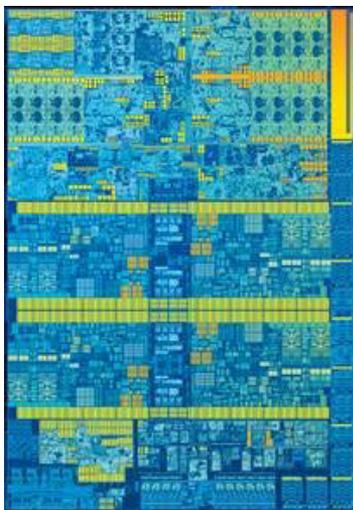# 6th Generation Intel® Core™ Processor-Based Platforms for Internet of Things (IoT) Solutions

(Intel® Core™ i7-6700, i7-6700TE, i5-6500, i5-6500TE, i3-6100, and i3-6100TE processors)
(Intel® Pentium® G4400, G4400TE, and Intel® Celeron® G3900, G3900TE processors)

**Harness the Performance, Features, and Edge-to-Cloud Scalability
to Build Tomorrow's IoT Solutions Today**

Product Overview

Intel is proud to announce its 6th generation Intel® Core™ processor family. Manufactured on the latest 14 nm technology, these processors offer dramatically higher CPU and graphics performance as compared to the previous generation, a broad range of power options, and new advanced features to boost edge-to-cloud Internet of Things (IoT) designs. The 6th generation Intel Core processor family also maintains a standardized thermal envelope for 65W and 35W desktop products, remaining consistent with the previous processor generation, and is as an ideal low-power option for manufacturing flexibility.

Stunning Visual Performance

The 6th generation Intel Core processors utilize the new Gen9 graphics engine, which improves graphic performance by up to 49 percent.[1] The improvements are demonstrated through faster 3-D graphics performance and rendering applications at low power. Video playback is also faster and smoother, thanks to the new multiplane overlay capability. The new generation offers up to three independent audio streams and displays, Ultra HD 4K support, and workload consolidation for lower BOM costs and energy output.

Users will also enjoy enhanced high-density streaming applications and optimized 4K video conferencing with accelerated 4K hardware media codecs HEVC (8-bit), VP8, VP9, and VDENC encoding, decoding, and transcoding. Together, the stunning visual performance enhancements add up to more immersive computing experiences.

Power-Efficient Performance

The new 6th gen Intel Core processors make a powerful difference on the efficiency front as well. The improved technology promises up to 35 percent faster CPU[2] and up to 49 percent faster graphics[1]—all at the same or similar thermal design power (TDP) as the prior generation.[3] Develop more flexible designs with up to 40 percent more high-speed I/O than previous generations and tap into new, faster memory performance with new memory support for DDR4 1.2V up to 2133, 64GB max capacity with 8GB density.

The 6th gen Intel® Core™ i7 and Intel® Core™ i5 processors come with Intel® Turbo Boost 2.0[4] Technology for that extra burst of performance and Intel® Hyper-Threading Technology[5] (only on Intel Core i7 processors) so each processor core can work on two tasks simultaneously. Other important

features include Intel® Advanced Vector Extensions 2 (Intel® AVX2), which provides optimized instructions to drive enhanced performance on floating point–intensive apps,[6] and Intel® Ready Mode Technology[7] for PCIe* storage for improved data reliability and greater levels of performance, responsiveness, and expandability.

Broad Design Range

In addition to stunning visuals and efficient performance, the 6th generation Intel Core processor offers a broad product line with multiple operating system (OS) choices that scale from low-power systems requiring greater productivity and graphics, to sleek, high performance computing systems.

