

## PLATFORM BRIEF

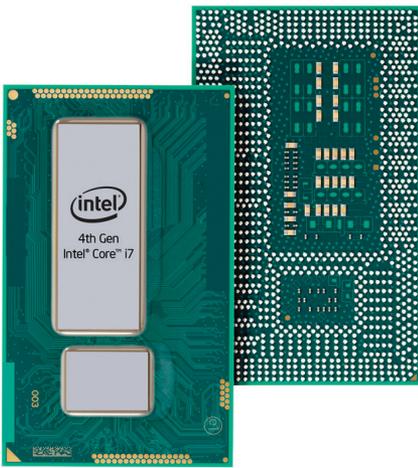
### Ultra Low-Power 4th Generation Intel® Core™ Processors (U-Processor Line)

Intelligent Systems



# 4th Generation Intel® Core™ Processors based on the Mobile U-Processor Line for Intelligent Systems (i7-4650U, i5-4300U, i3-4010U, 2980U)

Ideal for Intelligent Systems—context-aware, securely managed embedded devices that connect seamlessly to networks, clouds and each other.



## Product Overview

The 4th generation Intel® Core™ processor (U-processor line) features ultra low-power, 64-bit, multi-core processors built on 22nm process technology. Designed for small form-factor applications, this multi-chip package (MCP) integrates a low-power CPU and platform controller hub (PCH) onto a common package substrate. These dual-core processors deliver an outstanding balance of CPU/media performance and low power, along with enhanced security and I/O flexibility. They are ideal for a wide range of power and form-factor constrained intelligent systems, including retail transactional terminals, digital signage, industrial automation, and medical equipment.

These platforms support dual-channel DDR3L memory at 1600 MHz along with Intel® Rapid Start Technology<sup>1</sup> for increased system responsiveness and fast recovery from sleep states. They support faster connectivity and flexibility with integrated next-generation I/O technologies such as PCI Express\* Gen 2.0, SATA 6 Gbps, and USB 3.0 with Intel® Flex I/O, I<sup>2</sup>C\* and UART. A thermal design power (TDP) of 15 W (CPU+PCH) is configurable down to 11.5 W on select SKUs.

These 4th gen Intel Core processors offer numerous advancements over the 3rd generation Intel® Core™ processors. With the introduction of Intel® Advanced Vector Extensions (Intel® AVX) 2.0, they deliver improved integer/matrix-based calculation abilities, while upgrades to Intel® AES

New Instructions<sup>2</sup> (Intel® AES-NI) allow security algorithms to benefit from hardware acceleration for data encryption and decryption.

A third power state, known as active idle or S0ix, is an extremely low-power active state that wakes up almost instantly, yet uses much less power than previous-generation processors. While incorporating advanced technology like S0ix, these processors remain software-compatible with previous processors.

Next-generation Intel® graphics engines significantly improve graphics and media performance. The platform supports up to three independent displays, enabling one system to drive multiple screens without the need for a discrete graphics card. Built-in visual features, including Intel® Clear Video HD technology and Intel® Quick Sync Video 2.0, deliver smoother visual quality, improved ability to decode and transcode simultaneous video streams, and outstanding HD media playback. Additionally, the platform supports next-generation graphics APIs, such as Microsoft DirectX\* 11.1, OpenGL\* 4.0, and OpenCL\* 1.2.

Intel® vPro™ technology<sup>3</sup> is enabled on the 4th gen Intel Core i7 and Core i5 processors when running Intel vPro technology-based firmware. It delivers intelligent security to support operating system-absent manageability and down-the-wire security even when the system is powered off, the operating system is unresponsive, or software agents are disabled.

## Platform Highlights

**Intel® HD Graphics 5000 and 4400:** Supports enhanced high-end media and graphics capabilities and performance.

**Intel® Quick Sync Video 2.0:** Significantly improves decode and transcode performance and frees up the CPU for other tasks.

