

Thermal Test Report

Customer Confidential

Prepared on behalf of: **Eurocase**

on their: **ML5412 400 J1**

Lab Reference: **PVCS 1895**

Date: **Tuesday, 08 February 2005**

Revision 1.1
Application & Design-In Centre, EMEA



Revision History

| Revision Number | Description | Revision Date |
|-----------------|-------------------------|-----------------------------|
| 1.0 | Initial Release. | August 7 th 2003 |
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1 Introduction

This document is designed to report and evaluate the thermal performance, of the Eurocase ML5412 400 J1, Lab Reference PVCS 1895 to Intel Thermal Specifications.

The equipment under test was assessed by Intel Corporation (UK) LTD, in their environmental test facilities located at

Pipers Way,
Swindon,
SN3 1RJ
United Kingdom.

1.1 Documentation Review & Approval

Date of Test Completion: Tuesday 31 Jan 2005

Date of Report: Wednesday 2 Feb 2005

Test Engineer

Imran Dhansey



Approval

Gareth Lockwood



2 Test Results Summary

2.1 Summary of Issues

A summary of thermal related test issues is given below. A priority has been assigned to each problem to estimate the potential impact to users. Additionally, there may be some issues that are identified in this report as "FYI" (For Your Information) that may be of interest, but are not considered of high enough priority to be listed in the summary.

2.1.1 Test Result

The equipment under test met Intel Thermal specifications.

2.1.2 Priority 1 Critical

[High impact issues requiring immediate attention]
N/A

2.1.3 Priority 2 Important

[Issues that should be corrected]
N/A

2.1.4 Priority 3 Future Impact

[Issues that have little impact now. Some may have future impact]
N/A

2.1.5 FYI

[For Your Information. Miscellaneous information that may be of interest]

3 System Configuration

3.1 Overview

This section lists the original configuration of the equipment under test. If any changes are required for the system to pass thermal test specification, these will be stated in section 2.1, and only the system in this configuration is recognised as a qualifying result.

3.2 Equipment Under Test

3.2.1 System Pictures



3.2.2 Thermal Solution





3.2.3 EUT Configuration

| Manufacturer | Description | Model/Part Number | Serial Number | Location |
|--------------|---|-------------------|-------------------|--------------------------------------|
| Eurocase* | ATX Midi Tower Chassis | ML5412 400 J1 | Not Known | N/A |
| Eurocase | ATX12V 400W Switching Power Supply (W/PFC) | ATX-400 JSP | Not Known | Top back of Chassis |
| Intel | Intel® D915GAG µATX Desktop Motherboard | AA C64123-302 | BQAG44001907 | N/A |
| Intel | Intel® Pentium® 4 Processor 530 (3.0GHz/800/HT/1MB) | BX80547PG3000E | Not Known | LGA775 Socket |
| Samsung* | 256MB DDR 400MHz PC3200 SDRAM DIMM | PC3200U-30440-A1 | M368L3223D TM-CC4 | Channel A DIMM 0 Channel B DIMM 0 |
| EVGA* | GeForce* FX 128MB PCI Express* Graphics Card | GF-FX-5200 | Not Known | PCI Express x16 Slot |
| Maxtor* | DiamondMax* Plus 9 200GB Ultra ATA/133/ SATA 150 | 6Y080M0 | Y2DGP7XE | Internal HDD 3.5" bay |
| Samsung | 16x IDE DVD-Rom Drive | SD-616Q | Not Known | Top external 5.25"bay |
| Samsung | 52x IDE CDRW/DVD Drive | SM-348B | Not Known | Bottom external 5.25"bay |
| Not Known | 1.44 MB Floppy Drive | Not Known | Not Known | Internal FDD 3.5" bay |
| Not Known | USB/Audio Daughter Board | Not Known | Not Known | Bottom front of chassis |

| | |
|--------------------|---|
| Full BIOS Revision | EV91510A.86A.0213 |
| Operating System | Microsoft* Windows* XP Professional (SP2) |

