Intel® E7520/E7320/E7525 Memory Controller Hub (MCH)

Thermal/Mechanical Design Guide

August 2004

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Revision History

Revision Number	Description	Revision Date
-001	• Initial Release as an Intel® E7525 specific document	June 2004
-002	• Added Intel® E7520/E7320 chipset specific information and re-titled document	August 2004
-003	• Added “reference thermal solution rails to MCH package” footprint drawing (Figure 6-6) in Section 6.5	August 2004

1 Introduction

As the complexity of computer systems increases, so do the power dissipation requirements. Care must be taken to ensure that the additional power is properly dissipated. Typical methods to improve heat dissipation include selective use of ducting, and/or passive heatsinks.

The goals of this document are to:

- Outline the thermal and mechanical operating limits and specifications for the Intel® E7520/E7320/E7525 chipset memory controller hub (MCH).
- Describe two reference thermal solutions that meet the specification of the E7520/E7320/E7525 chipset MCH.

Properly designed thermal solutions provide adequate cooling to maintain the E7520/E7320/E7525 chipset MCH die temperatures at or below thermal specifications. This is accomplished by providing a low local-ambient temperature, ensuring adequate local airflow, and minimizing the die to local-ambient thermal resistance. By maintaining the E7520/E7320/E7525 chipset MCH die temperature at or below the specified limits, a system designer can ensure the proper functionality, performance, and reliability of the chipset. Operation outside the functional limits can degrade system performance and may cause permanent changes in the operating characteristics of the component.

The simplest and most cost effective method to improve the inherent system cooling characteristics is through careful chassis design and placement of fans, vents, and ducts. When additional cooling is required, component thermal solutions may be implemented in conjunction with system thermal solutions. The size of the fan or heatsink can be varied to balance size and space constraints with acoustic noise.

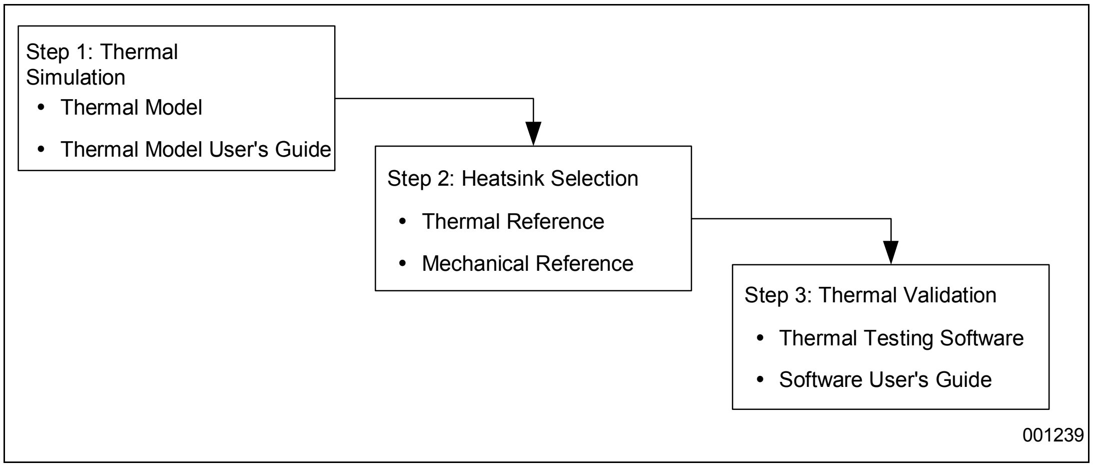
This document addresses thermal design and specifications for the E7520/E7320/E7525 chipset MCH component only. For thermal design information on other chipset components, refer to the respective component datasheet. For the PXH, refer to the *Intel® 6700PXH 64-bit PCI Hub (PXH) Thermal Design Guide*. For the ICH5R, refer to the *Intel® 82801EB I/O Controller Hub 5 (ICH5) and Intel® 82801ER I/O Controller Hub 5 R (ICH5R) Thermal Design Guide*.

Note: Unless otherwise specified, the term “MCH” refers to the E7520/E7320/E7525 chipset MCH.

1.1 Design Flow

To develop a reliable, cost-effective thermal solution, several tools have been provided to the system designer. Figure 1-1 illustrates the design process implicit to this document and the tools appropriate for each step.

Figure 1-1. Thermal Design Process


Step 1: Thermal Simulation
• Thermal Model
• Thermal Model User's Guide
Step 2: Heatsink Selection
• Thermal Reference
• Mechanical Reference
Step 3: Thermal Validation
• Thermal Testing Software
• Software User's Guide
001239

1.2 Definition of Terms

BGA	Ball grid array. A package type, defined by a resin-fiber substrate, onto which a die is mounted, bonded and encapsulated in molding compound. The primary electrical interface is an array of solder balls attached to the substrate opposite the die and molding compound.
BLT	Bond line thickness. Final settled thickness of the thermal interface material after installation of heatsink.
ICH5R	I/O controller hub. The chipset component that contains the primary PCI interface, LPC interface, USB, S-ATA, and other legacy functions.
MCH	Memory controller hub. The chipset component that contains the processor interface, the memory interface, and the hub interface.
PXH	6700PXH 64-bit PCI Hub. The chipset component that performs PCI bridging functions between the PCI Express* interface and the PCI Bus. It contains two PCI bus interfaces that can be independently configured to operate in PCI (33 or 66 MHz) or PCI-X mode 1 (66, 100 or 133 MHz), for either 32 or 64 bit PCI devices.
T_{case_max}	Maximum die temperature allowed. This temperature is measured at the geometric center of the top of the package die.
T_{case_min}	Minimum die temperature allowed. This temperature is measured at the geometric center of the top of the package die.

TDP	Thermal design power. Thermal solutions should be designed to dissipate this target power level. TDP is not the maximum power that the chipset can dissipate.

1.3 Reference Documents

The reader of this specification should also be familiar with material and concepts presented in the following documents:

- *Intel® 82801EB I/O Controller Hub 5 (ICH5) and Intel® 82801ER I/O Controller Hub 5 R (ICH5R) Datasheet*
- *Intel® 82801EB I/O Controller Hub 5 (ICH5) and Intel® 82801ER I/O Controller Hub 5 R (ICH5R) Thermal Design Guide*
- *Intel®6700PXH 64-bit PCI Hub (PXH) Thermal/Mechanical Design Guide*
- *Intel® 6700PXH 64-bit PCI Hub (PXH) Datasheet*
- *Intel® E7520 Memory Controller Hub (MCH) Datasheet*
- *Intel® E7320 Memory Controller Hub (MCH) Datasheet*
- *Intel® E7525 Memory Controller Hub (MCH) Datasheet*
- *Intel® E7525 Chipset Memory Controller Hub (MCH) Specification Update*
- *Intel® Xeon™ Processor with 800 MHz System Bus Thermal/MechanicalDesign Guidelines*
- *Intel® Xeon™ Processor with 800 MHz System Bus Datasheet*
- *BGA/OLGA Assembly Development Guide*
- Various system thermal design suggestions (http://www.formfactors.org)

Note: Unless otherwise specified, these documents are available through your Intel field sales representative. Some documents may not be available at this time.

2 Packaging Technology

The E7520, E7320 and E7525 chipsets consist of three individual components: the MCH, the PXH and the I/O controller hub (ICH5R). The E7520/E7320/E7525 chipset MCH components use a 42.5 mm, 10-layer flip chip ball grid array (FC-BGA) package (see Figure 2-1, Figure 2-2, and Figure 2-3). For information on the PXH package, refer to the *Intel® 6700PXH 64-bit PCI Hub (PXH) Thermal/Mechanical Design Guide*. For information on the ICH5R package, refer to the *Intel® 82801EB I/O Controller Hub 5 (ICH5) and Intel® 82801ER I/O Controller Hub 5 R (ICH5R) Thermal Design Guide*.

Figure 2-1. MCH Package Dimensions (Top View)

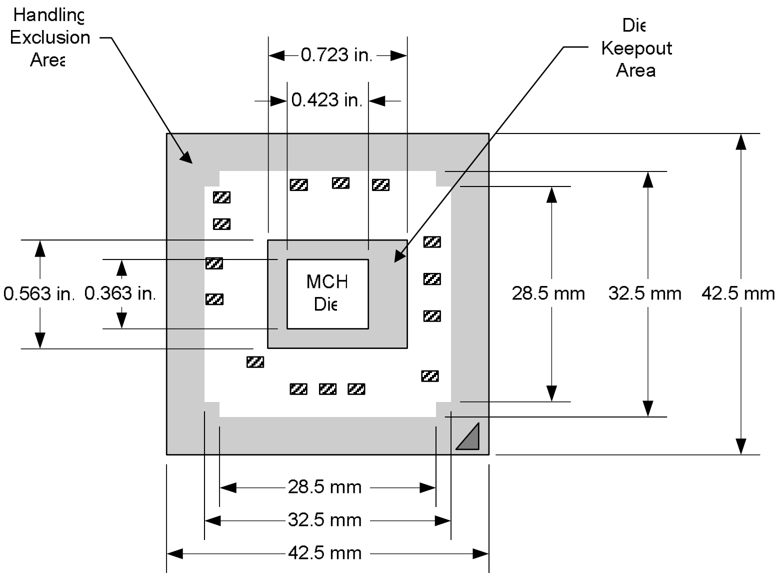
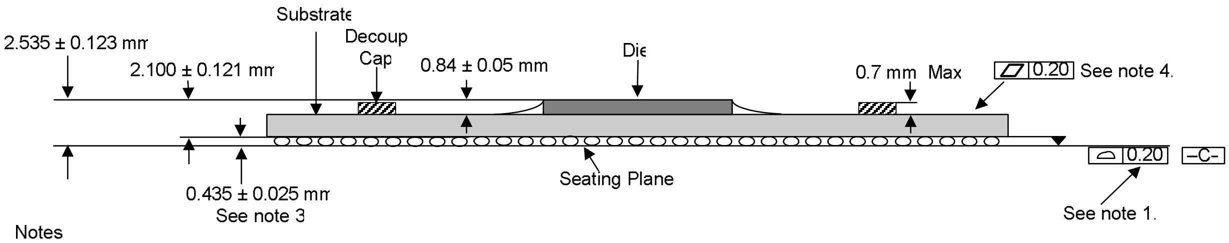
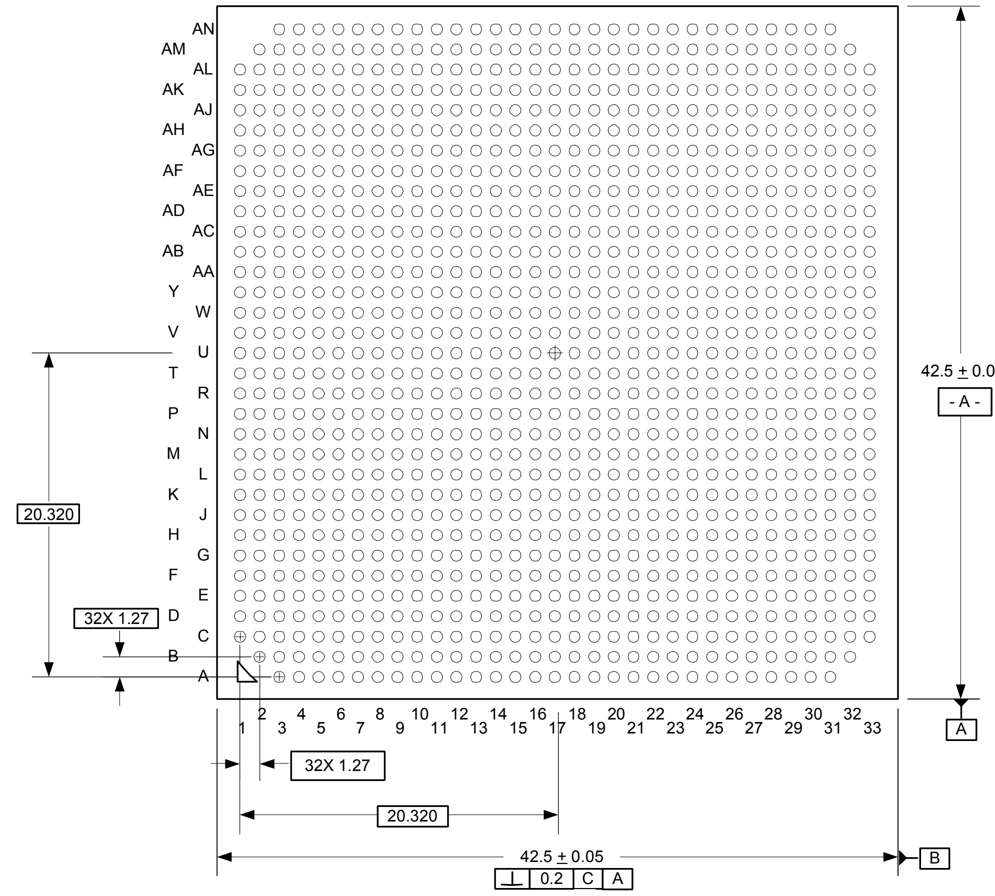

