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PRELIMINARY

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OverDrive™ Processor for Pentium™ Processor-Based Systems Socket Specification

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OverDrive™ Processor for Pentium™ Processor-Based Systems Socket Specification

CONTENTS

CONTENTS

1.0 FUNCTIONAL DESCRIPTION

The OverDrive™ processor for Pentium™ processor-based systems(1) will offer significant increases in overall system performance. Designed as an in-socket upgrade to the Pentium processor, the OverDrive processor will accelerate the performance of everyday DOS*, OS/2*, Windows* and UNIX* applications.

NOTE:

1. Subsequent references to the "OverDrive processor for Pentium processor-based systems" will be abbreviated to "OverDrive processor" in this document. The OverDrive processor for Pentium processor-based systems will be referred to as the "Higher performance Pentium OverDrive processor" in end-user advertising during the 1993-1994 timeframe.

The OverDrive processor will be socket compatible with the Pentium processor. The OverDrive processor for Pentium processor-based systems has the same pinout and A.C. timing specifications as the Pentium processor. The OverDrive processor is packaged in a 273-pin, ceramic, pin grid array package with an attached fan/heatsink present on the OverDrive processor chip. The active cooling solution will be composed of heat sink with attached fan. See Sections 5 and 6 in this document for OverDrive processor mechanical and thermal information. OEMs should be sure to address the OverDrive processor's additional vertical height and required horizontal clearance due to the active cooling solution.

Performance monitoring, a feature which allows trace instruction execution in order to optimize software code, will not be implemented the same on the Pentium processor and the OverDrive processor for Pentium processor based systems.

With the exception of the OverDrive processor's mechanical, thermal and performance monitoring differences from the Pentium processor, the OverDrive processor's functional characteristics will be compatible with the Pentium processor.

2.0 OverDrive™ PROCESSOR UPGRADABILITY

2.1 OverDrive™ Processor Upgradability Requirements

A Pentium processor based system should be designed to meet certain requirements to support upgradability.

The system must feature a 273-pin, Zero Insertion Force ("ZIF") socket.

The system, as originally shipped, must carry an Intel Pentium processor in the OverDrive socket.

The OverDrive socket should be in a visible and easily accessible location to facilitate end user removal of the Pentium processor and OverDrive processor installation in the same socket. Unacceptable locations or conditions would include placement beneath daughter cards, or which require removal of disk drives or power supplies. Removal of bus cards to permit end user access to the OverDrive socket would be acceptable.

The system should allow clearance of 1.2″ above the processor for the OverDrive processor's integrated fan/heatsink. This clearance is divided into the size of the fan/heatsink and the free space above the fan/heatsink needed to ensure proper air flow.

The thermal requirements are described in Section 6 of this document.

The system should allow full movement of the OverDrive socket handle. For example, any heat sink attached to the Pentium processor should not overhang the processor in any way that would impede full movement of the OverDrive socket handle.

The system must not require any hardware or software modifications to operate the OverDrive processor, including, but not limited to, jumper or switch setting changes, and/or BIOS or logic changes; e.g., jumper changes for frequency selection are acceptable if they are optional and not required for OverDrive processor operation.

OverDrive processor installation in the OEM system must not affect the system warranty.

OEM should provide end user documentation with the OEM system describing the OverDrive processor installation process.

2.2 OverDrive™ Socket

The following drawings in Figure 2-1 show the preliminary worst case OverDrive socket footprints from 2 potential OverDrive socket vendors, AMP and Yamaichi. OEMs should work directly with socket vendors for the most current socket information.

Figure 2-2 shows the OverDrive processor chip's orientation in the OverDrive socket.

