

# Ivy Bridge (microarchitecture)

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**Ivy Bridge** is the codename for a "third generation" line of processors based on the 22 nm manufacturing process developed by Intel. The name is also applied more broadly to the 22 nm die shrink of the Sandy Bridge microarchitecture based on FinFET ("3D") tri-gate transistors, which is also used in the Xeon and Core i7 *Ivy Bridge-EX* (Ivytown), *Ivy Bridge-EP* and *Ivy Bridge-E* microprocessors released in 2013.

Ivy Bridge processors are backwards compatible with the Sandy Bridge platform, but such systems might require a firmware update (vendor specific).<sup>[2]</sup> In 2011, Intel released the 7-series Panther Point chipsets with integrated USB 3.0 to complement Ivy Bridge.<sup>[3]</sup>

Volume production of Ivy Bridge chips began in the third quarter of 2011.<sup>[4]</sup> Quad-core and dual-core-mobile models launched on 29 April 2012 and 31 May 2012 respectively.<sup>[5]</sup> Core i3 desktop processors, as well as the first 22 nm Pentium, were announced and available the first week of September, 2012.<sup>[6]</sup>

## Contents

- 1 Overview
- 2 Ivy Bridge features and performance
  - 2.1 Benchmark comparisons
  - 2.2 Thermal performance and heat issues when overclocking
  - 2.3 Models and steppings
- 3 Ivy Bridge-E/EN/EP/EX features
  - 3.1 Models and steppings
- 4 List of Ivy Bridge processors
  - 4.1 Desktop processors
  - 4.2 Server processors
  - 4.3 Mobile processors
- 5 Roadmap
- 6 See also
- 7 Notes
- 8 References
- 9 External links

## Overview

The Ivy Bridge CPU microarchitecture is a shrink from Sandy Bridge and remains largely unchanged. Like its predecessor, Sandy Bridge, Ivy Bridge was also primarily developed by Intel's Israel branch, located in Haifa, Israel.<sup>[7]</sup> Notable improvements include:<sup>[8][9]</sup>

- 22 nm Tri-gate transistor ("3-D") technology (up to 50% less power consumption at the same performance level as 2-D planar transistors).<sup>[10]</sup>
- A new random number generator and the RdRand instruction,<sup>[11]</sup> codenamed Bull Mountain.<sup>[12]</sup>

## Ivy Bridge features and performance

The mobile and desktop Ivy Bridge chips also include significant changes over Sandy Bridge:

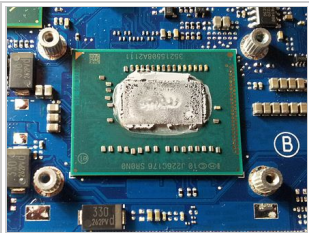
- F16C<sup>[13]</sup> (16-bit Floating-point conversion instructions).
- RdRand instruction (Intel Secure Key).<sup>[14]</sup>
- PCI Express 3.0 support (not on Core i3 and ULV processors).<sup>[15]</sup>
- Max CPU multiplier of 63 (57 for Sandy Bridge).<sup>[16]</sup>
- RAM support up to 2800 MT/s in 200 MHz increments.<sup>[16]</sup>
- The built-in GPU has 6 or 16 execution units (EUs), compared to Sandy Bridge's 6 or 12.<sup>[17]</sup>
- Intel HD Graphics with DirectX 11, OpenGL 3.1, and OpenCL 1.1 support. OpenGL 4.0 is supported with 10.18.10.4425 WHQL drivers<sup>[18][19]</sup> and later drivers.
- DDR3L and configurable TDP (cTDP) for mobile processors.<sup>[20]</sup>
- Multiple 4K video playback.
- Intel Quick Sync Video version 2.<sup>[17]</sup>
- Up to three displays are supported (with some limitations: with chipset of 7-series and using two of them with DisplayPort or eDP).<sup>[21]</sup>
- A 14- to 19-stage instruction pipeline, depending on the micro-operation cache hit or miss.<sup>[22]</sup>

### Ivy Bridge



Intel's internally used Ivy Bridge logo<sup>[1]</sup>

<b>CPUID code</b>	0306A9h
<b>Product code</b>	80637 (desktop)
<b>L1 cache</b>	64 KB per core
<b>L2 cache</b>	256 KB per core
<b>L3 cache</b>	2 MB to 8 MB shared
<b>Model</b>	Pentium G Series
<b>Created</b>	29 April 2012
<b>Transistors</b>	2,104 M 22 nm (Tri-Gate)
<b>Architecture</b>	Sandy Bridge x86
<b>Instructions</b>	MMX, AES-NI, CLMUL
<b>Extensions</b>	x86-64, Intel 64 SSE, SSE2, SSE3, SSSE3, SSE4, SSE4.1, SSE4.2 AVX, TXT, VT-x, VT-d, F16C
<b>Socket(s)</b>	LGA 1155 LGA 2011 LGA 2011-1 LGA 1356 Socket G2 BGA-1023 BGA-1224 BGA-1284
<b>Predecessor</b>	Sandy Bridge (Tock)
<b>Successor</b>	Haswell (Tock/Architecture)
<b>GPU</b>	HD Graphics 2500 650 MHz to 1150 MHz HD Graphics 4000 350 MHz to 1300 MHz HD Graphics P4000 650 MHz to 1250 MHz



Ivy Bridge processor

Translation lookaside buffer sizes<sup>[23][24]</sup>

Cache		Page Size		
Name	Level	4 KB	2 MB	1 GB
DTLB	1st	64	32	4
ITLB	1st	128	8 / logical core	none
STLB	2nd	512	none	none

Benchmark comparisons

Compared to its predecessor, Sandy Bridge:

- 3% to 6% increase in CPU performance when compared clock for clock<sup>[25][26]</sup>
- 25% to 68% increase in integrated GPU performance.<sup>[27]</sup>

Thermal performance and heat issues when overclocking

Ivy Bridge's temperatures are reportedly 10 °C higher compared to Sandy Bridge when a CPU is overclocked, even at default voltage setting.<sup>[28]</sup> Impress PC Watch, a Japanese website, performed experiments that confirmed earlier speculations that this is because Intel used a poor quality (and perhaps lower cost) thermal interface material (thermal paste, or "TIM") between the chip and the heat spreader, instead of the fluxless solder of previous generations.<sup>[29][30][31]</sup> The mobile Ivy Bridge processors are not affected by this issue because they do not use a heat spreader between the chip and cooling system.

Enthusiast reports describe the TIM used by Intel as low-quality,<sup>[31]</sup> and not up to par for a "premium" CPU, with some speculation that this is by design to encourage sales of prior processors.<sup>[29]</sup> Further analyses caution that the processor can be damaged or void its warranty if home users attempt to remedy the matter.<sup>[29][32]</sup> The TIM has much lower thermal conductivity, causing heat to trap on the die.<sup>[28]</sup> Experiments with replacing this TIM with a higher-quality one or other heat removal methods showed a substantial temperature drop, and improvements to the increased voltages and overclocking sustainable by Ivy Bridge chips.<sup>[29][33]</sup>

Intel claims that the smaller die of Ivy Bridge and the related increase in thermal density is expected to result in higher temperatures when the CPU is overclocked; Intel also stated that this is as expected and will likely not improve in future revisions.<sup>[34]</sup>

Models and steppings

All Ivy Bridge processors with one, two, or four cores report the same CPUID model 0x000306A9, and are built in four different configurations differing in the number of cores, L3 cache and GPU execution units.

Die Code Name	CPUID	Stepping	Die Size	Die Dimensions	Transistors	Cores	GPU EUs	L3 Cache	Sockets
Ivy Bridge-M-2	0x000306A9	P0	94 mm <sup>2</sup> <sup>[35]</sup>	7.656 x 12.223 mm	~634 million <sup>[a]</sup>	2	6 <sup>[36]</sup>	3 MB <sup>[37]</sup>	LGA 1155,
Ivy Bridge-H-2		L1	118 mm <sup>2</sup> <sup>[35]</sup>	8.141 x 14.505 mm	~830 million <sup>[a]</sup>	2	16	4 MB	Socket G2,
Ivy Bridge-HE-4		E1	160 mm <sup>2</sup> <sup>[35]</sup>	8.141 x 19.361 mm	1.4 billion <sup>[38]</sup>	4	16	8 MB	BGA-1224,
Ivy Bridge-HM-4		N0	133 mm <sup>2</sup> <sup>[35]</sup>	7.656 x 17.349 mm	~1.008 billion <sup>[a]</sup>	4	6	6 MB <sup>[37]</sup>	BGA-1023, BGA-1284

Ivy Bridge-E/EN/EP/EX features

Ivy Bridge-E family is the follow-up to Sandy Bridge-E, using the same CPU core as the Ivy Bridge processor, but in LGA 2011, LGA 1356 and LGA 2011-1<sup>[39]</sup> packages for workstations and servers.