Handling Exclusion Area
Die Keepout Area
0.723 in.
0.423 in.
0.563 in.
0.363 in.
MCH Die
28.5 mm
32.5 mm
42.5 mm
28.5 mm
32.5 mm
42.5 mm

Figure 2-2. MCH Package Dimensions (Side View)


Substrate
Decoup Cap
2.535 ± 0.123 mm
2.100 ± 0.121 mm
0.84 ± 0.05 mm
Die
0.7 mm Max
0.20
See note 4.
0.20
-C-
Seating Plane
0.435 ± 0.025 mm
See note 3
See note 1.

Notes
1. Primary datum -C- and seating plan are defined by the spherical crowns of the solder balls (shown before motherboard attach)
2. All dimensions and tolerances conform to ANSI Y14.5M-1994
3. BGA has a pre-SMT height of 0.5mm and post-SMT height of 0.41-0.46mm
4. Shown before motherboard attach; FCBGA has a convex (dome shaped) orientation before reflow and is expected to have a slightly concave (bowl shaped) orientation after reflow

Figure 2-3. MCH Package Dimensions (Bottom View)


AN
AM
AL
AK
AJ
AH
AG
AF
AE
AD
AC
AB
AA
Y
W
V
U
T
R
P
N
M
L
K
J
H
G
F
E
D
C
B
A
1
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4
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6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
20.320
32X 1.27
32X 1.27
20.320
42.5 ± 0.05
- A -
A
42.5 ± 0.05
⊥ 0.2 C A
B

NOTES:

1. All dimensions are in millimeters.
2. All dimensions and tolerances conform to ANSI Y14.5M-1994.

2.1 Package Mechanical Requirements

The E7520/E7320/E7525 chipset MCH package has an exposed bare die which is capable of sustaining a maximum static normal load of 15-lbf. The package is NOT capable of sustaining a dynamic or static compressive load applied to any edge of the bare die. These mechanical load limits must not be exceeded during heatsink installation, mechanical stress testing, standard shipping conditions and/or any other use condition.

Notes:

1. The heatsink attach solutions must not include continuous stress onto the chipset package with the exception of a uniform load to maintain the heatsink-to-package thermal interface.
2. These specifications apply to uniform compressive loading in a direction perpendicular to the bare die/IHS top surface.
3. These specifications are based on limited testing for design characterization. Loading limits are for the package only

3 Thermal Specifications

3.1 Thermal Design Power (TDP)

Analysis indicates that real applications are unlikely to cause the chipset MCH to consume maximum power dissipation for sustained time periods. Therefore, in order to arrive at a more realistic power level for thermal design purposes, Intel characterizes power consumption based on known platform benchmark applications. The resulting power consumption is referred to as the Thermal Design Power (TDP). TDP is the target power level that the thermal solutions should be designed to. TDP is not the maximum power that the chipset can dissipate.

For TDP specifications, see Table 3-1for the E7520 chipset MCH, Table 3-2 for the E7320 chipset MCH, and Table 3-3 for the E7525 chipset MCH. FC-BGA packages have poor heat transfer capability into the board and have minimal thermal capability without a thermal solution. Intel recommends that system designers plan for a heatsink when using the E7520/E7320/E7525 chipsets

3.2 Die Case Temperature Specifications

To ensure proper operation and reliability of the E7520/E7320/E7525 chipset MCH, the die temperatures must be at or between the maximum/minimum operating temperature ranges as specified in Table 3-1, Table 3-2 and Table 3-3. System and/or component level thermal solutions are required to maintain these temperature specifications. Refer to Chapter 5 for guidelines on accurately measuring package die temperatures.

Table 3-1. E7520 Chipset MCH Thermal Specifications

Parameter	Value	Notes
T_{case_max}	105°C	
T_{case_min}	5°C	
$TDP_{dual\ channel}$	10.0W	DDR-266
$TDP_{single\ channel}$	8.0W	DDR-266
$TDP_{dual\ channel}$	10.0W	DDR-333
$TDP_{single\ channel}$	8.5W	DDR-333
$TDP_{dual\ channel}$	9.7W	DDR2-400
$TDP_{single\ channel}$	9.1W	DDR2-400

Note: These specifications are based on silicon characterization, however, they may be updated as further data becomes available.

Table 3-2. E7320 Chipset MCH Thermal Specifications

Parameter	Value	Notes
T_{case_max}	105°C	
T_{case_min}	5°C	
$TDP_{dual\ channel}$	9.2W	DDR-266

Parameter	**Value**	**Notes**
$TDP_{dual\ channel}$	9.2W	DDR-333
$TDP_{dual\ channel}$	8.9W	DDR2-400

Note: These specifications are based on silicon characterization, however, they may be updated as further data becomes available.

Table 3-3. E7525 Chipset MCH Thermal Specifications

Parameter	**Value**	**Notes**
T_{case_max}	105°C	
T_{case_min}	5°C	
$TDP_{dual\ channel}$	10.1W	DDR-333
$TDP_{dual\ channel}$	9.2W	DDR2-400
$TDP_{single\ channel}$	7.3W	DDR2-400

Note: These specifications are based on silicon characterization, however, they may be updated as further data becomes available.

4 Thermal Simulation

Intel provides thermal simulation models of the E7520/E7320/E7525 chipset MCH and associated user's guides to aid system designers in simulating, analyzing, and optimizing their thermal solutions in an integrated, system-level environment. The models are for use with the commercially available Computational Fluid Dynamics (CFD)-based thermal analysis tool FLOTHERM* (version 3.1 or higher) by Flomerics, Inc. These models are also available in ICEPAK* format. Contact your Intel field sales representative to order the thermal models and user's guides.

5 Thermal Metrology

The system designer must make temperature measurements to accurately determine the thermal performance of the system. Intel has established guidelines for proper techniques to measure the MCH die temperatures. Section 5.1 provides guidelines on how to accurately measure the MCH die temperatures. Section 5.2 contains information on running an application program that will emulate anticipated maximum thermal design power. The flowchart in Figure 5-1 offers useful guidelines for thermal performance and evaluation.

5.1 Die Case Temperature Measurements

To ensure functionality and reliability, the T_{case} of the MCH must be maintained at or between the maximum/minimum operating range of the temperature specification as noted in Table 3-1 and Table 3-3. The surface temperature at the geometric center of the die corresponds to T_{case}. Measuring T_{case} requires special care to ensure an accurate temperature measurement.

Temperature differences between the temperature of a surface and the surrounding local ambient air can introduce errors in the measurements. The measurement errors could be due to a poor thermal contact between the thermocouple junction and the surface of the package, heat loss by radiation and/or convection, conduction through thermocouple leads, and/or contact between the thermocouple cement and the heatsink base (if a heatsink is used). For maximize measurement accuracy, only the 0° thermocouple attach approach is recommended.

Zero Degree Angle Attach Methodology

1. Mill a 3.3 mm (0.13 in.) diameter and 1.5 mm (0.06 in.) deep hole centered on the bottom of the heatsink base.
2. Mill a 1.3 mm (0.05 in.) wide and 0.5 mm (0.02 in.) deep slot from the centered hole to one edge of the heatsink. The slot should be parallel to the heatsink fins (see Figure 5-2).
3. Attach thermal interface material (TIM) to the bottom of the heatsink base.
4. Cut out portions of the TIM to make room for the thermocouple wire and bead. The cutouts should match the slot and hole milled into the heatsink base.
5. Attach a 36 gauge or smaller calibrated K-type thermocouple bead or junction to the center of the top surface of the die using a high thermal conductivity cement. During this step, ensure no contact is present between the thermocouple cement and the heatsink base because any contact will affect the thermocouple reading. **It is critical that the thermocouple bead makes contact with the die** (see Figure 5-3).
6. Attach heatsink assembly to the MCH and route thermocouple wires out through the milled slot.

