Intel® System Controller Hub (SCH) US15W

Features & Benefits

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SPOERLE

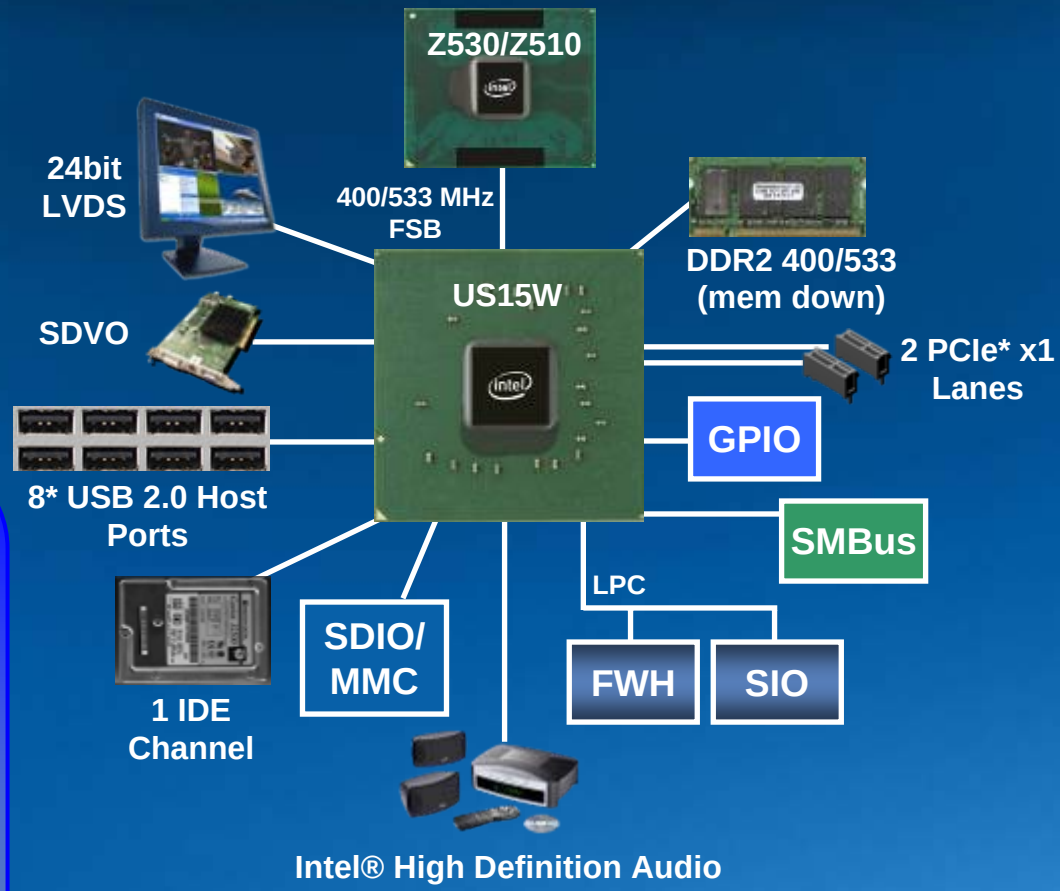
Intel® Atom™ Processor and US15W Block Diagram

Intel® Atom™ Processor Z5XX Series

- Low Power Microarchitecture on 45nm technology
- Ultra small 13x14mm package (HDI)
- Performance and Power Optimized for small form-factor, ultra-low power embedded platforms (TDP 2W)
- Advanced Features: Hyper-Threading technology, C6 low power state

Intel System Controller Hub US15W

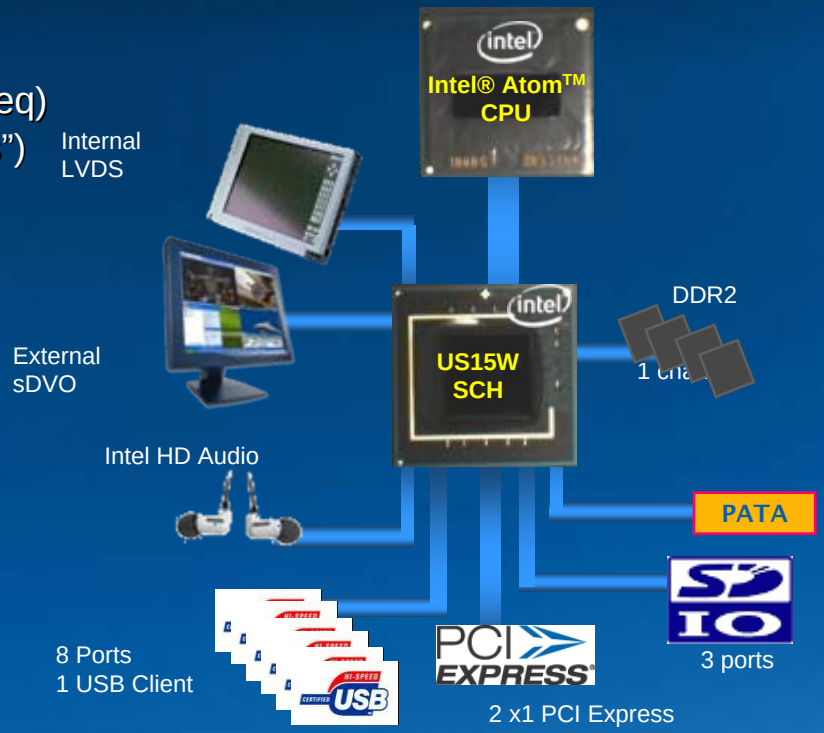
- Integrated GMCH+ICH (single chip)
- 22x22mm package (HDI)
- Ultra low power integrated graphics with 2D and 3D HW accelerator
- Integrated High Definition Video Decoder
- Expansion capability with most widely adopted USB2.0 and PCI-Express* standards



Highly Integrated 2-Chip Solution for Low Power, Small FF, Embedded Platforms

SCH US15W Overview

- Processor Host Interface:
  - 400/533 MT/s CMOS, 32-bit address
- Memory:
  - Single-Channel DDR2 400/533 MT/s (locked to FSB freq)
  - 1 or 2 ranks memory down (64-bit bus, 2 “rank selects”)
  - Up to 1 GB total memory
  - No on-die-termination
- Intel® Graphics Media Accelerator 500
  - Full HD HW Video Decode Engine
  - Ultra Low Power Integrated 3D Graphics Core
  - 200MHz at 1.05V
- Display (Single, Clone and Dual Independent)
  - 24bpp Single Channel LVDS
  - SDVO
- Intel® High Definition Audio
- I/O Connectivity
  - USB: 8 host ports (2.0), 1 client port option
  - PCI Express: 2 x1 ports (Ext Gfx Supported on Premium SKU ONLY)
  - SDIO: 3 ports (2 x8, 1 x4) ports (48 MHz)
  - PATA (IDE): Master/Slave, up to UDMA-100
- Legacy I/O
  - LPC FWH, EC, etc
  - SMBus I²C bus for system management
  - GMBus/DDC I²C for display control