Operating system support ranges from small footprint real-time operating systems (RTOSs) to feature-rich OSs to optimize choice, flexibility, and OS investment protection.
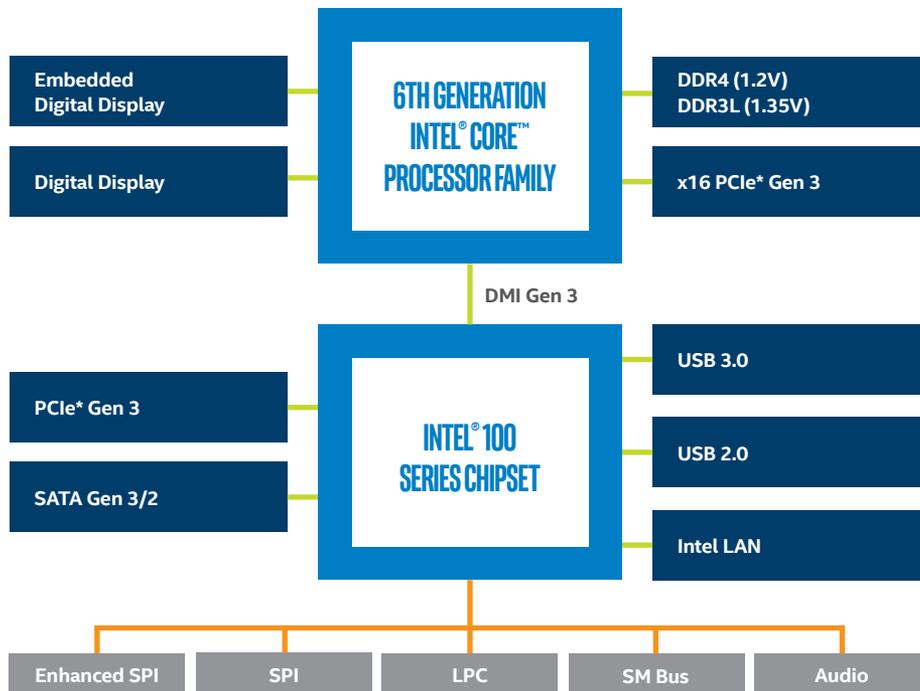
The new 6th generation Intel Core processors enable more flexible designs with configurable I/O offering additional high-speed ports compared to the previous generation. More high-speed input/output (HSIO) means improved flexibility, increasing to 26 total HSIO ports,[8] including up to 20 PCIe 3.0 ports,[8] and up to 10 USB 3.0 ports[8] and up to six SATA (6Gbps).

Advanced Security and Manageability

New 6th generation Intel Core processors protect IoT systems and data at rest and in flight through

hardware- and software-based security hardening. Keep increasingly connected devices more secure and enhance the firmware trusted platform module (TPM) with Intel® Platform Trust Technology (Intel® PTT), Intel® Software Guard Extensions (Intel® SGX) to protect data while in use, Intel® Memory Protection Extensions (Intel® MPX) to protect memory from buffer-overload attacks, and Intel® Boot Guard to securely boot machines.

Intel® vPro™ technology[9] allows you to remotely configure, diagnose, isolate, and repair an infected PC—even if it is turned off. In addition to helping secure the IT environment, hardware-based KVM Remote Control enables you to address issues remotely by seeing what users see.

Embedded Digital Display		**6TH GENERATION INTEL® CORE™ PROCESSOR FAMILY**		DDR4 (1.2V) DDR3L (1.35V)
Digital Display				x16 PCIe* Gen 3

DMI Gen 3

PCIe* Gen 3		**INTEL® 100 SERIES CHIPSET**		USB 3.0
				USB 2.0
SATA Gen 3/2				Intel LAN

Enhanced SPI	SPI	LPC	SM Bus	Audio

KEY FEATURES

INTEL® BUILT-IN VISUALS

NEW Gen9 graphics: Supports the latest graphics APIs, DirectX* 12 and OpenGL* 4.5, for improved 3-D rendering performance at low power.

NEW Accelerated 4K hardware media codecs: Enhances high-density streaming applications and optimized 4K videoconferencing with codecs HEVC (8-bit); VP8; VP9; and VDENC encoding, decoding, and transcoding.

Intel® HD Graphics: Plays HD video with exceptional clarity; permits viewing and editing of even the smallest image details.

Intel® Quick Sync Video: Delivers excellent videoconferencing capability, fast video conversion, and fast video editing and authoring.

Ultra HD 4K support: Provides stunning display resolutions,[10] now up to 4096 x 2304 pixels, and supports performance across three independent displays with audio.

Multiplane overlay: Enables faster, smoother, higher-quality video playback and improved 3-D graphics.

PERFORMANCE

Intel® Advanced Vector Extensions 2 (Intel® AVX2): Provides optimized instructions to deliver enhanced performance on floating point–intensive apps, adding 256-bit integer instructions and new instructions for Fused Multiply Add (FMA), which delivers better performance on media and floating-point computations.

