



# Builder's Guide for AMD Opteron™ Processor-Based Servers and Workstations



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## Contents

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<b>Revision History</b> .....	<b>7</b>
<b>Chapter 1 AMD Opteron™ Processor Key Architectural Features</b> .....	<b>9</b>
1.1 The AMD64 Architecture .....	9
<b>Chapter 2 Validated Server Program (VSP)</b> .....	<b>11</b>
2.1 Value Proposition .....	11
2.2 Design Methodology for the VSP Platform .....	11
2.3 Platform Description .....	12
2.3.1 Model A2210 1U/2P—Based on the AMD Opteron™ 200-Series Processor .....	12
2.3.2 4U/4P Model A8440—Based on the AMD Opteron 800-Series Processor .....	13
2.4 Not Yet a Member of VSP? .....	15
<b>Chapter 3 AMD Opteron™ Processor-In-a-Box</b> .....	<b>17</b>
<b>Chapter 4 Heatsink Installation</b> .....	<b>19</b>
4.1 Heatsink Installation Procedure .....	19
<b>Chapter 5 Hardware Considerations</b> .....	<b>29</b>
5.1 System Enclosures and Chassis Selection .....	29
5.1.1 Basic System Enclosure Selection Guidelines .....	29
5.1.2 Basic Chassis Selection Guidelines .....	29
5.1.3 Power Supply Considerations .....	30
5.2 Power Supply Guidelines .....	31
5.2.1 Server and Workstation Platform Power Supplies .....	31
5.2.2 Calculating System Power Consumption .....	32
5.3 Thermal Solution .....	34
5.3.1 AMD Opteron™ Processor Thermal Solution Guidelines .....	34
5.3.2 Thermally Tested Populated Chassis Server Solutions for AMD Opteron Processor .....	34
5.4 Memory Guidelines for AMD Opteron Processor-Based Systems .....	35
5.5 AMD Opteron Processor Information .....	35
5.6 AMD Chipset Information .....	37

5.6.1	AMD-8000™ Series Chipset .....	37
5.6.2	Graphics and Storage .....	38
5.7	AMD Opteron Processor Utilities and Updates .....	39
5.8	AMD-8000 Series Chipset Drivers .....	39
<b>Chapter 6</b>	<b>EMI Reduction Techniques.....</b>	<b>43</b>
6.1	EMI Emission Standards.....	43
6.2	AMD Opteron Processor-Based System Builder EMI Reduction Techniques.....	43
<b>Appendix A</b>	<b>AMD Opteron™ Processor-Based System Build Procedure .....</b>	<b>47</b>
<b>Appendix B</b>	<b>FAQs.....</b>	<b>51</b>
B.1	AMD Opteron™ Processor FAQs .....	51
B.2	Validated Server Program FAQs.....	53

## List of Figures

---

Figure 1. AMD Opteron™ Processor Architecture .....	9
Figure 2. Model A2210 1U/2P Rack Server .....	13
Figure 3. Model A8440 4U/4P Rack Server .....	14
Figure 4. AMD64 Processor-in-a-Box.....	17
Figure 5. Retention Frame and Backplate for the AMD Opteron Processor Heatsink.....	19
Figure 6. Backplate Release Liner .....	20
Figure 7. Motherboard Placed Over Backplate.....	20
Figure 8. Ensure Proper Contact Between Backplate and Motherboard .....	21
Figure 9. Retention Frame Screw Holes Aligned with Backplate Standoffs.....	21
Figure 10. Tightening Down the Retention Frame .....	22
Figure 11. Alignment Markers on Processor and Motherboard .....	22
Figure 12. Pushing Gently Down on the Processor .....	23
Figure 13. Plastic Cover Over Thermal Interface Material .....	23
Figure 14. Heatsink Centered Over Processor.....	24
Figure 15. Heatsink Spring Clip .....	24
Figure 16. Pushing Straight Down on the Clip.....	25
Figure 17. Correctly Installed Spring Clip.....	25
Figure 18. Turning the Cam Lever .....	26
Figure 19. Cam Lever Locked into Retention Frame .....	26
Figure 20. Installed Heatsink .....	27
Figure 21. Desirable Airflow—Power Supply with Bottom Inlet .....	30
Figure 22. Undesirable Airflow—Power Supply with Front Inlet Only .....	31

## List of Tables

---

Table 1. Power Worksheet 1—Component Power .....	32
Table 2. Power Worksheet 2—Total Watts.....	33
Table 3. AMD Opteron™ Processor Series and Model Numbers .....	36
Table 4. Microsoft® Drivers for the AMD-8000™ Series of Chipset Components .....	39
Table 5. Linux Drivers for the AMD-8000 Series of Chipset Components .....	41

## Revision History

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<b>Date</b>	<b>Revision</b>	<b>Description</b>
February 2004	3.04	Revised public release. Added EMEA contact information.
December 2003	3.00	Initial public release.





# Chapter 1 AMD Opteron™ Processor Key Architectural Features

The key architectural features of an AMD Opteron™ processor-based system include AMD64 architecture, integrated DDR DRAM memory controller, HyperTransport™ technology, and many other features.

Figure 1 shows a block diagram of the AMD Opteron processor architecture.

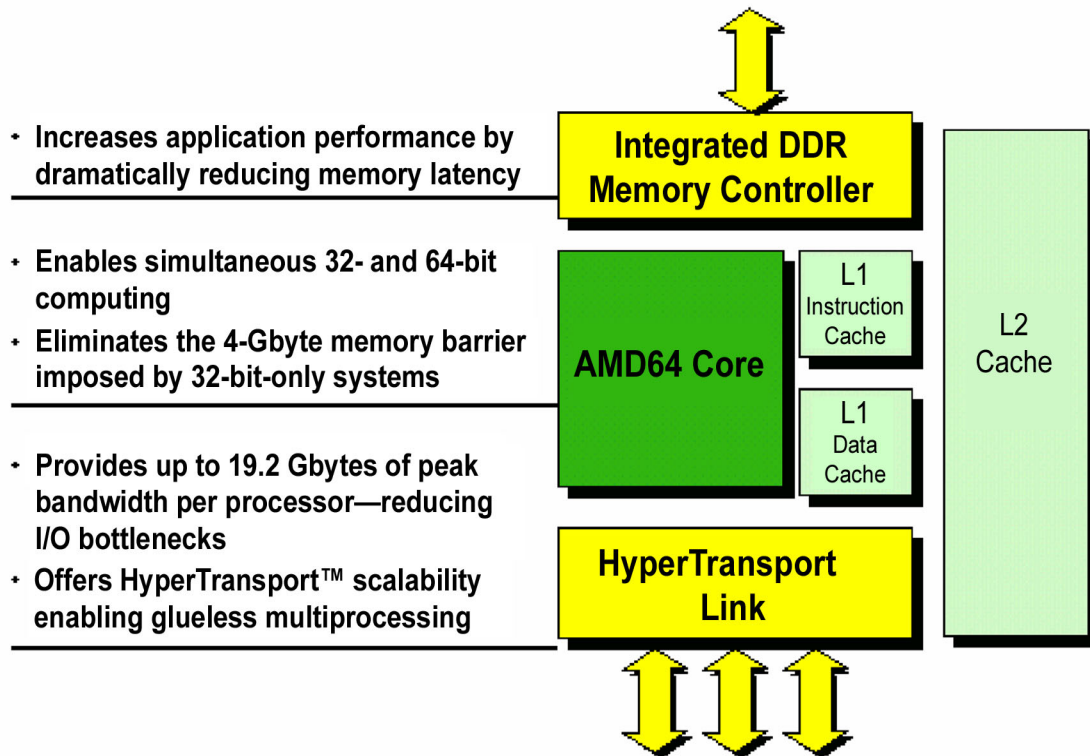


Figure 1. AMD Opteron™ Processor Architecture

## 1.1 The AMD64 Architecture

AMD64 architecture allows end users to run existing, installed 32-bit applications and operating systems at peak performance, while providing a migration path that is 64-bit capable. It is designed to enable 64-bit computing while remaining compatible with the vast x86 software infrastructure. AMD64 architecture represents a new class of computing, enabling a single architecture across 32- and 64-bit environments.

## **Integrated DDR DRAM Memory Controller**

The 128-bit wide integrated DDR DRAM memory controller:

- changes the way the processor accesses main memory, resulting in increased bandwidth, reduced memory latencies, and increased processor performance.
- allows available memory bandwidth to scale with the number of processors.
- can support up to eight registered DDR DIMMs per processor.
- has available memory bandwidth of up to 5.3 Gbytes/s (with PC2700) per processor.

## **HyperTransport™ Technology**

The HyperTransport technology of the AMD64 architecture offers the following features:

- A scalable bandwidth interconnection between processors, I/O subsystems, and other chipsets
- Support for up to three coherent HyperTransport links, providing up to 19.2 Gbytes/s of peak bandwidth per processor
- Up to 6.4 Gbytes/s bandwidth per link providing sufficient bandwidth for supporting new interconnects including PCI-X, DDR, InfiniBand, and 10G Ethernet
- Low power consumption (1.2 W) to help reduce the system thermal budget

## **Other Features of the AMD Opteron™ Processor**

Other features of the AMD Opteron processor include:

- 64-bit wide key data and address paths that incorporate a 48-bit virtual address space and a 40-bit physical address space
- ECC (error correcting code) protection for L1 cache data, L2 cache data and tags, and DRAM with hardware scrubbing of all ECC-protected arrays
- Lower thermal output levels and improved frequency scaling through .13 micron SOI (silicon-on-insulator) process technology
- Support for all instructions necessary to be fully compatible with SSE2 technology
- Two additional pipeline stages (compared to AMD's 32-bit architecture) for increased performance and frequency scalability
- Higher IPC (instructions-per-clock) achieved through additional key features, such as larger TLBs (translation lookaside buffer), flush filters, and enhanced branch prediction algorithms

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## Chapter 2 Validated Server Program (VSP)

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For those System Builders, VARs and Integrators that prefer a pre-built system, the Validated Server Program (VSP) is designed to enable rapid introduction of AMD Opteron™ processor-based servers. AMD has joined forces with Celestica, one of the world's leading electronics manufacturing services (EMS) providers, to bring you the VSP. Building on tested, stable, and reliable VSP solutions available from Celestica, your organization can:

- Gain leverage in a highly competitive market
- Streamline the development cycle and simplify your business
- Speed time-to-market
- Build revenue through value-added products and services
- Focus on customer service and other core competencies
- Boost customer satisfaction with Celestica's end-to-end service and support

### 2.1 Value Proposition

VSP platforms are designed to take advantage of the performance of AMD Opteron processors, HyperTransport™ technology links, and the AMD-8000™ series of chipsets. All of Celestica's server platforms are defined with reliability, availability, and serviceability as key objectives. This attention to detail provides servers that can be relied on for mission critical applications.