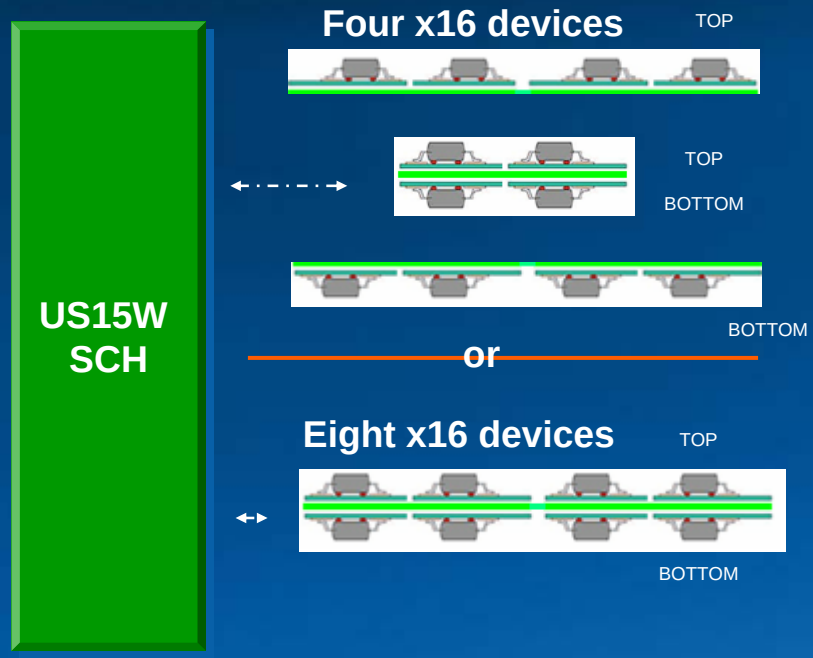
Intel® Atom™ Processor and System Controller Hub SKUs for Embedded

CPU	• Z530 • 1.6 GHz • 13x14mm HDI • HT, No VT • 533MHz FSB • TDP: 2.2W	• Z510 • 1.1 GHz • 13x14mm HDI • No HT, No VT • 400MHz FSB • TDP: 2.0W
SCH	• US15W • 533MHz DDR2 • 22x22 HDI • TDP: 2.3W	• US15W • 400MHz DDR2 • 22x22 HDI • TDP: 2.3W

SCH US15W Memory

DDR2** Memory Configurations

- Summary
  - Up to 1 GB of physical memory supported in a single channel (64 bits wide), 1 or 2 ranks
  - 400/533 MT/s, single-ended address and data busses, 1-N Address transfers
  - x16 devices supported
  - 512 Mb, 1Gb technologies
- Supported Configurations
  - Four x16 devices (1 rank), memory down on PCB
  - Eight x16 devices (2 ranks), memory down on PCB
  - Aggressive Power Management to minimize Idle consumption
- Termination
  - On-die termination removed from US15W to save power. Board-level termination required only on certain topologies
    - See *Menlow Design Guide* for more details



Mainstream Memory Target:
Eight x16 devices down = 1GB

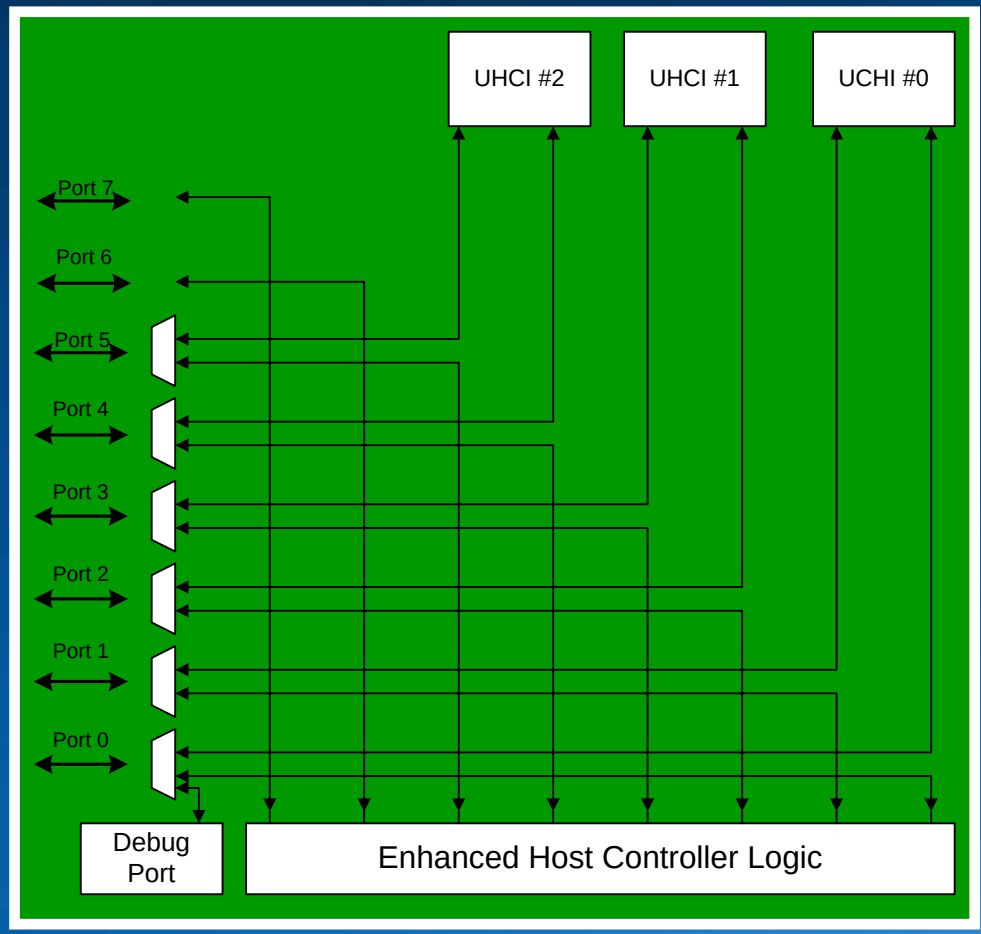
** DDR2 support limited to non-ECC and unbuffered.

SCH US15W I/O

USB

- **USB 1.1**
  - **Three (3) UHCI controllers, two USB 1.1 ports per controller (ports 0-5)**
- **USB 2.0**
  - **One (1) EHCI controller with 8 ports**
  - **Ports 6 and 7 must be internal only to meet USB spec requirements**
  - **Debug port lives on Port 0**
  - **Make port 0 externally available to assist the debug process**

Port 2 can be made into a USB client port



SMBus & LPC

LPC_LAD[3:0]
LPC_FRAME#
LPC_SERIRQ
LPC_CLKOUT[2:0]
LPC_CLKRUN#

- SMBus Host Controller
  - Compatible with most I^2C devices.
  - Provides a mechanism for the processor to initiate communications with SMBus peripherals (slaves).
  - See System Management Bus (SMBus) Specification, Version 1.0.
- LPC Interface
  - US15W implements an LPC interface as described in the LPC 1.1 Specification. FWH, Embedded Controller, other legacy devices.
  - The LPC interface has three PCI-based clock outputs that may be provided to different I/O devices, such as flash memory or an SIO chip.