Figure 5-1. Thermal Solution Decision Flowchart

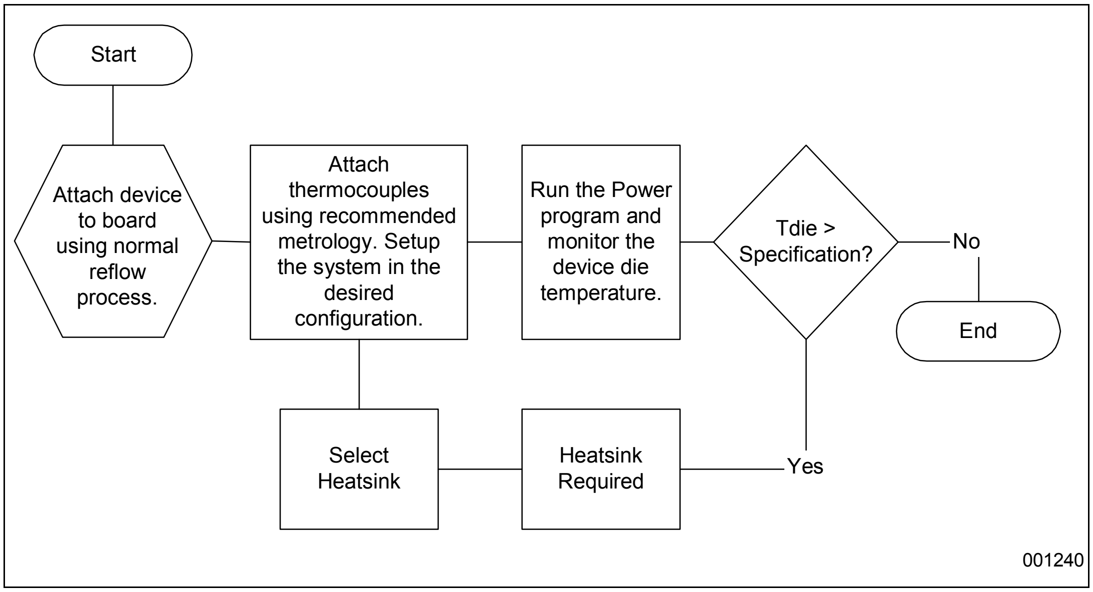
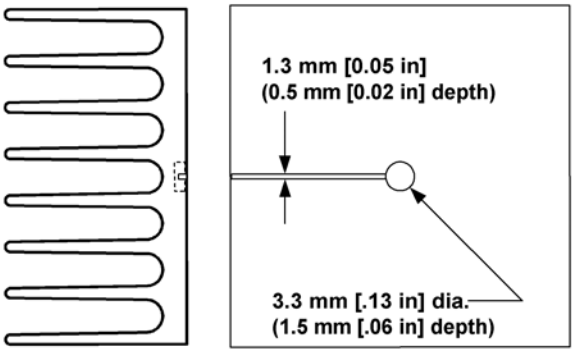
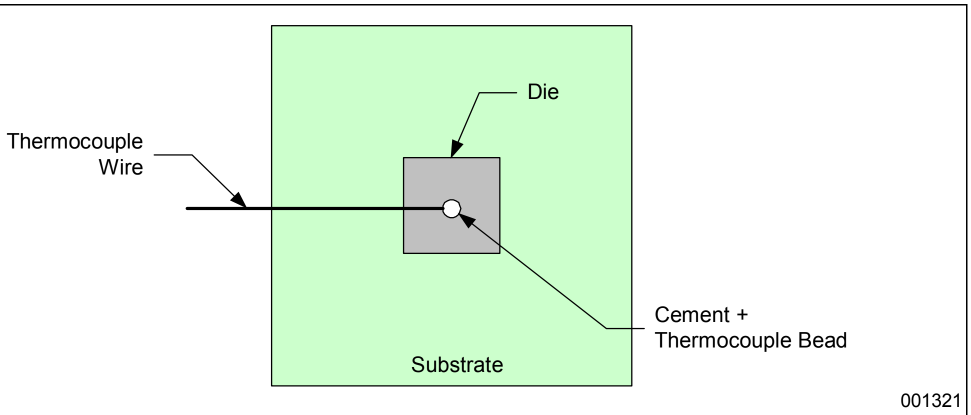

Start
Attach device to board using normal reflow process.
Attach thermocouples using recommended metrology. Setup the system in the desired configuration.
Run the Power program and monitor the device die temperature.
Tdie > Specification?
No
End
Yes
Heatsink Required
Select Heatsink
001240

Figure 5-2. Zero Degree Angle Attach Heatsink Modifications


1.3 mm [0.05 in]
(0.5 mm [0.02 in] depth)
3.3 mm [.13 in] dia.
(1.5 mm [.06 in] depth)

NOTE: Not to scale.

Figure 5-3. Zero Degree Angle Attach Methodology (Top View)


Die
Thermocouple Wire
Cement + Thermocouple Bead
Substrate
001321

NOTE: Not to scale.

5.2 Power Simulation Software

The power simulation software is a utility designed to dissipate the thermal design power on an E7520/E7320/E7525 chipset MCH when used in conjunction with the Xeon Processor with 800 MHz System Bus. The combination of the above mentioned processor and the higher bandwidth capability of the E7520/E7320/E7525 chipsets enable higher levels of system performance. To assess the thermal performance of the chipset MCH thermal solution under “worst-case realistic application” conditions, Intel is developing a software utility that operates the chipset at near worst-case thermal power dissipation.

The power simulation software being developed should only be used to test thermal solutions at or near the thermal design power. Figure 5-1. shows a decision flowchart for determining thermal solution needs. Real world applications may exceed the thermal design power limit for transient time periods. For power supply current requirements under these transient conditions, please refer to each component's datasheet for the ICC (Max Power Supply Current) specification. Contact your Intel field sales representative to order the power utility software and user's guide.

6 Reference Thermal Solution 1

Intel has developed two different reference thermal solutions designed to meet the cooling needs of the E7520/E7320/E7525 chipset MCH under operating environments and specifications defined in this document. This chapter describes the overall requirements for the Torsional Clip Heatsink reference thermal solution including critical-to-function dimensions, operating environment, and validation criteria. Other chipset components may or may not need attached thermal solutions, depending on your specific system local-ambient operating conditions. For information on the PXH, refer to thermal specification in the *Intel® 6700PXH 64-bit PCI Hub (PXH) Thermal/Mechanical Design Guide*. For information on the ICH5R, refer to thermal specification in the *Intel® 82801EB I/O Controller Hub 5 (ICH5) and Intel® 82801ER I/O Controller Hub 5 R (ICH5R) Thermal Design Guide*.

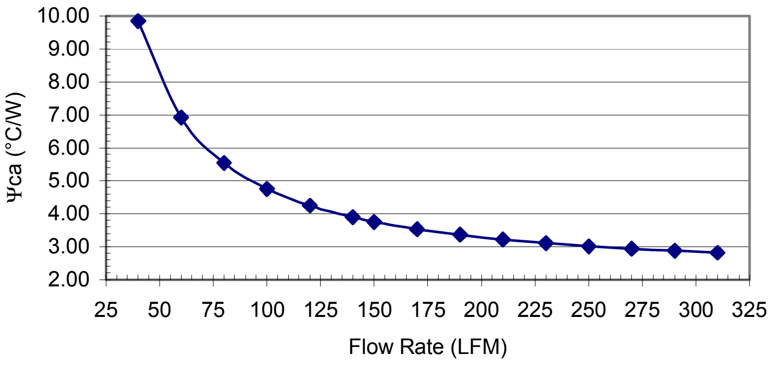
6.1 Operating Environment

The chipset MCH reference thermal solution was designed assuming a maximum local-ambient temperature of 50°C. The minimum recommended airflow velocity through the cross section of the heatsink fins is 200 linear feet per minute (lfm). The approaching airflow temperature is assumed to be equal to the local-ambient temperature. The thermal designer must carefully select the location to measure airflow to obtain an accurate estimate. These local-ambient conditions are based on a 35°C external-ambient temperature at sea level. (External-ambient refers to the environment external to the system.)

6.2 Heatsink Performance

Figure 6-1 depicts the measured thermal performance of the reference thermal solution versus approach air velocity. Since this data was measured at sea level, a correction factor would be required to estimate thermal performance at other altitudes.

Figure 6-1. Torsional Clip Heatsink Measured Thermal Performance vs. Approach Velocity

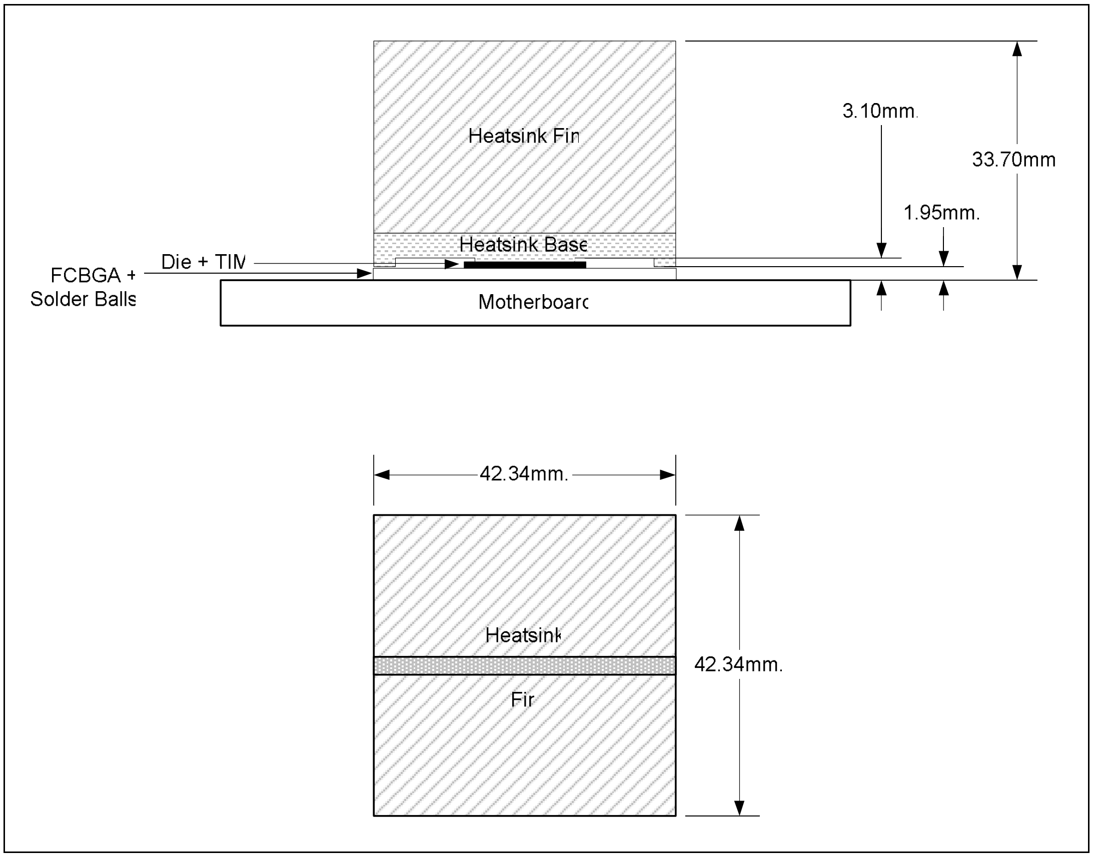


6.3 Mechanical Design Envelope

While each design may have unique mechanical volume and height restrictions or implementation requirements, the height, width, and depth constraints typically placed on the E7520/E7320/E7525 chipset MCH thermal solution are shown in Figure 6-2.