Intel® Turbo Boost Technology[4] 2.0: Dynamically increases the processor's frequency, as needed, by taking advantage of thermal and power headroom when operating below specified limits.

Intel® Hyper-Threading Technology[5]: Delivers two processing threads per physical core. Highly threaded applications can get more work done in parallel, completing tasks sooner.

NEW Faster memory performance: Offers new DDR4 memory support, including new support for DDR4 1.2V up to 2133[4], 64GB max capacity[5] with 8GB density.

NEW Additional HSIO: Increases flexibility from 18 to 26 total HSIO ports,[8] from up to eight PCIe* 2.0 to 20 PCIe 3.0 ports,[8] and from up to six USB 3.0 to 10 USB 3.0 ports.[8]

SECURITY

Intel® Identity Protection Technology (Intel® IPT) with multifactor authentication (MFA): Provides enhanced security by verifying the boot portion of the boot sequence; protects your one-time password (OTP) credentials and PKI certificates and adds a layer of encrypted second-factor authentication for online transactions.

Intel® Advanced Encryption Standard New Instructions (Intel® AES-NI)[11]: Access a fast, secure AES engine for a variety of encryption apps, including whole-disk encryption, file-storage encryption, conditional access of HD content, Internet security, and VoIP. Consumers benefit from protected Internet and email content, plus fast, responsive disk encryption.

Intel® OS Guard: Protects the OS kernel and prevents use of malicious data or attack code located in areas of memory marked as user-mode pages from taking over or compromising the OS kernel. Intel OS Guard is not application-specific and protects the kernel from any application.

NEW Intel® Platform Trust Technology with BIOS Guard: Safeguards credential storage and key management, while helping reduce BOM cost and board space.

NEW Intel® Software Guard Extensions (Intel® SGX): Allows application developers to protect sensitive data from unauthorized access or modification by rogue software running at higher privilege levels[12]; secures data while in use in a Windows* or Linux* environment.

Intel® Data Protection Technology (Intel® DPT) with Intel® Boot Guard: Prevents unauthorized software and malware takeover of boot blocks critical to a system's function, thus providing an added level of platform security based on hardware.

NEW Intel® Memory Guard Extensions (Intel® MPX): Identifies errant pointer usage which, if left undetected, puts an application at risk of data corruption or malicious attack via buffer overruns and overflows. By adding extensions to the underlying architecture, Intel MPX achieves improved performance over software-based solutions.

Intel® Secure Key[6]: Generates high-quality keys for cryptographic (encryption and decryption) protocols, and provides quality entropy that is highly sought after for added security.

BIOS Guard: Augments existing chipset-based BIOS flash protection capabilities targeted to address the increasing malware threat to BIOS flash storage; protects from modification without platform manufacturer authorization, helps defend the platform against low-level denial of service (DOS) attacks, and restores BIOS to a known good state after an attack.

VMCS shadowing: Allows a Virtual Machine Manager (VMM) running in a guest (nested virtualization) to access a shadow VMCS memory area using the normal VMRead/VMWrite instructions. This reduces overhead for a more natural and responsive user experience, allowing users to take control of their personal and professional data and apps while being protected by game-changing security.

KEY FEATURES

POWER EFFICIENCY

Integrated Memory Controller: Supports DDR4 and offers stunning memory read/write performance through efficient prefetching algorithms, lower latency, and higher-memory bandwidth, when compared to previous generations.

Intel® Smart Cache: Dynamically allocates shared cache to each processor core, based on workload, reducing latency and improving performance.

Intel® Power Optimization and processor c-states: Increases periods of silicon sleep state across the platform ingredients—including the CPU, chipset, and third-party system components—to reduce power.

PCI Express* 3.0 Interface: Offers up to 8 GT/s for fast access to peripheral devices and networking with up to 16 lanes.[13]
PCI Express ports can be configured as x1, x2, x4, x8, and x16 depending on motherboard designs.

Intel® Ready Mode Technology[7]: Improves OS boot time and wakes up from deep sleep state more quickly than previous generations for better system responsiveness.

INTEL® VPRO™ TECHNOLOGY

Intel® Active Management Technology (Intel® AMT): Remotely monitors, maintains, updates, upgrades, and repairs PCs through hardware and firmware technology for remote out-of-band management.

Intel® Trusted Execution Technology (Intel® TXT)[14]: 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.