Boot Devices

- BIOS device must be FWH, not SPI/LPC Flash
  - US15W issues FWH-specific commands to LPC interface that non FWH flash devices don't understand
- Alternatives being explored due to FWH availability concerns
  - EC-based SPI interface (requires new translation firmware)
  - LPC to SPI Bridging CPLD Solution (Ap. Note Available)
  - Long-life FWH support extension
    - Not automotive grade
    - SST and Chingas Technology Corporation have indicated that they will continue to support FWH devices to 2012 as long as business conditions warrant.
      - This is not a guarantee

Work with your FWH vendor directly to ensure long-life support

High Definition Audio

HDA_RST#
HDA_SYNC
HDA_CLK
HDA_SDO
HDA_SDI[1:0]
HDA_DOCKEN#
HDA_DOCKRST#

- Intel® High Definition Audio Controller
  - Supports up to four audio streams, two ports in (two streams) and one port out (two streams).
  - 1.5V and 3.0 V I/O is supported
  - Docking is supported
  - Each stream can contain up to 16 channels.
  - Support of multi-channel audio stream, 32-bit sample depth, and sample rate up to 192 kHz.
  - Uses a set of DMA engines to effectively manage the link bandwidth and support simultaneous independent streams on the link.
  - Supports isochronous data transfers allowing glitch free audio to the system.

General Purpose IO (GPIO)

- 10 Core-well GPIOs
  - 3 are muxed
    - GPIO9/EXTTS1# — External Thermal Sensor 1
    - GPIO8/PROCHOT# — Processor Hot
    - GPIO7/SLPIOVR# — Sleep IO Voltage Regulator
- 4 Sus-well GPIOs (can be used to wake from S3)
  - 1 is muxed
    - GPIOSUS3/USBCC — USB Client Connect

SCH US15W Storage

SCH US15W Storage

- SCH US15W will support:
- Fixed Type Media (OS bootable):
  - PATA/IDE HDD
  - Solid State Disk w. PATA interface Z-P140
  - CE-ATA HDD – for secondary HDD
- Removable Media:
  - ATAPI Optical drive (CD/DVD)
  - USB flash drive Z-U130
  - SDIO/MMC card
- PATA support only – no SATA

Parallel Advanced Technology Attachment (PATA)

PATA_DCS1#
PATA_DCS3#
PATA_DA[2:0]
PATA_DD[15:0]
PATA_DDREQ
PATA_DDACK#
PATA_DIOR#
PATA_DIOW#
PATA_IORDY PATA_IDEIRQ

- SCH 15W supports a single PATA channel
  - Two devices (master/slave) support
  - The following modes are supported...

PATA Standard	Transfer Modes Supported	Transfer Rate (MB/s)
ATA-1 (ATA, IDE)	PIO Modes 0, 1, 2	3.3, 5.2, 8.3
	Single-word DMA Modes 0, 1, 2	2.1, 4.2, 8.3
	Multi-word DMA Mode 0	4.2
ATA-2, ATA-3 (EIDE, Fast ATA)	PIO Modes 3,4	11.1, 16.6
	Multi-word DMA Modes 1,2	13.3, 16.6
ATA/ATAPI-4 (Ultra DMA, Ultra ATA)	Ultra DMA Modes 0, 1, 2 (a.k.a. Ultra DMA/33)	16.7, 25.0, 33.3
ATA/ATAPI-5 (Ultra-DMA, Ultra ATA)	Ultra DMA Modes 3, 4 (a.k.a. Ultra DMA/66)	44.4, 66.7
ATA/ATAPI-6 (Ultra-DMA, Ultra ATA)	Ultra-DMA Mode 5 (a.k.a. Ultra DMA/100)	100 (reads) 89 (writes)

SCH US15W PCI Express*

PCIE_PETp[2:1],
PCIE_PETn[2:1]

PCIE_PERp[2:1],
PCIE_PERn[2:1]

PCIE_CLKINP,
PCIE_CLKINN

PCIE_ICOMPO,
PCIE_ICOMPI

- PCI Express
  - SCH has two PCI Express root ports supporting PCI Express Base Specification, Revision 1.0a.
    - Each root port supports 2.5 Gb/s bandwidth in each direction.
    - Low power “L-states” are supported
    - Hot-plug is supported
  - Root ports 1–2 can be statically configured as two x1 ports (cannot be ganged together)
  - External x1 graphics devices are supported
    - Internal graphics device must be disabled via PCI configuration space
    - If Ext graphics are used, then SDVO and/or LVDS pipes are disabled

Integrated Graphics Core

Display Interfaces

- The Intel® Graphics Media Accelerator 500 includes LVDS and Serial DVO display ports permitting simultaneous independent operation of two displays.
- LVDS
  - The SCH supports a Low-Voltage Differential Signaling interface that allows the Intel® GMA 500 to communicate directly to an on-board flat-panel display.
  - The LVDS interface supports pixel color depths of 18 or 24 bits.
  - Max pixel clock of 112 MHz
    - Equates to 1376x768 @ 85 Hz
- Intel Serial DVO (SDVO) Display
  - The SCH has a digital display channel capable of driving SDVO adapters that provide interfaces to a variety of external display technologies (e.g., DVI, TV-Out, analog CRT).
  - Up to 160 MHz pixel clock supported
    - Equates to 1280x1024 @ 85 Hz

LVDS

LA_DATAP[3:0],
LA_DATAN[3:0]

LA_CLKP, LA_CLKN

- Single LVDS channel (channel A)
- Differential interface used for local flat panels
- Supports 18-bit or 24-bit color is supported
- EDID and EDIDless** support
- Max pixel clock of 112 MHz
- Min pixel clock of 40 MHz

** Panel timing must be supported by vBIOS
Use BMP tool to modify timings if not already supported by DEFAULT

SDVO

SDVOB_GREEN+, SDVOB_GREEN-

SDVOB_BLUE+, SDVOB_BLUE-

SDVOB_RED+, SDVOB_RED-

SDVOB_CLK+, SDVOB_CLK-

SDVOB_TVCLKIN+, SDVOB_TVCLKIN-

SDVO_INT+, SDVO_INT-

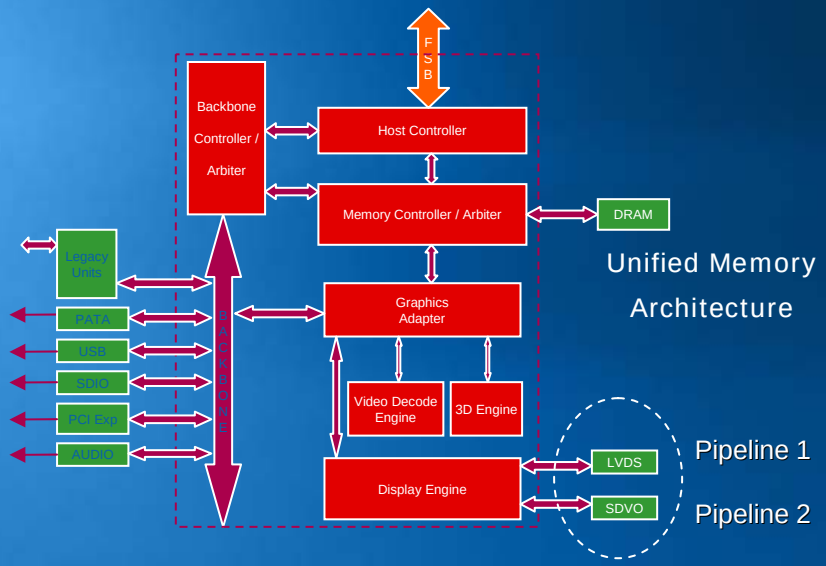
SDVO_STALL+, SDVO_STALL-

SDVO_CTRLCLK, SDVO_CTRLDATA

- Single SDVO channel (channel B)
- EDID and EDIDless** support
- Use for any external display device
  - HDMI/DVI, Analog TV, VGA/CRT, LVDS
- Up to 160 MHz pixel clock supported