- Dual memory controllers for Ivy Bridge-EP and Ivy Bridge-EX<sup>[40]</sup>
- Up to 12 CPU cores and 30 MB of L3 cache for Ivy Bridge-EP<sup>[40]</sup>
- Up to 15 CPU cores and 37.5 MB L3 cache for Ivy Bridge-EX<sup>[41]</sup> (released on 18 February 2014 as Xeon E7 v2<sup>[42]</sup>)
- Thermal design power between 50 W and 155 W<sup>[43]</sup>
- Support for up to eight DIMMs of DDR3-1866 memory per socket, with reductions in memory speed depending on the number of DIMMs per channel<sup>[44][45][46]</sup>
- No integrated GPU
- Ivy Bridge-EP introduced new hardware support for interrupt virtualization, branded as APICv.<sup>[47][48]</sup>

Models and steppings

The Ivy Bridge-E family is made in three different versions, by number of cores, and for three market segments: the basic Ivy Bridge-E is a single-socket processor sold as Core i7-49xx and is only available in the six-core S1 stepping, with some versions limited to four active cores.

Ivy Bridge-E	
<b>CPUID code</b>	0306Exh
<b>Product code</b>	80633
<b>L1 cache</b>	32 KB per core
<b>L2 cache</b>	256 KB per core
<b>L3 cache</b>	15 MB shared
<b>Model</b>	Core i7-49xx Series
<b>Created</b>	10 September 2013
<b>Transistors</b>	1.86B 22 nm (S1)
<b>Architecture</b>	Sandy Bridge x86
<b>Instructions</b>	MMX, AES-NI, CLMUL
<b>Extensions</b>	x86-64, Intel 64 SSE, SSE2, SSE3, SSSE3, SSE4, SSE4.1, SSE4.2 AVX, TXT, VT-x, VT-d

Ivy Bridge-EN (Xeon E5-14xx v2 and Xeon E5-24xx v2) is the model for single- and dual-socket servers using LGA 1356 with up to 10 cores, while Ivy Bridge-EP (Xeon E5-16xx v2, Xeon E5-26xx v2 and Xeon E5-46xx v2) scales up to four LGA 2011 sockets and up to 12 cores per chip.

There are in fact three die "flavors" for the Ivy Bridge-EP, meaning that they are manufactured and organized differently, according to the number of cores an Ivy Bridge-EP CPU includes:<sup>[49]</sup>

- The largest is an up-to-12-core die organized as three four-core columns with up to 30 MB L3 cache in two banks between the cores; these cores are linked by three rings of interconnects.
- The intermediate is an up-to-10-core die organized as two five-core columns with up to 25 MB L3 cache in a single bank between the cores; the cores are linked by two rings of interconnects.
- The smallest is an up-to-six-core die organized as two three-core columns with up to 15 MB L3 cache in a single bank between the cores; the cores are linked by two rings of interconnects.

Ivy Bridge-EX has up to 15 cores and scales to 8 sockets. The 15-core die is organized into three columns of five cores, with three interconnect rings connecting two columns per ring; each five-core column has a separate L3 cache.<sup>[50]</sup> The processor is supposed to have a new "Run Sure" technology, speculated by the odd number of cores to involve keeping one in reserve.<sup>[51]</sup>

Die Code Name	CPUID	Stepping	Die size	Transistors	Cores	L3 Cache	Socket
Ivy Bridge-E-6	0x0306Ex	S1	256.5 mm²	1.86 billion	6	15 MB	LGA 2011
Ivy Bridge-EN-6							LGA 1356
Ivy Bridge-EP-6							LGA 2011
Ivy Bridge-EX-6		D1					LGA 2011-1
Ivy Bridge-EN-10		M1	341 mm²	2.89 billion	10	25 MB	LGA 1356
Ivy Bridge-EP-10							LGA 2011
Ivy Bridge-EX-10		D1					LGA 2011-1
Ivy Bridge-EP-12		C1	541 mm²	4.31 billion	12	30 MB	LGA 2011
Ivy Bridge-EX-15		D1			15	37.5 MB	LGA 2011-1

Code Name	Brand Name (list)	Cores	L3 Cache	Socket	TDP	I/O Bus
Ivy Bridge-E	Core i7-48xx	4	10 MB	1×LGA 2011	130 W	DMI
	Core i7-49xx	6	12–15 MB	1×LGA 2011	130 W	DMI
Ivy Bridge-EN	Xeon E5-14xx v2	4–6	10–15 MB	1×LGA 1356	60–80 W	DMI
	Xeon E5-24xx v2	4–10	10–25 MB	2×LGA 1356	50–95 W	DMI+QPI
	Pentium 14xx v2	2	6 MB	1×LGA 1356	40–80 W	DMI
Ivy Bridge-EP	Xeon E5-16xx v2	4–6	10–15 MB	1×LGA 2011	130 W	DMI
	Xeon E5-26xx v2	4–12	10–30 MB	2×LGA 2011	80–150 W	DMI+2×QPI
	Xeon E5-26xxL v2	6–10	15–25 MB	2×LGA 2011	50–70 W	DMI+2×QPI
	Xeon E5-46xx v2	4–12	10–30 MB	4×LGA 2011	70–130 W	DMI+2×QPI
Ivy Bridge-EX	Xeon E7-28xx v2	12-15	24–37.5 MB	2×LGA 2011-1	105–155 W	DMI+3×QPI
	Xeon E7-48xx v2	6-15	12–37.5 MB	4×LGA 2011-1	105–155 W	DMI+3×QPI
	Xeon E7-88xx v2	6-15	24–37.5 MB	8×LGA 2011-1	105–155 W	DMI+3×QPI

Socket(s)	LGA 2011
Predecessor	Sandy Bridge-E
Successor	Haswell-E

Ivy Bridge-EN

CPUID code	0306Exh
Product code	80634
L1 cache	32 KB per core
L2 cache	256 KB per core
L3 cache	10 MB to 25 MB shared
Model	Xeon E5-x4xx v2 Series
Created	10 September 2013
Transistors	1.86B 22 nm (S1)
Architecture	Sandy Bridge x86
Instructions	MMX, AES-NI, CLMUL
Extensions	x86-64, Intel 64 SSE, SSE2, SSE3, SSSE3, SSE4, SSE4.1, SSE4.2 AVX, TXT, VT-x, VT-d
Socket(s)	LGA 1356
Predecessor	Sandy Bridge-EN
Successor	Haswell-EN

Ivy Bridge-EP

CPUID code	0306Exh
Product code	80635
L1 cache	32 KB per core
L2 cache	256 KB per core
L3 cache	10 MB to 30 MB shared
Model	Xeon E5-x6xx v2 Series
Created	September 10, 2013
Transistors	1.86B 22 nm (S1)
Architecture	Sandy Bridge x86
Instructions	MMX, AES-NI, CLMUL
Extensions	x86-64, Intel 64 SSE, SSE2, SSE3, SSSE3, SSE4, SSE4.1, SSE4.2 AVX, TXT, VT-x, VT-d
Socket(s)	LGA 2011
Predecessor	Sandy Bridge-EP
Successor	Haswell-EP

Ivy Bridge-EX

CPUID code	0306Exh
Product code	80636
L1 cache	32 KB per core
L2 cache	256 KB per core
L3 cache	12 MB to 37.5 MB shared
Model	Xeon E7-x8xx v2 Series
Created	Q1, 2014

<b>Transistors</b>	4.3B 22 nm (S1)
<b>Architecture</b>	Sandy Bridge x86
<b>Instructions</b>	MMX, AES-NI, CLMUL
<b>Extensions</b>	x86-64, Intel 64 SSE, SSE2, SSE3, SSSE3, SSE4, SSE4.1, SSE4.2 AVX, TXT, VT-x, VT-d
<b>Socket(s)</b>	LGA 2011-1 <sup>[39]</sup>
<b>Predecessor</b>	Westmere-EX
<b>Successor</b>	Haswell-EX

List of Ivy Bridge processors

Processors featuring Intel's HD 4000 graphics (or HD P4000 for Xeon) are set in **bold**. Other processors feature HD 2500 graphics unless indicated by N/A.