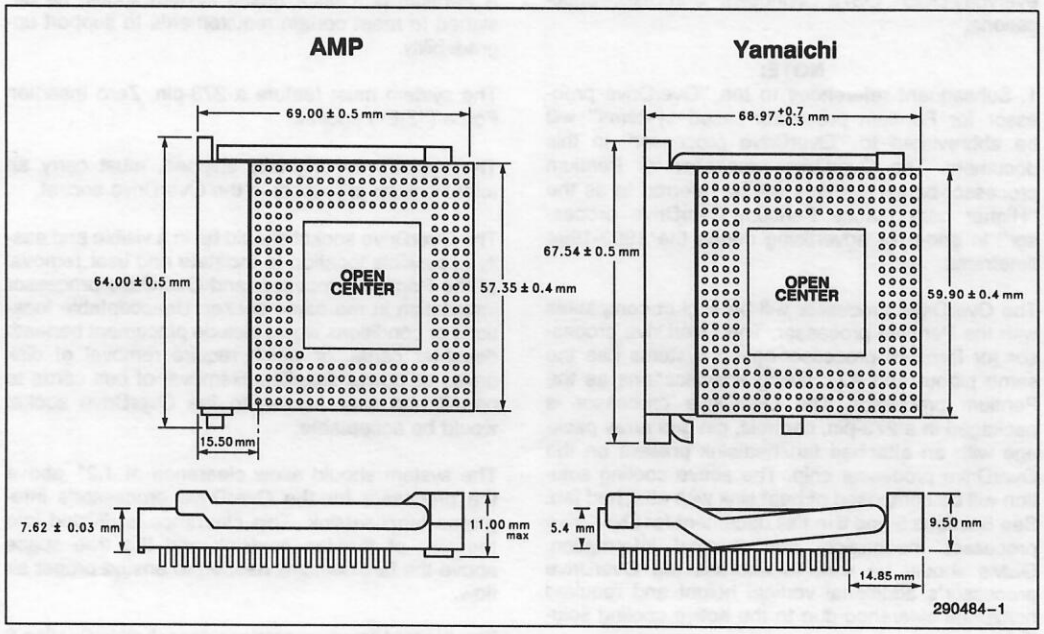


Figure 2-1. OverDrive™ Socket Footprint Dimensions (See socket manufacturer for the most current information.)

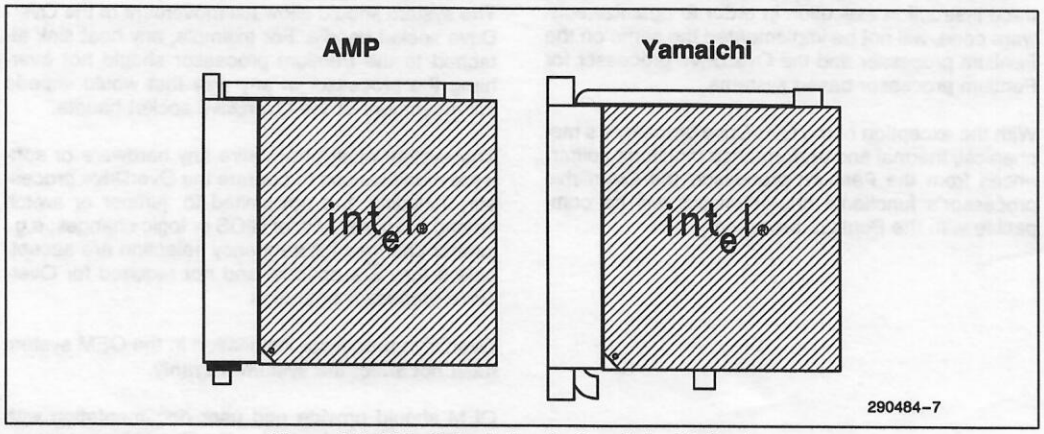


Figure 2-2. Chip Orientation in OverDrive™ Socket

3.0 PIN DESCRIPTIONS

The OverDrive processor pinout as well as the functionality of the OverDrive processor's pins are identical to that of the Pentium processor. For a detailed description, see the Hardware Interface chapter in the *Pentium Processor Data Book*. Note that all input pins must meet their A.C./D.C. specifications to guarantee proper functional behavior. Figures 3-1 and 3-2 show the OverDrive processor pinout.