### 2.2 Design Methodology for the VSP Platform

The design methodology for the VSP platform includes:

- Hot plug testing with multiple operating systems
- Peripheral compatibility testing with more than 100 cards, drives, and multiple operating systems
- Worst-case power consumption analysis (including PCI-X® peripherals and drives)
- Thermal analysis of components
- Accelerated life test (used to determine MTBF figures)
- Full Flotherm analysis using the latest software modeling tools to confirm sufficient airflow in the design
- Signal analysis on all high-speed bus and critical signal traces
- Acoustic testing
- Shock, vibration, and drop testing

In addition to the rigorous design and test methodologies, Celestica provides an Engineering Change Notice (ECN) procedure to give advanced warning of any modifications in hardware or firmware along with an explanation of the severity and cause. These ECNs are designed to allow you to proactively solve potential issues with your customers and provide orderly transitions to new revisions of the platforms.

Celestica offers comprehensive phone and web-based support for all VSP platforms. A knowledgebase is available for common issues while a trained staff of technicians and engineers handles more difficult situations. All issues are tracked with trouble tickets to help ensure a prompt response.

## **2.3 Platform Description**

VSP includes two product lines—one for 2-way multiprocessing and one for 4-way multiprocessing. Both product lines are available in *bare-bones* and fully-configured options. Both product lines feature AMD Opteron processors with AMD64 architecture, enabling end-users to leverage their current base of 32-bit applications and migrate to 64-bit applications when ready. In addition, each platform offers high-bandwidth I/O for increased flexibility and expandability, along with an integrated QLogic baseboard management controller (BMC) for streamlined management, IPMI v1.5-compliance, and remote management capabilities.

### **2.3.1 Model A2210 1U/2P—Based on the AMD Opteron™ 200-Series Processor**

This rack-optimized 1U platform is ideal for print/file server applications, Internet/network-edge devices, dedicated web servers, and high performance cluster nodes. Figure 2 on page 13 shows a 1U/2P rack-optimized server based on the AMD Opteron 200-series processor.



**Figure 2. Model A2210 1U/2P Rack Server**

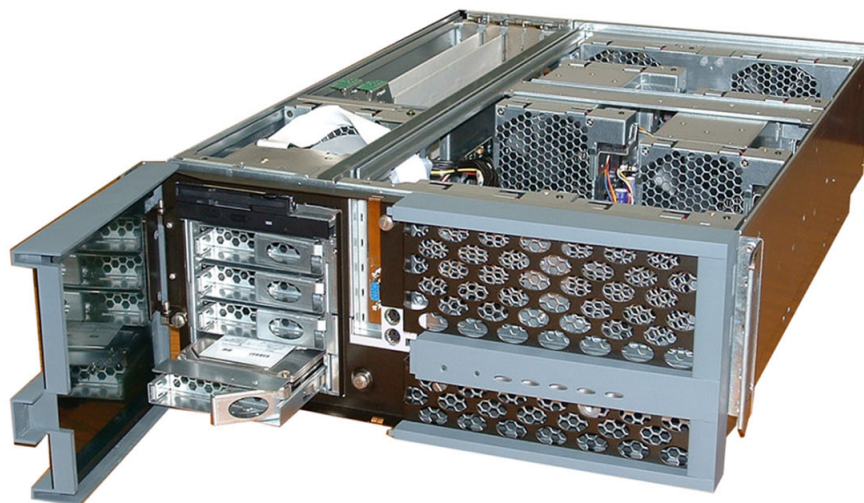
Key features of this platform include:

- Up to two AMD Opteron 200-series processors
- AMD64 architecture
- Up to 16 GBytes of DDR ECC registered memory (4 DIMMs per processor)
- One PCI-X 64-bit/133MHz or two PCI-X 64-bit/100 full length slots
- Up to two fixed IDE or two hot-swappable SCSI Ultra320 hard drives
- Slimline DVD-ROM or optional floppy disk drive
- Dual Broadcom 10/100/1000 Ethernet onboard
- 500-W power supply
- Integrated QLogic baseboard management controller (BMC); IPMI v1.5-compliant

### **2.3.2 4U/4P Model A8440—Based on the AMD Opteron™ 800-Series Processor**

The VSP 4-way multiprocessor solution is designed to deliver incredible performance for enterprise-level computing including—database, Internet infrastructure, data center environments, CAD/CAM, high performance cluster nodes, and scientific applications.

Figure 3 shows a 4U/4P server, based on the AMD Opteron 800-series processor.



**Figure 3. Model A8440 4U/4P Rack Server**

Key features of this platform include:

- Up to four AMD Opteron 800-series processors
- AMD64 architecture
- Up to 32 Gbytes of DDR memory (4 DIMMs per processor)
- Two PCI-X 64-bit/133-MHz hot-swappable slots
- Three 64-bit/66-MHz slots
- Two LSI Logic SCSI Ultra 320 channels—one internal and one external
- Four 1” hot-swap SCSI drive bays with U320 SCSI-capable SAF-TE backplane
- Slimline DVD-ROM and floppy drive
- Dual Broadcom 10/100/1000 Ethernet onboard
- Up to three hot-swap 500-W power supplies with 2+1 redundancy
- Integrated QLogic BMC management controller; IPMI v1.5-compliant

## 2.4 Not Yet a Member of VSP?

For more information, register as a member, and find out how to order VSP products, please visit <http://www.amd.com/vsp7> or contact us by email at [vsp@amd.com](mailto:vsp@amd.com). In Europe, the Middle East, and Africa (EMEA), please visit [www.amd.com/vsp](http://www.amd.com/vsp).





## Chapter 3      AMD Opteron™ Processor-In-a-Box

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The best solution for System Builders and Resellers manufacturing pedestal platforms is the processor-in-a-box (PIB) from AMD. The PIB is available now in a new retail box. The improved display options allow the product to be either free-standing, stacked, or hung. The boxed processor package is heat-sealed to alleviate lid tampering and to help ensure the authenticity of the AMD processor. The AMD PIB is covered by a three-year limited warranty.

Figure 4 shows the new PIB retail box.



**Figure 4. AMD64 Processor-in-a-Box**

The PIB includes the following items:

- The AMD64 processor of choice
- Heatsink and fan, properly sized for the thermal requirements of the processor
- Assembly and installation instructions
- AMD64 processor case sticker
- Double processor packaging allows higher impact resistance adding more protection
- A three-year limited warranty
- Certificate of Authenticity

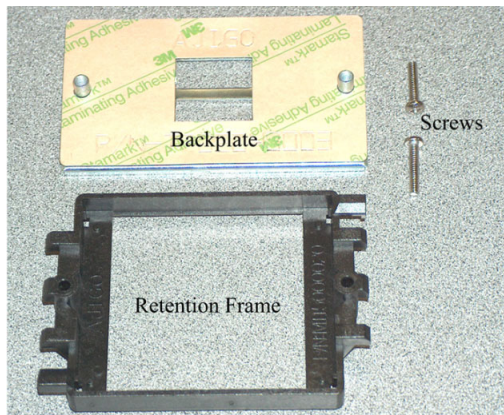
Check with your preferred distribution partner for AMD Opteron™ processor in a box or buy online at: <https://aac.avnet.com/AMDstore/index.jsp>. In EMEA, please check with your preferred distribution partner for AMD Opteron™ processor-in-a-box.



## Chapter 4 Heatsink Installation

This chapter contains instructions for the installation of the AMD Opteron™ processor heatsink.

The AMD Opteron processor heatsink requires the retention frame and the backplate to be attached to the motherboard. If the retention frame and backplate are already attached to the motherboard, proceed to step 10. Figure 5 shows the backplate and retention frame for the AMD Opteron processor heatsink. The heatsink assembly shown in Figure 5 may not exactly match the one provided in a PIB.



**Figure 5. Retention Frame and Backplate for the AMD Opteron™ Processor Heatsink**

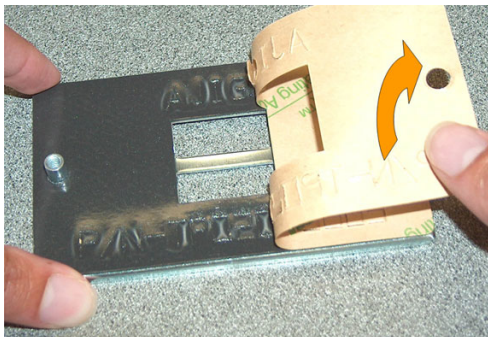
### 4.1 Heatsink Installation Procedure

Follow the instructions to install the AMD Opteron processor heatsink.