When using heatsinks that extend beyond the chipset MCH reference heatsink envelope shown in Figure 6-2, any motherboard components placed between the heatsink and motherboard cannot exceed 2.46 mm (0.10 in.) in height.

Figure 6-2. Torsional Clip Heatsink Volumetric Envelope for the Chipset MCH



6.4 Board-Level Components Keepout Dimensions

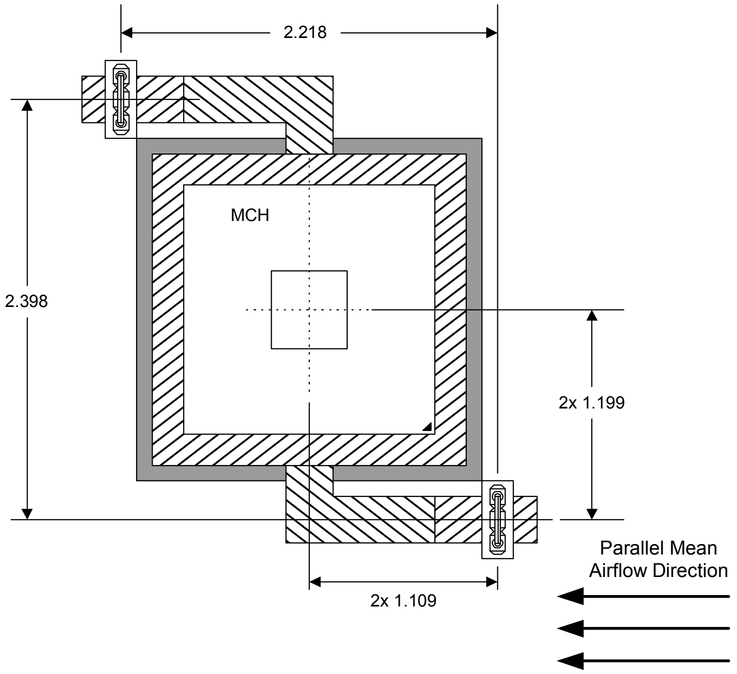
The location of hole pattern and keepout zones for the reference thermal solution are shown in Figure 6-3. and Figure 6-4. This reference thermal solution has the same hole pattern and keepout zones as that of the Intel® E7500/E7501/E7505 chipset.

6.5 Torsional Clip Heatsink Thermal Solution Assembly

The reference thermal solution for the chipset MCH is a passive extruded heatsink with thermal interface. It is attached using a clip with each end hooked through an anchor soldered to the board. Figure 6-5 shows the reference thermal solution assembly and associated components. Figure 6-6 shows the position of the heatsink rails relative to the MCH package top surface. The torsional clip and the clip retention anchor are the same as the one used on the E7500/E7501/E7505 reference thermal solution.

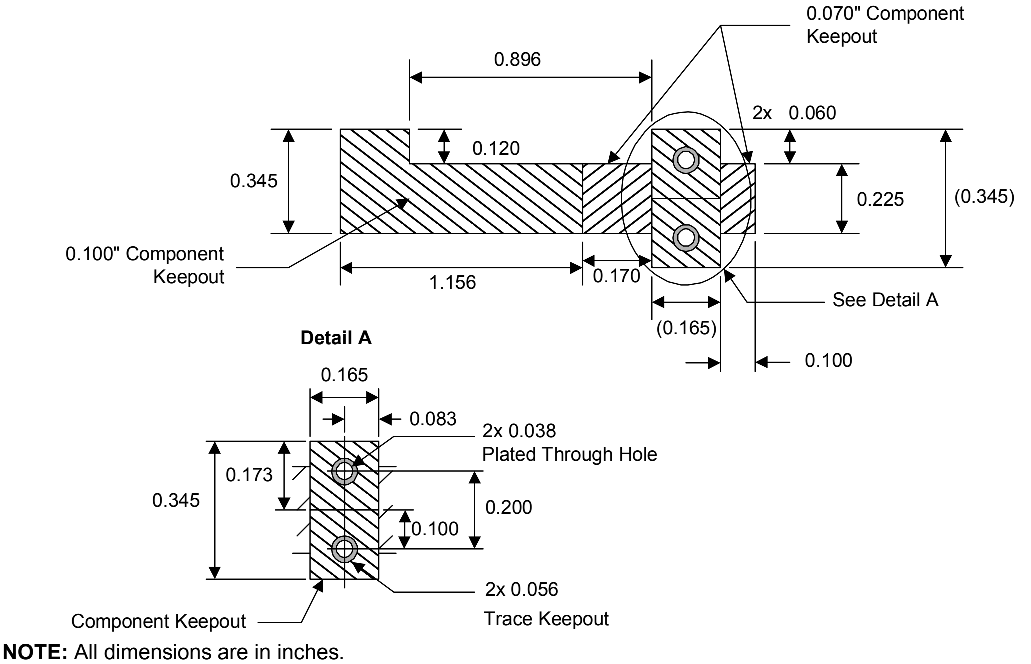
Full mechanical drawings of the thermal solution assembly and the heatsink clip are provided in Appendix B. Appendix A contains vendor information for each thermal solution component.

Figure 6-3. Torsional Clip Heatsink Board Component Keepout



NOTE: All dimensions are in inches.

Figure 6-4. Retention Mechanism Component Keepout Zones


0.070" Component Keepout
0.896
2x 0.060
0.120
0.345
0.225
(0.345)
0.100" Component Keepout
1.156
0.170
See Detail A
(0.165)
0.100
Detail A
0.165
0.083
2x 0.038 Plated Through Hole
0.173
0.345
0.200
0.100
2x 0.056 Trace Keepout
Component Keepout

NOTE: All dimensions are in inches.

6.5.1 Heatsink Orientation

Since this solution is based on a unidirectional heatsink, mean airflow direction must be aligned with the direction of the heatsink fins.

Figure 6-5. Torsional Clip Heatsink Assembly

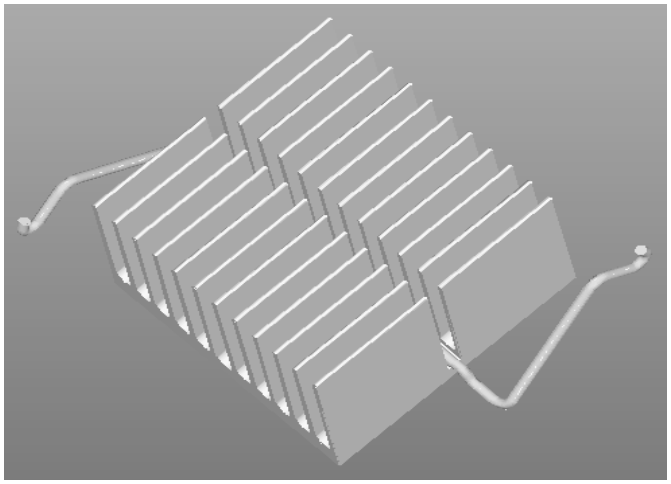
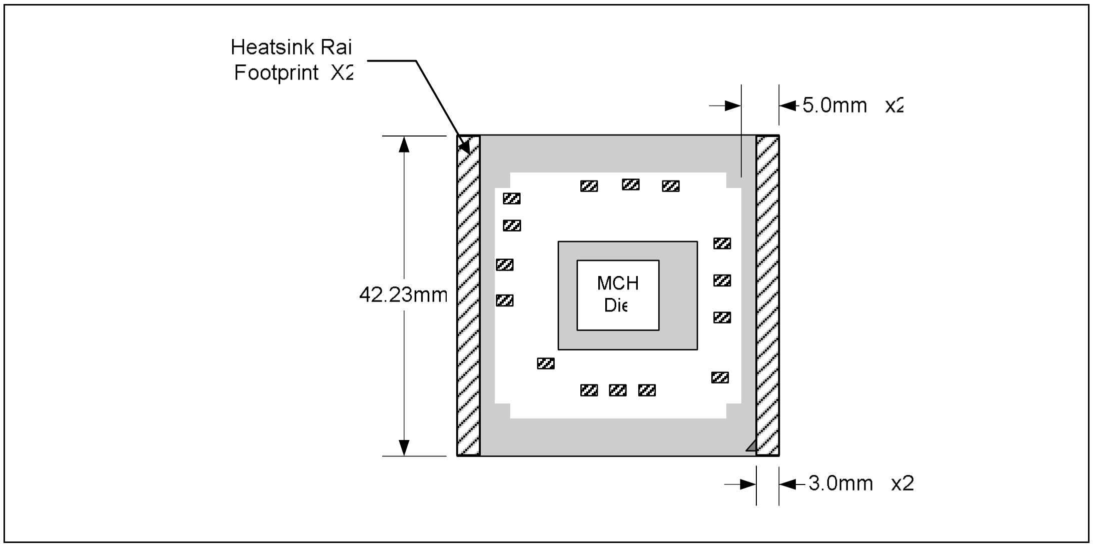


Figure 6-6. Heatsink Rails to MCH Package Footprint



6.5.2 Extruded Heatsink Profiles

The reference thermal solution uses an extruded heatsink for cooling the chipset MCH. Figure 6-7 shows the heatsink profile. Appendix A lists a supplier for this extruded heatsink. Other heatsinks with similar dimensions and increased thermal performance may be available. Full mechanical drawing of this heatsink is provided in Appendix B.

6.5.3 Mechanical Interface Material

There is no mechanical interface material associated with this reference solution.

6.5.4 Thermal Interface Material

A TIM provides improved conductivity between the die and heatsink. The reference thermal solution uses Chomerics T-710*, 0.127 mm (0.005 in.) thick, 12.7 mm x 12.7 mm (0.5 in. x 0.5 in.) square.

Note: Unflowed or “dry” Chomerics T710 has a material thickness of 0.005 inch. The flowed or “wet” Chomerics T710 has a material thickness of ~0.0025 inch after it reaches its phase change temperature.

6.5.4.1 Effect of Pressure on TIM Performance

As mechanical pressure increases on the TIM, the thermal resistance of the TIM decreases. This phenomenon is due to the decrease of the bond line thickness (BLT). BLT is the final settled thickness of the thermal interface material after installation of heatsink. The effect of pressure on the thermal resistance of the Chomerics T710 TIM is shown in Table 6-1. The heatsink clip provides enough pressure for the TIM to achieve a thermal conductivity of 0.17°C inch^2/W.

