mobile786EBX DFP interface is designed to support industry standard TFT and DSTN panels directly or through an optional external plug-in TMDS transmitter module. Digital Flat Panels from all the major manufacturers are supported at display resolutions up to 1280x1024 pixels. Additionally the Live Video input facility allows live video to be displayed with graphics on Flat Panels.

Live Video and MPEG Input Port

The Mobile786EBX optionally supports live video capture from an attached PAL/NTSC source and there is provision to plug in external video devices such as MPEG1 and MPEG2 decoders. Additionally, a zero-wait state host write buffer, read cache, and memory mapped I/O associated with Live video port increase operating speeds and further increase performance levels.

Composite PAL or NTSC Analogue TV Output

The Mobile786EBX optionally provides, in addition to VGA and FPD Outputs, a composite PAL or NTSC-encoded output for directly driving a TV monitor or multimedia LCDs and Flat Panels.

Complete Hardware Compatibility

The Mobile786EBX Graphics Controller is 100% VGA compatible at both the BIOS and Driver level, allowing full compatibility with virtually any VGA application software. The Mobile786EBX Graphics Controller provides hardware support to DirectDraw™, offering high-speed game and multimedia graphics on Windows 95.





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Audio capabilities of the Mobile786EBX

Advanced Audio System

- *SoundBlaster Pro Hardware and Direct Sound Ready AC97 Digital Audio Controller*
- Dual full-duplex Direct Sound channels between system memory and AC97 link
- PCI master interface with scatter / gather and bursting capability
- 32 byte FIFO of each direct sound channel
- Host based sample rate converter and mixer
- CDROM Analogue Input
- Standard v2.0 AC97 Codec plus 250mW Boomer audio amplifier
- Loopback capability for re-directing mixed audio streams into USB speakers
- Hardware SoundBlaster Pro for Windows DOS box and DOS legacy compatibility
- Plug and play with 4 IRQ, 4 DMA, and 4 I/O space options for SoundBlaster Pro
- Hardware assisted FM synthesis for legacy DOS compatibility
- Complete software driver support for Windows-95, Windows-98 and Windows-NT

The Mobile786EBX computer features an Advanced Audio System that provides full compatibility with Microsoft Windows Sound System standard and will run software written for SoundBlaster Pro and AC97 interfaces.

The Mobile786EBX Audio System provides hardware-assisted FM synthesis and CDROM attachment to support legacy applications. Standard features such as Microphone and Line Inputs are supported.

An on-board Boomer audio amplifier provides direct drive to external Loud Speakers.

High Performance Peripheral support on the Mobile786EBX

A wealth of high performance I/O ports for peripheral support

- *UltraDMA-33 Master Mode PCI EIDE Controller*
- Dual channel master mode PCI supporting four Enhanced IDE devices
- Transfer rate up to 33MB/sec for PIO mode 4, and UltraDMA-33 interface
- Thirty-two levels (doublewords) of prefetch and write buffers
- Dual DMA engine for concurrent dual channel operation
- Bus master programming interface for SFF-8038i rev.1.0 and Windows-95 compliant
- Full scatter gather capability
- Support ATAPI compliant devices including DVD devices
- Support PCI native and ATA compatibility modes
- Complete software driver support

The Mobile786EBX features a Master mode enhanced IDE controller port which can operate at the 33MB/sec UltraDMA Mode and provide very high performance data transport/storage solution for Multimedia applications. ATAPI and IDE devices such as disk drives,





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CDROMs, DVD drives can be attached to the IDE port.

· *Serial, Parallel, Floppy Disk Ports*

- Supports 2 serial ports, IR port

The Mobile786EBX supports 4 standard serial ports (Com1 - Com4) plus a dedicated Infra-Red communications port.

The serial ports can each be configured with RS232, RS422 or RS485 electrical interface and operate at up to 115.2KBits/sec.

Com1 and Com2 provide enhancement to support operations at higher baud rates of 230 and 460KBits/sec.

A fifth serial port is dedicated to IR function with support for Infrared-IrDA (HPSIR) and ASK (Amplitude Shift Keyed) IR protocols.

- Multi-mode Parallel port

The parallel port supports Standard, ECP and EPP modes.

- Floppy disk controller functions

The high performance Floppy Disk Controller with internal 16 bytes of FIFO supports data rates up to 1Mbps and Perpendicular recording.

· *Voltage, Temperature, Fan Speed Monitor and Controller*

- Five positive voltage , two temperature (one internal) and one fan-speed monitoring
- Automatic clock throttling with integrated temperature sensing
- Flexible external voltage sensing arrangement

The Mobile786EBX provides extensive system 'health' monitoring facilities for enhanced system reliability and robustness in embedded applications.

· *Universal Serial Bus Controller*

- USB v.1.1 and Intel Universal HCI v.1.1 compatible
- Eighteen level (doublewords) data FIFO with full scatter and gather capability
- Root hub and 2 function ports
- Integrated physical layer transceivers with over-current detection status on USB inputs

Two fully compliant US ports are provided as standard on the Mobile786EBX.





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· *Sophisticated PC98-Compatible Mobile Power Management*

- Supports both ACPI and legacy (APM) power management
- ACPI v1.0 Compliant
- APM v1.2 Compliant
- CPU clock throttling and clock stop control for complete ACPI C0 to C3 state support
- Power Management Enable (PME) control, and PCI/CPU clock generator stop control
- Power-on suspends with flexible CPU/PCI bus reset options
- Suspend to DRAM, and suspend to disk (soft-off), all with hardware automatic wake-up
- Normal, doze, sleep, suspend and conserve modes
- Support for System Wake-up by Ethernet or Modem

The Mobile786EBX provides extensive support for ACPI and APM especially for battery powered applications. This intelligent management of power resource ensures the system power is utilised most efficiently.

Mobile786EBX Fast Ethernet

The Mobile786EBX features a Fast Ethernet Controller that provides 32-bit performance, PCI bus master capability. The Fast Ethernet interface is fully compliant with IEEE 802.3u 100Base-T specifications and IEEE 802.3x Full Duplex Flow Control.

The Fast Ethernet interface on the Mobile786EBX supports both legacy 10MBit/sec network and the emerging 100Mbits/sec when operating in half-duplex mode. Data speed of 200MBit/sec is supported in full-duplex mode of operation.



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