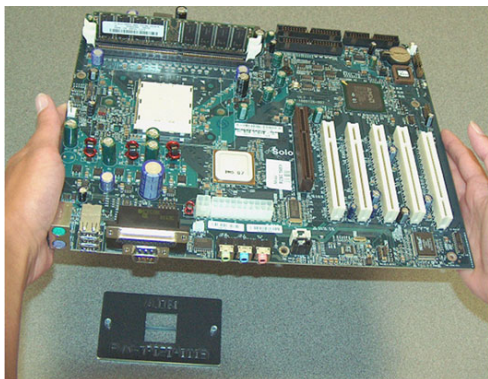
**CAUTION:** *As with all computer equipment, the processor and motherboard components may be damaged by electrostatic discharge (ESD). Please take proper ESD precautions when handling any board.*

**Warning:** *Do not apply voltage until the heatsink is fully installed. If voltage is applied before the heatsink is fully installed, the processor will overheat and failure will result. Read through the entire installation instructions completely to make sure you understand them before you begin.*

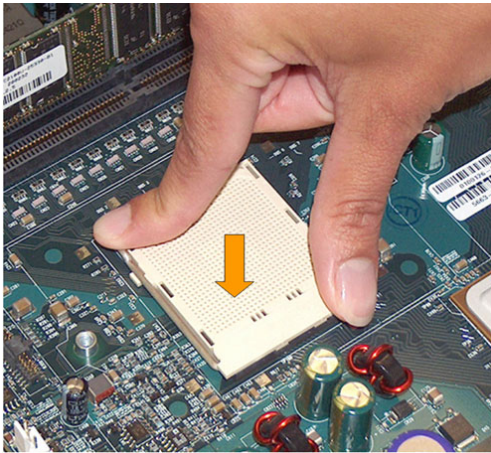
1. Place the backplate on a flat surface.
2. Peel the release liner off the backplate. (See Figure 6 on page 20.)

**Figure 6. Backplate Release Liner**

3. Gently lift the motherboard by the edges over the backplate.
4. Align the two threaded standoffs on the backplate with the two mounting holes near the socket on the motherboard. (See Figure 7.)

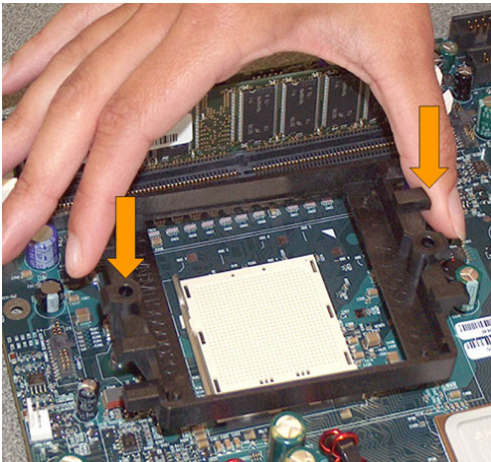
**Figure 7. Motherboard Placed Over Backplate**

5. Gently lower the motherboard until the standoffs fit through the holes near the socket and the backplate makes complete contact with the motherboard.
6. Press firmly on the socket to ensure proper contact between the backplate and motherboard. (See Figure 8 on page 21.)



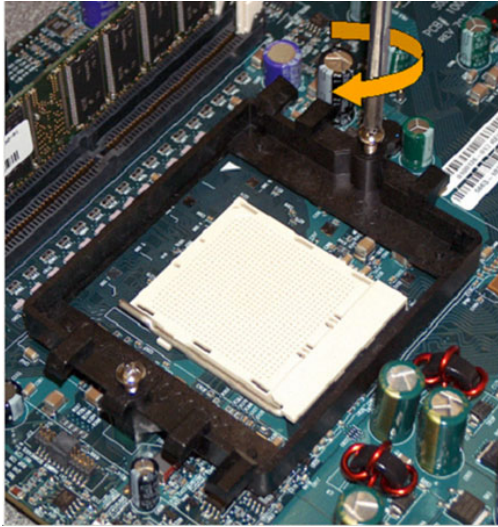
**Figure 8. Ensure Proper Contact Between Backplate and Motherboard**

7. Carefully place the retention frame on the motherboard.
8. The screw holes must align with the backplate standoffs. (See Figure 9.)



**Figure 9. Retention Frame Screw Holes Aligned with Backplate Standoffs**

9. Place the screws and tighten down the retention frame. (See Figure 10 on page 22.)
  - Ensure that the retention frame is flat with the motherboard.
  - Do not over-tighten the screws.



**Figure 10. Tightening Down the Retention Frame**

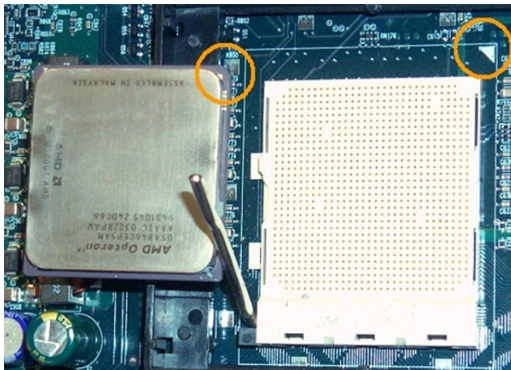
10. Lift the socket locking-lever. (Pull it out slightly, *and then* lift up.)

**Warning:** *Do not apply voltage until the heatsink is fully installed. If voltage is applied before the heatsink is fully installed, the processor will overheat and failure will result.*

11. Gently place the zero insertion force (ZIF) processor into the socket.

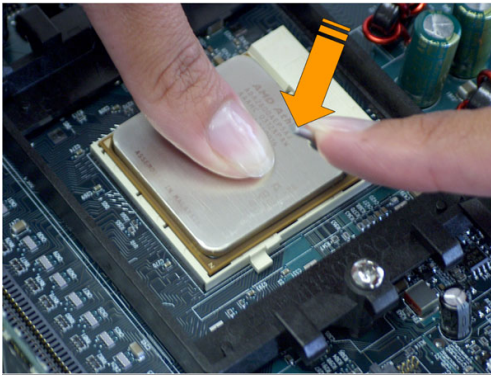
The AMD Opteron processor has a small triangle marking on one corner. (See Figure 11.) This triangle corresponds to the alignment marking on the motherboard. The corner with the triangle must be located at the corresponding corner marked on the motherboard.

Be careful not to bend the processor pins.



**Figure 11. Alignment Markers on Processor and Motherboard**

12. Push down gently on the processor while lowering the locking lever and latching it into the fully locked position. (See Figure 12 on page 23.)



**Figure 12. Pushing Gently Down on the Processor**

13. Inspect the thermal interface material for scratches or gaps.

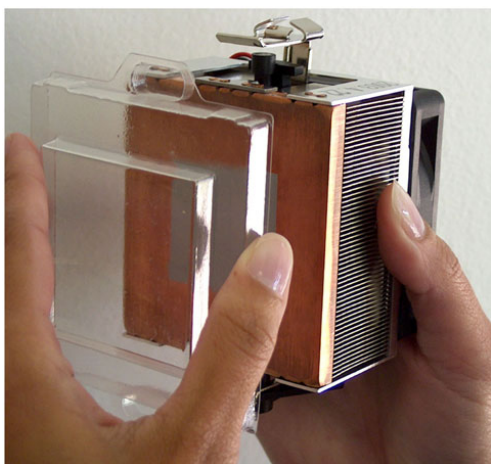
The heatsink has a thermal interface material pre-applied on the bottom. This material is protected by a plastic cover. (See Figure 13.)

Do not use the thermal interface material if it has scratches or gaps. If replacement thermal interface material is needed, contact AMD technical support for assistance at <http://ask.amd.com> or (408) 749-3060. In EMEA, please contact AMD technical support for assistance at <http://www.amd.com/support>.

If a heatsink is removed for any reason, clean the processor and heatsink surface and re-apply an AMD approved thermal interface material before re-installing the processor.

14. Remove and discard the plastic cover.

Be careful not to touch or scratch the thermal interface material.

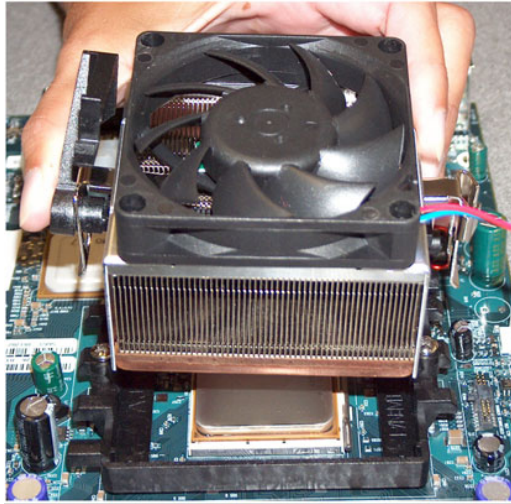


**Figure 13. Plastic Cover Over Thermal Interface Material**

15. Center the heatsink over the processor. (See Figure 14 on page 24.)

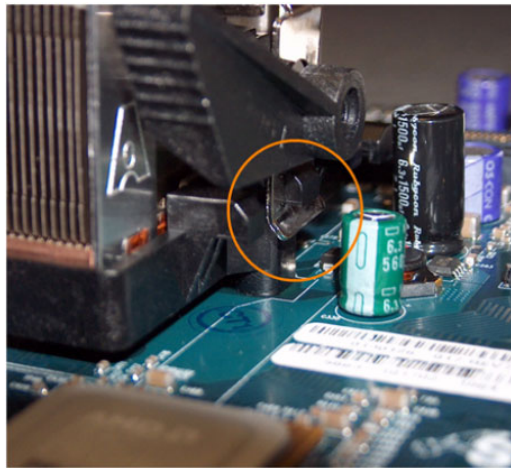
The mounting lug on the retention frame must match the heatsink clip.

The heatsink must have full contact with the processor.