Table 6-1. Chomerics T710 TIM Performance as a Function of Attach Pressure

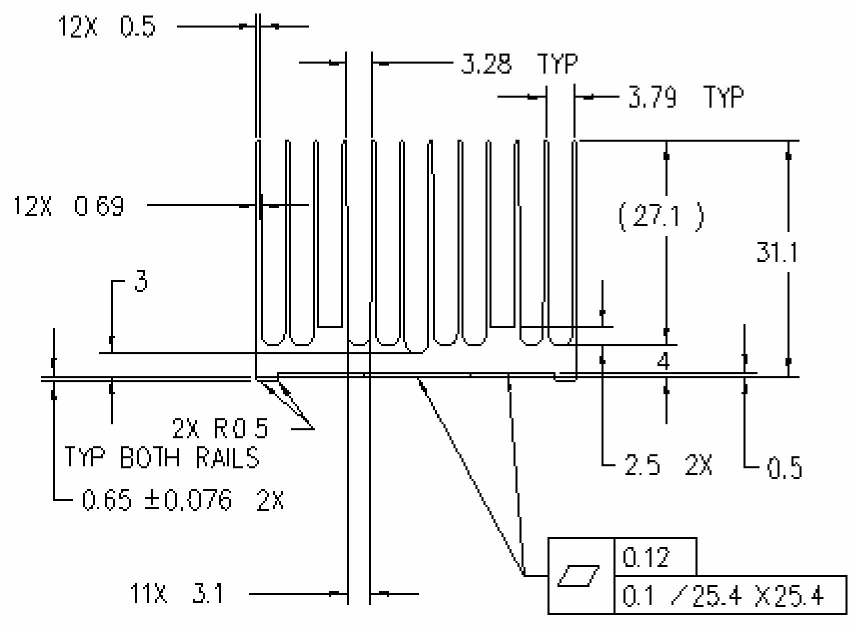
Pressure (psi)	Thermal Resistance (°C × in^2)/W
5	0.37
10	0.30
20	0.21
30	0.17

NOTE: All measured at 50°C.

6.5.5 Heatsink Clip

The reference solution uses a wire clip with hooked ends. The hooks attach to wire anchors to fasten the clip to the board. See Appendix B for a mechanical drawing of the clip.

Figure 6-7. Torsional Clip Heatsink Extrusion Profile



6.5.6 Clip Retention Anchors

For E7520/E7320/E7525 chipset-based platforms that have very limited board space, a clip retention anchor has been developed to minimize the impact of clip retention on the board. It is based on a standard three-pin jumper and is soldered to the board like any common through-hole header. A new anchor design is available with 45° bent leads to increase the anchor attach reliability over time. See Appendix A for the part number and supplier information.

6.6 Reliability Guidelines

Each motherboard, heatsink and attach combination may vary the mechanical loading of the component. Based on the end user environment, the user should define the appropriate reliability test criteria and carefully evaluate the completed assembly prior to use in high volume. Some general recommendations are shown in Table 6-2.

Table 6-2. Reliability Guidelines

Test (1)	Requirement	Pass/Fail Criteria (2)
Mechanical Shock	50 g, board level, 11 msec, 3 shocks/axis	Visual Check and Electrical Functional Test
Random Vibration	7.3 g, board level, 45 min/axis, 50 Hz to 2000 Hz	Visual Check and Electrical Functional Test
Temperature Life	85°C, 2000 hours total, checkpoints at 168, 500, 1000, and 2000 hours	Visual Check
Thermal Cycling	–5°C to +70°C, 500 cycles	Visual Check
Humidity	85% relative humidity, 55°C, 1000 hours	Visual Check

1. It is recommended that the above tests be performed on a sample size of at least twelve assemblies from three lots of material.
2. Additional pass/fail criteria may be added at the discretion of the user.

7 Reference Thermal Solution 2

Intel has two different reference thermal solutions designed to meet the coolings needs of the E7520/E7320/E7525 chipset MCH under operating environments and specifications defined in this document. This chapter describes the overall requirements for the Push Pin Heatsink reference thermal solution including critical-to-function dimensions, operating environment, and validation criteria. Other chipset components may or may not need attached thermal solutions, depending on your specific sytem local-ambient operating conditions. For information on the PXH, refer to thermal specification in the *Intel® 6700PXH 64-bit PCI Hub (PXH) Thermal/Mechanical Design Guide*. For information on the ICH5R, refer to thermal specification in the *Intel® 82801EB I/O Controller Hub 5 (ICH5) and Intel® 82801ER I/O Controller Hub 5 R (ICH5R) Thermal Design Guide*.

7.1 Operating Environment

The chipset MCH reference thermal solution was designed assuming a maximum local-ambient temperature of 50°C. The minimum recommended airflow velocity through the cross section of the heatsink fins is 400 linear feet per minute (lfm). The approaching airflow temperature is assumed to be equal to the local-ambient temperature. The thermal designer must carefully select the location to measure airflow to obtain an accurate estimate. These local-ambient conditions are based on a 35°C external-ambient temperature at sea level. (External-ambient refers to the environment external to the system.)

7.2 Heatsink Performance

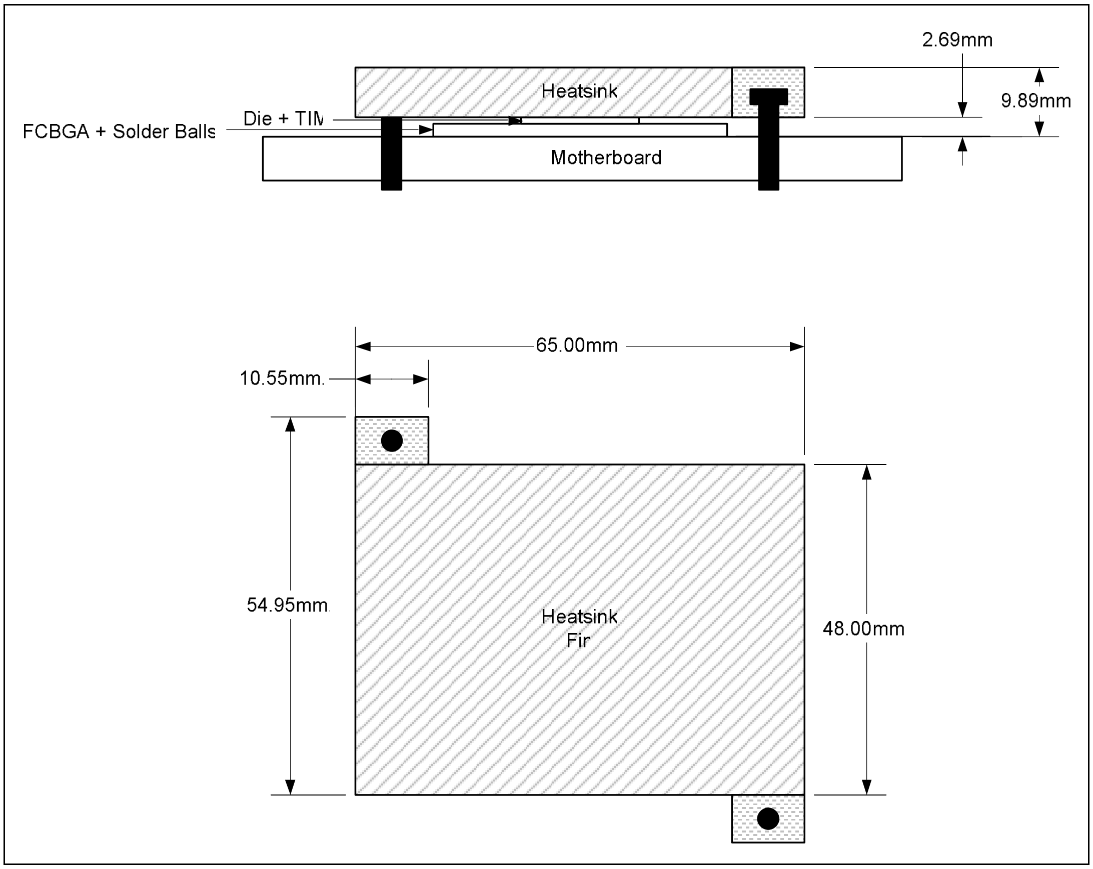
Please request actual measured data from the enabled supplier identified in Appendix A.

7.3 Mechanical Design Envelope

While each design may have unique mechanical volume and height restrictions or implementation requirements, the height, width, and depth constraints typically placed on the E7520/E7320/E7525 chipset MCH thermal solution are shown in Figure 7-1.

When using heatsinks that extend beyond the MCH reference heatsink envelope shown Figure 7-1, any motherboard components placed between the heatsink and motherboard cannot exceed 2.46 mm (0.10 in.) in height.

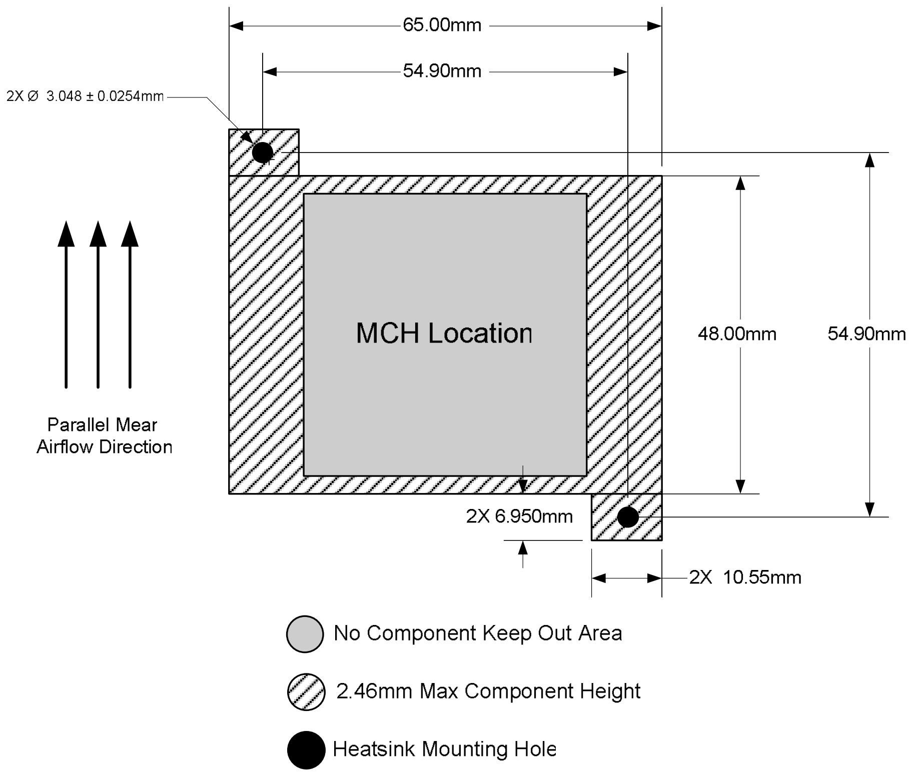
Figure 7-1. Push Pin Heatsink Volumetric Envelope for the MCH


2.69mm
9.89mm
Heatsink
Die + TIM
FCBGA + Solder Balls
Motherboard
65.00mm
10.55mm.
54.95mm.
Heatsink
Fir
48.00mm

7.4 Board-Level Components Keepout Dimensions

The location of hole pattern and keepout zones for the reference thermal solution are shown in Figure 7-2.