Additional information for fans, ferrites, etc fitted in the chassis

| Manufacturer | Description | Model/ Part Number | Position in chassis |
|---------------------|--------------------------------------|--------------------|--|
| Nidec Corp* | Intel Branded Processor Fan Heatsink | C25704-001 | N/A Processor Cooling |
| Tricod Electronics* | 120mm DC12V, 12A Chassis Fan | Not Known | Chassis Side Panel, positioned directly above processor cooling solution |



Additional parts supplied with the chassis/system for test

| Manufacturer | Description | Model/ Part Number | Position in chassis |
|---|----------------------------------|--------------------|---------------------|
| Xinruilian (Note: 3 Chassis fans) | 80mm DC12V, 0.11A Chassis Fan | RDM8025S | N/A |

4 Test Methodology

4.1 Thermal Test Equipment

Some or all of this equipment may have been used during thermal testing.

| Supplier | Description | Model/Part Number |
|----------------------|------------------------------|-----------------------|
| Thermotron* | Walk-In Thermal Chamber | WP-499-THCM-705 |
| Thermotron* | Thermal Chamber | S-8SLE |
| Cambridge Accusense* | Airflow Monitoring Equipment | ATM-24 CAFS-220-5M |
| Testo* | Digital Anemometer | 0560.4900 |
| Anville Instruments* | Data Acquisition Unit | X-435 |
| Fluke* | Hydra Data Logger | 2625A |
| Fluke* | Themocouple Calibrators | 51/52 & 714 Series |
| FLIR Systems* | Infra-Red Camera | Prism |
| Omega* | Hot-Point Cell | CL950-220 |

4.2 Tolerance/Accuracy

All thermal test equipment is maintained annually by traceable calibration. The accuracy of type T thermocouples is: -270 to +400°C, greater of 0.5°C or 0.4%.

4.3 Test Method

Thermal testing will be performed in a thermal chamber with a controlled ambient temperature of 35°C. Case and ambient temperature measurements, T_c and T_a respectively, will be taken at 20 second intervals until thermal equilibrium (steady state) is reached. Steady state is reached when the difference between the current reading and the previous reading is less than 0.5%. Data will be collected for 5 minutes past the time determined to be steady state. The last data point is recorded in the test report with no averaging.

4.3.1 Thermocouple Calibration Check

It is important to ensure that the thermocouples used for ambient and case temperature measurements are calibrated. A Hot-Point* Calibration Cell is used to check the accuracy of thermocouples prior to any thermocouple being used for testing – each thermocouple is placed in the cell and then set to 0°C and 100°C. The thermocouple reading should be within +/-0.5°C of the set point.

4.3.2 Thermocouple Placement

To record the ambient air temperature (T_a) measurements, place 4 thermocouples equally spaced 2.54mm (0.1”) above the fan hub vertically, halfway between the fan hub and housing horizontally (See Figure 1).

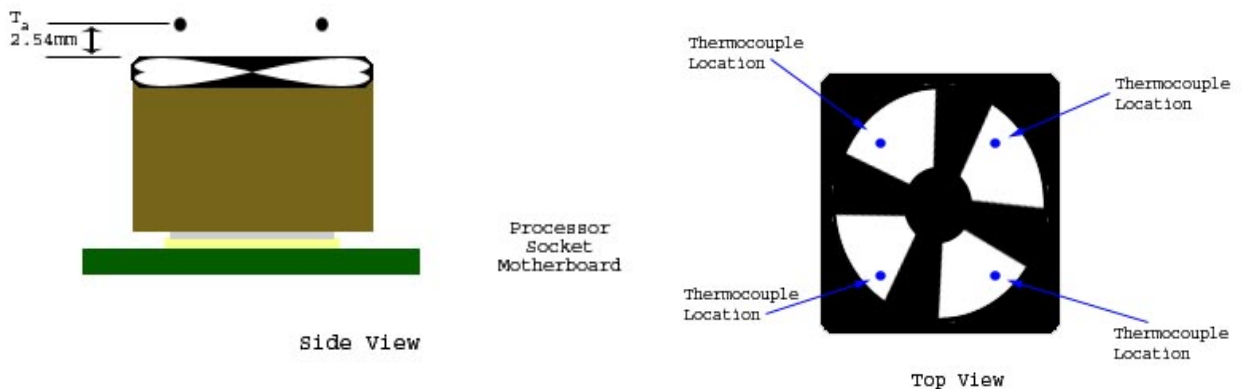


Figure 1

A characterised processor will be used during testing.