**Figure 14. Heatsink Centered Over Processor**

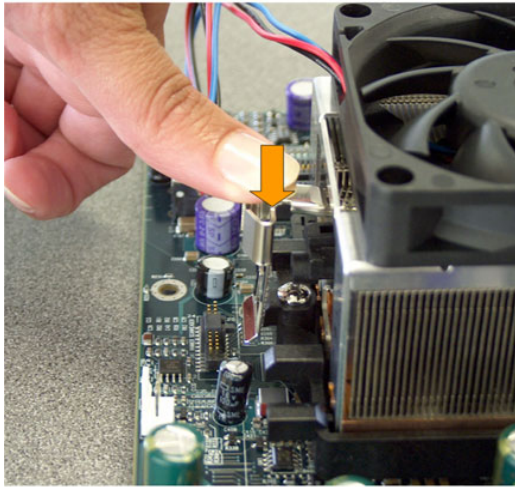
16. Hook the spring clip under the cam lever to the mounting lug on the retention frame.  
Some force may need to be applied.



**Figure 15. Heatsink Spring Clip**

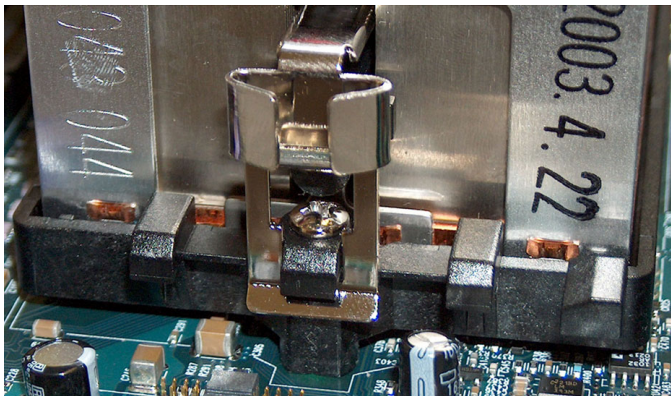
17. Ensure the spring clip is aligned with the plastic lug on the retention frame.
18. Carefully push straight down on the clip. (See Figure 16 on page 25.)  
This may take more force than the first side.





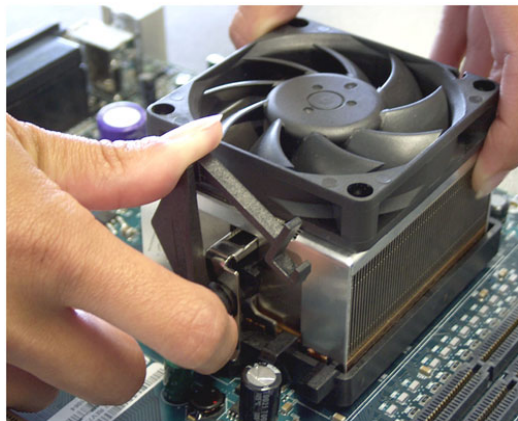
**Figure 16. Pushing Straight Down on the Clip**

The spring clip must be installed as shown in Figure 17.



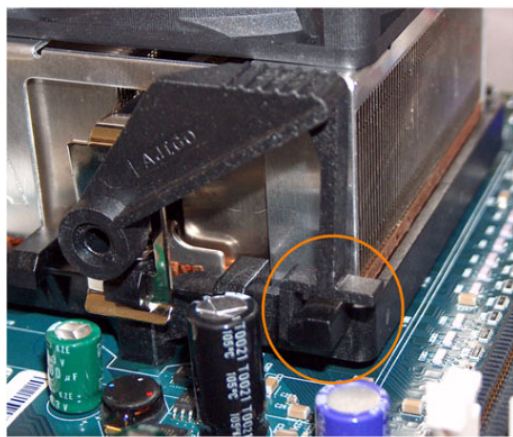
**Figure 17. Correctly Installed Spring Clip**

19. Carefully turn the cam lever to lock into place. (See Figure 18.)



**Figure 18. Turning the Cam Lever**

20. Ensure the cam lever is locked into the retention frame. (See Figure 19.)



**Figure 19. Cam Lever Locked into Retention Frame**

21. Connect the fan power lead to the proper connector on the motherboard.

Figure 20 shows an installed heatsink.



**Figure 20. Installed Heatsink**

22. Check the installation completely to make sure heatsink is installed correctly before starting the system.

23. Power-on the system.

24. Verify immediately that the fan on the processor heatsink is turning at a rapid rate.

If the fan is spinning at a slow rate or not spinning at all, power-down the system immediately to avoid any thermal damage.



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## Chapter 5 Hardware Considerations

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AMD frequently updates its list of motherboard solutions. For the most up-to-date list of providers please visit our Web site.

[http://www2.amd.com/us-en/Processors/ProductInformation/1,,30\\_118\\_8796\\_8819%5e8821,00.html?1063430341](http://www2.amd.com/us-en/Processors/ProductInformation/1,,30_118_8796_8819%5e8821,00.html?1063430341)

In EMEA, for the most up-to-date list of providers please visit our Web site.

[www.amd.com/opteronmotherboards](http://www.amd.com/opteronmotherboards)

### 5.1 System Enclosures and Chassis Selection

AMD Opteron™ processor-based motherboards can leverage industry-standard tower or pedestal chassis. The selection of the proper system chassis is a critical element to the success of the finished system. For best results, a system builder should always contact the motherboard and chassis suppliers or vendors to verify that each of the chosen components supports the desired system configuration. The following data is a basic guideline that has been tested by the engineering staff at AMD.

*Note: This data is only a guideline and is not a substitute for a system builder verifying that a chassis meets industry and customer requirements, nor is it a substitute for the system builder conducting its own research, testing, and validation.*

#### 5.1.1 Basic System Enclosure Selection Guidelines

The choice of the appropriate system enclosure depends on many factors as follows:

- It must be compatible with the chosen motherboard and power supply. Confirm the motherboard and power supply requirements with those suppliers.
- It must allow enough airflow through the system to adequately cool all the internal components, especially critical parts like the processor.
- It must have good fit and finish, e.g., no razor-sharp edges.

#### 5.1.2 Basic Chassis Selection Guidelines

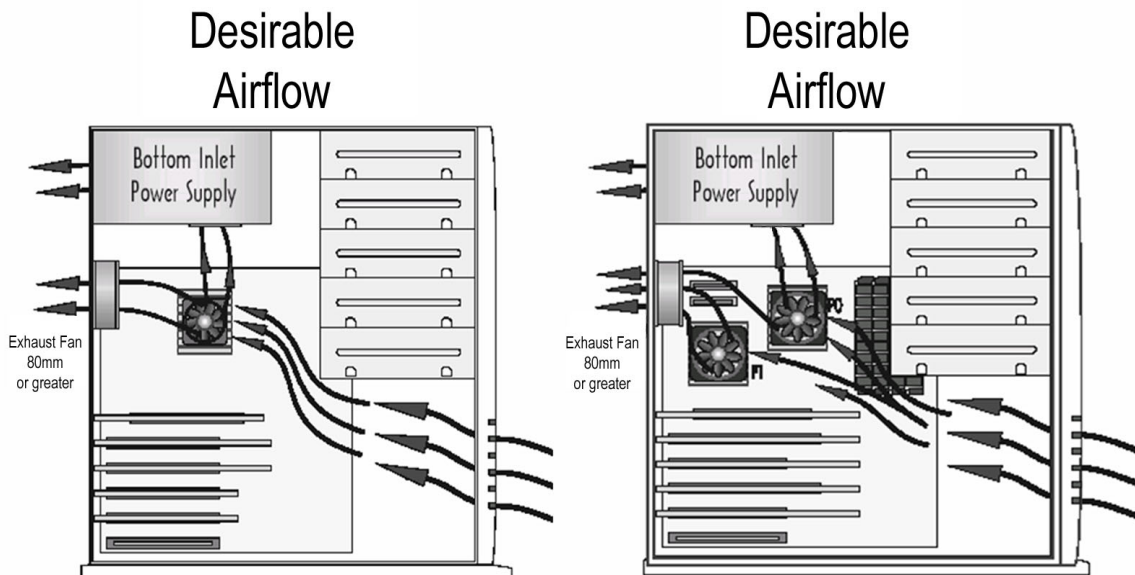
The following are some basic guidelines to aid in finding an enclosure with adequate cooling capability:

- Use 80 mm fans or larger.
- Choose a chassis with a fan in the back that is in addition to the processor fan.

- Cables inside the enclosure can cause airflow disruptions. Using cable ties, tie and route the cables out of the path of the cooling airflow.
- For tower chassis, choose a chassis with power supplies that have both ATX-style bottom air intake vents and front air intake vents.
- When the system is in a tower chassis, there must be clear space in front of the chassis to allow cool airflow in and space behind the chassis for the heated air to flow out.
- Rear fans should exhaust air in the same direction—out the back of the chassis.
- Front intake fans may not be of significant benefit to cooling a tower chassis, and should not be relied upon as the sole fan in a system.
- Testing done by the AMD thermal engineers has shown that the airflow pattern in Figure 21 is more desirable than the airflow pattern seen in Figure 22 on page 31.
- When the bottom inlet power supply is used, nearly all the air flows near or through the area of the processor. As a result, the processor remains cooler.

