Intel® 7500, 7510, and 7512 Scalable Memory Buffer

Thermal/Mechanical Design Guidelines

April 2011

Reference Number: 322828-002

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Revision History

Revision	Description	Date
001	Initial Release	April 2010
002	• Added product specifications for Intel 7510 and 7512 Scalable Memory buffer • Replaced reference to 'Intel 7500 Scalable Memory Buffer' with 'components' where guidance also applies to Intel 7510 and 7512 Scalable Memory Buffer. See change bars throughout document. • Section 2: Revised the figures title • Section 3.1: Reworded the paragraph • Table 3-1: Updated the table • Table 3-2: Added note 6	April 2011

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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.

Note: This document addresses thermal design and specifications for the Intel® 7500, 7510, and 7512 Scalable Memory Buffer. Information provided in this document is intended only for use with these products. Unless otherwise specified, specification and guidance provided in this document applies to products identified above. In this document the term 'component' refer to Intel 7500, 7510, and 7512 Scalable Memory Buffer components unless other wise identified.

The goals of this document are to:

- Outline the mechanical operating limits and specifications for the Intel® 7500, 7510, and 7512 Scalable Memory Buffer (MB).
- Outline reference TDP specifications for the Intel 7500, 7510, and 7512 Scalable Memory Buffer specific to that of Intel® Xeon® processor 7500 series-based platform and Intel® Itanium® processor 9300 series-based platform.
- Describe reference thermal solutions that meet the specifications of the Intel 7500, 7510, and 7512 Scalable Memory Buffer.

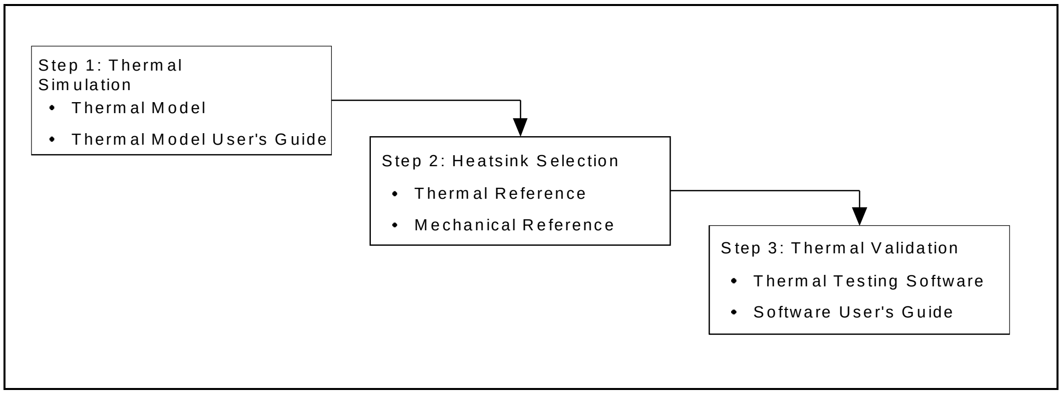
Properly designed thermal solutions provide adequate cooling to maintain the component die temperature at or below thermal specifications. This is accomplished by providing a low local-ambient temperature, ensuring adequate local airflow, and minimizing the die to local-ambient thermal resistance. By maintaining the memory buffer component 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 proper 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.

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



1.2 Definition of Terms

FC-BGA	Flip Chip Ball Grid Array. A package type defined by a plastic substrate where a die is mounted using an underfill C4 (Controlled Collapse Chip Connection) attach style. The primary electrical interface is an array of solder balls attached to the substrate opposite the die. Note that the device arrives at the customer with solder balls attached.
BLT	Bond Line Thickness. Final settled thickness of the thermal interface material after installation of heatsink.
MB	Intel 7500 Scalable Memory Buffer. The chipset component responsible for handling Intel® Scalable Memory Interconnect (Intel® SMI) channel and memory requests to and from the local DIMM. All memory control for the DRAM resides in the host, including memory request initiation, timing, refresh, scrubbing, sparing, configuration access, and power management.
T_{case_max}	Maximum die operating temperature, and is measured at the geometric center of the top of the die.
T_{case_min}	Minimum die operating temperature, and is measured at the geometric center of the top of the 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® 7500, 7510, and 7512 Scalable Memory Buffer Datasheet*
- Various system thermal design suggestions (http://www.formfactors.org)