Figure 7-2. Push Pin Heatsink Board Component Keepout

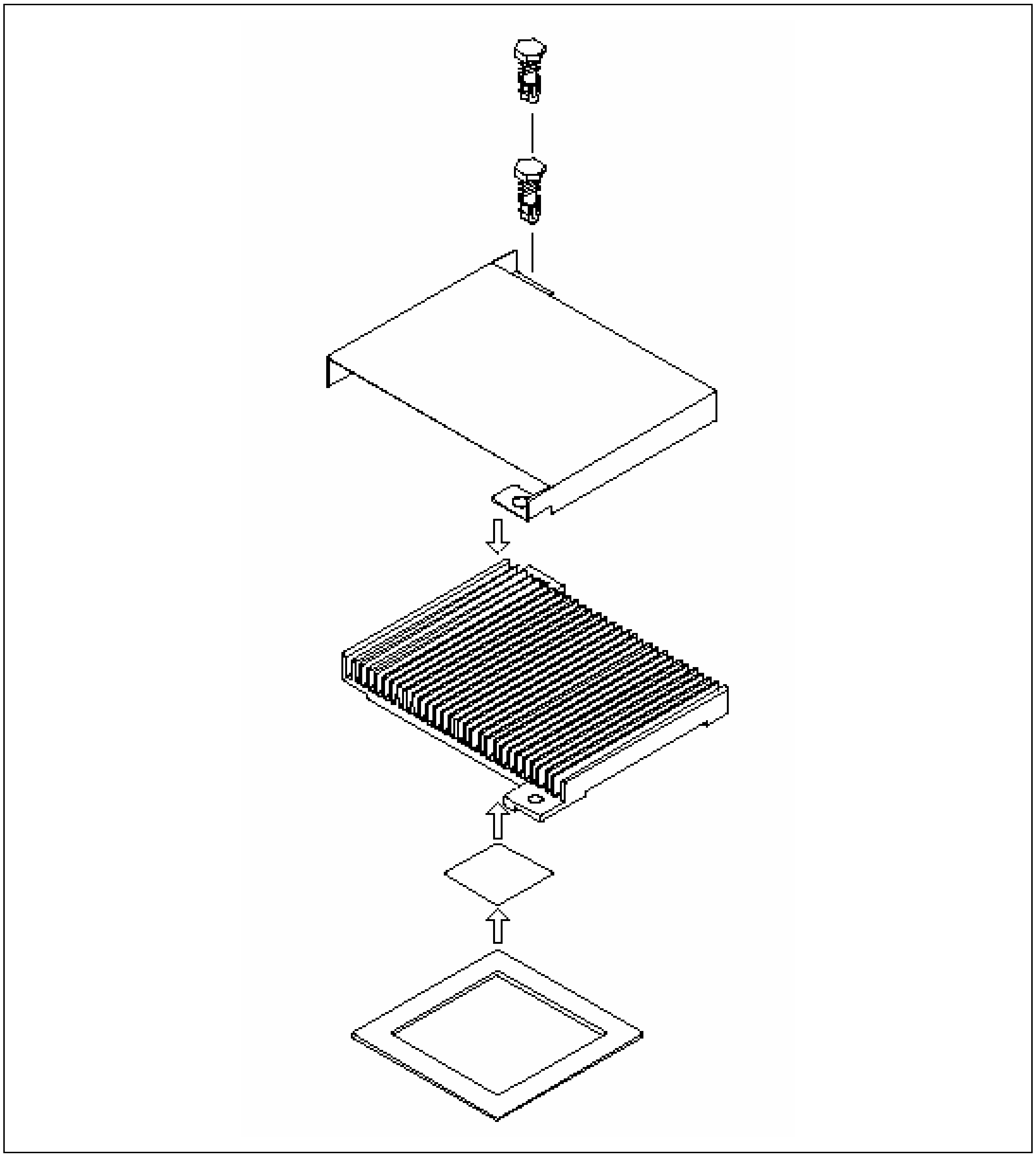

65.00mm
54.90mm
2X Ø 3.048 ± 0.0254mm
MCH Location
48.00mm
54.90mm
Parallel Mear
Airflow Direction
2X 6.950mm
2X 10.55mm
No Component Keep Out Area
2.46mm Max Component Height
Heatsink Mounting Hole

7.5 Push Pin Heatsink Thermal Solution Assembly

The reference thermal solution for the chipset MCH is a passive extruded heatsink with thermal and mechanical interfaces. It is attached to the board by using two two push pin fasteners. Figure 7-3 shows the reference thermal solution assembly and the associated components.

Please request mechanical drawings of this thermal solution from the enabled supplier identified in Appendix A.

Figure 7-3. Push Pin Heatsink Assembly



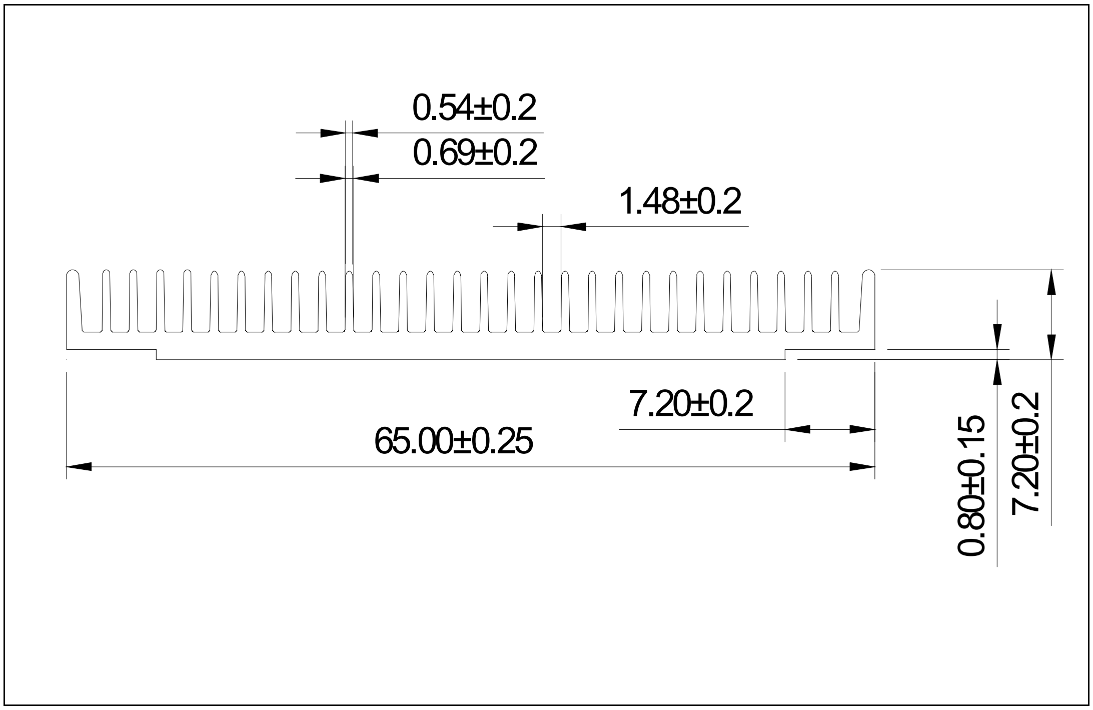
7.5.1 Heatsink Orientation

Since this solution is based on a unidreictional heatsink, mean airflow direction must be aligned with the direction of the heatsink fins.

7.5.2 Extruded Heatsink Profiles

The reference thermal solution uses an extruded heatsink for cooling the chipset MCH. Figure 7-4 shows the heatsink profile. Appendix A lists a supplier for this extruded heatsink. Other heatsinks with similar dimensions and increased thermal performance may be available. For mechanical drawings of this thermal solution, contact the enabled supplier identified in Appendix A.

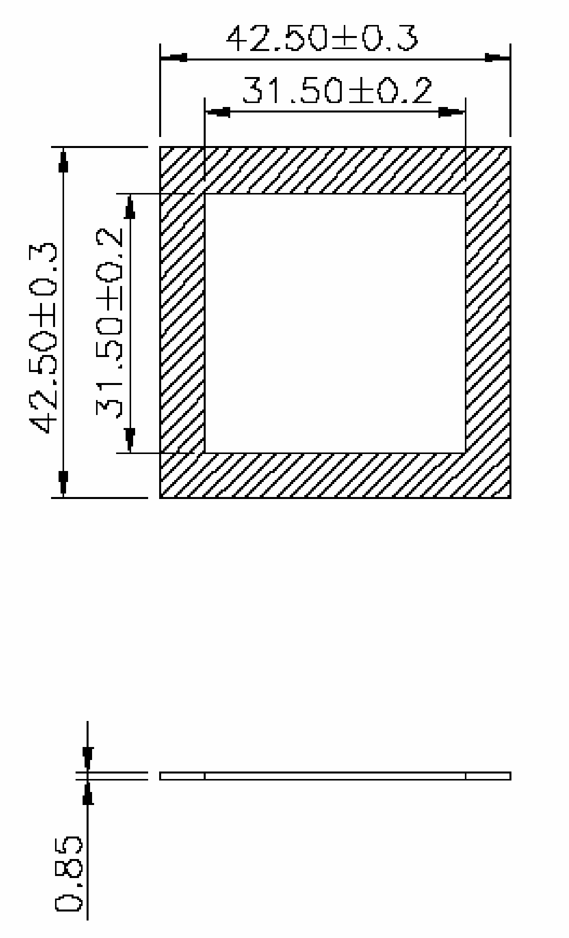
Figure 7-4. Push Pin Heatsink Extrusion Profile



7.5.3 Mechanical Interface Material

Intel recommends the use of a mechanical interface material to avoid cracking of the exposed die under loading. The interface material reduces mechanical loads experienced by the die. The reference thermal solution uses a picture frame gasket of 0.85 mm (0.033 in.) thick Poron KH-30* foam. The foam gasket is a one-piece design as showing in Figure 7-5.