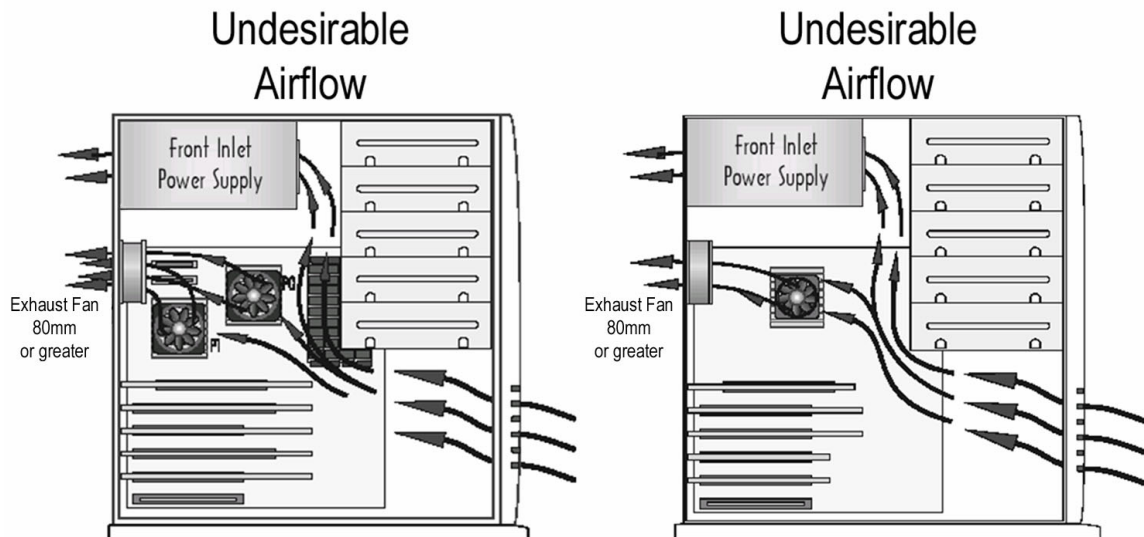
### 5.1.3 Power Supply Considerations

Because heatsinks are heat radiators, like the radiator in an automobile, they need airflow to function properly. Figure 21 shows desirable airflow through a chassis. Both desirable configurations use a bottom-inlet power supply.



**Figure 21. Desirable Airflow—Power Supply with Bottom Inlet**

Figure 22 on page 31 shows undesirable airflow through a chassis. Both undesirable configurations use a front-inlet power supply.



**Figure 22. Undesirable Airflow—Power Supply with Front Inlet Only**

## 5.2 Power Supply Guidelines

AMD Opteron processor-based motherboards may be designed to leverage industry standard power supplies. The selection of the proper system-power supply is a critical element to the success of the finished system. For best results, a system builder should always contact the motherboard, power supply, and chassis suppliers or vendors to verify that each of the chosen components supports the desired system configuration, and a system builder should verify that support through internal testing and validation.

### 5.2.1 Server and Workstation Platform Power Supplies

Depending on the motherboard vendors' design requirements, the server/workstation can use either an ATX 12-V power supply, or an EPS12V. The motherboard design can use one or two power connectors. Usually a separate power connector is used to provide power for the I/O components. It is important that you confirm with the motherboard manufacturer the exact connector requirements.

*Note: It is imperative that system builders ensure that the power supply of choice and the selected chassis are mechanically compatible.*

In order to have a reliable and cost-effective system, system builders should calculate the power requirements for the intended configuration.

*Note: System builders should refer to the motherboard manual to check the type of power connector and type of power supply the motherboard uses. The motherboard, power supply, and case must be mechanically and electrically compatible.*

### 5.2.2 Calculating System Power Consumption

The total combined wattage for the system configuration must be less than the output of the power supply used. Overall current usage limitation on the power supply should not exceed a combined system power output for the +5-V and +3.3-V outputs.

Use the power worksheets given in Table 1 on page 32 and Table 2 on page 33 to calculate the system power consumption. For current and voltage requirements of add-in boards and peripherals, refer to your vendor's documents. The current draw on each voltage tap should be included with the documentation from the motherboard vendor.

In Power Worksheet 1—Component Power list the peak current for each board and device applicable in the appropriate voltage level column. Add the currents in each column, then go to Power Worksheet 2—Total Watts.

**Table 1. Power Worksheet 1—Component Power**

Device	Item Qty	Maximum Current at Each Voltage Level				
		+3.3 V	+5 V	+12 V	-12 V	5 VSB
Motherboard w/on-board devices						
System fan						
Processor fan						
Memory module						
AGP VGA card						
PCI modem card						
PCI sound card						
PCI NIC card						
PCI SCSI card						
Other PCI card/Bus card						
PCI RAID card						
IDE hard drive						
SCSI hard drive						



**Table 1. Power Worksheet 1—Component Power (Continued)**

Component	Item Qty	Maximum Current at Each Voltage Level				
		+3.3 V	+5 V	+12 V	-12 V	5 VSB
CD-ROM drive						
CD-RW drive						
DVD drive						
Floppy drive						
Tape drive						
ZIP drive						
USB devices						
IEEE 1394 devices						
Keyboard						
Mouse						
Other devices (if any)						
Processor						
Total current for all devices						

Use the following steps to determine the total combined power used by the system.

1. From Power Worksheet 1—Component Power, enter the total current for each column.
2. Multiply the voltage by the total current to get the total wattage for each voltage level.
3. Add the total wattage for each voltage level to arrive at a total combined power usage on the power supply.

**Table 2. Power Worksheet 2—Total Watts**

Voltage Level and Total Current (V x A = W)	Total Watts for Each Voltage Level
+3.3 V x (total amps)	Total Watts for +3.3 V
+5 V x (total amps)	Total Watts for +5 V
+12 V (I/O) x (total amps)	Total Watts for +12 V (I/O)
+12 V (processor) x (total amps)	Total Watts for +12 V (processor)
-12 V x (total amps)	Total Watts for -12 V
+5 VSB x (total amps)	Total Watts for 5 VSB
Total=	Total Combined Wattage=

**Note:** To calculate the processor current at 12-V VRM source:

$$I = \left( \frac{\text{processor core voltage} \times \text{processor core current}}{12} \right) \times 1.25$$

Where 12 = VRM source voltage and 1.25 is the reciprocal of the 80% voltage regulator efficiency.

## 5.3 Thermal Solution

This information is only a guideline for the systems being constructed and is not intended to be a substitute for system builder verification, validation, and testing on the reliability and effectiveness of a thermal solution.

### 5.3.1 AMD Opteron™ Processor Thermal Solution Guidelines

For reliable operation of AMD Opteron processor-based systems, the selection of the correct thermal solution is critical. For a list of heatsink suppliers that have developed products designed to support AMD Opteron processors, please visit our Web site.

[http://www.amd.com/us-en/Processors/TechnicalResources/0,,30\\_182\\_869\\_8819^9396,00.html](http://www.amd.com/us-en/Processors/TechnicalResources/0,,30_182_869_8819^9396,00.html)

In EMEA, for a list of heatsink suppliers that have developed products designed to support AMD Opteron processors, please visit our Web site.

<http://www.amd.com/opteronhardware>

This selection of suppliers found at these Web sites is frequently updated and not intended to be a comprehensive listing of all heatsinks that support AMD Opteron processors.

### 5.3.2 Thermally Tested Populated Chassis Server Solutions for AMD Opteron™ Processor

AMD internal labs have tested the thermal performance of the server solutions outlined on our Web site at [http://www.amd.com/us-en/Processors/ProductInformation/0,,30\\_118\\_8796\\_8819^9398,00.html](http://www.amd.com/us-en/Processors/ProductInformation/0,,30_118_8796_8819^9398,00.html). In EMEA, please visit <http://www.amd.com/opteronhardware>. A thermally tested server solution is defined as chassis, heatsink(s), motherboard, and power supply. This testing is strictly limited to a thermal evaluation under AMD's internal tests for AMD Opteron processors at speeds to be released through the end of 2004 and does not include electromagnetic interference (EMI), or other component testing or considerations. Furthermore, AMD has not conducted individual thermal or functional testing on the power supplies and heatsinks in these systems.

AMD strongly recommends that the operation of the power supply is investigated and fully understood by the system builder to meet the requirements of each configuration. Verification of mechanical fit with the selected power supplies and other system components should also be investigated by the system builder prior to purchase.

Additional information on AMD Opteron™ Processor configuration is available at [www.amd.com/configuration](http://www.amd.com/configuration). In EMEA, please visit <http://www.amd.com/opteronhardware>. These documents that are additional resources designed to provide guidance to you with the configuration of a stable AMD Opteron™ processor-based platform.

## 5.4 Memory Guidelines for AMD Opteron™ Processor-Based Systems

AMD Opteron processor-based platforms may be designed to leverage industry standard DDR registered DIMMs. An independent testing company, Computer Memory Test Labs (CMTL), has conducted memory compatibility testing. CMTL is an independent test facility and is able to test RAM modules from different module suppliers. System builders should access the CMTL web site at <http://www.cmtlabs.com> and view the recommended memory module list for the specific motherboard manufacturer and motherboard model.

*Note: The CMTL website is provided for informational purposes only, and AMD recommends that a system builder conduct its own testing and validation to confirm that the memory modules are suitable for its systems.*

Several AMD Opteron processor-based motherboards currently support some of the following memory features:

- PC1600, PC2100, PC2700, and PC3200 registered memory modules
- 184-pin 2.5-V and 2.6-V DDR DIMMs
- 28-bit DDR memory bus
- 64-Mbyte, 128-Mbyte, 256-Mbyte, 512-Mbyte, 1-Gbyte, 2-Gbyte and 4-Gbyte memory technology
- Production DIMMs from industry standard DRAM memory manufacturers.—Only registered-type memory modules should be used.

## 5.5 AMD Opteron™ Processor Information

AMD Opteron processors are identified by a three digit model number, *xyy*, where:

*x*—Indicates the maximum scalability of the processor. In other words:

100 series = 1-way servers and workstations

200 series = Up to 2-way servers and workstations

800 series = Up to 8-way servers and workstations

yy—Indicates relative performance within the series. In other words, an AMD Opteron processor model 244 is higher performing than an AMD Opteron processor model 242, etc.