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2 Packaging Technology

The Intel 7500, 7510, and 7512 Scalable Memory Buffer components uses a 24.5 mm x 19.5 mm, 12-layer FC-BGA package (see Figure 2-1, Figure 2-2 and Figure 2-3).

Figure 2-1. Scalable Memory Buffer Package Dimensions (Top View)

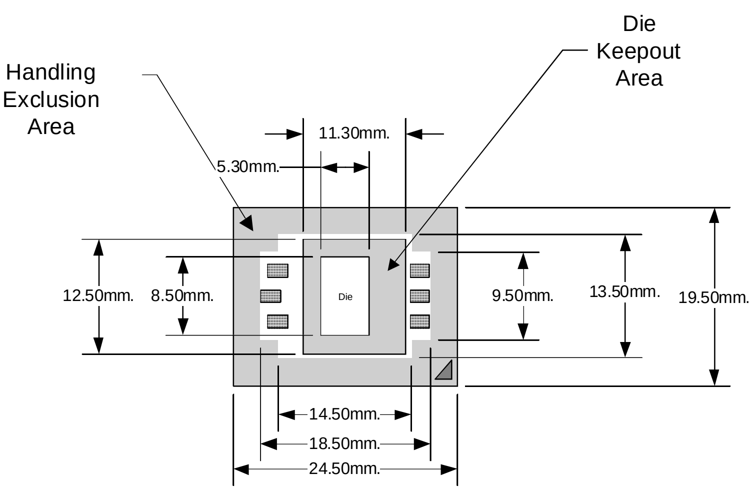
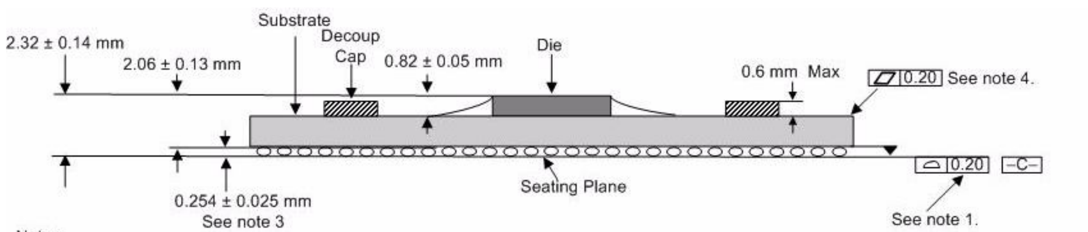
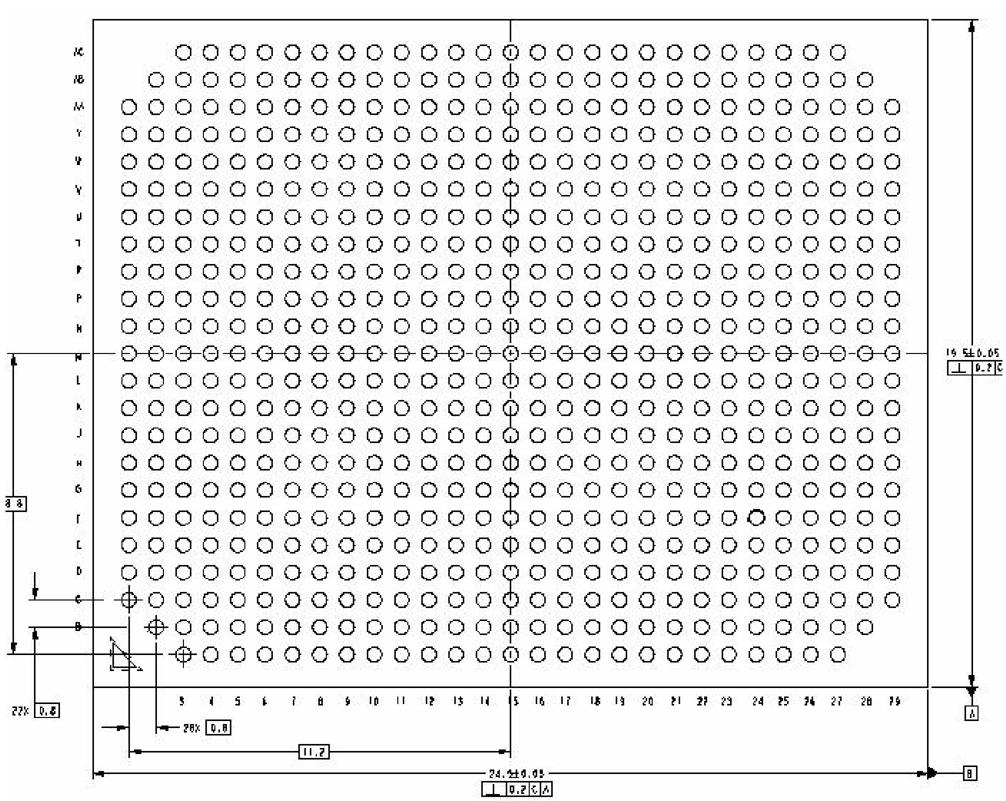