** Panel timing must be supported by vBIOS
Use BMP tool to modify timings if not already supported by DEFAULT

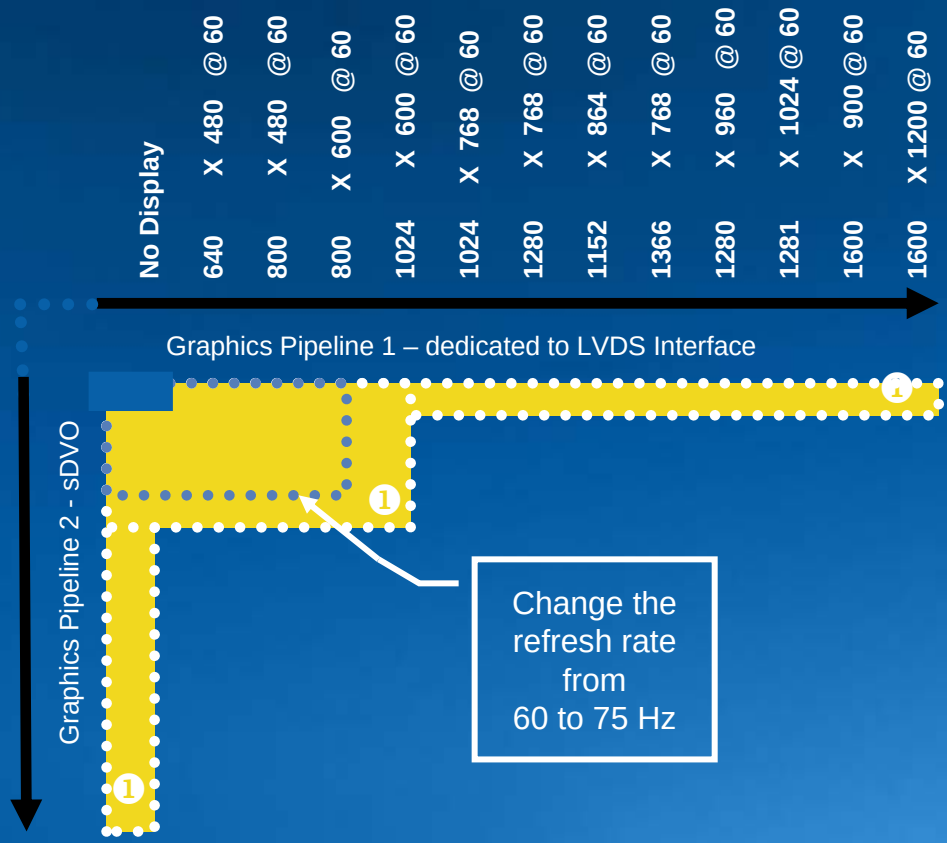
Dual Independent Display @ 60Hz Refresh Rate



Unified Memory Architecture

No Display
640 X 480 @ 60
800 X 480 @ 60
800 X 600 @ 60
1024 X 600 @ 60
1024 X 768 @ 60
1280 X 768 @ 60
1152 X 864 @ 60
1366 X 768 @ 60
1280 X 960 @ 60
1280 X 1024 @ 60
1600 X 900 @ 60
1600 X 1200 @ 60

Mem Freq: 533 MHz
Color Depth: 32-bits



SCH US15W Video Features

Feature	Benefit
Motion Compensation	Offloads CPU
Deblocking	Codec back-end video filtering
Entropy Coding	Master controller for the video accelerator
Hardware-Based Acceleration at macroblock level Supports full hardware acceleration of the following video decode standards: – H.264 Baseline profile L3, Main profile L4.1, High profile L4.1 – MPEG2 Main profile high level – MPEG4 Simple profile L3, Advanced simple profile L5 – VC1 all profiles up to L3 – WMV9 Simple profile Medium level – WMV9 Main profile High level	Eliminates the need for SW codecs, thus offloading the CPU

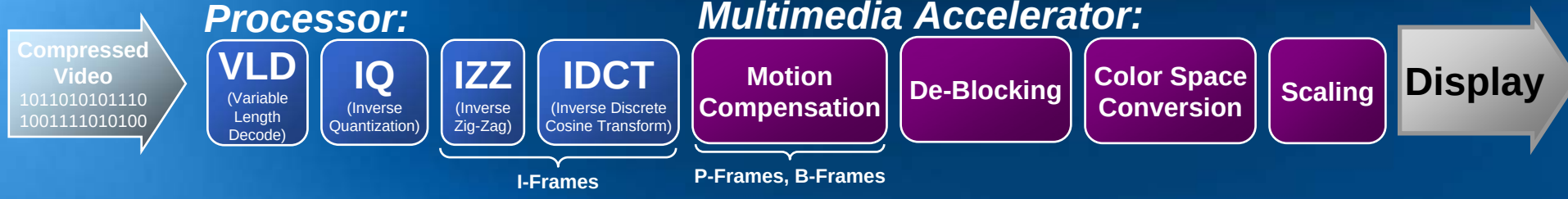
US15W Chipset – Graphics Hardware

Graphics Feature	Benefit
Programmable shader 3D accelerator Complex per pixel shading effects Differed pixel shading Screen Tiling On-chip Stencil, Z and Frame Buffer, 2 level cache Auto MipMap generation	High performance per watt Performance targets: • 10M Vertices/Sec • 400M Pixels/Sec Reduce memory accesses & power
Support for 32bit floating point operations	High image quality
Fine grain task switching, load balancing	Power and Performance Benefit
UMA Memory Architecture	Reduce board space and cost
Display Support Leverages Intel® 945 Express Chipset Design • Dual Display Pipe support • LVDS + SDVO for display output • Supports Extended Desktop or Clone Mode	Robust display controller offers flexibility
Windows[1]* and Linux* support DirectX[1]* 9.0Ex and OpenGL* 2.0 support	Comprehensive OS and API support

