Product Brief

Intel® Core™2 Duo Processors

Embedded Computing

Intel® Core™2 Duo Processors for Embedded Computing

Processors T9400, P8400, SL9400, SL9380, SP9300, SU9300, T7500, T7400, L7500, L7400 and U7500

Product Overview

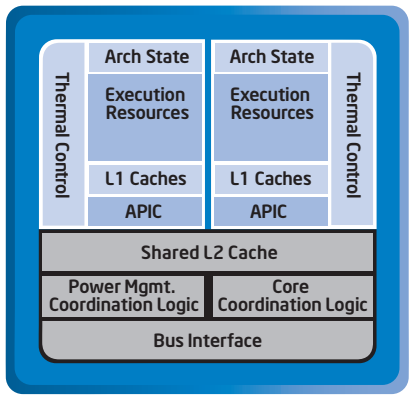
Intel® Core™2 Duo processors – members of Intel's growing product line of multi-core processors based on Intel® Core™ microarchitecture – now feature 45nm process technology to deliver even greater energy-efficient performance. Intel Core 2 Duo processor technology makes it possible to integrate two complete execution cores in one physical package, providing advancements in simultaneous computing for multi-threaded applications and multi-tasking environments. Intel's hafnium-based 45nm Hi-k silicon process technology enables even more processor performance by doubling transistor density and increasing cache size by up to 50 percent. The result is improved speed and efficiency, relative to previous-generation dual-core Intel® processors.

Intel Core 2 Duo processors meet the needs of a wide range of performance-intensive, low-power embedded applications in smaller form factors such as retail and transaction services (i.e., point-of-service terminals and ATMs), gaming platforms, industrial control and automation, digital security surveillance and medical imaging. While incorporating advanced processor technology, they remain software-compatible with previous IA-32 processors.

Intel® Core™ Microarchitecture

Energy-efficient performance helps equipment manufacturers optimally balance processing capabilities within power and space constraints.

- Intel® Wide Dynamic Execution allows each core to simultaneously complete up to four full instructions per clock cycle.
- Intel® Advanced Smart Cache significantly reduces memory latency to frequently used data through dynamic allocation of shared L2 cache.
- Intel® Smart Memory Access accelerates out-of-order execution, reduces time in-flight instructions must wait for data, and moves data from system memory into fast L2 cache prior to execution.
- Intel® Advanced Digital Media Boost accelerates execution of Streaming SIMD Extension (SSE) instructions to significantly improve performance of video, audio, and image processing for multimedia, encryption, financial, engineering, and scientific applications. 128-bit SSE instructions, issued at a throughput rate of one per clock cycle, effectively doubles speed of execution over previous-generation processors. 45nm versions include new Super Shuffle Engine to improve existing SSE instructions while enabling significant gains on the latest SSE4 instruction set. This provides additional performance improvements in SSE4-optimized applications, such as video editing and encoding in high-definition resolution.



Intel® Core™2 Duo processors, based on Intel® Core™ microarchitecture, include two complete execution cores, shared L2 cache, and intelligent power management capabilities. These features deliver significantly greater performance-per-watt over previous-generation dual-core Intel® processors.

Intel® Core™ Microarchitecture (continued)

- Intel® Virtualization Technology[1] allows one hardware platform to function as multiple "virtual" platforms, improving manageability, limiting downtime and maintaining worker productivity. Provides greater isolation and security between different applications and operating systems for added protection.
- Intel® 64 Architecture[2] supports 64-bit instructions, providing flexibility for 64-bit and 32-bit applications and operating systems.
- Intel® Trusted Execution Technology[3] (Intel® TXT) defends against software-based attacks and helps protect confidentiality and integrity of data stored or created on the system. Enables each application to run within its own space, protected from all other software on the system.
- Execute Disable Bit[4] marks memory regions as executable or non-executable when combined with a supporting operating system.
- Digital Thermal Sensor (DTS) enables efficient processor and platform thermal control. Thermal sensors located within the processor measure maximum temperature on the die at any given time.
- Embedded lifecycle support protects system investment by enabling extended product availability for embedded customers.
- Along with a strong ecosystem of hardware and software vendors, including members of the Intel® Embedded and Communications Alliance (intel.com/go/eca), Intel helps cost-effectively meet development challenges and speed time-to-market.