Figure 2-2. Scalable Memory Buffer Package Dimensions (Side View)



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 (SAC405) has a pre-SMT height of 0.401 - 0.411mm and post-SMT height of 0.229 - 0.279mm
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. Scalable Memory Buffer Package Dimensions (Bottom View)



Notes:
1. All dimensions are in millimeters.
2. All dimensions are tolerances confirm to ANSI Y14.5M-1994.

2.1 Package Mechanical Requirements

The component 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 top surface.
3. These specifications are based on limited testing for design characterization. Loading limits are for the package only.

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3 Thermal Specifications

3.1 Thermal Design Power (TDP)

Analysis indicates that real applications are unlikely to cause the component 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). Hence, TDP is the design target for the thermal solution. TDP is not the maximum power that the memory buffer component can dissipate.

For TDP specifications, see Table 3-1 for the Intel 7500, 7510, and 7512 Scalable Memory Buffer components. 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 an Intel 7500 Scalable Memory Buffer component.

3.2 Die Case Temperature Specifications

To ensure proper operation and reliability of the component, the die temperature must comply with the thermal profile as specified in Table 3-2. System and/or component level thermal solutions are required to maintain these temperature specifications. Refer to Chapter 4, "Thermal Metrology," for guidelines on accurately measuring package die temperatures.

Table 3-1. Intel® Scalable Memory Buffer Thermal Design Power

			RDIMM		LVDIMM	
Component	**Standard / Low Power**	**Platform Configurations**	**TDP_max[3]**	**Idle Power[3]**	**TDP_Max[3]**	**Idle Power[3]**
Intel® 7500 Scalable Memory Buffer	NA	4 Socket, 130 W Intel® Xeon® processor 7500 series	10 W	7 W	—	—
	NA	4 Socket, 185 W Intel® Itanium® processor 9300 series	10 W	7 W	—	—
Intel® 7510 Memory Buffer	Standard	4 Socket, 130 W Intel® Xeon® Processor 7500 Series	8.7 W	3 W	NA[4]	NA[4]