**Intel® Advanced Vector Extensions (Intel® AVX) 2.0:** Accelerates integer/matrix compute performance for signal and image processing applications.

**Intel® AES New Instructions (Intel® AES-NI):** Supports hardware acceleration for data encryption and decryption.

**Intel® Intelligent Power Technology:** Reduces idle power consumption through architectural improvements such as integrated power gates and automated low-power states.

**Intel® Flex I/O:** Allows user to assign up to two or four SATA 6 Gbps ports, up to six PCI Express\* Gen 2.0 devices across 12 lanes (4x1+2x4) and up to two or four USB 3.0 ports, based on configuration needs.

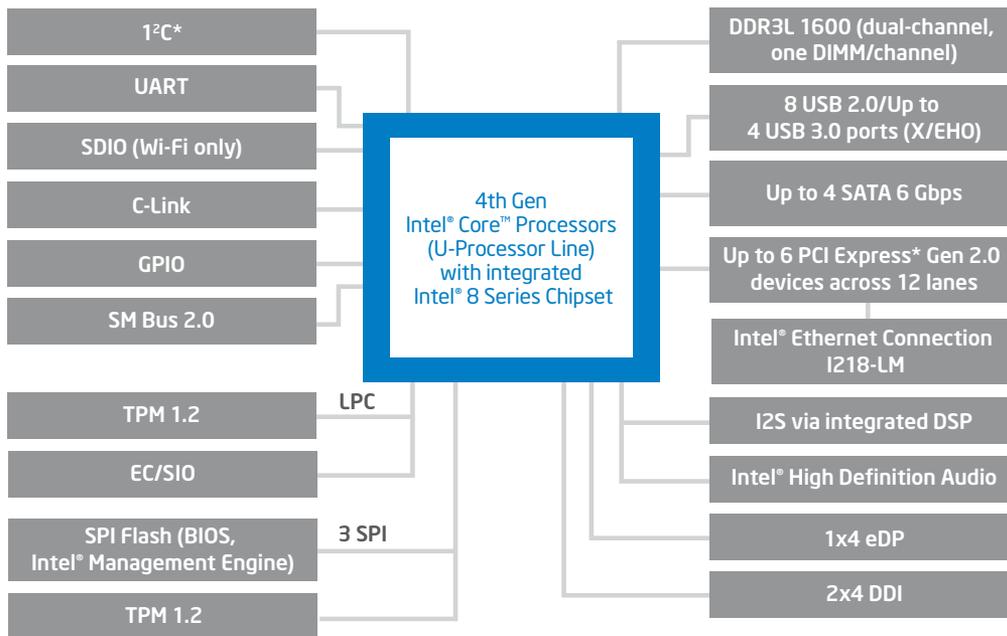
**I<sup>2</sup>C and UART:** Delivers additional I/O capabilities for peripherals such as sensors and GPS.

**Intel® Turbo Boost Technology<sup>4</sup> 2.0:** Runs applications faster by using available thermal headroom to run at a higher frequency.

**Intel® Hyper-Threading Technology<sup>5</sup>:** Simultaneous multi-threading helps boost performance for parallel, multi-threaded applications.

**Intel® vPro™ Technology:** Delivers unprecedented hardware support for vital security and management functions with Intel® Active Management Technology,<sup>6</sup> Intel® Virtualization Technology,<sup>7</sup> and Intel® Trusted Execution Technology.<sup>8</sup>

**Platform Power Management:** Based on new Intel® silicon and industry standards, this framework enables power management across major subsystems during long periods of system idle. Utilizes Windows\* 8.1 Connected Standby with S0ix system power management.



## Software Overview

The following independent operating system and BIOS vendors provide support for these platforms.