Intel® Core™2 Duo Processor Platform Features

Intel® Core™2 Duo Processors T9400Δ/P8400Δ/SL9400Δ/SL9380Δ/SP9300Δ/SU9300Δ	▪ Based on Intel® 45nm process technology ▪ Validated with Mobile Intel® GM45 Express chipset (T9400, P8400) and Mobile Intel® GS45 Express chipset (SL9400, SP9300, SU9300) – Excellent processor and graphics performance, storage speed and reliability – Up to 8 GB 667/800 MHz DDR2 or 800/1066 MHz DDR3 SODIMM system memory – Graphics core performance up to 533 MHz ▪ Validated with power-optimized Intel® 5100 Memory Controller Hub chipset with Intel® 82801IR I/O Controller Hub 9R (T9400, SL9400) – 30 lanes of PCI Express* for I/O connectivity – Supports dual-channel DDR2 registered ECC memory (533 MHz and 667 MHz) to help safeguard data and improve reliability – Performance-per-watt advantage for single-processor bladed form factor applications ▪ Validated with integrated Intel® 3100 chipset (SL9380, SU9300) – Supports single-channel DDR2, providing up to 16 GB max memory support – Optimized performance-per-watt for small form factors: PrAMC, CompactPCI* and COM Express* – Brings enterprise-level reliability, availability, serviceability, usability and manageability (RASUM) to embedded platforms
Intel® Core™2 Duo Processors T7500Δ/L7500Δ/U7500Δ	▪ Based on Intel® 65nm process technology ▪ Validated with Mobile Intel® GME965 Express chipset – Excellent storage speed, reliability and remote asset management capabilities – Integrated 32-bit 3D graphics engine, and up to 4 GB of 533/667 MHz DDR2 SODIMM system memory – Graphics core performance up to 500 MHz ▪ L7500 offers low-power, value-sensitive solution ▪ U7500 provides ultra low-power solution with excellent graphics performance
Intel® Core™2 Duo Processors T7400Δ/L7400Δ/U7500Δ	▪ Based on Intel® 65nm process technology ▪ Validated with Mobile Intel® 945GME Express chipset – Superb graphics, I/O bandwidth, storage speed, reliability and remote asset management capabilities – Integrated 32-bit 3D graphics engine – Up to 4 GB of 400/533/667 MHz DDR2 SODIMM system memory ▪ T7400 and L7400 also validated with Intel® E7520 chipset, addressing the needs of high-performance, low-power platforms within small form factor designs ▪ L7400 and U7500 also validated with Intel® 3100 chipset, an integrated chipset offering low-power platform solutions for thermally sensitive and performance-intensive embedded, communications and storage applications

