(intel®)

Intel® Atom™ Processor Z5xx Series for Embedded Computing

Product Overview

The Intel® Atom™ processor Z5xx series provides a variety of design options with 2.0 or 2.2 watts thermal design power[1] (TDP), two package sizes, and industrial as well as commercial temperature ranges. Based on 45nm Intel® architecture, these processors implement ground-breaking power management techniques, making them ideal for thermally constrained and fanless embedded applications. These processors include embedded lifecycle support and remain software compatible with previous 32-bit Intel architecture and complementary silicon.

These single-core processors are validated with the Intel® System Controller Hub US15W (Intel® SCH US15W), available in two package sizes, which integrates the Intel® Graphics Media Accelerator 500 (Intel® GMA 500), memory controller, and I/O controller in a single-chip. The Intel® SCH US15W features advanced 3D graphics, hardware video decode acceleration, and Intel® High Definition Audio[2] along with extensive I/O capabilities, such as USB 2.0, GPIO, PATA, LPC, and PCI Express.* It also offers a choice of both industrial and commercial temperature ranges.

These two-chip platform solutions help developers create a product line with diverse sizes and thermal requirements for embedded market segments such as in-vehicle infotainment, industrial control and automation, gaming, medical, media phones, and retail and transaction solutions (i.e., kiosks, point-of-service terminals).

Product Highlights

- Processor available in six options with variations in core speed, front-side bus (FSB), TDP, package size, temperature range and support for Intel® Hyper-Threading Technology[3] (HT Technology) See Table 2.

- Intel's hafnium-based 45nm Hi-k metal gate silicon technology reduces power consumption, increases switching speed, and significantly increases transistor density over previous 65nm technology.

- Multiple micro-ops per instruction are combined into a single micro-op and executed in a single cycle, resulting in improved performance and power savings and higher scheduling efficiency.

- In-order execution core consumes less power than out-of-order execution.

- HT Technology (available in designated SKUs) provides high performance-per-watt efficiency in an in-order pipeline. HT Technology provides increased system responsiveness in multi-tasking environments. One execution core is seen as two logical processors, and parallel threads are executed on a single core with shared resources.

- New C6 state (Deep Power Down Technology) removes power from processor core and caches, resulting in less leakage than C4 state. This technology is transparent to the operating system and meets existing mobile C-state exit latencies.

- Split VTT rail removes power from ~90 percent of the I/O, reducing C6 state leakage and achieving a significantly lower idle power.

- Utilizes CMOS drivers on many of the FSB signals for lower I/O power consumption.

- Dynamic L2 cache sizing reduces leakage due to transistor sleep mode.

- SSE3 instruction set enables software to accelerate data processing in specific areas, such as complex arithmetic and video decoding.

Product Highlights (continued)

- Enhanced Intel SpeedStep® technology reduces average system power consumption.

- Execute Disable Bit[4] prevents certain classes of malicious "buffer overflow" attacks.

- Along with a strong ecosystem of hardware and software vendors, including members of the Intel® Embedded and Communications Alliance (intel.com/go/eca), Intel helps cost effectively meet development challenges and speed time to market.

- Embedded lifecycle support protects system investment by enabling extended product availability for embedded customers.

Package and Operating Temperature Options

Small Form Factor Option

The small footprint version of the Intel Atom processor Z5xx series, with the 0.6mm ball pitch, provides robust performance-per-watt in an ultra small 13x14 mm package. It is suitable for a variety of handheld and small form-factor embedded designs such as small point-of-service machines used for fast checkout at retail, gaming machines for space-constrained facilities, and handheld medical devices for portable diagnostics.

This two-chip platform provides more than 80 percent reduction in total footprint over the previous-generation three-chip solution (Intel® Celeron® M processor Ultra Low Voltage 423Δ with Mobile Intel® 945GME Express chipset). See Table 1.

Large Form Factor Option

The larger footprint version features a 22x22 mm package with 1.0 mm ball pitch. It is ideal for designs without small space restrictions and/or with an industrial temperature range requirement. In addition to its ground-breaking power management capabilities, an integrated heat spreader further contributes to its value for thermally constrained, fanless applications.