### OPERATING SYSTEM

Microsoft Windows\* 8.1 Connected Standby  
Linux\* (Kernel 3.x)  
Wind River VxWorks\* 6.9

### SOLUTIONS DELIVERY AND SUPPORT

Intel provides drivers<sup>9</sup>  
Wind River, Red Hat, Novell  
Wind River

### BIOS

American Megatrends  
Insyde Software  
Byosoft  
Phoenix Technologies

## 4th Generation Intel® Core™ Processors (U-Processor Line) at a Glance

4th generation Intel® Core™ processors offer numerous advancements over 3rd generation Intel® Core™ processors.

### FEATURES

### BENEFITS

Key Embedded Support	
Extended life cycle product support	<ul style="list-style-type: none"> <li>Protects system investment by enabling extended product availability for embedded customers.</li> </ul>
Ecosystem support	<ul style="list-style-type: none"> <li>From modular components to market-ready systems, Intel and the 250+ global member companies of the Intel® Intelligent Systems Alliance (<a href="http://intel.com/go/intelligentsystems-alliance">intel.com/go/intelligentsystems-alliance</a>) provide the performance, connectivity, manageability, and security developers need to create smart, connected systems.</li> </ul>
Built-In Visuals	
Intel® HD Graphics 5000/4400	<ul style="list-style-type: none"> <li>Delivers enhanced visual experiences, including excellent 3D performance, the addition of HDMI 4K support, and enhanced color and deep color support for a broad range of intelligent systems.</li> <li>Provides repartitioned display architecture, allowing three independent displays and hybrid multi-monitor configurations.</li> <li>Integrated processor graphics help minimize power consumption while maximizing performance for decoding, encoding, and transcoding workloads with hardware acceleration of video codecs.</li> </ul>
Intel® Quick Sync Video 2.0	<ul style="list-style-type: none"> <li>Improved ability to decode and transcode simultaneous video streams for intelligent systems, including medical imaging and video surveillance functions.</li> </ul>
Intel® Clear Video HD Technology	<ul style="list-style-type: none"> <li>Provides visual quality and color fidelity enhancements for spectacular HD media playback for applications such as digital signs and gaming platforms.</li> </ul>
Security	
Intel® AES New Instructions <sup>2</sup> (Intel® AES-NI) and Intel® Secure Key <sup>2</sup>	<ul style="list-style-type: none"> <li>Helps protect media, data and assets from loss.</li> <li>Intel AES-NI accelerates data encryption/decryption and improves performance.</li> </ul>
Boot Integrity	<ul style="list-style-type: none"> <li>Enables hardware-based boot integrity of Initial Boot Block (IBB) module before launch.</li> <li>Helps prevent repurposing of the platform to run unauthorized software and boot block-level malware.</li> </ul>
Intel® OS Guard	<ul style="list-style-type: none"> <li>Helps detect and prevent malware.</li> </ul>
Intel® Platform Protection Technology with BIOS Guard	<ul style="list-style-type: none"> <li>Protects Flash from modification without platform manufacturer authorization.</li> </ul>
Performance	
Intel® Advanced Vector Extensions (Intel® AVX) 2.0	<ul style="list-style-type: none"> <li>Supports faster performance on digital signal and image processing workloads of compute-intensive applications such as radar detection, hurricane command centers, ruggedized navigation systems and remote medical image processing.</li> </ul>
Intel® Turbo Boost Technology <sup>4</sup> 2.0	<ul style="list-style-type: none"> <li>Boosts performance for specific workloads by increasing processor frequency.</li> </ul>
Intel® Hyper-Threading Technology <sup>5</sup>	<ul style="list-style-type: none"> <li>Enables simultaneous multi-threading within each processor core, up to two threads per core; reduces computational latency, making optimal use of every clock cycle.</li> </ul>
Intel® Smart Cache Technology	<ul style="list-style-type: none"> <li>Large on-die shared Last-Level Cache reduces latency to data, improving performance and power efficiency.</li> </ul>
Power Efficiency	
Intel® Intelligent Power Technology	<ul style="list-style-type: none"> <li>Automated energy efficiency to reduce power consumption.</li> </ul>
Automated low-power states	<ul style="list-style-type: none"> <li>Adjusts system power consumption based on real-time processor loads.</li> </ul>
Intel® Rapid Start Technology <sup>1</sup>	<ul style="list-style-type: none"> <li>Improves OS boot time and wakes up from deep sleep state more quickly than previous generations for better system responsiveness.</li> </ul>
Fully Integrated Voltage Regulator	<ul style="list-style-type: none"> <li>Simplifies power delivery by integrating legacy power delivery onto processor package/die.</li> </ul>
S0ix	<ul style="list-style-type: none"> <li>S0ix are the system S0 power management states.</li> <li>For a Connected Standby system, S0i3 enables the CPU to enter the deepest C10 state by turning the supply off and turning the external VR to 0V; display is off and device and applications are suspended.</li> </ul>
Intel® vPro™ Technology <sup>3</sup> (i7-4650U and i5-4300U platforms paired with Intel vPro technology-based firmware support)	
Intel® Active Management Technology <sup>6</sup> 9.5	<ul style="list-style-type: none"> <li>9.5 version of Intel's remote management and maintenance capabilities enables vendors to roll back firmware image; remote host capabilities help ease provisioning of end devices.</li> </ul>
Intel® Virtualization Technology <sup>7</sup>	<ul style="list-style-type: none"> <li>Speeds transfer of platform control and movement of data between the virtual machine monitor (VMM) and other platform agents (including guest OSs and I/O devices). By lowering the workload on the VMM, this technology addresses many embedded system design challenges, like migrating legacy software, increasing real-time performance, and making applications more secure.</li> </ul>
Intel® Trusted Execution Technology <sup>8</sup>	<ul style="list-style-type: none"> <li>Protects embedded devices and virtual environments against rootkit and other system-level attacks. Using an industry-standard TPM 1.2 to store keys and other protected data, this portion of Intel® vPro™ technology boots the BIOS, operating system, and software into a "trusted" execution state, verifying the integrity of the virtual machine and protecting the platform from unauthorized access.</li> </ul>