Desktop processors

List of announced desktop processors, as follows:

Target segment	Cores (Threads)	Processor Branding & Model		CPU Clock rate		Graphics Clock rate		L3 Cache	TDP	Release Date	Release price (USD)	Motherboard					
				Normal	Turbo	Normal	Turbo					Socket	Interface	Memory			
Extreme / High-End	6 (12)	Core i7 Extreme	4960X ( <a href="http://ark.intel.com/products/77779">http://ark.intel.com/products/77779</a> )	3.6 GHz	4.0 GHz	N/A		15 MB	130 W	10 September 2013	\$999 <sup>[52]</sup>	LGA 2011		Up to quad channel DDR3-1866			
			4930K ( <a href="http://ark.intel.com/products/77780">http://ark.intel.com/products/77780</a> )	3.4 GHz	12 MB			\$583 <sup>[52]</sup>									
		4820K ( <a href="http://ark.intel.com/products/77781">http://ark.intel.com/products/77781</a> )	3.7 GHz	10 MB	\$323 <sup>[52]</sup>												
Performance	4 (8)	Core i7	3770K ( <a href="http://ark.intel.com/products/65523">http://ark.intel.com/products/65523</a> )	3.5 GHz	3.9 GHz			8 MB	77 W	23 April 2012	\$332						
				3770 ( <a href="http://ark.intel.com/products/65719">http://ark.intel.com/products/65719</a> )					3.4 GHz		65 W				\$294		
				3770S ( <a href="http://ark.intel.com/products/65524">http://ark.intel.com/products/65524</a> )					3.1 GHz								
				3770T ( <a href="http://ark.intel.com/products/65525">http://ark.intel.com/products/65525</a> )	2.5 GHz			3.7 GHz	45 W								
				3770X ( <a href="http://ark.intel.com/products/65526">http://ark.intel.com/products/65526</a> )	3.5 GHz			3.9 GHz	65 W								

4 (4)	Core i5	3570K ( <a href="http://ark.intel.com/products/65520">http://ark.intel.com/products/65520</a> )	3.4 GHz	3.8 GHz	650 MHz	1150 MHz	6 MB	77 W	31 May 2012 <sup>[54]</sup>	\$225	DMI 2.0 PCIe 3.0 <sup>[a]</sup>
		3570 ( <a href="http://ark.intel.com/products/65702">http://ark.intel.com/products/65702</a> )									
		3570S ( <a href="http://ark.intel.com/products/65701">http://ark.intel.com/products/65701</a> )	3.1 GHz					65 W			
		3570T ( <a href="http://ark.intel.com/products/65521">http://ark.intel.com/products/65521</a> )	2.3 GHz	3.3 GHz				45 W	\$205		
		3550 ( <a href="http://ark.intel.com/products/65516">http://ark.intel.com/products/65516</a> )	3.3 GHz	3.7 GHz				77 W	23 April 2012		
		3550S ( <a href="http://ark.intel.com/products/65518">http://ark.intel.com/products/65518</a> )	3.0 GHz								
		3475S ( <a href="http://ark.intel.com/products/65515">http://ark.intel.com/products/65515</a> )	2.9 GHz	3.6 GHz				65 W		\$201	
		3470 ( <a href="http://ark.intel.com/products/68316">http://ark.intel.com/products/68316</a> )	3.2 GHz					77 W	31 May 2012 <sup>[54]</sup>		
		3470S ( <a href="http://ark.intel.com/products/68315">http://ark.intel.com/products/68315</a> )	2.9 GHz					65 W			
		3470T ( <a href="http://ark.intel.com/products/65703">http://ark.intel.com/products/65703</a> )						35 W	\$184		
		3450 ( <a href="http://ark.intel.com/products/65511">http://ark.intel.com/products/65511</a> )	3.1 GHz	3.5 GHz				77 W	23 April 2012		
		3450S ( <a href="http://ark.intel.com/products/65512">http://ark.intel.com/products/65512</a> )	2.8 GHz					65 W			
2 (4)		3350P ( <a href="http://ark.intel.com/products/69114">http://ark.intel.com/products/69114</a> )	3.1 GHz	3.3 GHz	N/A	6 MB	69 W	3 September 2012	\$177	Up to dual channel DDR3-	
4 (4)		3340 ( <a href="http://ark.intel.com/">http://ark.intel.com/</a> )					77 W				

Mainstream			products /76342)	2.8 GHz	3.2 GHz				1 September 2013	\$182			1600 <sup>[53]</sup>							
			3340S (http://ark.intel.com/products/76343)																	
			<b>3335S</b>											2.7 GHz						
			3330S (http://ark.intel.com/products/65510)																	
			3330 (http://ark.intel.com/products/65509)												3.0 GHz					
	2 (4)	Core i3	3250 (http://ark.intel.com/products/74744)	3.5 GHz			55 W	9 June 2013		\$138		LGA 1155								
			<b>3245</b> (http://ark.intel.com/products/74746)	3.4 GHz									\$134							
			3240 (http://ark.intel.com/products/65690)																	
			<b>3225</b> (http://ark.intel.com/products/65692)											3.3 GHz	\$134					
			3220 (http://ark.intel.com/products/65693)																	
			3210 (http://ark.intel.com/products/71053)	3.2 GHz																
			3250T (http://ark.intel.com/products/74745)	3.0 GHz	35 W								9 June 2013		\$138					
			3240T (http://ark.intel.com/products/66168)	2.9 GHz																
			3220T (http://ark.intel.com/products/65694)	2.8 GHz																
																G2140 (http://ark.intel.com/products/74744)	3.3 GHz		9 June 2013	

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2 (2)	Celeron	http://ark.intel.com/products/71072)	2.6 GHz	2 MB	35 W	1 September 2013	\$42						
		G1620T (http://ark.intel.com/products/76345)	2.4 GHz										
		G1610T (http://ark.intel.com/products/71074)	2.3 GHz										

- a. Requires a compatible motherboard.

Suffixes to denote:

- K – Unlocked (adjustable CPU multiplier up to 63 bins)
- S – Performance-optimized lifestyle (low power with 65 W TDP)
- T – Power-optimized lifestyle (ultra low power with 35–45 W TDP)
- P – No on-die video chipset
- X – Extreme performance (adjustable CPU ratio with no ratio limit)

## Server processors

Additional high-end server processors based on the Ivy Bridge architecture, code named Ivytown, were announced September 10, 2013 at the Intel Developer Forum, after the usual one year interval between consumer and server product releases.<sup>[55][56][57]</sup>

The Ivy Bridge-EP processor line announced in September 2013 has up to 12 cores and 30 MB third level cache, with rumors of Ivy Bridge-EX up to 15 cores and an increased third level cache of up to 37.5 MB,<sup>[58][59]</sup> although an early leaked lineup of Ivy Bridge-E included processors with a maximum of 6 cores.<sup>[60]</sup>

Both Core-i7 and Xeon versions are produced: the Xeon versions marketed as **Xeon E5-1400 V2** act as drop-in replacements for the existing Sandy Bridge-EN based Xeon E5, **Xeon E5-2600 V2** versions act as drop-in replacements for the existing Sandy Bridge-EP based Xeon E5, while Core-i7 versions designated i7-4820K, i7-4930K and i7-4960X were released on 10 September 2013, remaining compatible with the X79 and LGA 2011 hardware.<sup>[59][61]</sup>

For the intermediate LGA 1356 socket, Intel launched the **Xeon E5-2400 V2** (codenamed Ivy Bridge-EN) series in January 2014.<sup>[62]</sup> These have up to 10 cores.<sup>[63]</sup>

A new Ivy Bridge-EX line marketed as **Xeon E7 V2** had no corresponding predecessor using the Sandy Bridge microarchitecture but instead followed the older Westmere-EX processors.

Target Segment	Cores (Threads)	Processor Branding & Model		CPU Clock rate		Graphics Clock rate		L3 Cache	TDP	Release Date	Price (USD)	Motherboard		
				Normal	Turbo	Normal	Turbo					Socket	Interface	Memory
	6 (12)		8893v2 ( http://ark.intel.com/products/75260)	3.4 GHz	3.7 GHz			155 W			\$6841			
	10 (20)		8891v2 ( http://ark.intel.com/products/75259)	3.2 GHz										
			8895v2 ( http://ark.intel.com/products/79209)	2.8 GHz	3.6 GHz						OEM (Oracle) <sup>[64]</sup>			
			8890v2 ( http://ark.intel.com/products/75258)								\$6841			
			4890v2 ( http://ark.											