Intel® Core™2 Duo Processors for Embedded Computing

Product Number	Core Speed	Front-Side Bus Speed	L2 Cache	Thermal Design Power	VID	Tj Max	Package[5]
45nm process technology							
Intel® Core™2 Duo Processor T9400[Δ]							
AV80576GH0616M	2.53 GHz	1066 MHz	6 MB Unified	35 watts	0.75 V-1.3 V	105° C	479 µFC-BGA
AW80576GH0616M	2.53 GHz	1066 MHz	6 MB Unified	35 watts	0.75 V-1.3 V	105° C	478 µFC-PGA
Intel® Core™2 Duo Processor P8400[Δ]							
AV80577SH0513M	2.26 GHz	1066 MHz	3 MB Unified	25 watts	0.75 V-1.3 V	105° C	479 µFC-BGA
AW80577SH0513M	2.26 GHz	1066 MHz	3 MB Unified	25 watts	0.75 V-1.3 V	105° C	478 µFC-PGA
Intel® Core™2 Duo Processor SL9400[Δ]							
AV80576LH0366M	1.86 GHz	1066 MHz	6 MB Unified	17 watts	0.75 V-1.25 V	105° C	956 µFC-BGA (SFF)
Intel® Core™2 Duo Processor SL9380[Δ]							
AV80576LG0336M	1.80 GHz	800 MHz	6 MB Unified	17 watts	0.75 V-1.25 V	105° C	956 µFC-BGA (SFF)
Intel® Core™2 Duo Processor SP9300[Δ]							
AV80576SH0516M	2.26 GHz	1066 MHz	6 MB Unified	25 watts	0.75 V-1.3 V	105° C	956 µFC-BGA (SFF)
Intel® Core™2 Duo Processor SU9300[Δ]							
AV80577UG0093M	1.20 GHz	800 MHz	3 MB Unified	10 watts	0.75 V-1.3 V	105° C	956 µFC-BGA (SFF)
65nm process technology							
Intel® Core™2 Duo Processor T7500[Δ]							
LE80537GG0494M	2.20 GHz	800 MHz	4 MB Unified	35 watts	0.75 V-1.35 V	100° C	479 µFC-BGA
LF80537GG0494M	2.20 GHz	800 MHz	4 MB Unified	35 watts	0.75 V-1.35 V	100° C	478 µFC-PGA
Intel® Core™2 Duo Processor T7400[Δ]							
LE80537GF0484M	2.16 GHz	667 MHz	4 MB Unified	34 watts	0.75 V-1.3 V	100° C	479 µFC-BGA
LF80537GF0484M	2.16 GHz	667 MHz	4 MB Unified	34 watts	0.75 V-1.3 V	100° C	478 µFC-PGA
Intel® Core™2 Duo Processor L7500[Δ]							
LE80537LG0254M	1.60 GHz	800 MHz	4 MB Unified	17 watts	0.75 V-1.3 V	100° C	479 µFC-BGA
Intel® Core™2 Duo Processor L7400[Δ]							
LE80537LF0214M	1.50 GHz	667 MHz	4 MB Unified	17 watts	0.75 V-1.1 V	100° C	479 µFC-BGA
Intel® Core™2 Duo Processor U7500[Δ]							
LE80537UE0042M	1.06 GHz	533 MHz	2 MB Unified	10 watts	0.75 V-0.975 V	100° C	479 µFC-BGA

Intel in Embedded and Communications: Intel.com/go/embedded

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

[1] Intel® Virtualization Technology requires a computer system with an enabled Intel® processor, BIOS, virtual machine monitor (VMM) and, for some uses, certain platform software enabled for it. Functionality, performance or other benefits will vary depending on hardware and software configurations and may require a BIOS update. Software applications may not be compatible with all operating systems. Please check with your application vendor.

[2] 64-bit computing on Intel architecture requires a computer system with a processor, chipset, BIOS, operating system, device drivers and applications enabled for Intel® 64 architecture. Performance will vary depending on your hardware and software configurations. Consult with your system vendor for more information.

[3] No computer system can provide absolute security under all conditions. Intel® Trusted Execution Technology (Intel® TXT) requires a computer system with Intel® Virtualization Technology, an Intel TXT-enabled processor, chipset, BIOS, Authenticated Code Modules and an Intel TXT-compatible measured launched environment (MLE). The MLE could consist of a virtual machine monitor, an OS or an application. In addition, Intel TXT requires the system to contain a TPM v1.2, as defined by the Trusted Computing Group and specific software for some uses. For more information, see http://www.intel.com/technology/security

[4] Enabling Execute Disable Bit functionality requires a PC with a processor with Execute Disable Bit capability and a supporting operating system. Check with your PC manufacturer on whether your system delivers Execute Disable Bit functionality.

[5] SFF = Small Form Factor package.