## 4th Generation Intel® Core™ Processors (U-Processor Line) for Intelligent Systems

PROCESSOR NUMBER <sup>A</sup>	CORES/ THREADS	CORE FREQUENCY (GHz)		INTEL® SMART CACHE	THERMAL DESIGN POWER	PACKAGE	INTEL® AES-NI	INTEL® AVX	INTEL® GRAPHICS
		BASE FREQUENCY	1 CORE TURBO (MAX)						
Intel® Core™ i7-4650U Processor	2/4	1.7	3.3	4 MB	15 W (11.5 W cTPD)	BGA1168	Yes	Yes	Intel® HD Graphics 5000
Intel® Core™ i5-4300U Processor	2/4	1.9	2.9	3 MB	15 W (11.5 W cTPD)	BGA1168	Yes	Yes	Intel® HD Graphics 4400
Intel® Core™ i3-4010U Processor	2/4	1.7	N/A	3 MB	15 W	BGA1168	Yes	Yes	Intel® HD Graphics 4400
Intel® Celeron® 2980U Processor	2/2	1.6	N/A	2 MB	15 W	BGA1168	No	No	Intel® HD Graphics

### INTEL® vPRO™ TECHNOLOGY<sup>3</sup>

PROCESSOR NUMBER <sup>A</sup>	INTEL® TURBO BOOST TECHNOLOGY 2.0	INTEL® HYPER- THREADING TECHNOLOGY	INTEL® VIRTUALIZATION TECHNOLOGY	INTEL® ACTIVE MANAGEMENT TECHNOLOGY 9.5	INTEL® TRUSTED EXECUTION TECHNOLOGY	ERROR CORRECTING CODE
Intel® Core™ i7-4650U Processor	Yes	Yes	Yes	Yes <sup>a</sup>	Yes	No
Intel® Core™ i5-4300U Processor	Yes	Yes	Yes	Yes <sup>a</sup>	Yes	No
Intel® Core™ i3-4010U Processor	No	Yes	Yes	No	No	No
Intel® Celeron® 2980U Processor	No	No	Yes	No	No	No

<sup>a</sup>When paired with the Intel® vPro™ technology-based firmware.