Table 3 further explains the differences between AMD Opteron processor series and model numbers.

**Table 3. AMD Opteron™ Processor Series and Model Numbers**

Series	100 Series	200 Series	800 Series
<b>Scalability</b>	1-way	Up to 2-way	Up to 8-way
<b>Performance</b>	<a href="http://www.amd.com/opteronperformance">www.amd.com/opteronperformance</a>		
<b>Frequency</b>	A comprehensive list of available processors can be found on our Web site at <a href="http://www.amd.com/server">www.amd.com/server</a> or <a href="http://www.amd.com/workstation">www.amd.com/workstation</a>		
<b>Integrated DDR memory controller</b>	Yes	Yes	Yes
<b>Memory controller width</b>	128-bit	128-bit	128-bit
<b>ECC DRAM protection</b>	Yes	Yes	Yes
<b>HyperTransport™ technology</b>	Yes	Yes	Yes
<b>HyperTransport links (total/coherent)</b>	3/0	3/1	3/3
<b>HyperTransport link width</b>	16 bits x 16 bits	16 bits x 16 bits	16 bits x 16 bits
<b>HyperTransport bus frequency</b>	800MHz	800MHz	800MHz
<b>AMD64</b>	Yes	Yes	Yes
<b>Simultaneous 32- and 64-bit computing</b>	Yes	Yes	Yes
<b>L1 Cache size (data/instruction)</b>	64 Kbytes/64 Kbytes	64 Kbytes/64 Kbytes	64 Kbytes/64 Kbytes
<b>L2 Cache size</b>	1MB	1MB	1MB
<b>Pipeline stages (integer/floating point)</b>	12/17	12/17	12/17

**Table 3. AMD Opteron™ Processor Series and Model Numbers (Continued)**

Series	100 Series	200 Series	800 Series
<b>L1/L2 data cache protection</b>	ECC	ECC	ECC
<b>L1/L2 instruction cache protection</b>	Parity	Parity	Parity
<b>Global history counter entries</b>	16K	16K	16K
<b>L1 TLB entries (data/instruction)</b>	40/40	40/40	40/40
<b>L1 associativity (data/instruction)</b>	Full/Full	Full/Full	Full/Full
<b>L2 TLB entries (data/instruction)</b>	512/512	512/512	512/512
<b>L2 associativity (data/instruction)</b>	4-way/4-way	4-way/4-way	4-way/4-way
<b>Process</b>	.13 micron SOI	.13 micron SOI	.13 micron SOI
<b>Manufactured In</b>	Fab 30, Dresden Germany	Fab 30, Dresden Germany	Fab 30, Dresden Germany

## 5.6 AMD Chipset Information

AMD offers an array of chipset products designed to unleash the full power of AMD Opteron, processors. From workstations to multiprocessor servers, AMD provides a world-class high-performance chipset solution to enable the most demanding designs.

### 5.6.1 AMD-8000™ Series Chipset

Ushering in the next generation of computing platforms, AMD introduces the AMD-8000™ series of core-logic components designed to support the AMD Opteron processor. Implementing HyperTransport technology as the system backbone, these core-logic elements deliver outstanding performance and design flexibility. This chipset consists of several “building block” components that can be used together in a variety of system designs.

#### 5.6.1.1 AMD-8151™ HyperTransport™ AGP3.0 Graphics Tunnel

The AMD-8151™ HyperTransport™ AGP3.0 graphics tunnel provides AGP3.0 capability to workstation platforms requiring high-end graphics performance. Included in the AMD-8151 graphics tunnel are the following high-level features:

- AGP3.0 interface
- HyperTransport tunnel

Refer to the AMD-8151 graphics tunnel product brief and to the *Preliminary AMD-8151™ HyperTransport™ AGP3.0 Graphics Tunnel Data Sheet*, order# 24888 for detailed specifications.

### **5.6.1.2 AMD-8131™ HyperTransport™ PCI-X® Tunnel**

Targeting server and workstation applications, the AMD-8131™ HyperTransport™ PCI-X® tunnel provides high-speed PCI-X capability to platforms requiring high-performance I/O expansion. The AMD-8131 I/O bus tunnel high-level feature-set includes the following:

- Dual PCI-X interface (supporting 133-MHz, 100-MHz, 66-MHz, and legacy-PCI speeds).
- HyperTransport tunnel
- APIC

Refer to the AMD-8131 I/O bus tunnel product brief and the *Preliminary AMD-8131™ HyperTransport™ PCI-X® Tunnel Data Sheet*, order# 24637 for detailed specifications.

### **5.6.1.3 AMD-8111™ HyperTransport™ I/O Hub**

The AMD-8111™ HyperTransport I/O hub integrates the system I/O functions into a single component. The AMD-8111 I/O hub high-level feature-set includes the following:

- HyperTransport interface
- 10/100 Ethernet
- EIDE Controller, supporting up to ATA-133
- AC'97 Audio, USB
- I/O buses: PCI, LPC, SMBus, APIC

Refer to the AMD-8111 chipset component product brief and the *AMD-8111™ HyperTransport™ I/O Hub Data Sheet*, order# 24674 for detailed specifications.

## **5.6.2 Graphics and Storage**

Workstations are typically more graphic-intensive than servers. A workstation is used by a single user running applications that are more processor-intensive than a desktop. Programs such as CAD systems, scientific analysis programs such as finite element analysis, etc., are very graphic intensive. These types of applications require higher graphics capability than desktop systems. Therefore, if you are building a workstation you would want to use a motherboard that supports an AGP-8X graphics interface, such as is provided with the AMD-8151 HyperTransport AGP3.0 tunnel.

Servers are systems that are not typically used by just one operator sitting in front of a display attached directly to the server. The server is used to support other computers such as desktops or workstations, connected through a network. A server can be used to supply computational processing to connected thin clients. A thin client is a keyboard and display terminal that has very little computing power of its own, but relies on the server to which it is connected to run applications. A server can also be used to access data stored on very large storage devices. Therefore, a server may need to have the capability to connect to hundreds of disk drives.

Storage servers need to have an ample supply of PCI-X slots that can accept cards used for storage access. For example, a PCI-X SCSI can have four SCSI ports on it. Each port can support up to 15 SCSI drives. Therefore, one SCSI PCI-X card can support up to 60 SCSI drives. If a server has four PCI-X slots, it can support up to 240 SCSI drives.

## 5.7 AMD Opteron™ Processor Utilities and Updates

**AMD CPUID**—This application executes and displays the return data from the CPUID instruction set. No source code is provided.

**AMD Processor Information Display Utility**—This utility displays the processor signature, approximate speed, L1/L2 cache sizes, processor revision, and instruction extensions supported.

These utilities can be found and downloaded from [http://www.amd.com/us-en/Processors/ProductInformation/0,,30\\_118\\_8796\\_871,00.html](http://www.amd.com/us-en/Processors/ProductInformation/0,,30_118_8796_871,00.html).

In EMEA, these utilities can be found and downloaded from <http://www.amd.com/drivers>.

## 5.8 AMD-8000™ Series Chipset Drivers

Table 4 shows AMD-8000 series of chipset components drivers for Microsoft® operating systems.

**Table 4. Microsoft® Drivers for the AMD-8000™ Series of Chipset Components**

Drivers for Microsoft® Operating Systems	32-Bit Operating Systems				64-Bit Operating Systems
	Windows® 98	Windows 2000	Windows XP Pro	Windows Server 2003	Windows 64-Bit Editions for AMD64
AMD-8151™ HyperTransport™ AGP3.0 Graphics Tunnel Driver	√	√	√	√	enabled natively

**Table 4. Microsoft® Drivers for the AMD-8000™ Series of Chipset Components (Continued)**

Drivers for Microsoft® Operating Systems	32-Bit Operating Systems				64-Bit Operating Systems
	Windows® 98	Windows 2000	Windows XP Pro	Windows Server 2003	Windows 64-Bit Editions for AMD64
AMD-8131™ HyperTransport™ PCI-X® Tunnel IOAPIC Controller Driver		√	√	√	enabled natively
AMD-8131 HyperTransport PCI-X Tunnel Driver		√		√	
AMD-8111™ I/O Hub EIDE Driver		√	√	√	
AMD-8111 I/O Hub System Management Controller Driver		√	√	enabled natively	enabled natively
AMD-8111 I/O Hub 10/100 Ethernet Controller Driver	√	√	√	√	enabled natively
AMD-8111 I/O Hub AC'97 Audio Controller Driver	√	√	√	√	enabled natively
AMD-8111 I/O Hub SMBus 2.0 Controller Driver		√	√	enabled natively	enabled natively
AMD-8111 I/O Hub High-Precision Event Timer		√		√	√
AMD Driver Pack	√	√	√	√	√
For the latest drivers visit <a href="http://www.amd.com/drivers">www.amd.com/drivers</a>					



Table 5 shows AMD-8000 series core logic (chipset) drivers for Linux operating systems.

**Table 5. Linux Drivers for the AMD-8000™ Series of Chipset Components**

<b>Drivers for Linux Operating Systems</b>	<b>Kernel 2.4.18</b>	<b>Kernel 2.4.20</b>	<b>Kernel 2.4.21</b>	<b>Kernel 2.5, 2.6</b>
AMD-8151™ HyperTransport™ AGP3.0 Graphics Tunnel Driver for Linux 2P Platforms		√	√	√
AMD-8151 HyperTransport AGP3.0 Graphics Tunnel Driver for Linux 1P Platforms	√	√	√	√
AMD-8131™ PCI-X® Tunnel Standard Hot-Plug Controller (SHPC) Driver Version 1.03 for Linux				√
AMD-8131 PCI-X Tunnel Standard Hot-Plug Controller (SHPC) Driver Version 1.03 for Linux			√	√
AMD-8111™ 10/100 Ethernet Driver for Linux			√	√
AMD-8111 AC'97 Audio Driver for Linux			√	√
AMD-8111 IDE for Linux			√	√
For the latest drivers visit <a href="http://www.amd.com/drivers">www.amd.com/drivers</a>				



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## Chapter 6 EMI Reduction Techniques

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These electromagnetic interference (EMI) reduction techniques can be implemented with relatively short lead-times at the final system-assembly stage. Proper electromagnetic compatibility (EMC) and motherboard design techniques are assumed.