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Product Specs Intel® Processors Intel® Core™2 Duo Mobile Processor Intel® Core™2 Duo Processor T7000 Series T7400

Intel® Core™2 Duo Processor T7400 (4M Cache, 2.16 GHz, 667 MHz FSB)

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- Retired and Discontinued

Compatible Products
- Chipsets

Block Diagrams

Specifications	
Essentials	
Status	Launched
Launch Date	Q3'06
Processor Number	T7400
# of Cores	2
# of Threads	2
Clock Speed	2.16 GHz
L2 Cache	4 MB
Bus/Core Ratio	13
FSB Speed	667 MHz
FSB Parity	No
Instruction Set	64-bit
Embedded Options Available	Yes
Supplemental SKU	No
Lithography	65 nm
Max TDP	34 W
VID Voltage Range	1.1625V-1.300V
Recommended Channel Price	$265.00
Package Specifications	
TJUNCTION	100°C
Package Size	35mm x 35mm
Processing Die Size	143 mm²
# of Processing Die Transistors	291 million
Sockets Supported	PBGA479, PPGA478
Low Halogen Options Available	No
Advanced Technologies	
Intel® Turbo Boost Technology	No
Intel® Hyper-Threading Technology	No
Intel® Virtualization Technology (VT-x)	Yes

Enhanced Intel SpeedStep® Technology	Yes
Intel® Demand Based Switching	No
Execute Disable Bit	Yes

Ordering and Spec Information

Ordering and Spec Information

Intel® Core™2 Duo Processor T7400 (4M Cache, 2.16 GHz, 667 MHz FSB) uFCPGA, Socket M, Tray

Socket	Step	Step TDP	Ordering Code	Spec Code	Low Halogen	VT-x
PPGA478	G2	34 W	LF80537GF0484M	SLGFJ	No	Yes
PPGA478	B2	34 W	LF80537GF0484M	SL9SE	No	Yes

Intel® Core™2 Duo Processor T7400 (4M Cache, 2.16 GHz, 667 MHz FSB) uFCBGA, Socket M, Tray

Socket	Step	Step TDP	Ordering Code	Spec Code	Low Halogen	VT-x
PBGA479	G2	34 W	LE80537GF0484M	SLGFV	No	Yes

Retired and Discontinued

Boxed Intel® Core™2 Duo Processor T7400 (4M Cache, 2.16 GHz, 667 MHz FSB) uFCPGA, Socket M

Socket	Step	Step TDP	Ordering Code	Spec Code	Low Halogen	VT-x
PPGA478	B2	34 W	BX80537T7400	SL9SE	No	Yes

Intel® Core™2 Duo Processor T7400 (4M Cache, 2.16 GHz, 667 MHz FSB) uFCBGA, Socket M, Tray

Socket	Step	Step TDP	Ordering Code	Spec Code	Low Halogen	VT-x
PBGA479	B2	34 W	LE80537GF0484M	SL9SK	No	Yes

Compatible Products

Chipsets

Intel® E7520 Chipset (Configurations: 2)

Intel® E7520 Chipset with 6300ESB I/O Controller Hub
- # of CPUs: 1
- Embedded: Yes
- System Price: $333
- System TDP: 47.9W

Intel® E7520 Chipset with 82801ER I/O Controller Hub 5 R (ICH5R)
- # of CPUs: 1
- Embedded: No
- System Price: N/A
- System TDP: 46.4W

Mobile Intel® 945GM Express Chipset (Configurations: 2)

Mobile Intel® 945GM Express Chipset with 82801GBM I/O Controller Hub (ICH7M)
- # of CPUs: 1
- Embedded: No
- System Price: $304
- System TDP: 44.3W

Mobile Intel® 945GM Express Chipset with 82801GHM I/O Controller Hub 7 (ICH7MDH)
- # of CPUs: 1
- Embedded: No
- System Price: $307
- System TDP: 44.3W

Mobile Intel® 945GME Express Chipset (Configurations: 2)

Mobile Intel® 945GME Express Chipset with 82801GBM I/O Controller Hub (ICH7M)
- # of CPUs: 1
- Embedded: Yes
- System Price: $304
- System TDP: 44.3W