Intel® Virtualization Technology[15]: Allows one hardware platform to function as multiple "virtual" platforms; offers improved manageability by limiting downtime and maintaining productivity by isolating computing activities into separate partitions.

Intel® Transactional Synchronization Extensions (Intel® TSX)[7]: Focuses on enterprise-level multithreaded performance scaling, making parallel operations more efficient via improved control of software threads and locks. This offers performance benefits for enterprise-level big data analytics/business intelligence and visualization apps, which involve multiuser collaboration. (Available on the Intel® Core™ i7 and Intel® Core™ i5 processors with Intel® vPro™ technology and unlocked processors.)

SUSTAINABILITY

Green technology: Manufactured with lead-free and halogen-free component packages.

Conflict-free: Products do not contain conflict minerals (tin, tantalum, tungsten, and/or gold) that directly or indirectly finance or benefit armed groups in the Democratic Republic of the Congo (DRC) or adjoining countries.

SOFTWARE OVERVIEW

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

OS VENDOR	OPERATING SYSTEM (TARGETED FOR SUPPORT)	DISTRIBUTION	SUPPORT	BIOS
Microsoft	Windows* 10 (64b)	Microsoft	Intel/Microsoft	American Megatrends Inc. Insyde Software Phoenix Technologies Byosoft
	Windows* 8.1 Au (64b)	Microsoft	Intel/Microsoft	
	Windows* Embedded Industry 8.1 (64b)	Microsoft	Intel/Microsoft	
	Windows* 7 Pro (32/64b)	Microsoft	Intel/Microsoft	
	Windows* POSready 7 and WES7* (32/64b)	Microsoft	Intel/Microsoft	
Linux*	Fedora* Distribution (64b)	Open Source		
	Ubuntu*, SUSE*, Red Hat Enterprise (64b)	Canonical Ltd.*, Attachmate Group, Red Hat, and Open Source		
	Yocto* Tool-Based Embedded Linux* (64b) Distribution	Yocto Project* Community		
Google	Chromium* (Chrome*) (64b)	The Chromium Projects*	Google	
RTOS	Wind River VxWorks 7* (64b)	Wind River Systems		

Not all features are supported. Contact your local Intel representative for more information.

6TH GENERATION INTEL® CORE™ PROCESSORS FOR INTERNET OF THINGS SOLUTIONS

PROCESSOR NUMBER	CORE FREQUENCY (GHz)			INTEL® SMART CACHE	THERMAL DESIGN POWER	PACKAGE	INTEL® AES-NI	INTEL® AVX
	CORES/ THREADS	BASE FREQUENCY	1 CORE TURBO (MAX)					
Intel® Core™ i7-6700 processor	4C/8T	3.4 GHz	4.0 GHz	8M	65W	LGA1151	Y	Intel® AVX2
Intel® Core™ i7-6700TE processor	4C/8T	2.4 GHz	3.4 GHz	8M	35W	LGA1151	Y	Intel® AVX2
Intel® Core™ i5-6500 processor	4C/4T	3.2 GHz	3.6 GHz	6M	65W	LGA1151	Y	Intel® AVX2
Intel® Core™ i5-6500TE processor	4C/4T	2.3 GHz	3.3 GHz	6M	35W	LGA1151	Y	Intel® AVX2
Intel® Core™ i3-6100 processor	2C/4T	3.7 GHz	3.7 GHz	3M	65W	LGA1151	Y	Intel® AVX2
Intel® Core™ i3-6100TE processor	2C/4T	2.7 GHz	2.7 GHz	4M	35W	LGA1151	Y	Intel® AVX2
Intel® Pentium® G4400 processor	2C/2T	3.3 GHz	3.3 GHz	3M	65W	LGA1151	Y	SSE4.1, SSE4.2
Intel® Pentium® G4400TE processor	2C/2T	2.4 GHz	2.4 GHz	3M	35W	LGA1151	Y	SSE4.1, SSE4.2
Intel® Celeron® G3900 processor	2C/2T	2.8 GHz	2.8 GHz	2M	65W	LGA1151	Y	SSE4.1, SSE4.2
Intel® Celeron® G3900TE processor	2C/2T	2.3 GHz	2.3 GHz	2M	35W	LGA1151	Y	SSE4.1, SSE4.2