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	10 (20)	4830v2 ( http://ark. intel.com /products /75247)	2.2 GHz	2.7 GHz	20 MB			\$2059			
	8 (16)	4820v2 ( http://ark. intel.com /products /75246)	2.0 GHz	2.5 GHz	16 MB			\$1446			
	6 (12)	4809v2 ( http://ark. intel.com /products /75245)	1.9 GHz	N/A	12 MB			\$1223			Up to quad channel DDR3- 1333
	12 (24)	4657Lv2 ( http://ar k.intel.co m/produ cts/75290)	2.4 GHz	3.2 GHz	30 MB	115 W		\$4394			
		4650v2 ( http://ark. intel.com /products /75289)			25 MB			\$3616			
	10 (20)	4640v2 ( http://ark. intel.com /products /75288)	2.2 GHz	2.7 GHz	20 MB	95 W		\$2725			Up to quad channel DDR3- 1866
		4624Lv2 ( http://ar k.intel.co m/produ cts/76350)	1.9 GHz	2.5 GHz	25 MB	70 W		\$2405			
	8 (8)	4627v2 ( http://ark. intel.com /products /75287)	3.3 GHz	3.6 GHz	16 MB	130 W	3 March 2014	\$2108			
		4620v2 ( http://ark. intel.com /products /75286)	2.6 GHz	3.0 GHz	20 MB			\$1611			Up to quad channel DDR3- 1600
	8 (16)	4610v2 ( http://ark. intel.com /products /75285)	2.3 GHz	2.7 GHz	16 MB			\$1219			
		4607v2 ( http://ark. intel.com /products /75794)	2.6 GHz		15 MB	95 W		\$885			
	6 (12)	4603v2 ( http://ark. intel.com /products /75793)	2.2 GHz		10 MB			\$551			Up to quad channel DDR3- 1333
	4 (8)										
		2697v2 ( http://ark. intel.com /products /75283)	2.7 GHz	3.5 GHz		130 W		\$2614			
		2696v2	2.5 GHz	3.3 GHz		120 W	10 September 2013	OEM			
	12 (24)	2695v2 ( http://ark.			30 MB						

[https://en.wikipedia.org/w/index.php?title=Ivy\\_Bridge\\_\(microarchitecture\)&printable=yes](https://en.wikipedia.org/w/index.php?title=Ivy_Bridge_(microarchitecture)&printable=yes) Page 11 of 19

	6 (12)	Xeon E5	intel.com /products /75268)	3.5 GHz	3.8 GHz	25 MB	130 W		\$1552			channel DDR3-1866
			2630v2 (http://ark.intel.com /products /75790)	2.6 GHz	3.1 GHz	15 MB	80 W		\$612			Up to quad channel DDR3-1600
			2630Lv2 (http://ark.intel.com /products /75791)	2.4 GHz	2.8 GHz		60 W					
			2620v2 (http://ark.intel.com /products /75789)	2.1 GHz	2.6 GHz		80 W		\$406			
			2618Lv2 (http://ark.intel.com /products /75788)	2.0 GHz	N/A		50 W		\$520			Up to quad channel DDR3-1333
	4 (8)		2637v2 (http://ark.intel.com /products /75792)	3.5 GHz	3.8 GHz		130 W		\$996			Up to quad channel DDR3-1866
	4 (4)		2609v2 (http://ark.intel.com /products /75787)	2.5 GHz	N/A	10 MB	80 W		\$294			Up to quad channel DDR3-1333
			2603v2 (http://ark.intel.com /products /76157)	1.8 GHz					\$202			
	10 (20)		2470v2 (http://ark.intel.com /products /75266)	2.4 GHz	3.2 GHz	25 MB	95 W		\$1440			Up to triple channel DDR3-1600
			2448Lv2 (http://ark.intel.com /products /75973)	1.8 GHz	2.4 GHz		70 W		\$1424			
			2450Lv2 (http://ark.intel.com /products /75265)	1.7 GHz	2.1 GHz		60 W		\$1219			
	8 (16)		2450v2 (http://ark.intel.com /products /75264)	2.5 GHz	3.3 GHz	20 MB	95 W		\$1107			
			2440v2 (http://ark.intel.com /products /75263)	1.9 GHz	2.4 GHz				\$832			
			2428v2 (http://ark.intel.com /products /75974)	1.8 GHz	2.3 GHz		60 W		\$1013			
								9 January		LGA	1× QPI DMI 2.0	

	6 (12)	2430v2 ( http://ark. intel.com /products /75785)	2.5 GHz	3.0 GHz	15 MB	80 W	2014	\$551	1356	PCIe 3.0	Up to triple channel DDR3- 1333				
		2420v2 ( http://ark. intel.com /products /75784)	2.2 GHz	2.7 GHz				\$406							
		2430Lv2 (http://ar k.intel.co m/produc ts/75786)	2.4 GHz	2.8 GHz				\$612							
		2418Lv2 (http://ar k.intel.co m/produc ts/75783)	2.0 GHz	N/A				\$607							
	4 (4)	2407v2 ( http://ark. intel.com /products /75782)	2.4 GHz		\$250										
		2403v2 ( http://ark. intel.com /products /75975)	1.8 GHz	\$192											
	8 (16)	1680v2 ( http://ark. intel.com /products /77912)	3.0 GHz	3.9 GHz	25 MB		10 September 2013	\$1723	LGA 2011	0x QPI DMI 2.0 PCIe 3.0	Up to quad channel DDR3- 1866				
	6 (12)	1660v2 ( http://ark. intel.com /products /75781)	3.7 GHz	4.0 GHz				15 MB				\$1080			
		1650v2 ( http://ark. intel.com /products /75780)	3.5 GHz	3.9 GHz	12 MB			\$583							
		1620v2 ( http://ark. intel.com /products /75779)	3.7 GHz		10 MB			\$294							
	4 (8)	1607v2 ( http://ark. intel.com /products /77785)	3.0 GHz	N/A				\$244				Up to quad channel DDR3- 1600			
	6 (12)	1428Lv2 (http://ar k.intel.co m/produc ts/75778)	2.2 GHz	2.7 GHz	15 MB			60 W			\$494		LGA 1356	Up to triple channel DDR3- 1600	
		4 (8)	1410v2 ( http://ark. intel.com /products /75777)	2.8 GHz	3.2 GHz			10 MB			80 W				9 January 2014
			1403v2 ( http://ark. intel.com /products	2.6 GHz											

1P Server	2 (2)	Pentium	/77919)		N/A			6 MB							
			1405v2 ( http://ark. intel.com /products /77918)	1.4 GHz					40 W		\$156				
	4 (8)	Xeon E3	1290v2 ( http://ark. intel.com /products /65722)	3.7 GHz	4.1 GHz			8 MB	87 W		\$885		DMI 2.0 PCIe 3.0 <sup>[a]</sup>	Up to dual channel DDR3- 1600	
			1280v2 ( http://ark. intel.com /products /65725)	3.6 GHz	4.0 GHz				69 W		\$623				
			1275v2 ( http://ark. intel.com /products /65726)	3.5 GHz	3.9 GHz	650 MHz	1.25 GHz		77 W		\$350				
			1270v2 ( http://ark. intel.com /products /65727)			N/A			69 W		\$339				
			1265Lv2 (http://ar k.intel.co m/produc ts/65728)	2.5 GHz	3.5 GHz	650 MHz	1.15 GHz		45 W		\$305				
			1245v2 ( http://ark. intel.com /products /65729)	3.4 GHz	3.8 GHz	650 MHz	1.25 GHz		77 W	14 May 2012	\$273	LGA 1155			
			1240v2 ( http://ark. intel.com /products /65730)			N/A			69 W		\$261				
			1230v2 ( http://ark. intel.com /products /65732)	3.3 GHz	3.7 GHz						\$230				
			1225v2 ( http://ark. intel.com /products /65733)	3.2 GHz	3.6 GHz	650 MHz	1.25 GHz		77 W		\$224				
			1220v2 ( http://ark. intel.com /products /65734)	3.1 GHz	3.5 GHz				69 W		\$203				
			1220Lv2 (http://ar k.intel.co m/produc ts/65735)	2.3 GHz					3 MB	17 W		\$189			
			1135Cv2 (http://ar k.intel.co m/produc ts/78519)	3.0 GHz	N/A			55 W		OEM					
			1125Cv2						10						

4 (8)	(http://ark.intel.com/products/78168)	2.5 GHz	N/A	8 MB	40 W	September 2013	\$448	BGA 1284		
		1105Cv2 (http://ark.intel.com/products/78167)			25 W		\$320			

a. Requires a compatible motherboard.