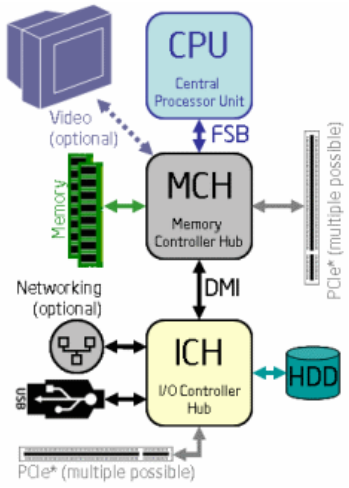
Mobile Intel® 945GME Express Chipset with 82801GHM I/O Controller Hub 7 (ICH7MDH)
- # of CPUs: 1
- Embedded: Yes
- System Price: $307
- System TDP: 44.3W

Mobile Intel® 945PM Express Chipset (Configurations: 2)

Mobile Intel® 945PM Express Chipset with 82801GBM I/O Controller Hub (ICH7M)

Mobile Intel® 945PM Express Chipset with 82801GHM I/O Controller Hub 7 (ICH7MDH)

Block Diagrams



Disclaimers

"Announced" SKUs are not yet available. Please refer to the Launch Date for market availability.

Enabling Execute Disable Bit functionality requires a PC with a processor with Execute Disable Bit capability and a supporting operating system. Check with your PC manufacturer on whether your system delivers Execute Disable Bit functionality.

64-bit computing on Intel® architecture requires a computer system with a processor, chipset, BIOS, operating system, device drivers and applications enabled for Intel® 64 architecture. Processors will not operate (including 32-bit operation) without an Intel 64 architecture-enabled BIOS. Performance will vary depending on your hardware and software configurations. Consult with your system vendor for more information.

Hyper-Threading Technology (HT Technology) requires a computer system with an Intel® processor supporting HT Technology and an HT Technology enabled chipset, BIOS and operating system. Performance will vary depending on the specific hardware and software you use. See www.intel.com/products/ht/hyperthreading_more.htm for more information including details on which processors support HT Technology.

Intel® Virtualization Technology requires a computer system with a processor, chipset, BIOS, virtual machine monitor (VMM) and for some uses, certain platform software, enabled for it. Functionality, performance or other benefit will vary depending on hardware and software configurations. Intel Virtualization Technology-enabled VMM applications are currently in development.

Note: Prices subject to change without notice. Prices are for direct Intel customers in 1000-unit bulk quantities and, unless specified, represent the latest technology versions of the products. Taxes and shipping, etc. not included. Prices may vary for other package types and shipment quantities, and special promotional arrangements may apply.

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

System and Maximum TDP is based on worst case scenarios. Actual TDP may be lower if not all I/Os for chipsets are used.

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All PCB laminates must meet Br and Cl requirements for low halogen as defined in IPC-4101B
For components other than PCB laminates, all homogeneous materials must contain < 900 ppm (0.09%) of Bromine [if the Bromine (Br) source is from BFRs] and < 900 ppm (0.09%) of Chlorine [if the Chlorine (Cl) source is from CFRs or PVC. Higher concentrations of Br and Cl are allowed in homogenous materials of components other than PCB laminates as long as their sources are not BFRs, CFRs, PVC.
Although the elemental analysis for Br and Cl in homogeneous materials can be performed by any analytical method with sufficient sensitivity and selectivity, the presence or absence of BFRs, CFRs or PVC must be verified by any acceptable analytical techniques that allow for the unequivocal identification of the specific Br or Cl compounds, or by appropriate material declarations agreed to between customer and supplier.

Max Turbo Frequency refers to the maximum single-core frequency that can be achieved with Intel® Turbo Boost Technology, which requires a PC with a processor with Intel Turbo Boost Technology capability. Intel Turbo Boost Technology performance varies depending on hardware, software, and overall system configuration. Check with your PC manufacturer on whether your system delivers Intel Turbo Boost Technology. See www.intel.com/technology/turboboost/ for more information.

Some products can support AES New Instructions with a Processor Configuration update, in particular, i7-2630QM/i7-2635QM, i7-2670QM/i7-2675QM, i5-2430M/i5-2435M, i5-2410M/i5-2415M. Please contact OEM for the BIOS that includes the latest Processor configuration update.

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