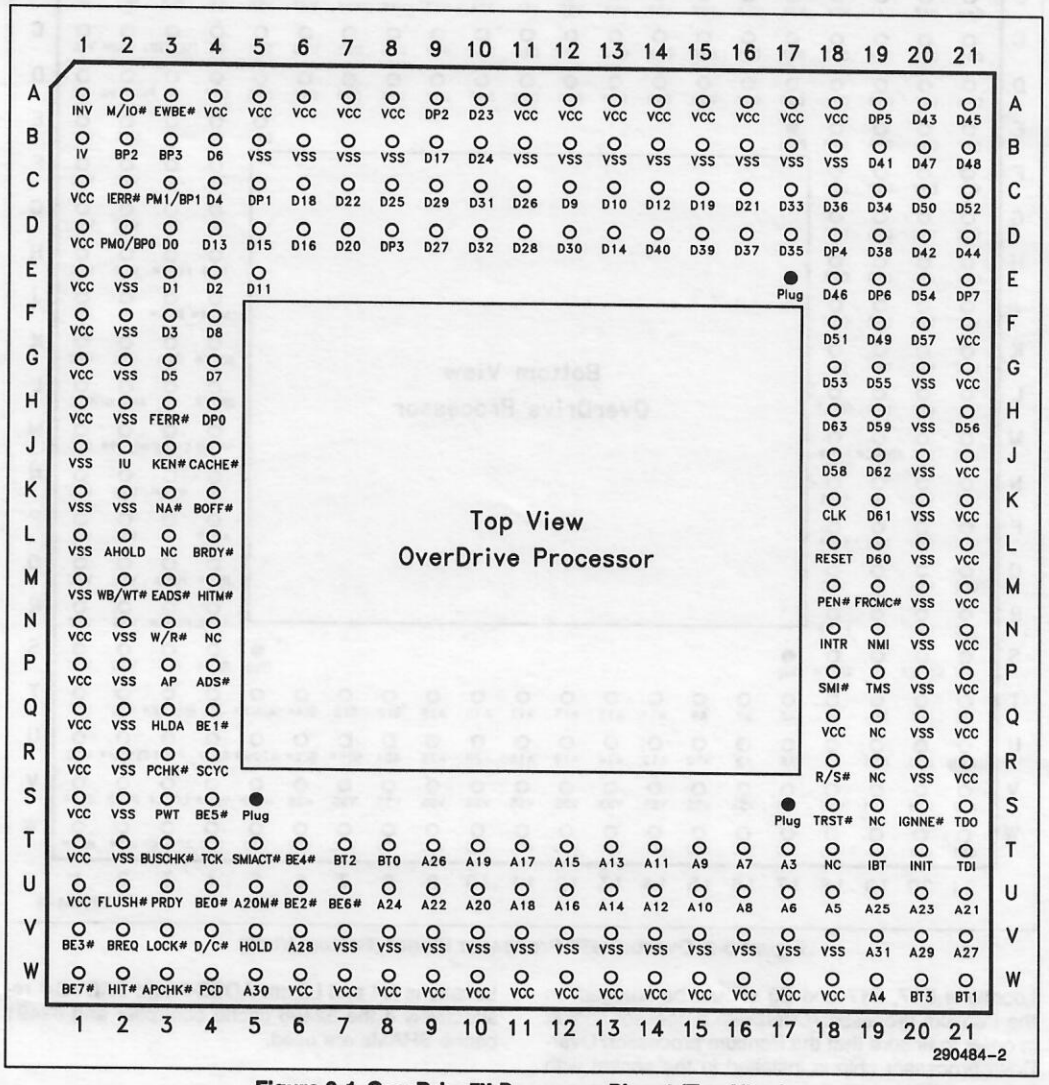


Figure 3-1. OverDrive™ Processor Pinout (Top View)