The effectiveness of all the EMI-reduction techniques varies from system to system. This chapter is provided as a guideline only, to help identify and close the common EMI energy paths that allow radiated emissions to escape from the chassis enclosure.

### 6.1 EMI Emission Standards

EMI emissions from a computer system must be controlled and kept below regulatory limits. Radiated EMI emissions are measured with an antenna, typically 10 meters away from the computer system under test. There are different EMI standards for systems marketed in the United States and Europe, and all standards are continually updated. Typically, most computers must meet FCC Class “B” for the US and CE Class “B” EMI requirements to be sold in Europe.

### 6.2 AMD Opteron™ Processor-Based System Builder EMI Reduction Techniques

This document describes system-level EMI reduction techniques based on past successful problem resolution of EMI radiated emissions. All the techniques described may be able to be implemented at the final system assembly stage with relatively short lead-time. This document does not contain long lead-time techniques involving motherboard re-layout or chassis sheet metal redesign. Proper up-front electromagnetic compatibility (EMC) motherboard design techniques are assumed. For more information on these techniques, please refer to the *AMD Athlon™ 64 FX and AMD Opteron™ Processors Motherboard Design Guide*, order# 25180.

The effectiveness of the following EMI reduction techniques varies among different computer systems. EMC engineering tests must be performed to determine how effective each of the following EMI reduction techniques is for a particular system.

This list of EMI reduction techniques is numbered in the recommended order of evaluation and relative simplicity. Each item is described in detail for clarity.

#### 1. Spread Spectrum Clocking

AMD processors are designed to run with spread spectrum clocking enabled. Ensure that the motherboard BIOS has enabled the spread spectrum feature of the system clock generator. Enabling the spread spectrum setting often lowers frequency amplitudes by more than 5 dB.

## **2. Disable Unused Clocks**

Clock signals that have no load can have high levels of ringing that can lead to EMI problems. The motherboard BIOS firmware should be programmed to detect and disable unused memory DIMM and PCI clocks.

## **3. Processor Heatsink Fan Cable Routing**

A problem sometimes encountered with the processor heatsink DC fan cable is the large loop formed in its routing to the motherboard connector. Shorten this cable length to reduce the loop area as much as possible.

## **4. Power Supply Cable Routing**

Historically, the system power supply cable has been found to be very susceptible to picking up EMI energy from within the system and coupling into the power supply and then onto the AC power cord. It is best to keep the power supply cable against the metal chassis and as far away from the processor, memory DIMMs, and VRM components as possible. This cable routing should be fixed in place with plastic cable ties.

## **5. Other Internal Cable Routing**

Cable routing inside the system should generally be routed along the metal chassis and away from EMI sources such as the processor heatsink, clock modules, memory DIMMS, VRM components, and high speed VLSI modules. Internal cables that connect to front I/O ports such as USB and Audio are particularly sensitive. The use of a shielded cable or a ferrite core or both over these internal cables can be effective at reducing EMI.

## **6. Rear I/O Connector Shield**

One common problem in many computer systems is poor electrical contact between the metal I/O connector plate and the cut out in the system chassis wall. This problem is usually due to soft metal being used in the I/O connector plate. If the metal does not have good spring characteristics, the finger contacts can be depressed and not make reliable contact. A solution to this is to use a hardened stainless spring steel. Additionally, some designs have an insufficient number of contact points to the I/O connectors and the wall of the system chassis. This is usually most apparent around the keyboard/mouse and USB housings. Each of these connectors should have at least two contacts. As a general rule, there should be a contact point at least every 1 cm to 1.5 cm.

## **7. Chassis Shielding**

All chassis designs have gaps and seams to enable assembly and option installation. From an EMI standpoint, however, some gaps are worse than others. The important dimension of a gap or seam is the longest dimension. If you can slide a piece of paper for several inches along a seam, that seam could cause an EMI problem. Spring fingers or foam EMI gasket can be used to seal these gaps or seams.

## **8. Processor Heatsink Grounding**

Although grounding of the processor heatsink has not yet been required on any AMD Opteron processor-based systems, grounding of the processor heat sink can further lower the harmonic EMI levels of the processor. Many AMD Opteron processor-based motherboards contain grounding pads around the footprint area of the processor. These grounding pads can be used to ground the heatsink to the motherboard.

If excessive system level EMI radiated emissions exist after attempting all the listed EMI reduction techniques, then more extensive remedies may be necessary. First, determine if the emissions emanate from the system I/O cables (including the AC power cord) or from aperture leaks in the system chassis. If EMI emissions emanate from a particular I/O cable, then improved filtering or cable shielding may be required on that cable. If EMI emissions emanate from slots or seams in the chassis enclosure, use copper tape across the apertures to improve shielding effectiveness. If copper tape reduces emission levels to a satisfactory level, then chassis sheet metal changes or conductive EMI gasketing can be added at that location.



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## Appendix A AMD Opteron™ Processor-Based System Build Procedure

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Always verify that the system you are building only uses components from the list recommended by AMD, or follow the recommendations outlined in this document to select a suitable component, and then follow this procedure to build your system

For additional configuration information, go to: [www.amd.com/configuration](http://www.amd.com/configuration)

In EMEA, please go to: [www.amd.com/opteronhardware](http://www.amd.com/opteronhardware)

1. Ensure the selected motherboard is appropriate for the chosen processor model and frequency. Check the AMD Opteron™ processor recommended motherboard list as to compatibility.
2. Verify that your case follows the system case (chassis) airflow guidelines on the AMD website.
3. Calculate the power requirements for the intended configuration prior to selecting and installing a power supply.

*Note: Ensure that the power supply wattage selected meets the intended configuration requirement and the motherboard and chassis are electrically and mechanically compatible.*

4. Ensure that you are properly grounded at all times during the system construction to protect the delicate electronic components from static electricity damage.
5. Install the selected hard drives, floppy disk drives, DVD or CD-ROM player, and other devices into the chassis.

*Note: Check the hard drive installation guide. For full performance, you must also install the appropriate data cable (see drive installation instructions).*

6. Remove the motherboard from its protective packaging and place it on a firm (but not hard) surface—ideally the surface will be a grounded anti-static pad.
7. Remove the AMD Opteron processor from its protective packaging (always make sure you are electrically grounded), install the processor into the motherboard socket, then install only an AMD recommended heatsink and fan assembly. For more specific information, follow the instructions found in Chapter 4 of this document.

8. Install the assembled motherboard and processor with heatsink into the chassis. Always install any standoffs needed to support the motherboard, especially in the areas where cards will be placed.
9. Check the motherboard for any jumper settings. (Most motherboards do not require jumpers.)
10. Ensure the selected memory (256 Mbytes or more are recommended for server/workstations) is shown on the motherboard maker's recommended memory list. If the motherboard manufacturer does not have a verified/recommended memory listing, check with the memory supplier to verify that they have tested your chosen motherboard and deemed it to be compatible with the DIMM memory modules you plan to use.
11. Install the recommended memory into the motherboard. Be sure to install the RAM in the sequence required for the chosen motherboard. Verify each memory DIMM is inserted all the way into the socket and locked in place.
12. Install a high-performance AGP video graphics card. Have the latest drivers available (see the Web site of the card maker). You will need the drivers shortly.
13. Connect the power cables to the drives and motherboard.
14. Connect the hard drive, floppy-disk drive, and DVD (CD-ROM) data cables in the normal manner. Verify that the cables are installed securely and with the proper edge near Pin 1.
15. Connect the monitor data cable, keyboard cable, and mouse cable to the rear of the system.
16. Install the AC-line power cord on the power supply and connect to the power outlet.
17. Go to the Web sites of the motherboard vendor or the chipset maker for the latest drivers and utilities.
18. Check your motherboard vendor's Web site for the latest version of the BIOS, AGP miniport driver and bus mastering IDE driver. (AMD has drivers available for its chipsets at [www.amd.com](http://www.amd.com). In EMEA, please go to <http://www.amd.com/drivers>.)
19. Check the peripheral manufacturer's Web site for the latest drivers for the sound card, network interface card, the video graphics card, and any other added devices.
20. Power the system on and begin loading software and drivers, following the installation instructions.
21. Make sure the system starts and runs reliably with just the graphics card installed. Restart and run the system multiple times.
22. Install additional cards at this time, if additional cards are to be installed.



- a. Turn off the system and unplug it before installing each card.
- b. Install additional cards one at a time.
- c. Restart the system after every card installation.

**Note:** *If you have difficulties with the installation of any of the cards or drivers, refer to Complex Configurations and IRQ Info, available on the AMD website.*

23. As you install each card, verify the card is properly seated (connector fully inserted into the slot, front and back) and that the retention screws are in place.
24. Test the complete system for proper operation. If system functions properly, load any other software.



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## Appendix B      FAQs

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Appendix B contains frequently asked questions concerning AMD Opteron™ processors and the validated server program.

### B.1      AMD Opteron™ Processor FAQs

**Q:** *What markets are the AMD Opteron series processors targeted for?*

**A:** The AMD Opteron processor 100 series is for use in 1-way servers and workstations. One-way servers are commonly used by Internet and application service providers (ISPs/ASPs), eBusiness and data center customers for edge-of-the-network workloads such as DNS servers, DHCP servers, security encryption as well as in network attached storage (NAS) and storage area network (SAN) devices. One-way workstations are commonly used by CAD, architectural, and DCC professionals to create solid models, diagrams, or digital effects.