Because the automotive and transportation industries require that components be qualified for a -40˚ to +85˚ C temperature range, the industrial temperature option is critical for many
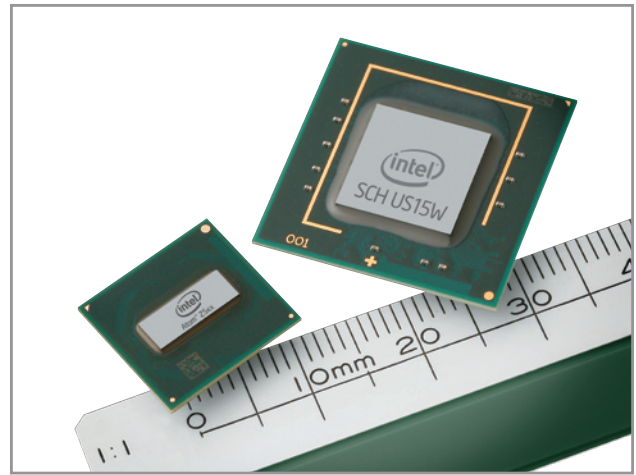
Small form factor Intel® Atom™ processor Z5xx platform

embedded in-vehicle infotainment system designs in consumer and commercial vehicles. This option is also important for industrial control and automation applications, often found in factories with unconstrained thermal environments.

Benefits of the Intel® Atom™ Processor-based Platform for Embedded Applications

In-Vehicle Infotainment Systems: The combination of high performance, low power, and integrated graphics/video makes this platform well suited for in-vehicle infotainment systems. It enables the automotive industry to offer products that let consumers experience their digital worlds inside their vehicles, with access to personal connections, business productivity, up-to-the-minute navigation/location information, radio, and rear-seat entertainment (gaming, DVD, streaming video, satellite TV).

Industrial Control: Factories are moving away from PLCs designed with proprietary architectures and looking toward real-time connectivity, from the plant to enterprise-level systems. The high performance, low power, and open architecture of this platform maintains the same form factor as traditional PLCs yet handles multiple domains—not only logic, but motion, drives, and process control—on a single platform to help meet the demand for more distributed intelligence within today's digital factory.

Table 1. Two-chip, small-footprint platform provides more than 80 percent reduction in total footprint over previous-generation three-chip Intel platform.

Two-Chip Platform		Three-Chip Platform	
Intel® Atom™ processor Z5xx (13x14 mm)	182 mm²	Intel® Celeron® M processor Ultra Low Voltage 423Δ (35x35 mm)	1225 mm²
Intel® System Controller Hub US15W (22x22 mm)	484 mm²	Intel® 82945GME Graphics Memory Controller Hub (37.5x37.5 mm)	1406 mm²
		Intel® I/O Controller Hub 7-M (31x31 mm)	961 mm²
Total footprint of two chips	666 mm²	Total footprint of three chips	3592 mm²

Gaming: This platform is ideal for a variety of gaming applications, including player tracking, handheld casino gaming, and electronic table games, that are constrained by form factor, yet require low thermals and strong 3D and video performance.

Medical: The low power, Intel architecture performance, and software scalability of this platform benefit diagnostic and therapeutic medical devices where a fanless, quiet operation in a portable form factor is paramount.

Retail and Transaction Solutions: By combining performance with graphics, reduced power consumption and a smaller footprint, this platform provides a cost-effective solution for entry point-of-service terminals, information kiosks, and integrated digital signage. See diagram below for an example of a digital signage application design.

Media Phones: This new product category is taking full advantage of the performance, graphics, and power efficiency of the Intel Atom processor-based platform to deliver outstanding Internet experiences while delivering wire-line voice quality. The media phone is poised to become the "fourth" screen for the home—complementing the television, cell phone, and PC— to offer a range of services without the need to power up a PC or the limitation of a small cell phone screen. OEMs can significantly reduce system development efforts, using a media phone reference design from Intel or other Intel architecture-based commercial media phone vendors.

Software

The operating systems and BIOSs listed below are supported on the Intel Atom processor Z5xx series and the Intel System Controller Hub US15W platform. In addition, Intel provides software drivers for this platform. Please contact your preferred vendor or an Intel representative for operating system and BIOS options. Intel® Embedded Graphics Drivers and video BIOS, developed specifically for embedded markets, enable new products and applications (developer.intel.com/design/intarch/SWsup/graphics_drivers.htm).