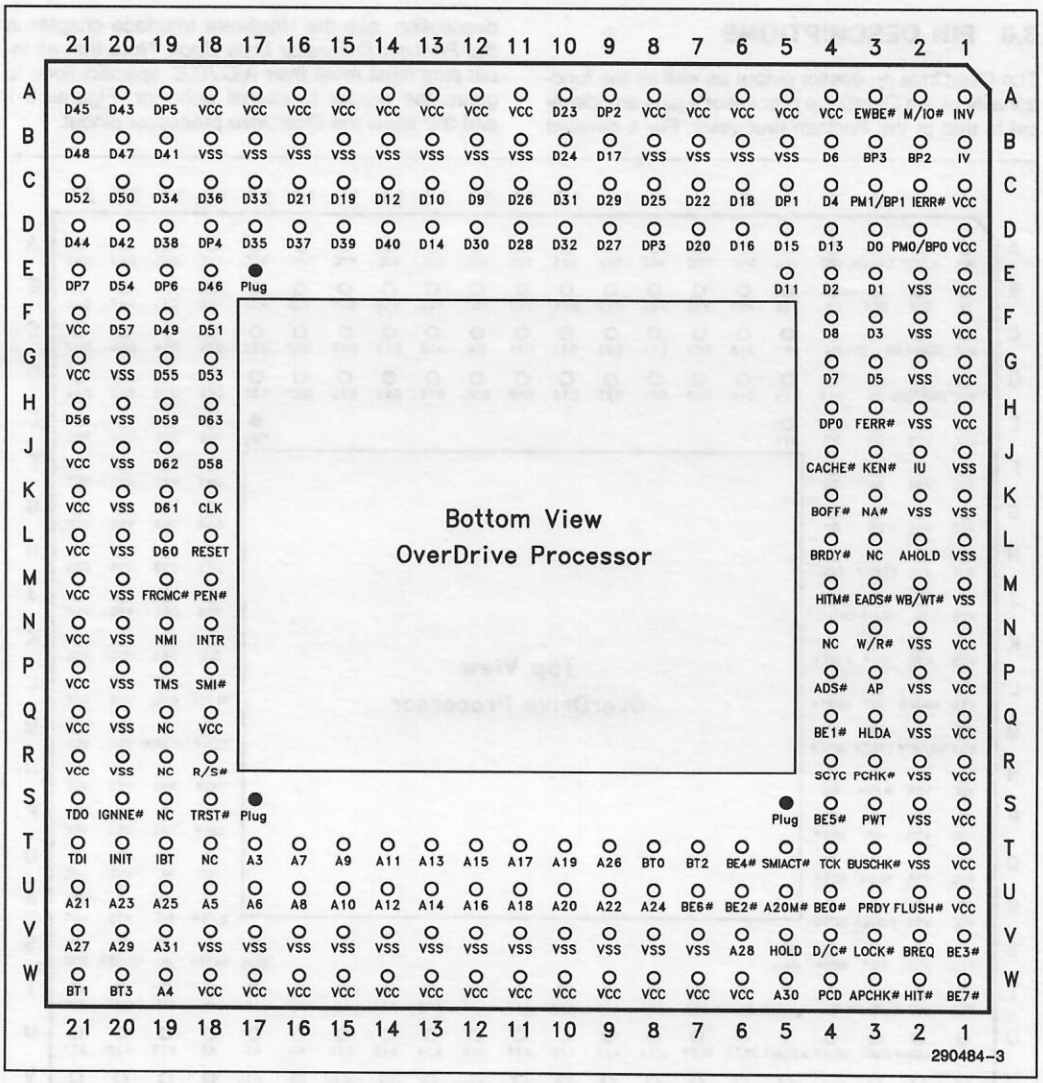


Figure 3-2. OverDrive™ Processor Pinout (Bottom View)

Locations E17, S17 and S5 should be plugged on the Pentium processor/OverDrive processor socket in order to ensure that the Pentium processor/OverDrive processor chip is installed in the socket with the correction orientation.

Locations N4 and L3 are ADSC# and BRDYC# respectively if the 82496 cache controller and 82491 cache SRAMs are used.

4.0 ELECTRICAL SPECIFICATIONS

4.1 Power and Ground

For clean on-chip power distribution, the OverDrive processor for Pentium processor based systems has 50 V_{CC} (power) and 49 V_{SS} (ground) inputs. Power and ground connections must be made to all external V_{CC} and V_{SS} pins of the OverDrive processor. On the circuit board, all V_{CC} pins must be connected on a V_{CC} plane. All V_{SS} pins must be connected on a V_{SS} plane.