Mobile processors

Target segment	Cores (Threads)	Processor Branding & Model		Programmable TDP				CPU Turbo	Graphics Clock rate		L3 Cache	Release Date	Price (USD)	
				SDP <sup>[65]</sup>	cTDP down	Nominal TDP	cTDP up	1-core	Normal	Turbo				
Performance	4 (8)	Core i7	3940XM ( <a href="http://ark.intel.com/products/71096">http://ark.intel.com/products/71096</a> )	N/A	45 W / ? GHz	55 W / 3.0 GHz	65 W / ? GHz	3.9 GHz	650 MHz	1350 MHz	8 MB	30 September 2012	\$1096	
			3920XM ( <a href="http://ark.intel.com/products/64887">http://ark.intel.com/products/64887</a> )		45 W / ? GHz	55 W / 2.9 GHz	65 W / ? GHz	3.8 GHz		1300 MHz		23 April 2012		
			3840QM ( <a href="http://ark.intel.com/products/70846">http://ark.intel.com/products/70846</a> )			45 W / 2.8 GHz						1250 MHz	30 September 2012	\$568
			3820QM ( <a href="http://ark.intel.com/products/64889">http://ark.intel.com/products/64889</a> )			45 W / 2.7 GHz							23 April 2012	
			3740QM ( <a href="http://ark.intel.com/products/70847">http://ark.intel.com/products/70847</a> )					3.7 GHz		1300 MHz	6 MB	30 September 2012	\$378	
			3720QM ( <a href="http://ark.intel.com/products/64891">http://ark.intel.com/products/64891</a> )		45 W / 2.6 GHz	3.6 GHz		1250 MHz		23 April 2012				
			3635QM ( <a href="http://ark.intel.com/products/71460">http://ark.intel.com/products/71460</a> )		N/A	45 W / 2.4 GHz	N/A	3.4 GHz		1200 MHz			N/A	
			3632QM ( <a href="http://ark.intel.com/products/71458">http://ark.intel.com/products/71458</a> )			35 W / 2.2 GHz		3.2 GHz		1150 MHz		30 September 2012	\$378	
			3630QM ( <a href="http://ark.intel.com/products/71459">http://ark.intel.com/products/71459</a> )			45 W / 2.4 GHz		3.4 GHz		1100 MHz				
			3615QM ( <a href="http://ark.intel.com/products/64900">http://ark.intel.com/products/64900</a> )			45 W / 2.3 GHz		3.3 GHz		1200 MHz				
			3612QM ( <a href="http://ark.intel.com/products/64901">http://ark.intel.com/products/64901</a> )			35 W / 2.1 GHz		3.1 GHz		23 April 2012				
			3610QM ( <a href="http://ark.intel.com/products/64899">http://ark.intel.com/products/64899</a> )			45 W / 2.3 GHz		3.3 GHz						
			3689Y ( <a href="http://ark.intel.com/products/72015">http://ark.intel.com/products/72015</a> )	7 W / ? GHz	10 W / ? GHz	13 W / 1.5 GHz		2.6 GHz	350 MHz	850 MHz		7 January 2013	\$362	
			3687U ( <a href="http://ark.intel.com/products/71258">http://ark.intel.com/products/71258</a> )		14 W / ? GHz	17 W / 2.1 GHz	25 W / 3.1 GHz	3.3 GHz		1200 MHz		20 January 2013	\$346	
			3667U ( <a href="http://ark.intel.com/products/64898">http://ark.intel.com/products/64898</a> )		14 W / ? GHz	17 W / 2.0 GHz	25 W / 3.0 GHz	3.2 GHz		1150 MHz		3 June 2012		
			3537U ( <a href="http://ark.intel.com/products/72054">http://ark.intel.com/products/72054</a> )		14 W / ? GHz		25 W / 2.9 GHz	3.1 GHz		1200 MHz		20 January 2013		
							3555LE ( <a href="http://ark.intel.com/products/64899">http://ark.intel.com/products/64899</a> )							

Mainstream	2 (4)	Core i5	<a href="http://ark.intel.com/products/65712">el.com/products/65712)</a>	N/A	N/A	25 W / 2.5 GHz	N/A	3.2 GHz	550 MHz	1000 MHz	4 MB	3 June 2012	\$360	
			<a href="http://ark.intel.com/products/71255">3540M (http://ark.intel.com/products/71255)</a>			35 W / 3.0 GHz		3.7 GHz		1300 MHz		20 January 2013	\$346	
			3525M			35 W / 2.9 GHz		3.6 GHz	650 MHz	1350 MHz		Q3 2012		
			<a href="http://ark.intel.com/products/64893">3520M (http://ark.intel.com/products/64893)</a>							1250 MHz		3 June 2012	\$346	
			<a href="http://ark.intel.com/products/65714">3517U (http://ark.intel.com/products/65714)</a>			14 W / ? GHz	17 W / 1.9 GHz	25 W / 2.8 GHz	3.0 GHz	350 MHz	1150 MHz		\$330	
			<a href="http://ark.intel.com/products/65713">3517UE (http://ark.intel.com/products/65713)</a>			14 W / ? GHz	17 W / 1.7 GHz	25 W / 2.6 GHz	2.8 GHz		1000 MHz			
			<a href="http://ark.intel.com/products/65704">3610ME (http://ark.intel.com/products/65704)</a>	7 W / ? GHz	10 W / ? GHz	35 W / 2.7 GHz	N/A	3.3 GHz	650 MHz	950 MHz	3 MB		\$276	
			<a href="http://ark.intel.com/products/72014">3439Y (http://ark.intel.com/products/72014)</a>					2.3 GHz	350 MHz	850 MHz			7 January 2013	\$250
			<a href="http://ark.intel.com/products/71259">3437U (http://ark.intel.com/products/71259)</a>			14 W / ? GHz	17 W / 1.9 GHz	25 W / 2.4 GHz	2.9 GHz	650 MHz			1200 MHz	20 January 2013
			<a href="http://ark.intel.com/products/64903">3427U (http://ark.intel.com/products/64903)</a>			14 W / ? GHz	17 W / 1.8 GHz	25 W / 2.3 GHz	2.8 GHz	350 MHz		1150 MHz	3 June 2012	
			<a href="http://ark.intel.com/products/71256">3380M (http://ark.intel.com/products/71256)</a>			N/A	N/A	35 W / 2.9 GHz	3.6 GHz	650 MHz		1250 MHz	20 January 2013	\$266
			3365M									1350 MHz	Q3 2012	
		<a href="http://ark.intel.com/products/64895">3360M (http://ark.intel.com/products/64895)</a>	3.5 GHz					1200 MHz				3 June 2012	\$266	
		<a href="http://ark.intel.com/products/71257">3340M (http://ark.intel.com/products/71257)</a>	35 W / 2.7 GHz					3.4 GHz	1250 MHz	20 January 2013		\$225		
		<a href="http://ark.intel.com/products/72013">3339Y (http://ark.intel.com/products/72013)</a>	7 W / ? GHz			10 W / ? GHz	13 W / 1.5 GHz		2.0 GHz	350 MHz		850 MHz	7 January 2013	\$250
		<a href="http://ark.intel.com/products/72055">3337U (http://ark.intel.com/products/72055)</a>	N/A	14 W / ? GHz	17 W / 1.8 GHz		2.7 GHz	350 MHz	1100 MHz	20 January 2013		\$225		
		<a href="http://ark.intel.com/products/64896">3320M (http://ark.intel.com/products/64896)</a>			N/A	35 W / 2.6 GHz	3.3 GHz	650 MHz	1200 MHz	3 June 2012				
		<a href="http://ark.intel.com/products/65707">3317U (http://ark.intel.com/products/65707)</a>			14 W / ? GHz	17 W / 1.7 GHz	2.6 GHz	350 MHz	1050 MHz	20 January 2013				
		<a href="http://ark.intel.com/products/72164">3230M (http://ark.intel.com/products/72164)</a>			N/A	35 W / 2.6 GHz	3.2 GHz	650 MHz	1100 MHz			3 June 2012		
		<a href="http://ark.intel.com/products/67355">3210M (http://ark.intel.com/products/67355)</a>				35 W / 2.5 GHz	3.1 GHz							
		Core i3	<a href="http://ark.intel.com/products/72012">3229Y (http://ark.intel.com/products/72012)</a>	7 W / ? GHz	10 W / ? GHz	13 W / 1.4 GHz			350 MHz	850 MHz		7 January 2013	\$250	
			<a href="http://ark.intel.com/products/72057">3227U (http://ark.intel.com/products/72057)</a>		14 W / ? GHz	17 W / 1.9 GHz				1100 MHz		20 January 2013	\$225	
			<a href="http://ark.intel.com/products/65697">3217U (http://ark.intel.com/products/65697)</a>		14 W / ? GHz	17 W / 1.8 GHz				1050 MHz		24 June 2012		
			<a href="http://ark.intel.com/products/65696">3217UE (http://ark.intel.com/products/65696)</a>		14 W / ? GHz	17 W / 1.6 GHz				900 MHz		July 2013	\$261	
			<a href="http://ark.intel.com/products/72058">3130M (http://ark.intel.com/products/72058)</a>			35 W / 2.6 GHz				1100 MHz		20 January 2013		