The case temperature (T_c) measurement will be taken with a thermocouple placed in the centre of the processor Integrated Heat Spreader (IHS). The IHS will be grooved to 0.508mm (0.02") – 0.635mm (0.025") deep, 0.889mm (0.035") – 1.016mm (0.04") wide, and half the length of the IHS. The thermocouple will be Type T, 36 gauge for processor case temperature measurement with Teflon* insulation. The thermocouple will be attached using Loctite* 315 thermally conductive adhesive in the manner shown in Figure 2 and 3. A continuity check will be performed to ensure contact between the thermocouple and the processor IHS.

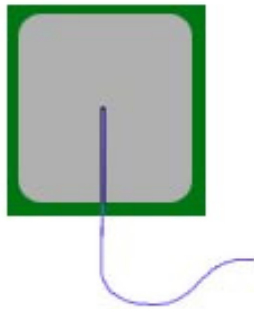


Figure 2 – Top View

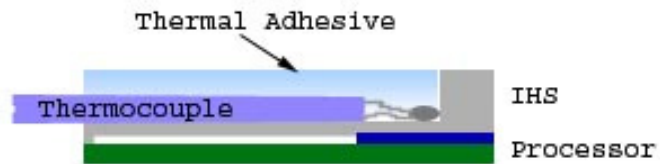


Figure 3 – Cross Section

4.3.3 Test Procedure

The BIOS of the system under test is reset to default settings where appropriate and all power saving features and system management functions are disabled. The system is then booted into the relevant Operating System and test software installed.

The applications used for thermal testing are:

- Intel® P4MaxPower version 2.1 [set to 100% power level]
- Intel® Frequency Display Utility
- Intel® Active Monitor [if applicable]

P4MaxPower is activated to stress the processor to its Thermal Design Point and at no point during the test should the processor activate its thermal control circuit (monitored by Frequency Display Utility).

The thermocouple temperatures throughout the system are logged by the chamber control software over a period as stated in section 4.3.

5 Thermal Test Results

All pass results are within the accuracy of the test equipment (see section 4.2).

Note.

The power level output of different processors and processor lines can vary, this can either have a positive or negative impact on the overall Tcase temperature specification for a processor/chassis/heatsink under test, an example:

A power output increase of 2.7Watts could approximately equate to an additional 1°C – 3°C* on the Tcase temperature measurement. A similar calculation can be made regarding a power output decrease. These test results are only valid for the processor tested and should only be used as an indication unless specific processor measured power is stated.

*Based on the power versus max Tcase temperature increases of the P4 2.0GHz and 2.2GHz processors.

5.1 Test Specifications & Limits

The information in this section is taken from the relevant processor Electrical, Mechanical & Thermal Specification document (EMTS).

5.1.1 Intel® Pentium® 4 Processor 530 @ 3.0GHz

| Criteria | Specification | Notes |
|--------------------------|---------------|--------------------------|
| Processor T _c | 67.7°C | 84W Thermal Design Power |
| Processor T _a | 38°C | |

5.2 Test Results

This section contains the Thermal test results for the equipment under test using the Intel® Pentium® 4 Processor 530 @ 3.0GHz, to the specification in section 5.1.1.

5.2.1 Test Equipment/Test Deviations

None.

5.2.2 Thermal Stress Test Results

| Monitor Point | Temperature | Status |
|--------------------------|-------------|--------|
| Processor T _c | 65.05°C | PASS |
| Processor T _a | 38°C | PASS |

6 *References*

6.1 Thermal Support Documentation

Refer to the following documentation for more information.

| |
|---|
| Relevant Intel® Processor Electrical, Mechanical & Thermal Specification (EMTS) |
|---|

| |
|--|
| Relevant Intel® Processor Thermal Design Guidelines. |
|--|

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|--|
| ATX and μ ATX specifications [http://www.formfactors.org] |
|--|