4.2 Decoupling Recommendations

Liberal decoupling capacitance should be placed near the OverDrive processor for Pentium processor based systems. The OverDrive processor driving its large address and data buses at high frequencies can cause transient power surges, particularly when driving large capacitive loads.

Low inductance capacitors (i.e., surface mount capacitors) and interconnects are recommended for best high frequency electrical performance. Inductance can be reduced by connecting capacitors directly to the V_{CC} and V_{SS} planes, with minimal trace length between the component pads and vias to the plane. Capacitors specifically for PGA packages are also commercially available.

These capacitors should be evenly distributed among each component. Capacitor values should be chosen to ensure they eliminate both low and high frequency noise components.

4.3 Connection Specifications

All NC pins must remain unconnected.

For reliable operation, always connect unused inputs to an appropriate signal level. Unused active low inputs should be connected to V_{CC}. Unused active high inputs should be connected to ground.

4.4 Maximum Ratings

Table 4-1 is a stress rating only. Functional operation at the maximums is not guaranteed. Functional operating conditions are given in the A.C. and D.C. specification tables. Extended exposure to the maximum ratings may affect device reliability. Furthermore, although the OverDrive processor contains protective circuitry to resist damage from static electric discharge, always take precautions to avoid high static voltages or electric fields.

Table 4-1. Absolute Maximum Ratings

Case Temperature under Bias	−65°C to +110°C
Storage Temperature	−65°C to +150°C
Voltage on Any Pin with Respect to Ground	−0.5 V_{CC} to V_{CC} + 0.5V
Supply Voltage with Respect to V_{SS}	−0.5V to +6.5V

4.5 D.C. Specifications

Table 4-2 lists the D.C. specifications associated with the OverDrive processor.

Table 4-2. OverDrive Processor D.C. Specifications V_{CC} = 5V ±5%, T_{SINK} = 0°C to +70°C

Symbol	Parameter	Min	Max	Unit	Notes
V_{IL}	Input Low Voltage	−0.3	+0.8	V	TTL Level
V_{IH}	Input High Voltage	2.0	V_{CC} + 0.3	V	TTL Level
V_{OL}	Output Low Voltage		0.45	V	TTL Level(1)
V_{OH}	Output High Voltage	2.4		V	TTL Level(2)
I_{CC}	Power Supply Current		2700 2500	mA mA	66 MHz(6) 60 MHz(6)
I_{LI}	Input Leakage Current		±15	μA	$0 \le V_{IN} \le V_{CC}$(3)
I_{LO}	Output Leakage Current		±15	μA	$0 \le V_{OUT} \le V_{CC}$ Tristate(3)
I_{IL}	Input Leakage Current		−400	μA	V_{IN} = 0.45V(4)
I_{IH}	Input Leakage Current		200	μA	V_{IN} = 2.4V(5)
C_{IN}	Input Capacitance		15	pF	
C_O	Output Capacitance		20	pF	
$C_{I/O}$	I/O Capacitance		25	pF	
C_{CLK}	CLK Input Capacitance		8	pF	
C_{TIN}	Test Input Capacitance		15	pF	
C_{TOUT}	Test Output Capacitance		20	pF	
C_{TCK}	Test Clock Capacitance		8	pF	

NOTES:
1. Parameter measured at 4 mA load.
2. Parameter measured at 1 mA load.
3. This parameter is for input without pullup or pulldown.
4. This parameter is for input with pullup.
5. This parameter is for input with pulldown.
6. Worst case average I_{CC} for a mix of test patterns. (The mix of test patterns will be determined after silicon is examined.)

4.6 A.C. Specifications

The OverDrive processor will have the same A.C. specifications as the Pentium processor. The functional parameters for the OverDrive processor's A.C. specifications are the following:

V_{CC} = 5V ±5%

T_{SINK} = 0°C to +70°C

C_L = 0 pF

See the *Pentium Processor Data Book* for a listing of the A.C. specifications.

