digital

Alpha 21164

ALPHA GENERATION

Digital Semiconductor Alpha 21164 Microprocessor Product Brief

The Digital Semiconductor 21164 Alpha microprocessor is a high-performance implementation of Digital's Alpha architecture designed for Windows NT desktop PCs and workstations. The 21164 improves productivity in today's demanding business world by bringing supercomputer performance to the desktop.

Description

The 21164 has a superscalar design capable of issuing four instructions every clock cycle. The integration of an instruction cache, data cache, and second-level cache offers unrivaled microprocessor performance. The 21164 uses a high-performance interface to access main memory, data buses, and an optional board-level cache.

Benefits

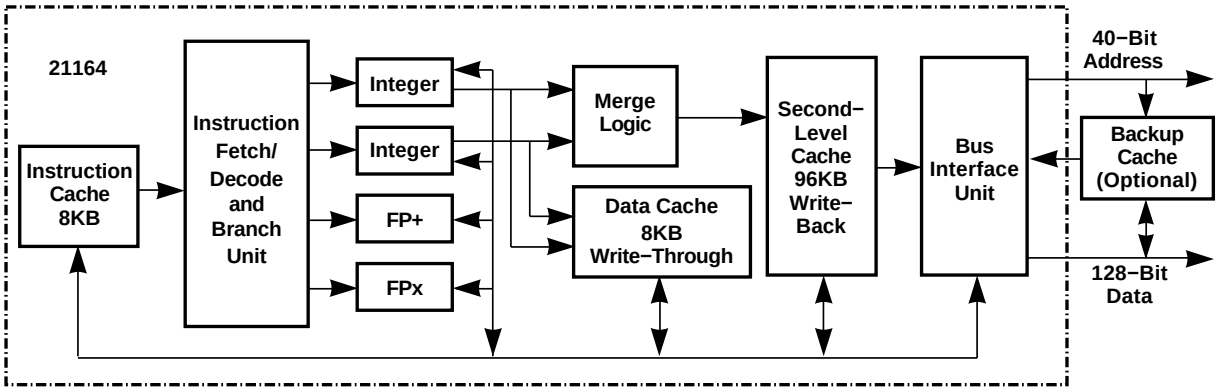
- 100% Windows compatible
  - Thousands of native applications
  - High-performance translation technology for x86 applications
- Highest performance Windows NT systems
- Increased engineering and business productivity
- Host-based DVD playback
- Designed for the future using the 64-bit Alpha architecture
- Designed to meet the needs of the PC industry
  - Standard cooling
  - Lower power
- ATX motherboard turnkey OEM solution is available for quick time to market

Features

- Fully pipelined 64-bit advanced RISC (reduced instruction set computing) architecture
- Superscalar (4-way instruction issue)
- 0.35 µm CMOS technology
- Onchip, 8KB, direct-mapped L1 instruction cache
- Onchip, 8KB, direct-mapped, write-through L1 data cache
- Onchip, 96KB, 3-way, set-associative, write-back L2 unified instruction and data cache
- Memory-management unit
- Serial ROM interface for initialization
- Flexible high-performance interface
  - 128-bit memory data path
  - 3.3-V I/O
  - Selectable parity protection or error correction code (ECC) on data
  - Programmable system interface; one-third to one-fifteenth of clock speed
  - Control for optional offchip L3 cache, with multiple timing options for industry-standard synchronous and asynchronous SRAMs
- Chip- and module-level test supports JTAG (IEEE 1149.1)
- 499-pin ceramic interstitial pin grid array (IPGA) package
- Enhancements:
  - Support for byte and word data types
  - 2.0-V core for reduced power consumption

21164 Functional Block Diagram

The 21164 consists of five independent functional units: the instruction fetch, decode, and branch unit; the integer execution unit; the memory-management unit; the cache control and bus interface unit; and the floating-point unit. There are three onchip caches: the instruction cache, the data cache, and the second-level cache.



Thermal Management

The 21164 dissipates approximately 28 W at 366 MHz. Conventional forced air cooling methods are sufficient to remove heat and maintain the highest levels of reliability. The user may also define an application-specific heat sink.

Estimated Performance

Speed	SPECint95	SPECfp95	BIPS (billions of instructions/sec)
500 MHz	15.4	21.1	2.0
433 MHz	13.3	18.3	1.7
366 MHz	11.3	15.4	1.5

Characteristics	
Electrical	
Power supply	**Vss** = 0.0 V, **Vdd** = 3.3 V ±5%, **Vddi** = 2.5 V ±0.1 V
Environmental	
Operating temperature	**Ta** = 50°C maximum (122°F) **Tj** = 85°C maximum (185°F)
Storage temperature range	–55°C to +125°C (–67°F to +257°F)
Power dissipation @ **Vdd** = 3.3 V **Vddi** = 2.5 V Frequency = 366 MHz	28 W maximum
For frequencies greater than 366 MHz, add 5 W for every 66 MHz.	
Physical	
Package	499-pin IPGA

For More Information

To learn more about the availability of the 21164, contact your local semiconductor distributor. To learn more about Digital Semiconductor's product portfolio, contact the Digital Semiconductor Information Line:

United States and Canada
1–800–332–2717
Outside North America
+1–508–628–4760

or visit the Digital Semiconductor World-Wide Web Internet site:

http://www.digital.com/info/semiconductor