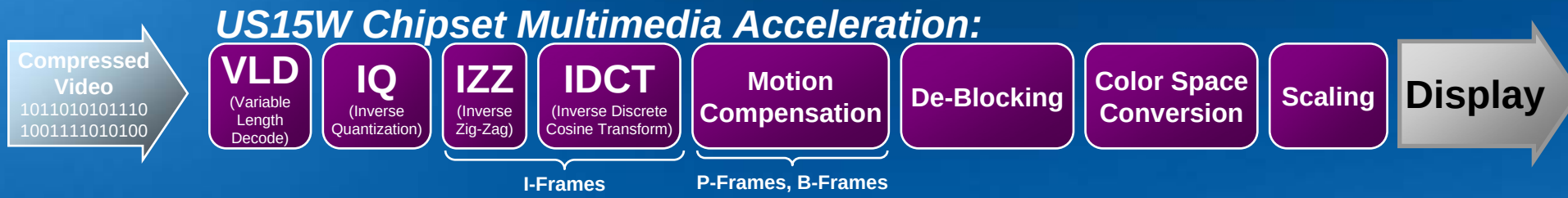
[1] Features subject to change prior to product release

Embedded Menlow Platform
Video Decode Acceleration

Common acceleration for video decode pipeline:



Embedded Menlow Platform acceleration for video decode pipeline:



Benefits of Embedded Menlow video decode acceleration

- Reduces power consumption by offloading CPU
- Support for HD resolution decode (1080i and 720p)
- Content protection and DRM support

Embedded Menlow supports VLD entry point acceleration for:

- MPEG 2
- MPEG 4
- H.264
- WMV9
- VC1

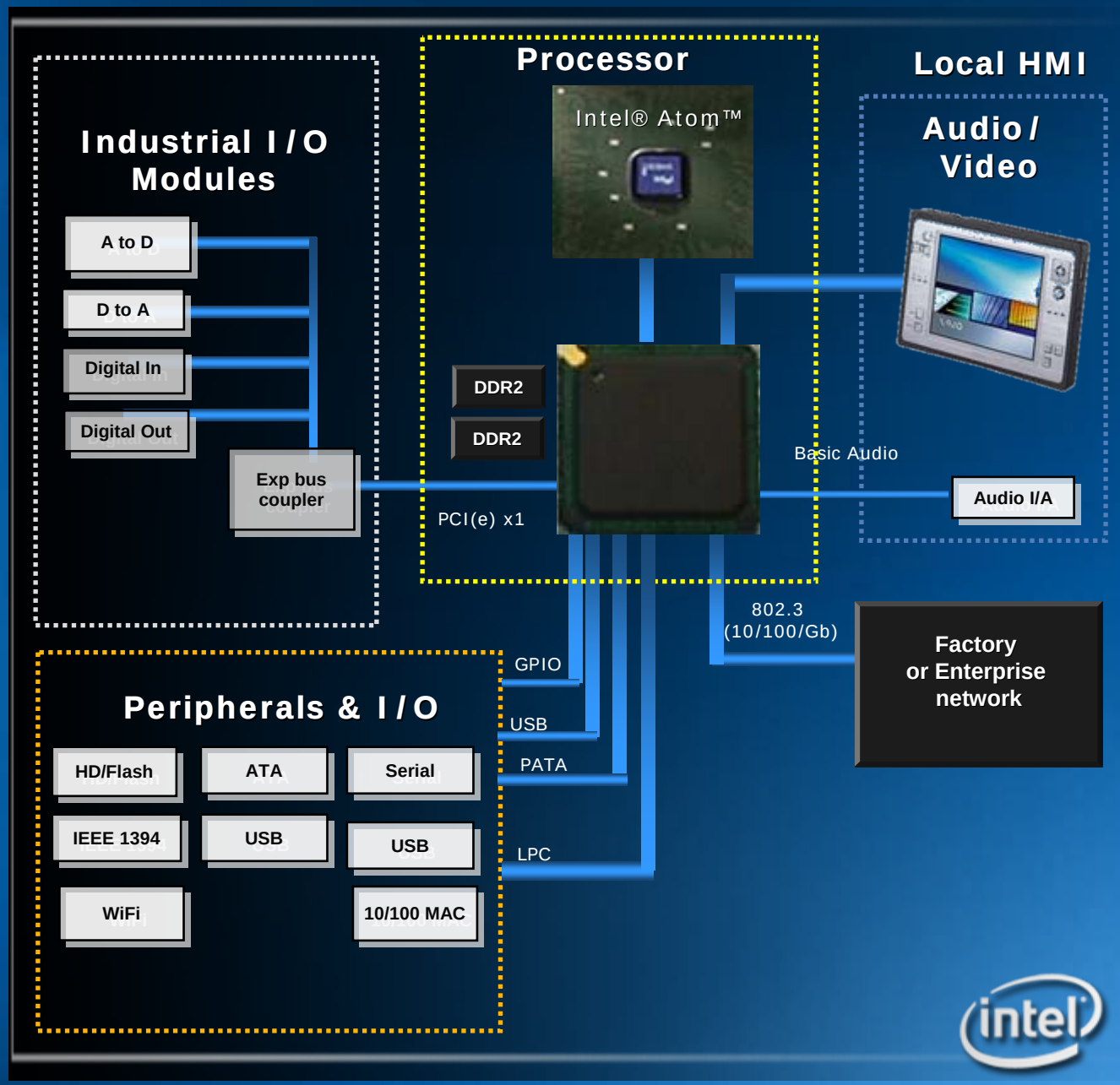
US15W – Supported Video Codecs

Codec	Profile @ Level	Max Bit Rate (bps)	Resolution and Frame Rate
H.264	BP@L3	10M	720 x 480 @ 30fps (NTSC), 720 x 576 @ 25fps (PAL)
H.264	MP@L4.1	50M	1920 x 1080 @ 30fps, 1280 x 720 @ 60fps
H.264	HP@L4.1	50M	1920 x 1080 @ 30fps, 1280 x 720 @ 60fps
VC-1 (WMV9)	SP@MP	384K	240 x 176 @ 30fps , 352 x 288 @ 15fps (CIF)
VC-1 (WMV9)	MP@HP	20M	1920 x 1080 @ 30fps
VC-1 (WMV9)	AP@L3	45M	1920 x 1080p @ 24fps, 1920 x 1080i @ 30, 1280 x 720p @ 60
MPEG-4 Part 2	SP@L3	384K	CIF @ 30fps
MPEG-4 Part 2	ASP@L5	8M	720 x 480 @ 30fps (NTSC), 720 x 576 @ 25fps (PAL)
DivX	Certified HD	4M	1280 x 720 @ 30 fps
MPEG-2	MP@HL	80M	1920 x 1080 @ 30fps
MPEG-1	CPB	1.856M	768 x 576 @ 30fps
JPEG	Baseline	N/A	Not restricted

*Features subject to change prior to product release
** Resolutions depend on bandwidth available