Notes:
1. These specifications are based on preliminary post-silicon measurement and subject to change.
2. Maximum of four (4) memory buffers are supported per processor socket. Additionally, Each memory buffer can support up to 4 memory DIMMs. See specific memory buffer datasheet or electronic design specification documents for additional information.
3. TDP values for the memory buffers are based on loading Quad Rank, two DIMM per Channel per Intel 7510/7512 Scalable Memory Buffer.
4. When Intel 7510/7512 Scalable Memory Buffer is used with the Intel® Xeon® processor 7500/6500 series, only the Intel 7500 Scalable Memory Buffer feature set is supported and validated; no validation, support, or warranty of LV-DIMMs with Intel 7510/7512 Scalable Memory Buffer on Intel® Xeon® processor 7500 series-based platforms.
5. Intel 7510/7512 Scalable Memory Buffer idle power assumption is with the processor C3E power saving mode enabled.

Table 3-2. Intel® 7500 Scalable Memory Buffer Thermal Specification

Parameter	Value	Note
Tcase_max	92°C	1,2,6
Tcase_min	5°C	1,2,3,4,5,6
Tcontrol	87°C	1,2,3,4,5,6

Notes:
1. Tcase_min and Tcase_max represent the operating temperature range of the memory buffer. For additional information on memory buffer thermal specifications Refer to the *Intel® 7500,7510, and 7512 Scalable Memory Buffer Datasheet*.
2. Refer to the *Intel® 7500, 7510, 7512 Scalable Memory Buffer Datasheet* for thermal management mechanism and Tcontrol usage.
3. The Tcontrol threshold value to be compared against the thermal sensor reading.
4. When the thermal sensor reading is less than the Tcontrol value, system can run under acoustic condition.
5. When the thermal sensor reading is larger than the Tcontrol value, the fan speed must increase as necessary to maintain the sensor temperature at or below the Tcontrol value.
6. These specifications apply to Intel 7500, 7510, and 7512 Scalable Memory Buffer.

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4 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 component die temperatures. Section 4.1 provides guidelines on how to accurately measure the Intel 7500 Scalable Memory Buffer die temperatures.

4.1 Die Temperature Measurements

To ensure functionality and reliability, the component T_{case} must be maintained at or between the maximum/minimum operating range of the temperature specification as noted in Table 3-1. 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 maximum measurement accuracy, only the 0° thermocouple attach approach is recommended.

4.1.1 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 4-2).
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 4-3).
6. Attach heatsink assembly to the component and route thermocouple wires out through the milled slot.