Figure 7-5. Push Pin Heatsink Mechanical Interface Material



7.5.4 Thermal Interface Material

A thermal interface material provides improved conductivity between the die and the heatsink. The reference thermal solution uses Shin-Etsu G-751, 0.15 mm (0.006 in.) thick, 16 mm x 16mm (0.63 in. x 0.63 in.) square.

7.5.5 Heatsink Retaining Fastener

The reference solution uses two heatsink retaining push pins. The fasteners attach the heatsink to the motherboard by expanding its prong to snap into each of the two heatisnk mouting hole. These fasteners are intended to be used on a 0.062” thickness motherboard. For mechanical drawings of this fastener, contact the enabled supplier identified in Appendix A.

7.6 Reliability Guidelines

Please refer to Section 6.6 for detail.

A Thermal Solution Component Suppliers

Table A-1. Torsional Clip Heatsink Thermal Solution

Part	Intel Part Number	Supplier (Part Number)	Contact Information
Heatsink Assembly includes: • Unidirectional Fin Heatsink • Thermal Interface Material • Torsional Clip	C76432-001	CCI/ACK*	Harry Lin (USA) - 714-739-5797 hlinack@aol.com Monica Chih (Taiwan) 866-2-29952666, x131 monica_chih@ccic.com.tw
Undirectional Fin Heatsink (42.34 x 42.34 x 31.1 mm)	C76431-001	CCI/ACK	Harry Lin (USA) - 714-739-5797 hlinack@aol.com Monica Chih (Taiwan) 866-2-29952666, x131 monica_chih@ccic.com.tw
Thermal Interface (T-710)	689850-001	Chomerics 69-12-21545-T710*	Todd Sousa (USA) - 360-606-8171 tsousa@parker.com
Heatsink Attach Clip	A69230-001	CCI/ACK	Harry Lin (USA) - 714-739-5797 hlinack@aol.com Monica Chih (Taiwan) 866-2-29952666, x131 monica_chih@ccic.com.tw
		Foxconn	Bob Hall (USA) - 503-693-3509, x235 bhall@foxconn.com
Solder-Down Anchor	A13494-005	Foxconn (HB96030-DW)	Julia Jiang (USA) - 408-919-6178 juliaj@foxconn.com

Table A-2. Push Pin Heatsink Thermal Solution

Part	Intel Part Number	Supplier (Part Number)	Contact Information
Heatsink Assembly includes: • Unidirectional Fin Heatsink • Heatsink Shroud • Thermal Interface Material • Mechanical Interface Material • Retaining Fastener	N/A	AVC (S940200001 v1)	David Chao (Taiwan) 886-2-22996930, x619 david_chao@avc.com.tw

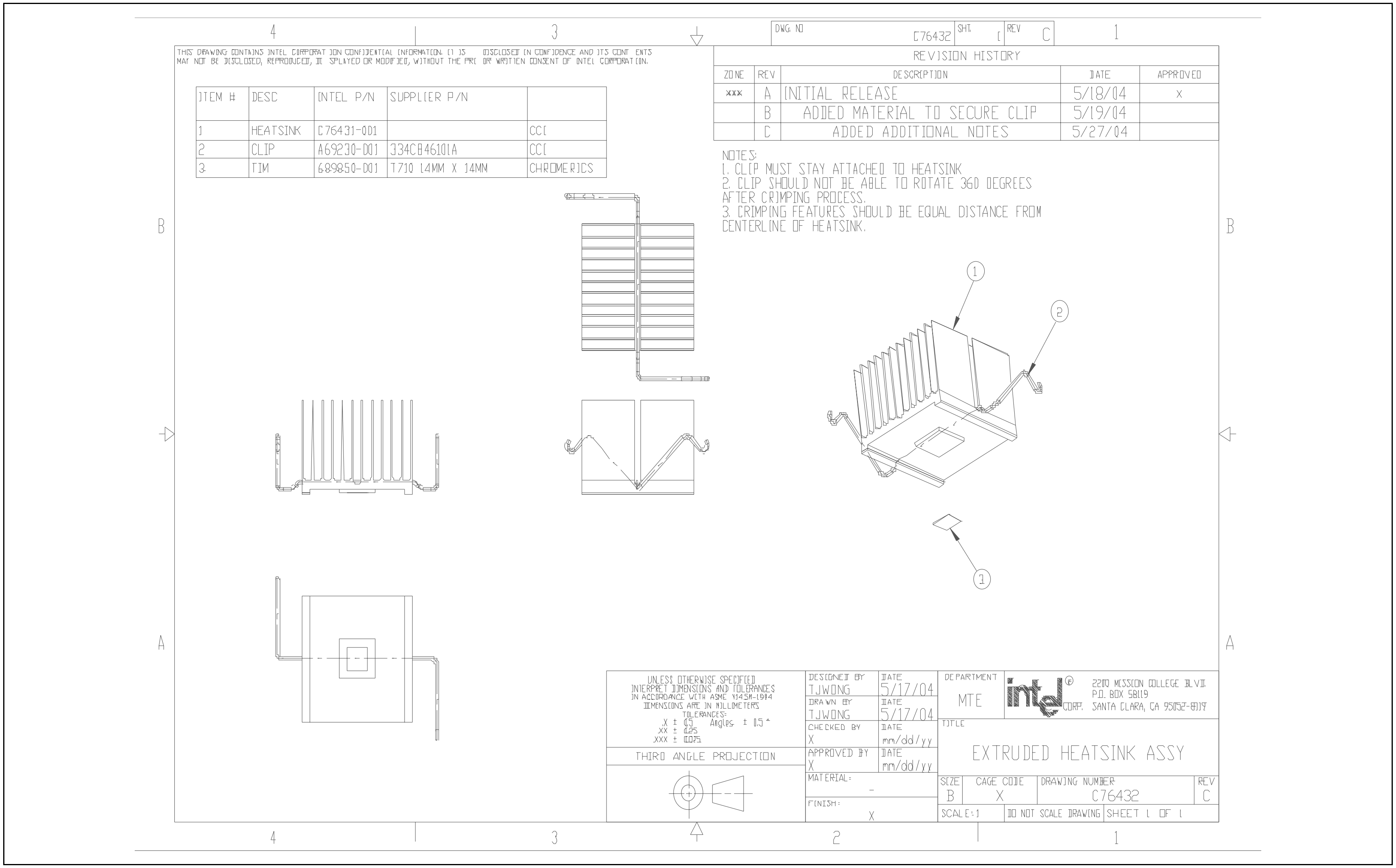
Note: The enabled components may not be currently available from all suppliers. Contact the supplier directly to verify time of component availability.

B Mechanical Drawings

Table B-1. Mechanical Drawing List

Drawing Description	Figure Number
Torsional Clip Heatsink Assembly Drawing	Figure B-1
Torsional Clip Heatsink Drawing	Figure B-2
Torsional Clip Drawing	Figure B-3

Figure B-1. Torsional Clip Heatsink Assembly Drawing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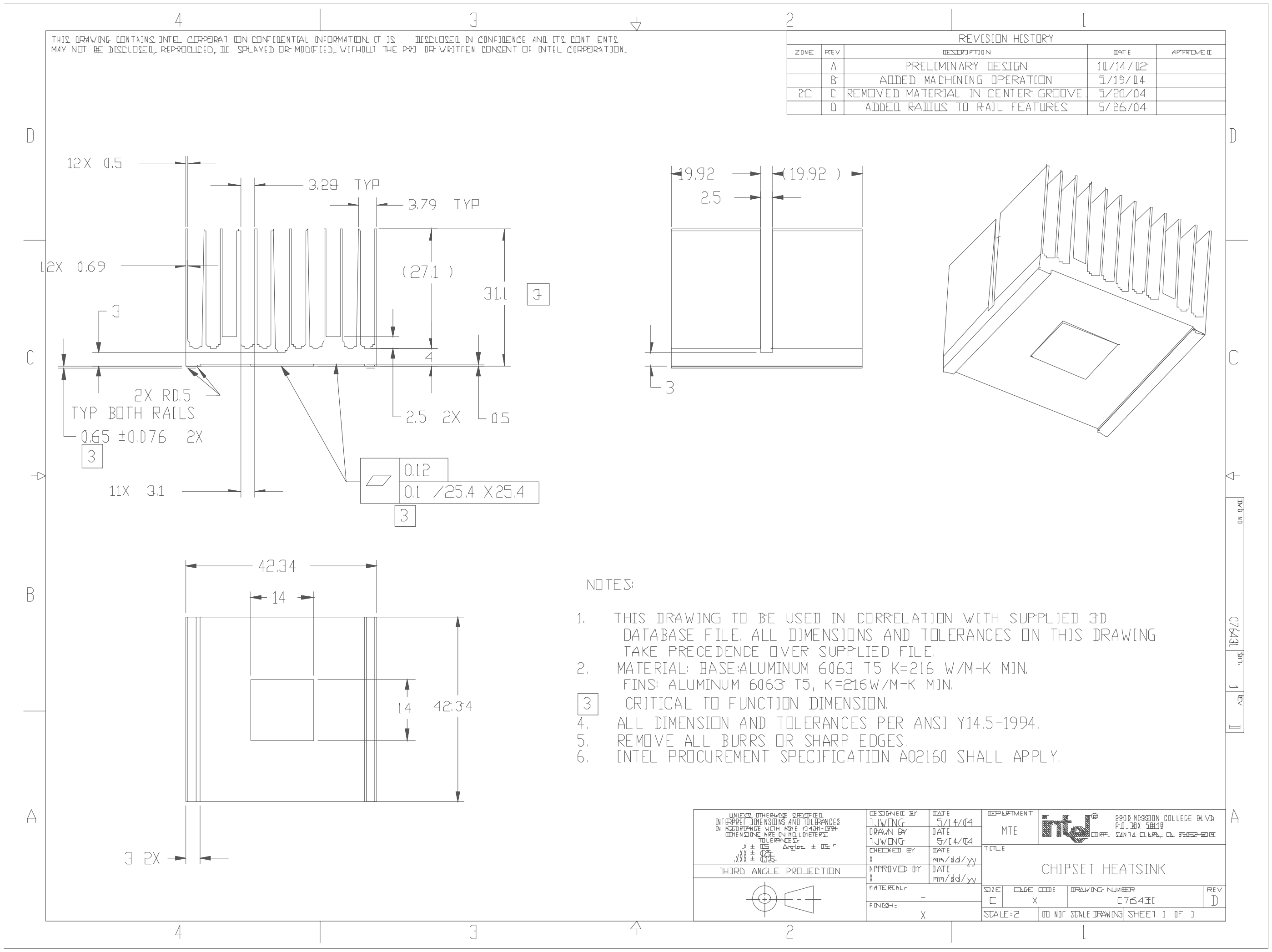
ITEM #
DESC
INTEL P/N
SUPPLIER P/N
1
HEATSINK
C76431-001
CCI
2
CLIP
A69230-001
334CB46101A
CCI
3
TIM
689850-001
T710 14MM X 14MM
CHROMERICS
DWG NO
C76432
SHT
1
REV
C
REVISION HISTORY
ZONE
REV
DESCRIPTION
DATE
APPROVED
***
A
INITIAL RELEASE
5/18/04
X
B
ADDED MATERIAL TO SECURE CLIP
5/19/04
C
ADDED ADDITIONAL NOTES
5/27/04
NOTES:
1. CLIP MUST STAY ATTACHED TO HEATSINK
2. CLIP SHOULD NOT BE ABLE TO ROTATE 360 DEGREES AFTER CRIMPING PROCESS.
3. CRIMPING FEATURES SHOULD BE EQUAL DISTANCE FROM CENTERLINE OF HEATSINK.
1
2
3
4
A
B
UNLESS OTHERWISE SPECIFIED INTERPRET DIMENSIONS AND TOLERANCES IN ACCORDANCE WITH ASME Y14.5M-1994
DIMENSIONS ARE IN MILLIMETERS
TOLERANCES:
.X ± 0.5 Angles ± 0.5°
.XX ± 0.25
.XXX ± 0.125
THIRD ANGLE PROJECTION
DESIGNED BY
TJWONG
DATE
5/17/04
DRAWN BY
TJWONG
DATE
5/17/04
CHECKED BY
X
DATE
mm/dd/yy
APPROVED BY
X
DATE
mm/dd/yy
MATERIAL:
-
FINISH:
X
DEPARTMENT
MTE
intel CORP.
2200 MISSION COLLEGE BLVD.
P.O. BOX 58119
SANTA CLARA, CA 95052-8119
TITLE
EXTRUDED HEATSINK ASSY
SIZE
B
CAGE CODE
X
DRAWING NUMBER
C76432
REV
C
SCALE:1
DO NOT SCALE DRAWING
SHEET 1 OF 1