2 (2)		3120M ( <a href="http://ark.intel.com/products/71465">http://ark.intel.com/products/71465</a> )	N/A		35 W / 2.5 GHz	N/A		650 MHz			30 September 2012	\$225
		3120ME ( <a href="http://ark.intel.com/products/65698">http://ark.intel.com/products/65698</a> )							900 MHz		July 2013	
		3110M ( <a href="http://ark.intel.com/products/65700">http://ark.intel.com/products/65700</a> )							1000 MHz		24 June 2012	
		3115C ( <a href="http://ark.intel.com/products/78170">http://ark.intel.com/products/78170</a> )						N/A		4 MB	10 September 2013	\$241 OEM
	Pentium	B925C ( <a href="http://ark.intel.com/products/78169">http://ark.intel.com/products/78169</a> )	N/A		15 W / 2.0 GHz	N/A	650 MHz	1000 MHz	1 MB	June 2013	\$86 (India)	
		A1018 ( <a href="http://ark.intel.com/products/78429">http://ark.intel.com/products/78429</a> )			35 W / 2.1 GHz			1100 MHz	2 MB	20 January 2013	\$134	
		2030M ( <a href="http://ark.intel.com/products/72059">http://ark.intel.com/products/72059</a> )			35 W / 2.5 GHz					30 September 2012		
		2020M ( <a href="http://ark.intel.com/products/71142">http://ark.intel.com/products/71142</a> )			35 W / 2.4 GHz		350 MHz	9 June 2013				
		2127U ( <a href="http://ark.intel.com/products/75191">http://ark.intel.com/products/75191</a> )			17 W / 1.9 GHz			30 September 2012		\$150		
		2117U ( <a href="http://ark.intel.com/products/71469">http://ark.intel.com/products/71469</a> )			17 W / 1.8 GHz			7 January 2013				
		2129Y ( <a href="http://ark.intel.com/products/72016">http://ark.intel.com/products/72016</a> )			10 W / 1.1 GHz			850 MHz		April 2013	\$153	
		Celeron			1019Y ( <a href="http://ark.intel.com/products/75102">http://ark.intel.com/products/75102</a> )		10 W / 1.0 GHz	650 MHz	1000 MHz	2 MB	20 January 2013	\$86
					1020E ( <a href="http://ark.intel.com/products/74344">http://ark.intel.com/products/74344</a> )		35 W / 2.2 GHz				9 June 2013	
					1020M ( <a href="http://ark.intel.com/products/71994">http://ark.intel.com/products/71994</a> )		35 W / 2.1 GHz				20 January 2013	
					1005M ( <a href="http://ark.intel.com/products/75193">http://ark.intel.com/products/75193</a> )		35 W / 1.9 GHz				9 June 2013	
					1000M ( <a href="http://ark.intel.com/products/72060">http://ark.intel.com/products/72060</a> )		35 W / 1.8 GHz	350 MHz	900 MHz	1 MB	20 January 2013	\$134
					1037U ( <a href="http://ark.intel.com/products/71995">http://ark.intel.com/products/71995</a> )		17 W / 1.8 GHz					
					1017U ( <a href="http://ark.intel.com/products/75192">http://ark.intel.com/products/75192</a> )		17 W / 1.6 GHz					
					1007U ( <a href="http://ark.intel.com/products/72061">http://ark.intel.com/products/72061</a> )		17 W / 1.5 GHz					
					1047UE ( <a href="http://ark.intel.com/products/74345">http://ark.intel.com/products/74345</a> )		17 W / 1.4 GHz					
	1 (1)	927UE ( <a href="http://ark.intel.com/products/74346">http://ark.intel.com/products/74346</a> )			17 W / 1.5 GHz							\$107

Suffixes to denote:

- M – Mobile processor
- Q – Quad-core
- U – Ultra-low power
- X – "Extreme"
- Y – Extreme ultra-low power

Roadmap

Intel demonstrated the Haswell architecture in September 2011, which began release in 2013 as the successor to Sandy Bridge and Ivy Bridge.<sup>[66]</sup>

See also

- List of Intel CPU microarchitectures

## Notes

- a. Transistor counts for M-2, H-2 and HM-4 were determined by a comparison of transistor counts in Sandy Bridge and HE-4. Performing a comparative analysis gave counts of 108 million transistors per core, 67 million transistors per 1 MB of L3 cache, 88 million transistors for the memory controller and other chip features, and roughly 21 million transistors for each execution unit inside the Intel HD 4000. All this is an attempt to determine the transistor count mathematically, and is not backed by any sources. Thus, these transistor counts may be inaccurate.