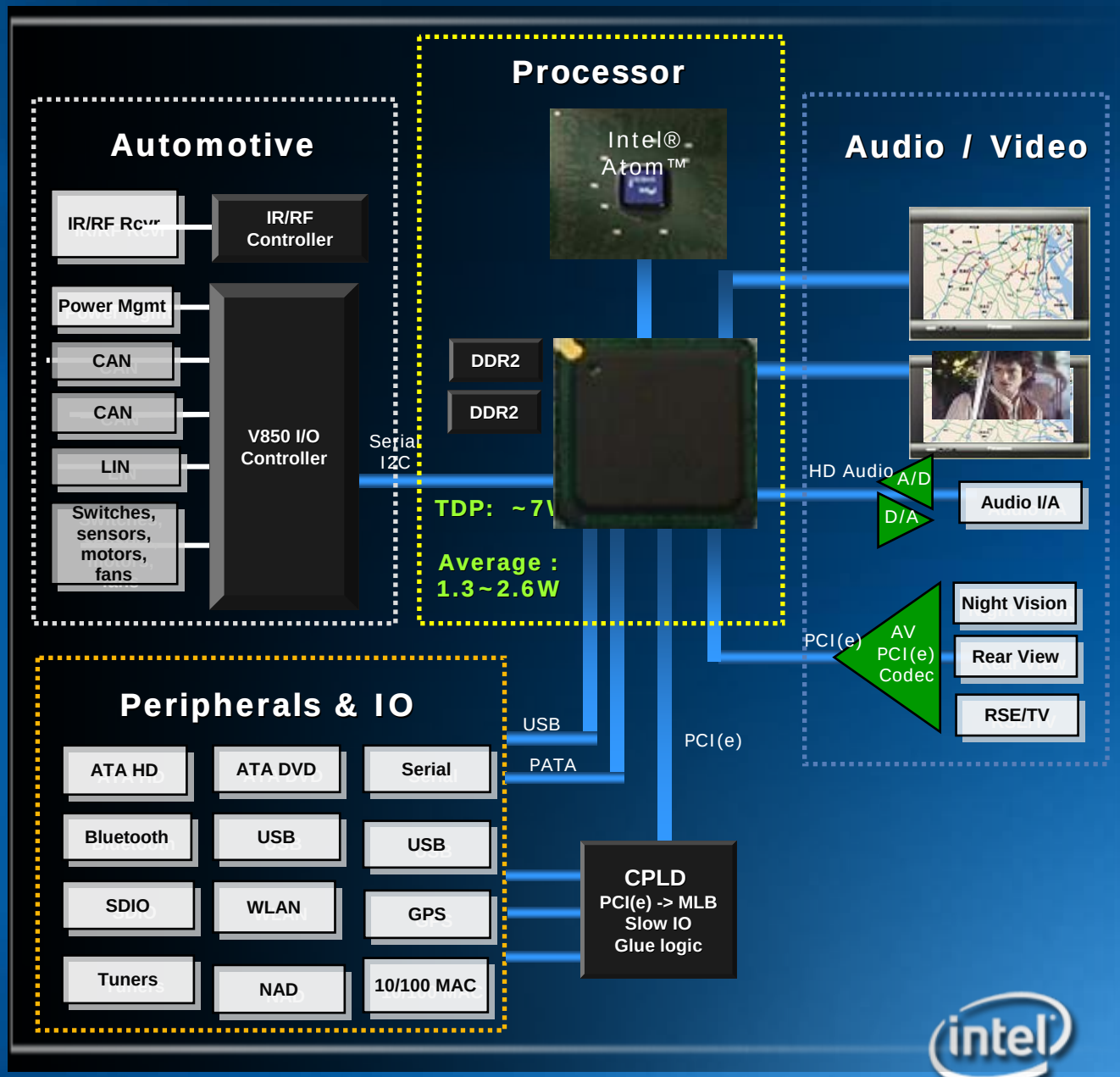
Example Usage: PAC (Programmable Automation Controller)

- Benefits
  - Embedded graphics supports integrated HMI
  - Audio support for alarms, and voice enabled help.
  - Fanless Small form-factor addresses a wide range of applications: PLC, Motion Control, Machine Vision and HMI.
  - Common architecture (to span high/mid/low platforms)
  - Ecosystem



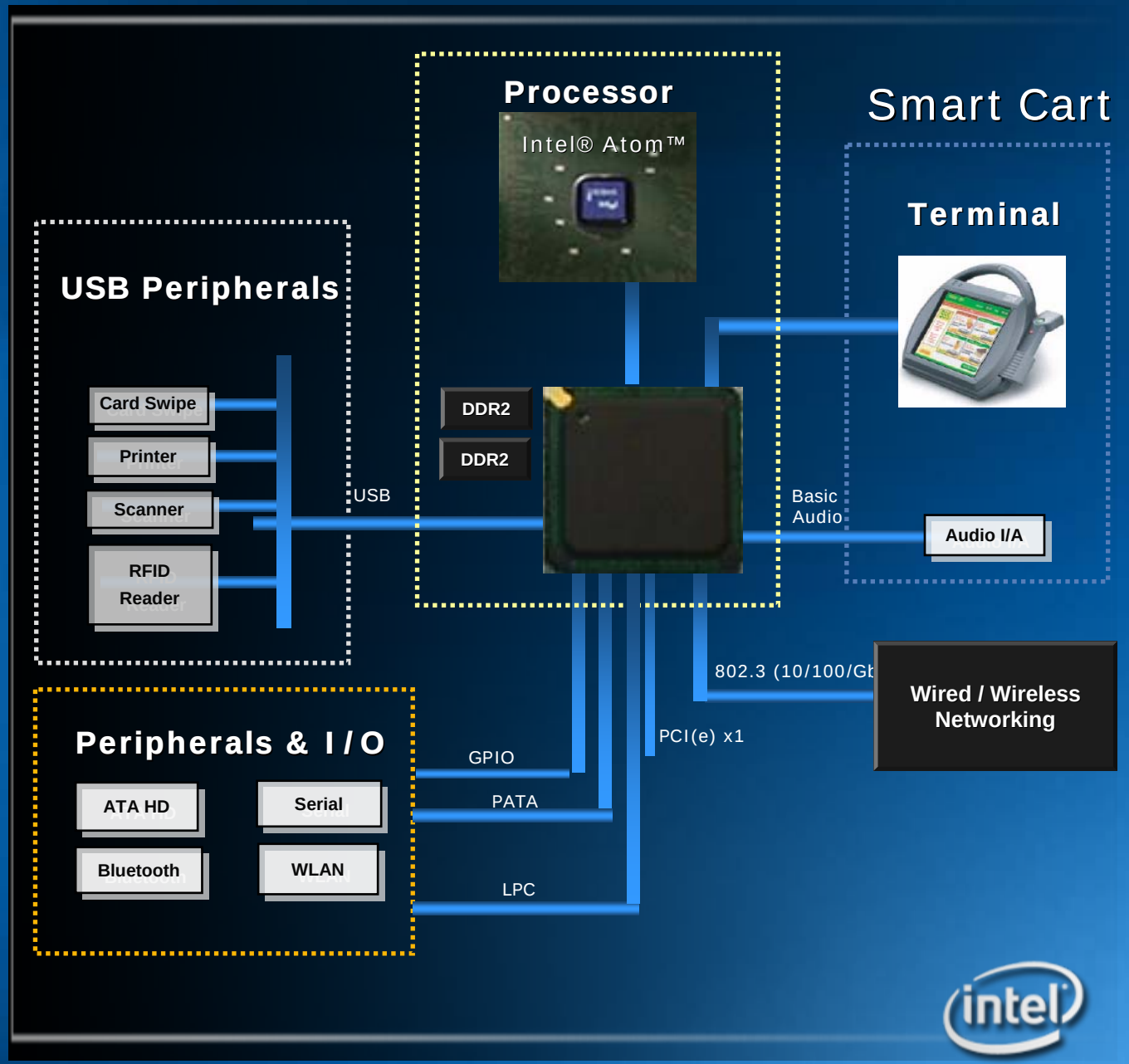
Example Usage: In-vehicle Infotainment Headunit

- Benefits
  - Low power, high performance
  - High integration for lower BOM
  - Smaller form factor
  - Increased I/O
    - 6 USBs
    - 2xPCIe*



Example Usage: Portable Point-of-Sale

- Benefits
  - Low power, high performance
  - Small form factor with integrated graphics (3D capable)
  - Connectivity
    - USB
    - PCIe*
    - Serial
  - Platform Flexibility
  - Strong Ecosystem



*Other names and brands may be claimed as the property of others.