5.0 MECHANICAL SPECIFICATIONS

The OverDrive processor for Pentium processor based systems is packaged in a 273-pin ceramic pin grid array (PGA) with attached fan/heatsink. The pins are arranged in a 21 x 21 matrix and the package dimensions will be 2.16" x 2.16" (5.49 cm x 5.49 cm).

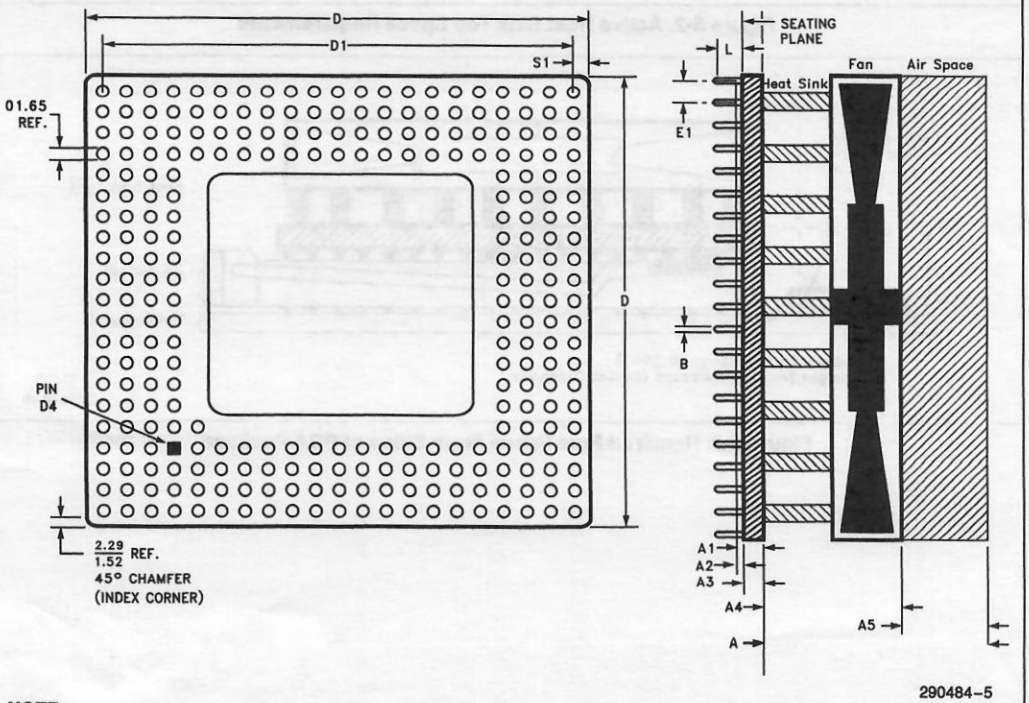
Table 5-1. OverDrive™ Processor Package Information Summary

Package Type	Total Pins	Pin Array	Package Size	Estimated Max Wattage
PGA	273	21 x 21	2.16" x 2.16" 5.49 cm x 5.49 cm	13.5

NOTE:
See D.C. Specifications for more detailed power specifications.

Table 5-2. OverDrive™ Processor Mechanical Specifications

Family: Ceramic Pin Grid Array Package						
Symbol	Millimeters			Inches		
	Min	Max	Notes	Min	Max	Notes
A		37.49	Solid Lid*		1.476	Solid Lid*
A1	2.84	3.51	Solid Lid	0.112	0.138	Solid Lid
A2	0.33	0.43	Solid Lid	0.013	0.017	Solid Lid
A3	2.51	3.07		0.099	0.121	
A4		20.32			0.800	
A5	10.16			0.400		
B	0.43	0.51		0.017	0.020	
D	54.61	55.11		2.150	2.170	
D1	50.67	50.93		1.995	2.005	
E1	2.29	2.79		0.090	0.110	
L	3.05	3.30		0.120	0.130	
N	273			273		
S1	1.65	2.16		0.065	0.085	



NOTE:
See Figure 5-3 for required free space from sides of the PGA package.