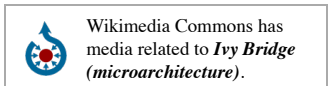
## References

1. "Origin of a Codename: Ivy Bridge" (<http://www.intelfreepress.com/news/origin-of-a-codename-ivy-bridge/48>). Intelfreepress.com. 2012-04-19. Retrieved 2014-01-16.
2. "Ivy Bridge Quad-Core to Have 77W TDP, Intel Plans for LGA1155 Ivy Bridge Entry" (<http://www.techpowerup.com/153756/Ivy-Bridge-Quad-Core-to-Have-77W-TDP-Intel-Plans-for-LGA1155-Ivy-Bridge-Entry.html>). techPowerUp. 2011-10-18. Retrieved 2013-10-12.
3. Anand Lal Shimpi (2011-06-01). "Correction: Ivy Bridge and Thunderbolt – Featured, not Integrated" (<http://www.anandtech.com/show/4406/correction-ivy-bridge-and-thunderbolt-featured-not-integrated/>). *AnandTech*. Retrieved 2011-11-11.
4. Gruener, Wolfgang (2011-10-19). "Intel to Sell Ivy Bridge Late in Q4 2011" (<http://www.tomshardware.com/news/ivy-bridge-processor-release-22nm-3d-transistor,13753.html>). *Tom's Hardware*. Retrieved 2011-11-11.
5. Demerjian, Charlie (2012-04-23). "Intel launches Ivy Bridge amid crushing marketing buzzwords" (<http://semiaccurate.com/2012/04/23/intel-launches-ivy-bridge-amid-crushing-marketing-buzz-words/>). SemiAccurate. Retrieved 2012-05-25.
6. "Intel's Pentium and Core i3 Desktop Ivy Bridge CPUs Arrive" (<http://www.anandtech.com/show/6249/intels-pentium-and-core-i3-desktop-ivy-bridge-cpus-arrive>). AnandTech. Retrieved 2013-10-12.
7. "Intel Israel: Innovation as a Leadership Strategy" (<http://www.intel.com/cd/corporate/europe/emea/heb/290083.htm>). Intel.com. Retrieved 2014-05-06.
8. Webster, Clive (2011-10-10). "Ivy Bridge Media Upgrades and Security Features" (<http://www.bit-tech.net/hardware/cpus/2011/10/10/all-about-ivy-bridge/6>). *bit-tech*. Dennis Publishing Limited. Retrieved 2013-12-22.
9. Shvets, Gennadiy (2011-11-27). "Ivy Bridge desktop CPU lineup details" ([http://www.cpu-world.com/news\\_2011/2011112701\\_Ivy\\_Bridge\\_desktop\\_CPU\\_lineup\\_details.html](http://www.cpu-world.com/news_2011/2011112701_Ivy_Bridge_desktop_CPU_lineup_details.html)). *CPU World*. Retrieved 2013-12-22.
10. "Intel Reinvents Transistors Using New 3-D structure" ([http://newsroom.intel.com/community/intel\\_newsroom/blog/2011/05/04/intel-reinvents-transistors-using-new-3-d-structure](http://newsroom.intel.com/community/intel_newsroom/blog/2011/05/04/intel-reinvents-transistors-using-new-3-d-structure)). Intel. Retrieved 2011-05-04.
11. Taylor, Greg; Cox, George (September 2011). "Behind Intel's New Random-Number Generator" (<http://spectrum.ieee.org/computing/hardware/behind-intels-new-randomnumber-generator/0>). *Spectrum*. IEEE.
12. "Bull Mountain Software Implementation Guide" (<http://software.intel.com/en-us/articles/download-the-latest-bull-mountain-software-implementation-guide/?wapkw=%28bull+mountain%29>). Intel. 2011-06-12. Retrieved 2011-12-04.
13. <https://blogs.msdn.microsoft.com/chuckw/2012/09/11/directxmath-f16c-and-fma/>
14. <http://electronicdesign.com/learning-resources/understanding-intels-ivy-bridge-random-number-generator>
15. Delahunty, James (2011-03-30). "Intel Ivy Bridge chips feature PCI Express 3.0" ([http://www.afterdawn.com/news/article.cfm/2011/03/30/intel\\_ivy\\_bridge\\_chips\\_feature\\_pci\\_express\\_3\\_0](http://www.afterdawn.com/news/article.cfm/2011/03/30/intel_ivy_bridge_chips_feature_pci_express_3_0)). *After Dawn News*. Retrieved 2011-11-11.
16. "Ivy Bridge Overclocking: Ratio Changes Without Reboot, More Ratios and DDR3-2800" (<http://www.anandtech.com/show/4790/ivy-bridge-overclocking-ratio-changes-without-reboot-more-ratios-and-ddr32800>). Retrieved 2012-02-21.
17. Vättö, Kristian (2011-05-06). "Intel's Roadmap: Ivy Bridge, Panther Point, and SSDs" (<http://www.anandtech.com/show/4318/intel-roadmap-ivy-bridge-panther-point-ssds>). *AnandTech*. Retrieved 2011-11-11.
18. "Intel Download Center" (<https://downloadcenter.intel.com/download/25977>). *Intel Download Center*. Retrieved 13 May 2016.
19. "Intel HD Graphics Drivers v10.18.10.3621 with one new OpenGL Extension" (<http://www.geeks3d.com/20140605/intel-hd-graphics-drivers-v10-18-10-3621-with-one-new-opengl-extension/>). Geeks3D. Retrieved 2014-06-05.
20. Karmehed, Ahmed (2011-05-31). "Intel Ivy Bridge gets variable TDP and Thunderbolt" (<http://www.nordichardware.com/news/69-cpu-chipset/43332-intel-ivy-bridge-gets-variable-tdp-and-thunderbolt.html>). NHW.
21. LG Nilsson, Most desktop Ivy Bridge systems won't support three displays (<http://vr-zone.com/articles/most-desktop-ivy-bridge-systems-won-t-support-three-displays/15407.html>) // VR Zone, March 31, 2012 Archived (<https://web.archive.org/web/20121017150543/http://vr-zone.com/articles/most-desktop-ivy-bridge-systems-won-t-support-three-displays/15407.html>) 17 October 2012 at the Wayback Machine.
22. Anand Lal Shimpi (2012-10-05). "Intel's Haswell Architecture Analyzed" (<http://www.anandtech.com/show/6355/intels-haswell-architecture/6>). AnandTech. Retrieved 2013-10-20.
23. "Intel 64 and IA-32 Architectures Optimization Reference Manual" (<http://www.intel.com/content/www/us/en/architecture-and-technology/64-ia-32-architectures-optimization-manual.html>). Intel.com. Retrieved 2013-10-12.
24. "Intel 64 and IA-32 Architectures Optimization Reference Manual" ([http://www.intel.com/Assets/en\\_US/PDF/manual/248966.pdf?wapkw=order+number+248966-025](http://www.intel.com/Assets/en_US/PDF/manual/248966.pdf?wapkw=order+number+248966-025)) (PDF). Intel.com. Retrieved 2013-10-12.
25. Chris Angelini. "Intel Core i7-4960X Review: Ivy Bridge-E, Benchmarked – Ivy Bridge-E: Core i7-4960X Gets Tested" (<http://www.tomshardware.com/reviews/core-i7-4960x-ivy-bridge-e-benchmark,3557.html>). Tomshardware.com. Retrieved 2013-10-12.
26. "Intel's Core i7-4960X processor reviewed – The Tech Report – Page 7" (<http://techreport.com/review/25293/intel-core-i7-4960x-processor-reviewed/7>). The Tech Report. Retrieved 2013-10-12.
27. "The Ivy Bridge Preview: Core i7 3770K Tested" (<http://www.anandtech.com/show/5626/ivy-bridge-preview-core-i7-3770k/>). AnandTech. Retrieved 2012-05-25.
28. "Intel's Ivy Bridge Hotter Than Sandy Bridge When Overclocked" (<http://www.tomshardware.com/news/ivy-bridge-overclocking-high-temp,15512.html>).
29. "Ivy Bridge proven to suffer from poor thermal grease by" (<http://vr-zone.com/articles/ivy-bridge-proven-to-suffer-from-poor-thermal-grease/15844.html>). Vr-zone.com. 2012-05-11. Retrieved 2012-05-25.
30. "TIM is Behind Ivy Bridge Temperatures After All" (<http://www.techpowerup.com/165882/TIM-is-Behind-Ivy-Bridge-Temperatures-After-All.html>).
31. "Intel to Officially Enable Better Overclocking in Haswell" (<http://news.softpedia.com/news/Intel-to-Officially-Enable-Better-Overclocking-in-Haswell-293719.shtml>). News.softpedia.com. 2012-09-20. Retrieved 2013-10-12.
32. "Ivy Bridge's heat problem is indeed caused by Intel's TIM choice" (<http://www.tweaktown.com/news/24059/>). US: TweakTown. 2012-05-11. Retrieved 2013-10-12.
33. WhiteFireDragon (2012-08-03). "Fixing Haswell and Ivy Bridge CPU temps: IHS removal" (<https://www.youtube.com/watch?v=XXs0l5kuoX4>). youtube.com. Retrieved 2013-11-08.
34. "Intel admits Ivy Bridge chips run hotter" (<http://www.theinquirer.net/inquirer/news/2171299/intel-admits-ivy-bridge-chips-run-hotter>). The Inquirer. Retrieved 2012-05-25.
35. "Mobile 3rd Generation Intel® Core™ Processor Family Datasheet" (<http://www.intel.com/content/dam/www/public/us/en/documents/datasheets/3rd-gen-core-family-mobile-vol-1-datasheet.pdf>) (PDF). Intel. 2012-04-23.
36. "The Intel Ivy Bridge (Core i7 3770K) Review" (<http://www.anandtech.com/show/5771/the-intel-ivy-bridge-core-i7-3770k-review>). AnandTech. Retrieved 2012-05-25.
37. Hiroshige Goto (2012-02-22). "Ivy Bridge Modular Design" ([http://pc.watch.impress.co.jp/docs/column/kaigai/20120222\\_513581.html](http://pc.watch.impress.co.jp/docs/column/kaigai/20120222_513581.html)) (in Japanese). Retrieved 2013-12-22.
38. "Ivy Bridge: 1.4B Transistors" (<http://www.anandtech.com/show/4798/ivy-bridge-148b-transistors>).
39. "Intel Xeon Processor E7-2800/4800/8800 v2 Product Family Thermal/Mechanical Specifications and Design Guide" (<http://www.intel.com/content/dam/www/public/us/en/documents/design-guides/xeon-e7-v2-thermal-guide.pdf>) (PDF). Intel. February 2014. pp. 17–18, 81. Retrieved 2014-08-24.
40. "Intel's Xeon E5-2600 V2: 12-core Ivy Bridge EP for Servers" (<http://www.anandtech.com/show/7285/intel-xeon-e5-2600-v2-12-core-ivy-bridge-ep>). AnandTech. 2013-09-17. Retrieved 2014-01-21.
41. "Some details of Ivy Bridge-EX processors" ([http://www.cpu-world.com/news\\_2013/2013100101\\_Some\\_details\\_of\\_Ivy\\_Bridge-EX\\_processors.html](http://www.cpu-world.com/news_2013/2013100101_Some_details_of_Ivy_Bridge-EX_processors.html)). Cpu-world.com. Retrieved 2013-10-12.
42. Charlie Demerjian. "Intel releases Ivy Bridge-EX now known as Xeon E7 v2" (<http://semiaccurate.com/2014/02/18/intel-releases-ivy-bridge-ex-now-known-xeon-e7-v2/>). SemiAccurate. Retrieved 2014-02-19.
43. "Intel Xeon E7 'Ivy Bridge-EX' Lineup Detailed – Xeon E7-8890 V2 'Ivy Town' Chip With 15 Cores and 37.5 MB LLC" (<http://wccftech.com/intel-xeon-e7-ivy-bridgeex-lineup-detailed-xeon-e7-8890-v2-ivy-town-chip-with-15-cores-and-37-5-mb-llc/>)