Figure B-2. Torsional Clip Heatsink Drawing



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REVISION HISTORY

ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	PRELIMINARY DESIGN	10/14/02	
	B	ADDED MACHINING OPERATION	5/19/04	
2C	C	REMOVED MATERIAL IN CENTER GROOVE.	5/20/04	
	D	ADDED RADIUS TO RAIL FEATURES	5/26/04	

NOTES:

1. THIS DRAWING TO BE USED IN CORRELATION WITH SUPPLIED 3D DATABASE FILE. ALL DIMENSIONS AND TOLERANCES ON THIS DRAWING TAKE PRECEDENCE OVER SUPPLIED FILE.
2. MATERIAL: BASE:ALUMINUM 6063 T5 K=216 W/M-K MIN.
   FINS: ALUMINUM 6063 T5, K=216W/M-K MIN.
3. CRITICAL TO FUNCTION DIMENSION.
4. ALL DIMENSION AND TOLERANCES PER ANSI Y14.5-1994.
5. REMOVE ALL BURRS OR SHARP EDGES.
6. INTEL PROCUREMENT SPECIFICATION A02160 SHALL APPLY.

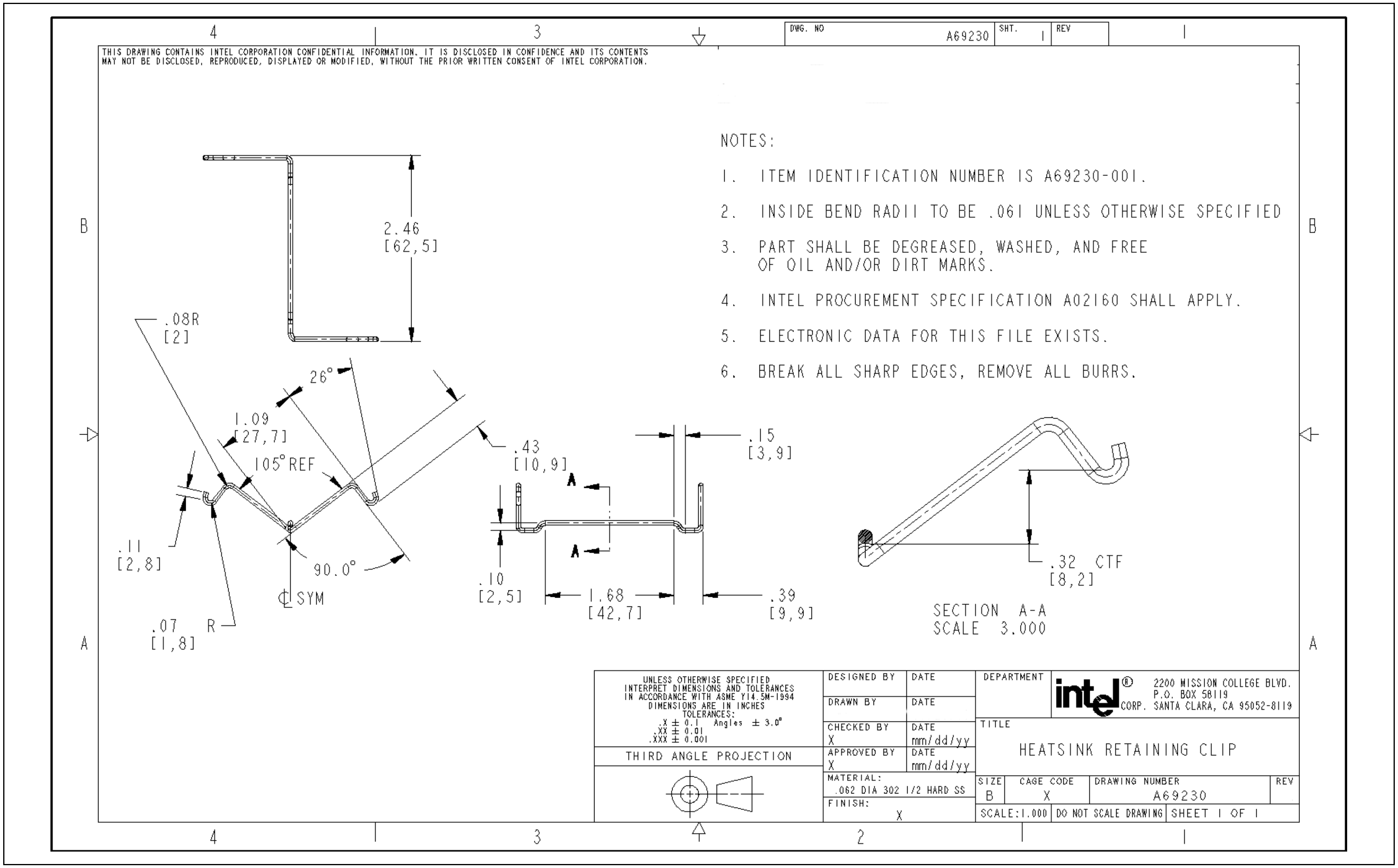
UNLESS OTHERWISE SPECIFIED
INTERPRET DIMENSIONS AND TOLERANCES
IN ACCORDANCE WITH ASME Y14.5M-1994
DIMENSIONS ARE IN MILLIMETERS
TOLERANCES:

DESIGNED BY J.WONG	DATE 5/14/04
DRAWN BY J.WONG	DATE 5/14/04
CHECKED BY X	DATE mm/dd/yy
APPROVED BY X	DATE mm/dd/yy
MATERIAL: -	
FINISH: X	

DEPARTMENT MTE	2200 MISSION COLLEGE BLVD. P.O. BOX 58119 SANTA CLARA, CA 95052-8119		
TITLE CHIPSET HEATSINK			
SIZE C	CAGE CODE X	DRAWING NUMBER C76431	REV D
SCALE: 2	DO NOT SCALE DRAWING	SHEET 1 OF 1	

4
3
2
1
D
C
B
A
12X 0.5
3.28 TYP
3.79 TYP
12X 0.69
(27.1)
31.1
3
3
2X R0.5
TYP BOTH RAILS
0.65 ±0.076 2X
3
11X 3.1
2.5 2X
0.5
4
0.12
0.1 /25.4 X25.4
3
19.92
(19.92)
2.5
3
42.34
14
14
42.34
3 2X
.X ± 0.5 Angles ± 0.5°
.XX ± 0.25
.XXX ± 0.125
THIRD ANGLE PROJECTION
DWG NO
C76431
SHT. 1
REV D

Figure B-3. Torsional Clip Drawing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DWG. NO A69230
SHT. 1
REV
2.46 [62,5]
.08R [2]
26°
1.09 [27,7]
105° REF
.11 [2,8]
90.0°
℄ SYM
.07 R [1,8]
.43 [10,9]
.15 [3,9]
A
A
.10 [2,5]
1.68 [42,7]
.39 [9,9]
.32 CTF [8,2]
SECTION A-A
SCALE 3.000
UNLESS OTHERWISE SPECIFIED INTERPRET DIMENSIONS AND TOLERANCES IN ACCORDANCE WITH ASME Y14.5M-1994
DIMENSIONS ARE IN INCHES
TOLERANCES:
.X ± 0.1 Angles ± 3.0°
.XX ± 0.01
.XXX ± 0.001
THIRD ANGLE PROJECTION
DESIGNED BY
DATE
DRAWN BY
DATE
CHECKED BY X
DATE mm/dd/yy
APPROVED BY X
DATE mm/dd/yy
MATERIAL: .062 DIA 302 1/2 HARD SS
FINISH: X
DEPARTMENT
intel® CORP.
2200 MISSION COLLEGE BLVD.
P.O. BOX 58119
SANTA CLARA, CA 95052-8119
TITLE
HEATSINK RETAINING CLIP
SIZE B
CAGE CODE X
DRAWING NUMBER A69230
REV
SCALE: 1.000
DO NOT SCALE DRAWING
SHEET 1 OF 1
4
3
2
1
B
A

NOTES:

1. ITEM IDENTIFICATION NUMBER IS A69230-001.
2. INSIDE BEND RADII TO BE .061 UNLESS OTHERWISE SPECIFIED
3. PART SHALL BE DEGREASED, WASHED, AND FREE OF OIL AND/OR DIRT MARKS.
4. INTEL PROCUREMENT SPECIFICATION A02160 SHALL APPLY.
5. ELECTRONIC DATA FOR THIS FILE EXISTS.
6. BREAK ALL SHARP EDGES, REMOVE ALL BURRS.