Figure 5-1. OverDrive™ Processor Package Dimensions

As can be seen in the mechanical dimensions in Table 5-2 and Figure 5-1, the actual height required by the heat sink and fan is less than the total space allotted. Since the OverDrive processor for Pentium processor based systems employs a fan/heatsink, a certain amount of space is required above the fan/heatsink unit to ensure that the airflow is not blocked. Figure 5-2 shows unacceptable blocking of the airflow for the OverDrive processor fan/heatsink. Figure 5-3 details the minimum space needed around the PGA package to ensure proper heat sink airflow.

As shown in Figure 5-3, it is acceptable to allow any device (i.e., add-in cards, surface mount device, chassis, etc.) to enter within the free space distance of 0.2" from the PGA package if it is not taller than the level of the heat sink base. In other words, if a component is taller than height "B", it cannot be closer to the PGA package than distance "A". This applies to all four sides of the PGA package, although the back and handle sides of a ZIF socket will generally automatically meet this specification since they have widths larger than distance "A".

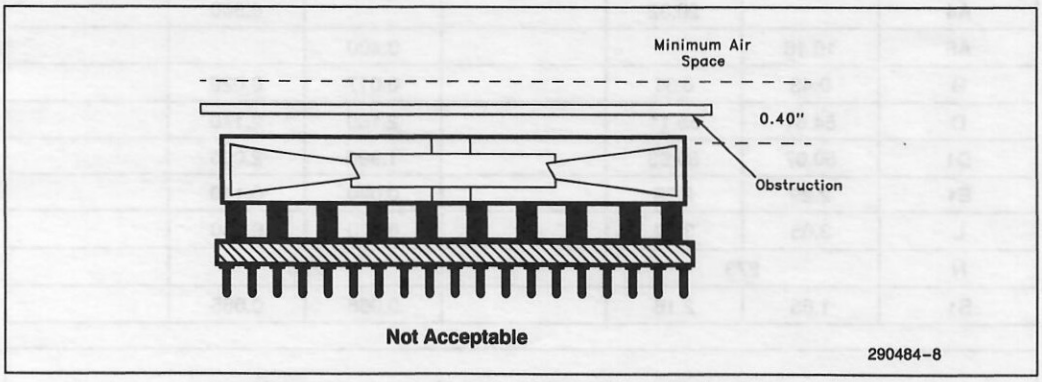


Figure 5-2. Active Heat Sink Top Space Requirements

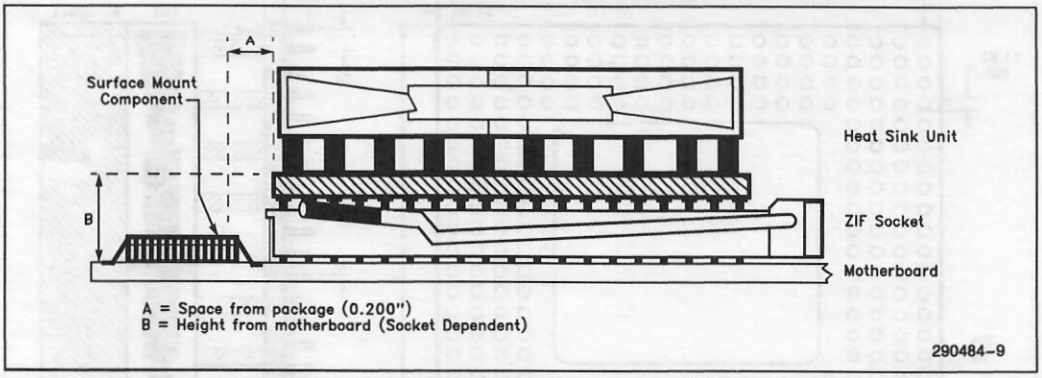


Figure 5-3. Required Free Space From Sides of PGA Package

6.0 THERMAL SPECIFICATIONS

The fan/heatsink cooling solution will properly cool the OverDrive processor as long as the maximum air temperature entering the fan/heatsink cooling solution (T_A(in)) does not exceed 45°C. It is left up to the OEM to ensure that T_A(in) meets this specification by providing sufficient airflow around the OverDrive processor heat sink unit.

