Platform Overview

The Intel® Atom™ processor E6x5C series delivers, in a single package, the benefits of the Intel® Atom™ processor E6xx combined with a Field-Programmable Gate Array (FPGA) from Altera. This series offers exceptional flexibility to incorporate a wide range of standard and user-defined I/O interfaces, high-speed connectivity, memory interfaces, and process acceleration to meet the requirements of a variety of embedded applications in industrial, medical, communication, vision systems, voice over Internet protocol (VoIP), military, high-performance programmable logic controllers (PLCs) and embedded computers.

The Intel Atom processor E6x5C series is a multi-chip, single-package device that reduces board footprint, lowers component count, and simplifies inventory control and manufacturing. This compact design offers single-vendor support while providing Intel Atom processors for new applications that require a more integrated solution.

The user-programmable FPGA features high-speed transceivers, LVDS with SERDES, support for interfacing to a variety of memory devices, dedicated DSP blocks, and more than sixty thousand logic elements. It provides enough programmable space for users to integrate their own intellectual property or use off-the-shelf, third-party IP that completes a powerful embedded system. The FPGA features a hard IP PCI Express® lane that connects directly to the Intel Atom processor E6xx inside the device.

Available with industrial and commercial temperature ranges, this processor series provides embedded lifecycle support and is supported by the broad Intel® architecture ecosystem as well as standard Altera development tools. Additionally, a compatible, dedicated Power Management Integrated Circuit (PMIC) solution may be obtained from leading PMIC suppliers to help minimize platform part count and reduce bill of material costs and design complexity. Options include separate PMIC and clock generator chips (available from ROHM Co., Ltd.) or a single-chip solution that integrates the voltage regulator and clock generator (available from Dialog Semiconductor).

Product Highlights

• **Single-package**: A compact 37.5 x 37.5 mm, 0.8 mm ball pitch, multi-chip device internally connects the Intel Atom processor E6xx with a user-programmable FPGA. This configurable device allows for one board layout to support multiple application designs, plus the ability to incorporate custom logic without having to invest in application-specific integrated circuit development.

• **Integrated Intel® Atom™ processor E6xx**: Includes a 45nm processor core (512K L2 cache, 24K data, and 32K instruction L1 cache), 3D graphics, and video encode/decode, as well as memory and display controllers.
• Integrated Intel® Graphics Media Accelerator (Intel® GMA) 600: Power-optimized 2D/3D graphics engine provides up to 400 MHz graphics core frequency. Supports OpenGL® ES2.0, OpenGL 2.1, and OpenVG® 1.1, along with hardware-accelerated HD video decode (MPEG4 part 2, H.264, WMV, and VC1) and encode (MPEG4 part 2, H.264). Also supports LVDS display using a pixel clock of 80 MHz and SDVO using a pixel clock of 160 MHz.

• Integrated memory controller and DDR2 support: Integrated 32-bit single-channel memory controller provides fast memory read/write performance through efficient pre-fetching algorithms, low latency, and high-memory bandwidth. Processors include support for up to 2 GB of DDR2 800 MT/s memory.

• Intel® Hyper-Threading Technology*: Provides performance and support for multi-threaded applications. Delivers increased performance and system responsiveness for demanding embedded applications by enabling the processor to execute two instruction threads in parallel.

• Integrated, hardware-assisted Intel® Virtualization Technology® (Intel® VT) for IA-32 Intel® architecture (Intel® VT-x): Provides greater flexibility and maximum system utilization by consolidating multiple environments into a hardware platform. With support from the processor, BIOS, and enabling software, Intel VT-x improves traditional software-only-based virtualization. By offloading workloads to system hardware, virtualization software can provide more streamlined software stacks and “near native” performance characteristics. The required virtualization software (virtual memory manager [VMM]) is available from third parties.

• High-performance, power-optimized FPGA: Features transceiver speeds up to 3.125 Gbps, high-speed LVDS with SERDES at up to 840 Mbps, support for DDR3, DDR2, DDR SDRAM, QDR II, and QDR II+ SRAM memory interfacing, up to four general-purpose PLLs, 312 18 x 18 multipliers and more than 60,000 logic elements and 350 user I/O pins. Each of the high-speed transceiver channels have a clock data recovery (CDR) feature, and support for multiple I/O standards such as 3.3-V LVTTL/3.3-V LVCMOS, single-ended SSTL/HSTL and differential SSTL/HSTL.

• Industrial temperature range option: -40° to +85° C temperature range meets requirements for industrial, medical and military application designs with constrained thermal environments.

• Green technology: Manufactured and available only in lead-free component packages.

• Reliable technology ecosystem: Along with a strong ecosystem of hardware and software vendors, including members of the Intel® Embedded Alliance (intel.com/go/embeddedalliance), Intel helps cost-effectively meet developer challenges and speed time-to-market.