Operating System	Contact
Microsoft Windows XP Embedded SP2*	Intel provides drivers
Microsoft Windows XP SP2*	Intel provides drivers
Microsoft Windows WEPOS SP2*	Intel provides drivers
Microsoft Windows Embedded CE 6.0*	Adeneo, BSQUARE, WiPro
QNX Neutrino*	QNX Software Systems
Fedora-based Linux*	Red Hat Global Engineering Services (GES)
Red Flag Linux*	Red Flag Software
VxWorks 6.6*	Wind River
Wind River Linux* Platform for Infotainment	Wind River
MontaVista Linux* Professional Edition	MontaVista Software

BIOS/Contact

American Megatrends, Inc.
Insyde Software
Phoenix Technologies, including AwardCore*
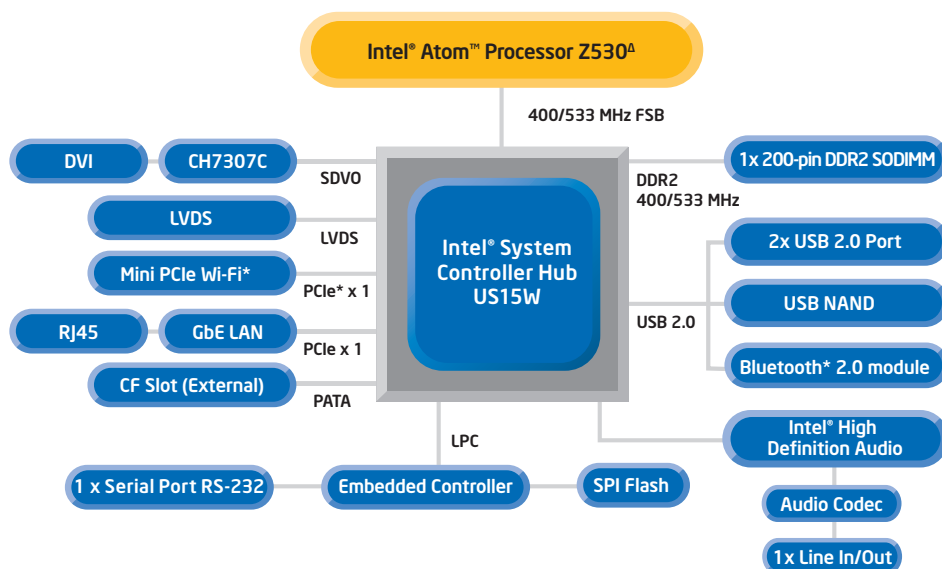
Example Design for a Digital Signage Application

Table 2. Intel® Atom™ processor Z5xx Series for Embedded Computing

Product Name	Product Number	Core Speed	Front-Side Bus	L2 Cache	L1 Cache	Thermal Design Power[1]	Support for HT Technology	Tjunction	Temperature Range	Package	Chipset Pairing
Small Form Factor Options											
Intel® Atom™ processor Z530△	AC80566UE025DW	1.60 GHz	CMOS, 533 MHz, 32-bit address	512 kB	32 kB instruction cache, 24 kB data cache	2.2 watts	Yes	90˚ C	Commercial 0 to +70˚ C	441-ball lead-free USFFBGA 13x14 mm	Intel® SCH US15W
Intel® Atom™ processor Z510△	AC80566UC005DE	1.10 GHz	CMOS, 400 MHz, 32-bit address	512 kB	32 kB instruction cache, 24 kB data cache	2.0 watts	No	90˚ C	Commercial 0 to +70˚ C	441-ball lead-free USFFBGA 13x14 mm	Intel® SCH US15W
Large Form Factor Options											
Intel® Atom™ processor Z530P△	CH80566EE025DW	1.60 GHz	CMOS, 533 MHz, 32-bit address	512 kB	32 kB instruction cache, 24 kB data cache	2.2 watts	Yes	90˚ C	Commercial 0 to +70˚ C	437-ball lead-free FCBGA 22x22 mm	Intel® SCH US15WP
Intel® Atom™ processor Z510P△	CH80566EC005DW	1.10 GHz	CMOS, 400 MHz, 32-bit address	512 kB	32 kB instruction cache, 24 kB data cache	2.2 watts	Yes	90˚ C	Commercial 0 to +70˚ C	437-ball lead-free FCBGA 22x22 mm	Intel® SCH US15WP
Large Form Factor with Industrial Temperature Options											
Intel® Atom™ processor Z520PT△	CH80566EE014DT	1.33 GHz	CMOS, 533 MHz, 32-bit address	512 kB	32 kB instruction cache, 24 kB data cache	2.2 watts	Yes	110˚ C	Industrial -40 to +85˚ C	437-ball lead-free FCBGA 22x22 mm	Intel® SCH US15WPT
Intel® Atom™ processor Z510PT△	CH80566EC005DT	1.10 GHz	CMOS, 400 MHz, 32-bit address	512 kB	32 kB instruction cache, 24 kB data cache	2.2 watts	Yes	110˚ C	Industrial -40 to +85˚ C	437-ball lead-free FCBGA 22x22 mm	Intel® SCH US15WPT

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