Software

Intel® ATOM Z510/Z530 (SC) + US15W SCH Platform and Graphics Drivers

Name/OS		Platform Drivers		Graphics Drivers & Codecs		
		Availability	Where to get	Availability	Where to get	7 Year Support
OS	Windows XPe SP2	now	Intel	now	Intel (IEGD)	yes
	Windows XP SP2	now	Intel	now	Intel (IEGD)	yes
	Windows WEPOS SP2	now	Intel	now	Intel (IEGD)	yes
	WinCE 6.0	now	ISV	now	Intel (IEGD)	yes
	Linux: Wind River Linux	now	Wind River	now	Intel (IEGD)	yes
	Linux: Red Hat (Emb)	now	Red Hat	now	Intel (IEGD)	yes
	Linux: Red Flag (Emb)	now	Red Flag	now	Intel (IEGD)	yes
	QNX Neutrino	See QNX	QNX	See QNX	QNX	See QNX
	Wind River VxWorks*	See WRS	Wind River	See WRS	Wind River	See WRS
	Linux: Monta Vista PRO 5.0*	See MV	Monta Vista	See MV	Monta Vista	See Monta Vista
	Vista	now	Intel	now	Intel	no
	Linux: (Ubuntu)	now	Intel	now	Intel	no
BIOS Support (UEFI Based)	AMI	now	AMI			yes
	Insyde	now	Insyde			yes
	Phoenix	now	Phoenix			yes
	General Software*	See GS	GS			

*: ISV self enabled and supported for this platform.

No† = No features, defect fixes, or technical support. Product must be used with understanding that no Intel support for embedded designs will be available.

WinCE BSP Features and Availability

Intel HD Audio	Default Graphics	IEGD	IDE/PATA
Fast Ethernet (Via PCI Exp)	USB (1 Client 7 Host)	ACPI 2.0	PCI Express
SDIO (3 Ports)	KITL	I2C	GPIO

The WinCE BSP is available on the 3 ISV websites.

http://www.adeneo-embedded.com/srt/en/document/show?location.id:=1360

http://www.bsquare.com/partners/siliconvendors/intel.asp

http://www.wipro.com/pes/alliances/ica/wincebsp.htm

Intel® Embedded Graphics Drivers

Roadmap for Intel® Atom™ Processors for Embedded

IEGD Today

- Linux
  - WindRiver Autograde Linux*
  - Red Hat Embedded*
  - Red Flag MIDINUX*
  - OpenGL 2.0
  - HW-accelerated Video Decode
    MPEG2, MPEG4, H.264, VC-1
- XP*, XPe
  - DirectDraw
  - Direct3D 9.0c
  - HW-accelerated Video Decode
    MPEG2 only
- Windows Embedded CE* 6.0
  - Direct3D-Mobile
- Legacy Video BIOS
- UEFI Video BIOS
- Intel® Dynamic Display Configuration Technology
- Graphics Overlay
- Power Management

Features to come

Linux
- OpenGL ES 1.1 & 2.0
- Anti-Aliasing
- Installer

- XP*, XPe
  - OpenGL 2.0
  - OpenGL ES 1.1 & 2.0
  - Anti-Aliasing
- Windows Embedded CE* 6.0
  - HW-accelerated Video Decode
    MPEG2, MPEG4, H.264, VC-1
  - OpenGL 2.0
  - OpenGL ES 1.1 & 2.0
  - Anti-Aliasing
- Vista XPDM
  - Direct3D 9.0c
  - Graphics Development Kit

Roadmap and features are subject to change without notification

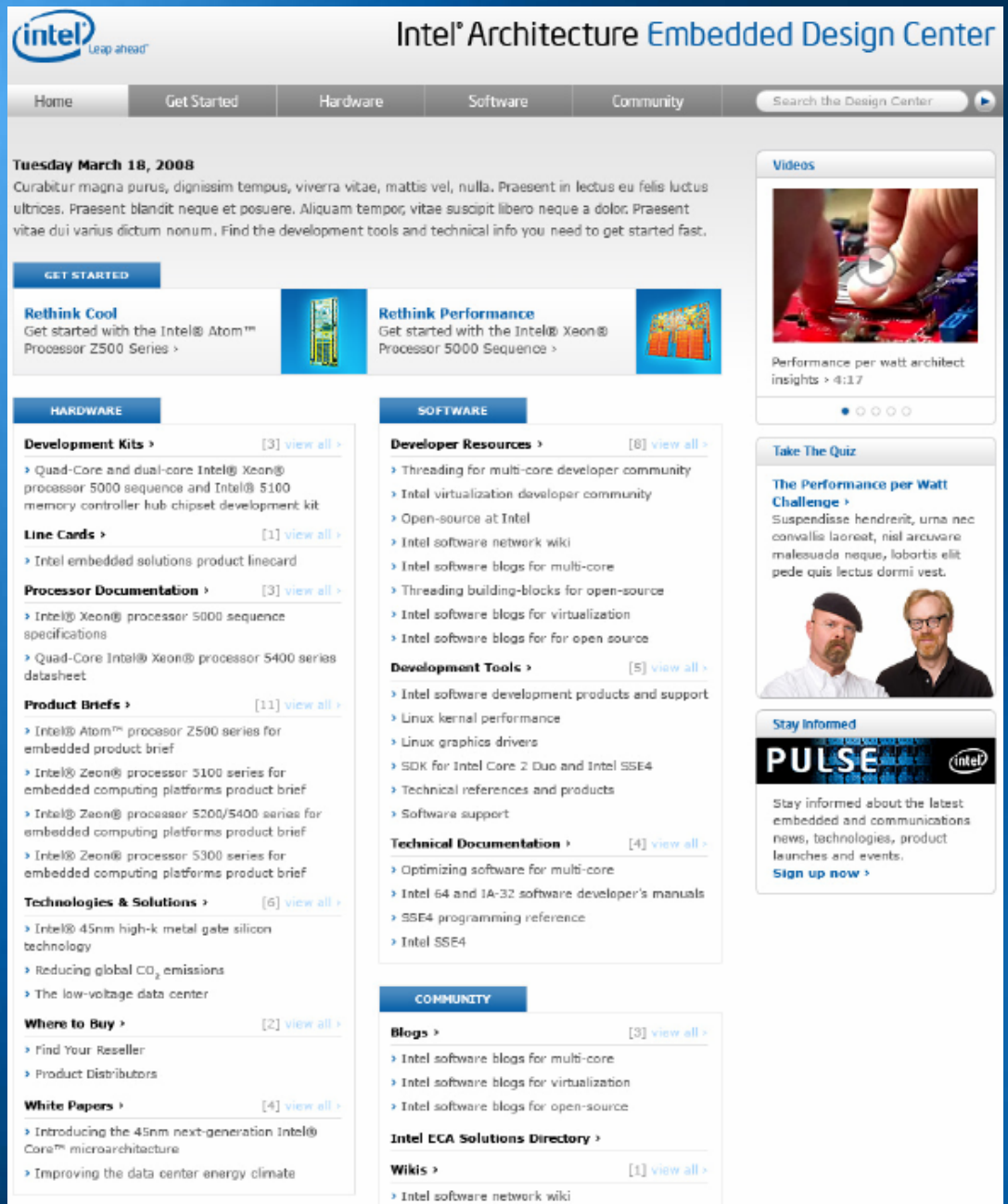
** Internal code names, subject to change

May 9, 2008


intel
Leap ahead™
Thank you!