• Embedded lifecycle support: Protects system investment by enabling extended product availability for embedded customers.
Software Overview

The following independent operating system and BIOS vendors provide support for this device:

<table>
<thead>
<tr>
<th>OPERATING SYSTEM</th>
<th>CONTACT</th>
<th>BIOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microsoft Windows* XP SP3</td>
<td>Intel provides drivers</td>
<td>American Megatrends</td>
</tr>
<tr>
<td>Microsoft Windows Embedded Standard 2009</td>
<td>Intel provides drivers</td>
<td>Insyde Software</td>
</tr>
<tr>
<td>Microsoft Windows* 7</td>
<td>Intel provides drivers</td>
<td>Phoenix Technologies</td>
</tr>
<tr>
<td>MeeGo* 1.0</td>
<td>MeeGo community, Wind River</td>
<td></td>
</tr>
<tr>
<td>Wind River VxWorks*</td>
<td>Wind River</td>
<td></td>
</tr>
</tbody>
</table>

*Windows* XP, Windows* 7 and MeeGo* 1.0 were used to test the Intel® Atom™ processor E6xSC series.

**Intel® Atom™ Processor E6xSC Series for Embedded Computing**

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Product Number</th>
<th>Clock Speed (GHz)</th>
<th>Graphics Speed (MHz)</th>
<th>Thermal Design Power</th>
<th>Temperature Range</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel® Atom™ processor E625C</td>
<td>CY80632007227AB</td>
<td>0.6</td>
<td>320</td>
<td>2.7 W</td>
<td>Commercial 0 to 70° C</td>
<td>1466 ball FCBGA 375x375 mm</td>
</tr>
<tr>
<td>Intel® Atom™ processor E625CT</td>
<td>CY80632007227AA</td>
<td>0.6</td>
<td>320</td>
<td>2.7 W</td>
<td>Industrial -40 to 85° C</td>
<td>1466 ball FCBGA 375x375 mm</td>
</tr>
<tr>
<td>Intel® Atom™ processor E645C</td>
<td>CY80632007221AB</td>
<td>1.0</td>
<td>320</td>
<td>3.6 W</td>
<td>Commercial 0 to 70° C</td>
<td>1466 ball FCBGA 375x375 mm</td>
</tr>
<tr>
<td>Intel® Atom™ processor E645CT</td>
<td>CY80632007221AA</td>
<td>1.0</td>
<td>320</td>
<td>3.6 W</td>
<td>Industrial -40 to 85° C</td>
<td>1466 ball FCBGA 375x375 mm</td>
</tr>
<tr>
<td>Intel® Atom™ processor E665C</td>
<td>CY80632007224AB</td>
<td>1.3</td>
<td>400</td>
<td>3.6 W</td>
<td>Commercial 0 to 70° C</td>
<td>1466 ball FCBGA 375x375 mm</td>
</tr>
<tr>
<td>Intel® Atom™ processor E665CT</td>
<td>CY80632007224AA</td>
<td>1.3</td>
<td>400</td>
<td>3.6 W</td>
<td>Industrial -40 to 85° C</td>
<td>1466 ball FCBGA 375x375 mm</td>
</tr>
</tbody>
</table>

*Total package thermal design power depends on functions included in the FPGA. Altera Quartus* II PowerPlay Early Power Estimator (EPE) tools can perform power calculations based on a given design.
Third-Party Vendors

FPGA
Altera — www.altera.com

POWER MANAGEMENT INTEGRATED CIRCUIT (PMIC)
Dialog Semiconductor — www.dialog-semiconductor.com
ROHM Co., Ltd. — www.rohm.com

Intel in Embedded and Communications: intel.com/embedded

*Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. See www.intel.com/products/processor_number for details.

1Requires an Intel® HT Technology enabled system; check with your PC manufacturer. Performance will vary depending on the specific hardware and software used. Not available on Intel® Core™ i5-750 processor. For more information including details on which processors support HT Technology, visit http://www.intel.com/info/hyperthreading.

2Intel® Virtualization Technology requires a computer system with an enabled Intel® processor, BIOS, virtual machine monitor (VMM). Functionality, performance or other benefits will vary depending on hardware and software configurations.
Software applications may not be compatible with all operating systems. Consult your PC manufacturer. For more information, visit http://www.intel.com/go/virtualization.

3Intel 45nm manufactured on a lead-free process. Lead is below 1000 PPM per EU RoHS directive (2002/95/EC, Annex A). Some EU RoHS exemptions for lead may apply to other components used in the product package.

4Drivers available at: http://downloadcenter.intel.com (enter chipset name).

5TDP values for Intel® Atom™ Processor E6x5C Series are pre-silicon estimates.

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