Intel's fan/heatsink will dissipate approximately 0.5W and is powered by the chip such that no external wires or connections are required. The extra power needed for the fan is taken into account in the I_{CC} numbers of the processor. Additionally, Intel is evaluating the feasibility of having the OverDrive processor monitor its temperature. No BIOS or hardware changes will be needed for this thermal protection mechanism. The shut down temperature will be greater than the maximum temperature specification of the processor. The fan unit will be designed to be removable so that if fan failure should occur, the unit may be easily replaced. Figure 6-1 gives a functional representation of the processor and heat sink unit. The actual heat sink unit may be different from the one shown in the figure.

Since the OverDrive processor for Pentium processor based systems employs a fan/heatsink, it is not as important that the processor heat sink receive direct airflow, rather that the system has sufficient capability to remove the warm air that the OverDrive processor will generate. This implies that enough airflow exists at the OverDrive processor socket site to keep localized heating from occurring. This can be accomplished by a standard power supply fan with a clear path to the processor. It is recommended that the power supply use a fan that can supply a minimum of **35 CFM** of airflow at the fan exit. This will help ensure that the air exchange rate of the system will be sufficient to meet the OverDrive processor thermal requirements. Figure 6-2 shows how system design can cause localized heating to occur by limiting the airflow in the area of the processor. The airflow supplied in the system should also be enough to ensure that the OEM processor shipped with the system will meet the OEM processor thermal specifications before the system is upgraded with the OverDrive processor.

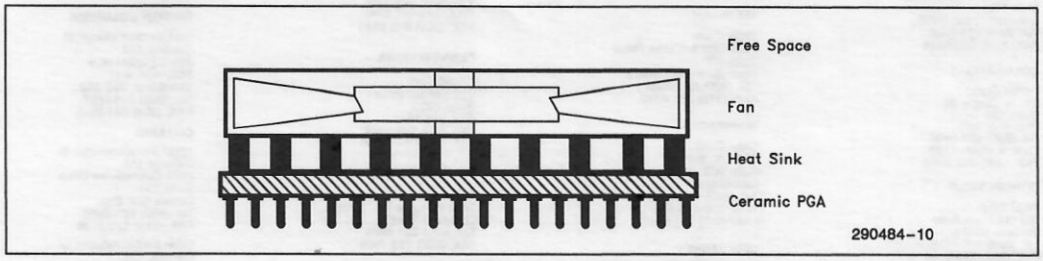


Figure 6-1. Active Heat Sink Example

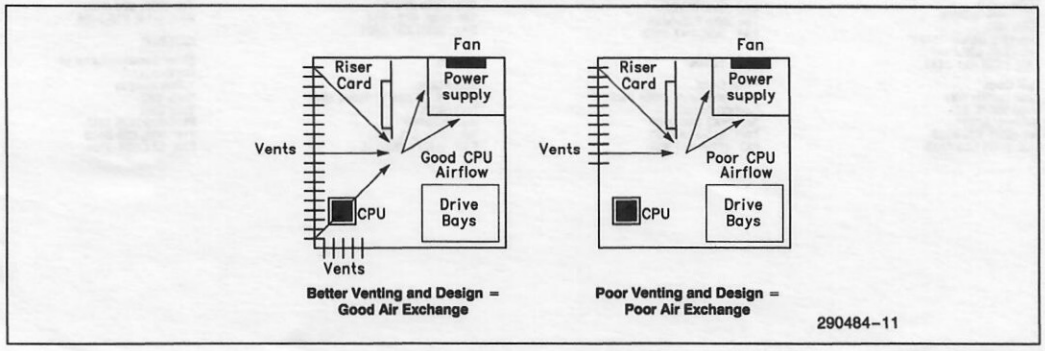


Figure 6-2. OverDrive™ Processor Airflow Design Examples

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