- /8890-v2-ivy-town-chip-15-cores-3/5-mb-llc/). Wccftech.com. 2014-02-02. Retrieved 2014-02-16.
44. Johan De Gelas (2013-12-19). "Server Buying Decisions: Memory" (<http://www.anandtech.com/show/7479/server-buying-decisions-memory/2>). AnandTech. Retrieved 2014-09-09.
  45. "Fujitsu PRIMERGY Servers Memory Performance of Xeon E5-2600 v2 (Ivy Bridge-EP) based Systems" (<http://globalsps.ts.fujitsu.com/dmsp/Publications/public/wp-ivy-bridge-ep-memory-performance-ww-en.pdf>) (PDF). *fujitsu.com*. 2013-11-14. pp. 4–5. Retrieved 2014-09-09.
  46. Jason Fan (2013). "The importance of proper memory configuration for optimal performance (Intel Reference – E5-2600 v2 DDR3 RDIMM Memory Speeds; Intel Reference – E5-2600 v2 DDR3 LRDIMM & ECC UDIMM Memory Speeds)" (<http://www.worldhostingdays.com/downloads/2013-china/mF1a.pdf>) (PDF). *worldhostingdays.com*. Kingston Technology. pp. 7–8. Retrieved 2014-09-09.
  47. Khang Nguyen (2013-12-17). "APIC Virtualization Performance Testing and Iozone" (<https://software.intel.com/en-us/blogs/2013/12/17/apic-virtualization-performance-testing-and-iozone>). *software.intel.com*. Retrieved 2014-07-12.
  48. "Product Brief Intel Xeon Processor E5-4600 v2 Product Family" (<http://www.intel.com/content/dam/www/public/us/en/documents/product-briefs/xeon-e5-4600-v2-brief.pdf>) (PDF). Intel. 2014-03-14. Retrieved 2014-07-12.
  49. Novakovic, Nebojsa (2014-02-12). "Ivy Bridge-EP: Xeon E5 gets its 2013 refresh" (<http://vr-zone.com/articles/ivy-bridge-ep-xeon-e5-gets-2013-refresh/56672.html>). Vr-zone.com. Retrieved 2014-02-16.
  50. "Better late than never: Monster 15-core Xeon chips let loose by Intel" ([http://www.theregister.co.uk/2014/02/18/intel\\_releases\\_mission\\_critical\\_two\\_four\\_and\\_eight\\_socket\\_xeon\\_e7\\_v2\\_line/](http://www.theregister.co.uk/2014/02/18/intel_releases_mission_critical_two_four_and_eight_socket_xeon_e7_v2_line/)). The Register. 2014-02-18. Retrieved 2014-02-20.
  51. Timothy Prickett Morgan (2013-12-15). "Future Intel Xeon E7 Processors Sighted" (<http://www.enterprisetech.com/2013/12/15/future-intel-xeon-e7-processors-sighted/>). Enterprisetech.com. Retrieved 2014-01-21.
  52. Cyril Kowaliski (2013-08-01). "Ivy Bridge-E processors to start at \$310" (<http://techreport.com/news/25168/report-ivy-bridge-e-processors-to-start-at-310>).
  53. "Intel Core i7-3770K Processor (8M Cache, up to 3.90 GHz)" ([http://ark.intel.com/products/65523/Intel-Core-i7-3770K-Processor-%288M-Cache-up-to-3\\_90-GHz%29](http://ark.intel.com/products/65523/Intel-Core-i7-3770K-Processor-%288M-Cache-up-to-3_90-GHz%29)). Ark.intel.com. Retrieved 2012-05-25.
  54. "Intel details 14 dual-core Ivy Bridge processors ahead of Computex" (<http://www.engadget.com/2012/05/31/intel-dual-core-ivy-bridge/>). Retrieved 2012-09-30.
  55. Doug Crowthers (2012-08-08). "Intel's Ivy Bridge-E set for Q3 2013, Shows Leaked Slide" ([http://www.tomshardware.com/news/Ivy\\_Bridge-E-LGA\\_2011-X79-cpu-mobo,16588.html](http://www.tomshardware.com/news/Ivy_Bridge-E-LGA_2011-X79-cpu-mobo,16588.html)). Tomshardware.com. Retrieved 2013-10-12.
  56. Timothy Prickett Morgan (September 10, 2013). "Intel carves up Xeon E5-2600 v2 chips for two-socket boxes" ([http://www.theregister.co.uk/2013/09/10/intel\\_ivy\\_bridge\\_xeon\\_e5\\_2600\\_v2\\_launch/](http://www.theregister.co.uk/2013/09/10/intel_ivy_bridge_xeon_e5_2600_v2_launch/)). *The Register*. Retrieved September 13, 2013.
  57. "Intel Introduces Highly Versatile Datacenter Processor Family Architected for New Era of Services" ([http://newsroom.intel.com/community/intel\\_newsroom/blog/2013/09/10/intel-introduces-highly-versatile-datacenter-processor-family-architected-for-new-era-of-services](http://newsroom.intel.com/community/intel_newsroom/blog/2013/09/10/intel-introduces-highly-versatile-datacenter-processor-family-architected-for-new-era-of-services)). *Press release*. September 10, 2013. Retrieved September 13, 2013.
  58. "Intel roadmap reveals 10-core Xeon E5-2600 V2 Ivy Bridge CPU" (<http://www.engadget.com/2012/10/17/intel-roadmap-reveals-10-core-xeon-e5-2600-v2-cpu/>). Retrieved 2013-01-03.
  59. S., Mike (2013-01-03). "Leak: Enthusiast-Grade IB-E CPUs Slated for Q3 along with SB-E Core i7-3980X 8 Core CPU for Q2" (<http://www.legitreviews.com/news/14815/>). Legit Reviews. Retrieved 23 January 2013. (citing an original post by Hassan Mujtaba on the same website (<http://wccftech.com/intels-leaked-roadmap-shows-ivy-bridgeopen-processors-12-cores-30mb-cache-130w-tdp/>))
  60. "Leaked slide outs Ivy Bridge-E models" (<http://techreport.com/news/24591/leaked-slide-outs-ivy-bridge-e-models>).
  61. Shvets, Gennadiy (2013-03-30). "Intel Ivy Bridge-E extreme CPUs to launch in Q3 2013" ([http://www.cpu-world.com/news\\_2013/2013033001\\_Intel\\_Ivy\\_Bridge-E\\_extreme\\_CPUs\\_to\\_launch\\_in\\_Q3\\_2013.html](http://www.cpu-world.com/news_2013/2013033001_Intel_Ivy_Bridge-E_extreme_CPUs_to_launch_in_Q3_2013.html)). CPU World. Retrieved March 30, 2013. (citing VR Zone (<http://chinese.vr-zone.com/57511/naming-same-as-haswell-ivy-bridge-e-will-have-core-i7-4960x-4930k-4820k-03292013/>))
  62. Thomas Ryan (2014-01-10). "Intel Announces the Xeon E5-2400 v2 Series at CES" (<http://semiaccurate.com/2014/01/10/intel-announces-xeon-e5-2400-v2-series-ces/>). SemiAccurate. Retrieved 2014-01-21.
  63. "Intel extends Xeon E5 server chip family with E5-2400 v2 line-up – IT News from" (<http://www.v3.co.uk/v3-uk/news/2322218/intel-extends-xeon-e5-server-chip-family-with-e5-2400-v2-line-up>). V3.co.uk. Retrieved 2014-01-21.
  64. "Intel makes custom Xeons for Oracle" (<http://www.itworld.com/hardware/428779/intel-makes-custom-xeons-oracle>). Retrieved 2014-06-25.
  65. "The technical details behind Intel's 7 watt Ivy Bridge CPUs" (<http://arstechnica.com/gadgets/2013/01/the-technical-details-behind-intels-7-watt-ivy-bridge-cpus/>). <http://arstechnica.com/>. Retrieved 2013-01-14. External link in |publisher= (help)
  66. Crothers, Brooke (September 14, 2011). "Haswell chip completes Ultrabook 'revolution' " ([http://news.cnet.com/8301-13924\\_3-20106098-64/haswell-chip-completes-ultrabook-revolution/](http://news.cnet.com/8301-13924_3-20106098-64/haswell-chip-completes-ultrabook-revolution/)). *The Circuits Blog*. CNET.com. Retrieved November 11, 2011.

## External links

- "Intel Core i7-3770K Review: A Small Step Up For Ivy Bridge" (<http://www.tomshardware.com/reviews/ivy-bridge-benchmark-core-i7-3770k,3181.html>). Tom's Hardware. 23 April 2012.
- "Video Animation: Mark Bohr Gets Small: 22 nm Explained" (<https://www.youtube.com/watch?v=YIkMaQJSyP8>). *Video presentation*. Intel. Retrieved 11 November 2011.
- David Kanter (22 April 2012). "Intel's Ivy Bridge Graphics Architecture" (<http://realworldtech.com/page.cfm?ArticleID=RWTO42212225031>). realworldtech.com. Retrieved 24 April 2012.
- "Roundup: Intel Core i5 Processors with Ivy Bridge Microarchitecture" (<http://www.xbitlabs.com/articles/cpu/display/core-i5-ivy-bridge.html>). X-bit labs. 19 September 2012.
- "Roundup: Intel Core i3 Processors with Ivy Bridge Microarchitecture" (<http://www.xbitlabs.com/articles/cpu/display/core-i3-ivy-bridge.html>). X-bit labs. 25 September 2012.
- Memory Configuration Guide for X9 Series DP Motherboards – Revised Ivy Bridge Update (Socket R & B2) ([http://www.supermicro.com/support/resources/memory/X9\\_DP\\_memory\\_config.pdf](http://www.supermicro.com/support/resources/memory/X9_DP_memory_config.pdf)), January 2014, Super Micro Computer, Inc.



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