Where to get more info

Embedded Design Center



Launch: April 2

Functionally oriented – a design center for developers

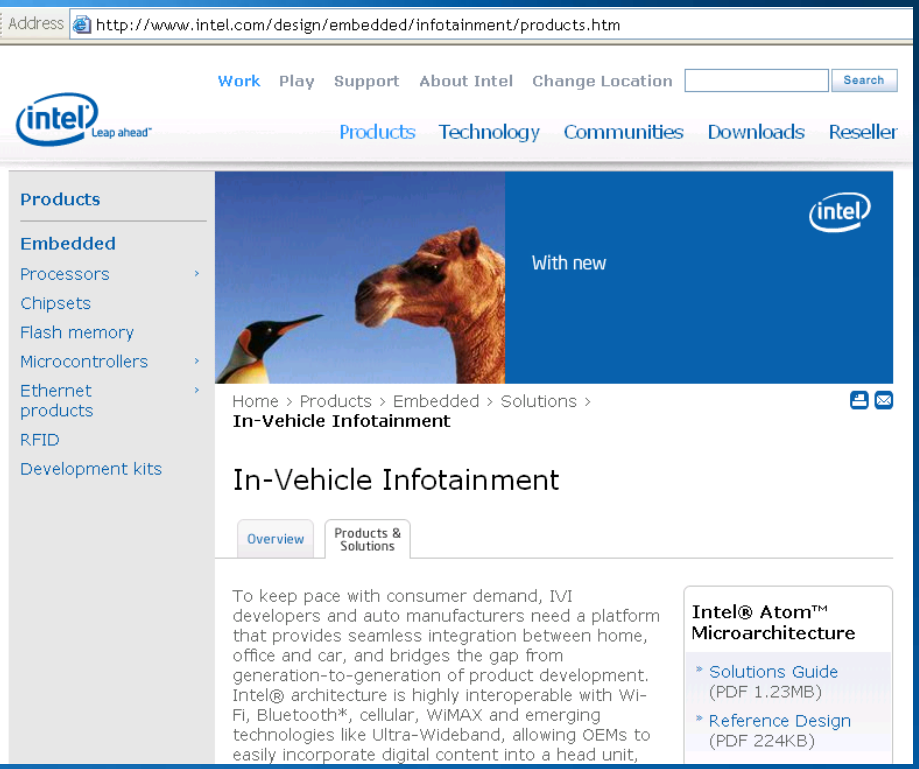
Shallow navigation –valuable information in a single click

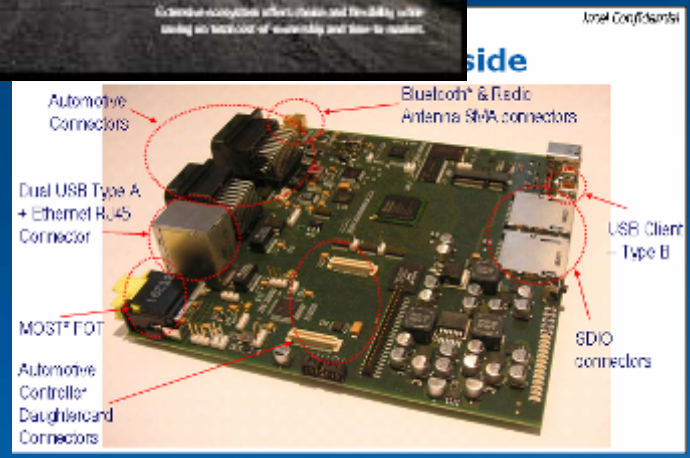
Dynamic –newest / most popular content auto displayed on the home page

Easy to update –content tagged for auto display in correct areas of the site

Solid foundation for future expansion and integration with ongoing Intel web efforts

Accelerate your In Vehicle Application Design





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- Videos
- Demos

More Info: embedded.intel.com

Atom Details

Embedded Design Center (rethink.intel.com)

Documentation

More Info: rethink.intel.com -> Atom

HARDWARE

Product Briefs ›

› Intel® Atom™ processor Z5xx Series
› Intel® System Controller Hub US15W chipset

Platform Overview ›

› Intel® Atom processor on Intel® System Controller Hub US15W chipset-based platform

Datasheets ›

› Intel® Atom™ processor Z5xx Series
› Intel® System Controller Hub US15W chipset

White Papers ›

› Introducing the 45nm next-generation Intel® Core™ microarchitecture
› New innovations that improve the performance and energy efficiency of Intel® architecture

Evaluate ›

› Applied Data/Eurotech Catalyst* evaluation kit

Specification Updates ›

› Intel® Atom™ processor Z5xx Series
› Intel® System Controller Hub US15W chipset

Tools ›

› Run Control Tool – EMC XDP

Where To Buy ›

› Operating systems, software and hardware available from Intel® Embedded and Communications Alliance members
› Product Distributors/Resellers

Training ›

› Intel® Atom™ Processor and Intel® System Controller Hub (SCH) US15W Audio Enabled Presentation

SOFTWARE

Tools ›

› Drivers
› Linux graphics drivers
› Linux kernel performance
› Operation System development

Intel® Atom™ processor Z5XX series ›
Bring Intel® architecture-based applications to places where you've never been able to use Intel chips before.

Take The Quiz

Test Your Low Power IQ ›
How much do you know about Intel's new power-optimized embedded platform? Take our quiz to see just how cool Intel® architecture can be.

Register Today

Intel® Embedded Solutions Conference
Learn about the latest Intel® multicore and low power platforms, software solutions and more in this seven-city roadshow.
Register now ›

Stay Informed

Stay informed about the latest embedded and communications news, technologies, product launches and events.

VirtuaLab Overview

- Launched in 1996, TechOnline is the design and engineering resource for engineers and engineering managers involved in the electronics sector. To achieve this goal, TechOnline provides users with a host of education resources, which range from Webinars to online courses to a research library of white papers.
- At the same time, the site offers engineers the chance to evaluate products using TechOnline's patented VirtuaLab technology, the ability to sort through new products from around the Electronics sector, and insights into design approaches through the site's Under the Hood tear down section.
- http://www.techonline.com/

VirtuaLab Overview (cont)

Real-time evaluation of a platform using only a web browser