The AMD Opteron processor 200 series is for use in 2-way servers or workstations. Enterprise workloads typically benefiting from 2-way server processing power include large databases, business processing (ERP, CRM, and SCM), business intelligence, as well as other IT infrastructure applications including heavy-duty Web serving and messaging. Workstation applications that take advantage of the performance of the AMD Opteron processor include digital content creation, mechanical and electrical design, financial analysis, and 3-D modeling.

The AMD Opteron processor 800 series is for use in up to 8-way servers. Enterprise workloads typically benefiting from 4-way and 8-way server processing power include large, mission-critical databases, business processing (ERP, CRM, and SCM), business intelligence, as well as other IT infrastructure applications including heavy-duty Web serving and messaging.

**Q:** *What motherboard support is available for the 100 series processors?*

**A:** The AMD Opteron processor 100 series is currently supported by the ASUS SK8N motherboard with NVIDIA Nforce3 Pro150 chipset, available through distribution worldwide. It is also supported by the MSI MS-9130 motherboard with VIA K8T800 chipset, available through the manufacturer.

**Q:** *What software supports these processors?*

**A:** AMD Opteron processors are based on the industry-standard x86 instruction set and are thus supported by the thousands of applications based on this instruction set. All 32-bit Microsoft® Windows® operating systems, including Microsoft Windows Server 2003, include support for the AMD Opteron processor, as do the major 32-bit Linux distributions SuSE, Red Hat, TurboLinux, MandrakeSoft, SCO, among others. Commercial 64-bit versions of SuSE Linux, United Linux, and MandrakeSoft are available today and several other 64-bit operating systems are in development, including the 64-bit version of Microsoft

Windows Server 2003 and Microsoft Windows XP. Sixty-four-bit applications for the AMD Opteron processor include Apache Server, Mental Ray, Zeus, Cluster Strike Server, SendMail, MY SQL, IBM DB2, and CA Ingres. Sixty-four-bit versions of Microsoft IIS, Red Hat Stronghold, Oracle 9i, MS SQL Server 2000, MS Terminal server, Synopsys VCS, and CA Unicenter are under development.

**Q:** *What is the value proposition of the AMD Opteron processor?*

**A:** The AMD Opteron processor is the world's first x86-based processor that can simultaneously run 32-bit and 64-bit applications, with leading performance for both. This gives businesses a competitive advantage with world-leading 32-bit performance, while allowing them to easily take advantage of 64-bit applications when conditions are right for their business to do so. By choosing open-standard, non-proprietary computer architecture, a business can maintain its current investment in IT and lower its total cost of ownership—there is no need to retrain IT professionals in a new proprietary architecture, no forced migration to 64-bit applications, and no need to overhaul hardware or change existing software. AMD Opteron processor models are available for 1- to 2-way workstations, and 1- to 8-way servers that support the full range of company's computing needs from entry-level to enterprise workloads.

**Q:** *For what types of servers is the AMD Opteron processor suitable?*

**A:** The AMD Opteron processor is suitable for different workloads across an enterprise. Some examples are:

- 1P and 2P servers are suitable for front-end “edge-of-the-network” firewall, cache, and load balancing servers, as well as for Web servers and general purpose IT infrastructure servers.
- 2P through 4P servers are suitable for mid-tier heavy-duty Web servers and applications servers and for general purpose IT infrastructure servers.
- 4P through 8P servers are suitable for back-end database, decision support, and storage servers.

**Q:** *What operating systems does the AMD Opteron processor support?*

**A:** As a fully backward-compatible x86 microprocessor, the AMD Opteron processor is designed to support all existing 32-bit server and workstation operating systems from Microsoft (Windows Server 2003, Windows XP, etc.), major Linux distributors (Red Hat, SuSE, TurboLinux, SCO, MandrakeSoft), and Sun Microsystems Solaris. In addition, several 64-bit operating systems exist in production versions (SuSE Linux Enterprise Server 8, UnitedLinux V1, MandrakeLinux Corporate Version 2.1 and NetBSD) and several, including AMD64 for Windows, Red Hat Advanced Server 3.0, and TurboLinux, are in development.

**Q:** *What are the benefits of the AMD Opteron processor?*

**A:** The AMD Opteron processor architecture is designed to provide unparalleled performance and supports the x86 instruction set, delivering outstanding performance for both 32-bit code and 64-bit code. As the need for memory-intensive 64-bit applications becomes greater, our

plan is for IT managers to seamlessly move to 64-bit applications that benefit their business while continuing to leverage their investment in 32-bit software and personnel. Additionally, the HyperTransport™ technology interface addresses the high memory and I/O bandwidth needs we believe will be required for future personal computers, workstations, and servers.

**Q:** *What kind of performance does the AMD Opteron processor deliver?*

**A:** Validated by independent industry-standard benchmark organizations, the world's highest performing 2P and 4P industry standard servers are powered by AMD Opteron processors. On many industry-standard server and workstation benchmarks, the AMD Opteron processor Model 146 powers the world's highest performing 1P servers and workstations.

**Q:** *What specific applications can benefit from the performance of the AMD Opteron processor?*

**A:** Many applications will run faster on the AMD Opteron processor due to its doubled-data paths. Current 32-bit processors have a 4-GByte memory addressing cap. The 40-bit physical and 48-bit virtual addressing of the AMD Opteron processor remove that limitation, permitting up to 1 Terabyte (Tbyte) of physical memory space and 256 Tbytes of virtual memory addressing space. E-commerce applications, ERP, CRM, and other highly transactional database applications can benefit from the AMD Opteron processor's larger cache, and big workload features that make manipulating larger data sets faster. Other large data set applications that can benefit from the AMD Opteron processor include CAD and DCC type applications, as well as financial and scientific modeling applications.

**Q:** *Where is the AMD Opteron processor manufactured?*

**A:** AMD Opteron processors are manufactured at Fab 30 in Dresden, Germany

**Q:** *Is the AMD Opteron processor manufactured on 0.13 micron technology?*

**A:** Yes, AMD Opteron processors are manufactured on 130 nm (.13 micron) SOI (silicon-on-insulator) process technology.

**Q:** *Where are EMI guidelines for motherboards located?*

**A:** The EMI guidelines for AMD Opteron processors can be found in the *AMD Athlon™ 64 FX and AMD Opteron™ Processors Motherboard Design Guide*, order# 25180.

**Q:** *Does the AMD Opteron processor incorporate a thermal shutdown feature?*

**A:** Yes. Please see the *AMD Opteron™ Processor Data Sheet*, order# 23932 and the *AMD Athlon™ 64 FX and AMD Opteron™ Processors Motherboard Design Guide*, order# 25180 for how to connect the pins.

## **B.2 Validated Server Program FAQs**

**Q:** *What is the Validated Server Program?*

**A:** The Validated Server Program (VSP) is a collaboration between AMD and Celestica that combines AMD's world-class silicon technologies with Celestica's world-class electronic manufacturing services. The VSP design undergoes a validation that tests compatibility and

reliability of the configuration. The program was designed to simplify a system builder's business by making it easy for them to provide AMD Opteron processor-based server platforms that are backed by world-class manufacturing and support. System builder partners purchase these systems (either barebones or fixed configuration), add additional hardware, software, or services, and resell them as system builder branded server—providing system builders with fast time to market and a competitive advantage and allowing them to provide their customers with AMD64 technology quickly and simply.

**Q:** *What is meant by barebones vs. fixed-configuration server systems?*

**A:** Barebones systems include these components—chassis, motherboard with chipset, thermal solution, and power supply, allowing a system builder to add processors, memory, hard disk drives, and other components to meet the needs of their customers. The fixed-configuration is a complete server system that includes all of the components of the barebones system plus the operating system. Fixed-configuration servers further reduce both the amount of system integration required and the amount of support required from the system builder, because all of the components are covered by a limited warranty and rapid product replacement plan through Celestica.

**Q:** *What are the benefits of the Validated Server Program to commercial customers?*

**A:** AMD Opteron processors are designed to simplify a customer's business by providing reliability for today's demanding enterprise applications, with simultaneous high-performance 32-bit computing and the ability to migrate to 64-bit computing as the customer requires. Celestica is a world-leading electronics manufacturing services provider in the execution of integrated and seamless end-to-end support and customer service. Commercial customers can purchase servers knowing that they have been validated and are backed by Celestica's world-class service and support.

**Q:** *What markets are these servers targeted for?*

**A:** Solutions available through the VSP cover a range of end-user needs. The 1U/2P A2210 is targeted at Internet and network infrastructure workloads for customers who require high performance, scalability and availability in a dense 1U package. The 4U/4P A8440 is designed for computation-intensive enterprise workloads, such as databases, business processing, messaging and business intelligence applications.

**Q:** *Will these servers be branded as AMD servers?*

**A:** No. AMD does not brand servers. VSP solutions will be branded by the system builder partners involved in this program.

**Q:** *Is AMD manufacturing servers?*

**A:** No. The servers will be manufactured by Celestica, a world leader in electronics manufacturing services and the delivery of end-to-end service and support.

**Q:** *Will these validated servers be available in all regions?*

**A:** The VSP is currently available in North American and in Europe.

**Q:** *What products will be offered through the Validated Server Program?*

- A:** The first platforms planned for availability from the VSP will be the A8440 and the A2210. The A8440 is a 4U/4P rack-mountable server based on the AMD Opteron processor 800 series. The A2210 is a 1U/2P rack-mountable server based on the AMD Opteron processor 200 series.
- Q:** *What system builders are currently ordering systems from Celestica? When will their systems be available?*
- A:** System builders in North America currently offering VSP servers include APPRO, Aspen Systems and RackSaver. We expect other system builders to join the VSP over time.