PROCESSOR NUMBER	INTEL® TURBO BOOST TECH 2.0	INTEL® HYPER-THREADING TECH	INTEL® VPRO™ TECHNOLOGY			ERROR-CORRECTING CODE
			INTEL® VIRTUALIZATION TECH	INTEL® ACTIVE MANAGEMENT TECH 9.0	INTEL® TRUSTED EXECUTION TECH	
Intel® Core™ i7-6700/i7-6700TE	Yes	Yes	Yes	Yes	Yes	No
Intel® Core™ i5-6500/i5-6500TE	Yes	No	Yes	Yes	Yes	No
Intel® Core™ i3-6100/i3-6100TE	No	Yes	Yes	No	No	Yes
Intel® Pentium® G4400, G4400TE	No	No	Yes	No	No	Yes
Intel® Celeron® G3900, G3900TE	No	No	Yes	No	No	Yes

INTEL® CHIPSETS FOR INTERNET OF THINGS SOLUTIONS

PRODUCT	PRODUCT CODE	PACKAGE	FEATURES
Intel® Q170 Chipset	GL82Q170 PCH	FC-BGA13	Up to six SATA ports (6 Gbps); 14 total USB ports (up to 10 USB 3.0); up to 20 PCI Express* x1 gen 3.0 ports; 1x16, 2x8 or 1x8+2x4 PCI Express graphics support; memory channels/DIMM per channel = 2/2; support Intel® vPro™ technology
Intel® H110 Chipset	GL82H110 PCH	FC-BGA13	Up to four SATA ports (6 Gbps); 10 total USB ports (up to 4 USB 3.0); up to six PCI Express* x1 gen 2.0 ports; 1 x 16 PCI Express graphics support; memory channels/DIMM per channel = 2/1

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1. Measured by Intel on systems with Intel® Xeon® Processor E3-1268L v5 and Intel® Xeon® Processor E3-1268L v3 using 3DMark11*.
2. Measured by Intel on systems with Intel® Xeon® Processor E3-1268L v5 and Intel® Xeon® Processor E3-1268L v3 using SPECfp2006 (1-copy).
3. Based on industry-standard cooling solutions. Actual TDP may vary.
4. 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.
5. 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.
6. Intel® Advanced Vector Extensions (Intel® AVX) are designed to achieve higher throughput to certain integer and floating point operations. Due to varying processor power characteristics, utilizing AVX instructions may cause, a) some parts to operate at less than the rated frequency and, b) some parts with Intel® Turbo Boost Technology 2.0 to not achieve any or maximum turbo frequencies. Performance varies depending on hardware, software, and system configuration and you should consult your system manufacturer for more information. Intel® Advanced Vector Extensions refers to Intel® AVX, Intel® AVX2 or Intel® AVX-512. For more information on Intel® Turbo Boost Technology 2.0, visit http://www.intel.com/go/turbo.
7. Intel technologies' features and benefits depend on system configuration and may require enabled hardware, software or service activation. Performance varies depending on system configuration. Check with your system manufacturer or retailer or learn more at www.intel.com.
8. Actual number of ports available may vary by processor number and system configuration. Please refer to the specifications corresponding to the processor number of interest or consult your system vendor for more information.
9. 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.
10. On eDP/DP at 24bpp and 60Hz.
11. Intel® AES-NI requires a computer system with an AES-NI-enabled processor, as well as non-Intel software to execute the instructions in the correct sequence. AES-NI is available on select Intel® processors. For availability, consult your reseller or system manufacturer. For more information, see http://software.intel.com/en-us/articles/intel-advanced-encryption-standard-instructions-aes-ni/.
12. No computer system can be absolutely secure. Intel technologies may require enabled hardware, specific software, or services activation. Check with your system manufacturer or retailer.
13. Actual number of ports available may vary by processor number and system configuration. Please refer to the specifications corresponding to the processor number of interest or consult your system vendor for more information.
14. No computer system can provide absolute security under all conditions. Intel® Trusted Execution Technology (Intel® TXT) requires a computer with Intel® Virtualization Technology, and Intel TXT-enabled processor, chipset, BIOS, Authenticated Code Modules and an Intel TXT-compatible measured-launched environment (MLE). Intel TXT also requires the system to contain a TPM v1.s. For more information, visit http://www.intel.com/technology/security.
15. 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.