### PROCESSOR NUMBER<sup>A</sup> INTEGRATED CHIPSET FEATURES

i7-4650U/i5-4300U/i3-4010U Processors	4 SATA ports (0 to 4 SATA 6 Gbps); 8 total USB ports (2 or 4 USB 3.0); up to 6 PCI Express* x1 Gen 2.0 devices across 12 lanes; SOix; two I <sup>2</sup> C/two UART
Intel® Celeron® 2980U Processor	2 SATA ports (2 SATA 6 Gbps); 8 total USB ports (2 or 4 USB 3.0); up to 6 PCI Express x1 Gen 2.0 devices across 10 lanes; SOix; two I <sup>2</sup> C/two UART

## Intel in Intelligent Systems: [intel.com/intelligentsystems](http://intel.com/intelligentsystems)

<sup>A</sup> Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. Go to: [http://www.intel.com/products/processor\\_number](http://www.intel.com/products/processor_number) for details.

<sup>1</sup> Requires a select Intel® processor, Intel® software and BIOS update, and Intel® Solid-State Drive (SSD). Depending on system configuration, your results may vary. Contact your system manufacturer for more information.

<sup>2</sup> No computer system can provide absolute security. Requires an enabled Intel® processor and software optimized for use of the technology. Consult your system manufacturer and/or software vendor for more information.

<sup>3</sup> Intel® vPro™ Technology is sophisticated and requires setup and activation. Availability of features and results will depend upon the setup and configuration of your hardware, software and IT environment. To learn more visit: <http://www.intel.com/technology/vpro>.

<sup>4</sup> Requires a system with Intel® Turbo Boost Technology. Intel Turbo Boost Technology and Intel Turbo Boost Technology 2.0 are only available on select Intel® processors. Consult your system manufacturer. Performance varies depending on hardware, software, and system configuration. For more information, visit <http://www.intel.com/go/turbo>.

<sup>5</sup> Available on select Intel® Core™ processors. Requires an Intel® HT Technology-enabled system. Consult your PC manufacturer. Performance will vary depending on the specific hardware and software used. For more information including details on which processors support HT Technology, visit <http://www.intel.com/info/hyperthreading>.

<sup>6</sup> Requires activation and a system with a corporate network connection, an Intel® AMT-enabled chipset, network hardware and software. For notebooks, Intel AMT may be unavailable or limited over a host OS-based VPN, when connecting wirelessly, on battery power, sleeping, hibernating or powered off. Results dependent upon hardware, setup and configuration. For more information, visit: <http://www.intel.com/content/www/us/en/architecture-and-technology/intel-active-management-technology.html>.

<sup>7</sup> Intel® Virtualization Technology requires a computer system with an enabled Intel® processor, BIOS, and 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>.

<sup>8</sup> No computer system can provide absolute security. Requires an enabled Intel® processor, enabled chipset, firmware, software and may require a subscription with a capable service provider (may not be available in all countries). Intel assumes no liability for lost or stolen data and/or systems or any other damages resulting thereof. Consult your Service Provider for availability and functionality. For more information, visit <http://www.intel.com/go/anti-theft>. Consult your system manufacturer and/or software vendor for more information.

<sup>9</sup> Drivers available at: [downloadcenter.intel.com](http://downloadcenter.intel.com) (enter chipset name).

Performance results are based on certain tests measured on specific computer systems. Any difference in system hardware, software or configuration will affect actual performance. Configurations: [describe config + what test used + who did testing]. For more information go to <http://www.intel.com/performance>.

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