Figure 4-1. Thermal Solution Decision Flowchart

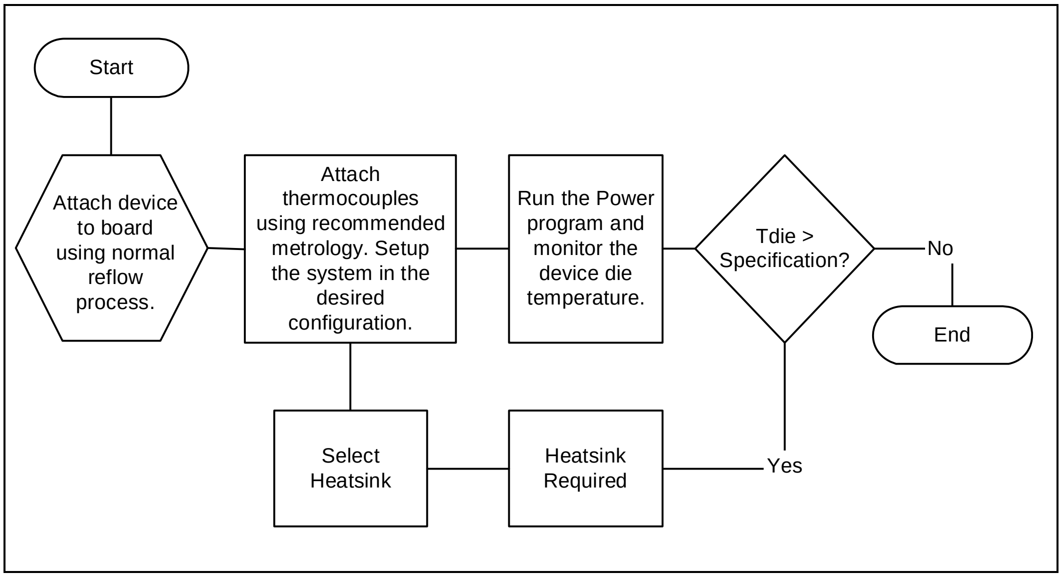
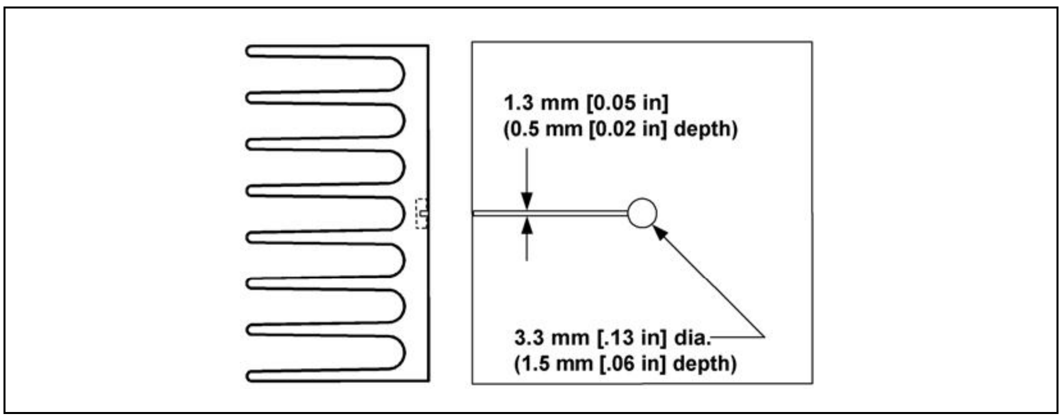
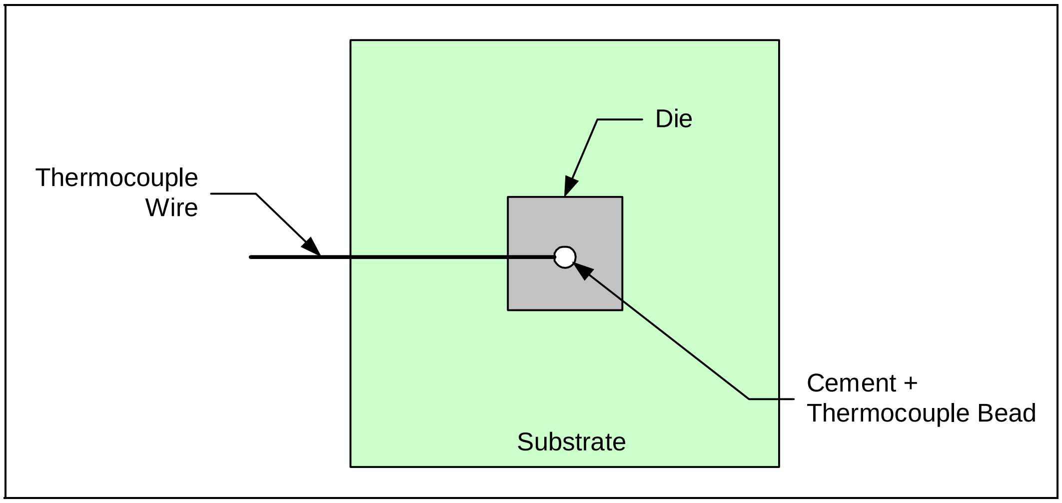


Figure 4-2. Zero Degree Angle Attach Heatsink Modifications



Note: Not to scale.

Figure 4-3. Zero Degree Angle Attach Methodology (Top View)



Note: Not to scale.

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5 Reference Thermal Solution 1

Intel has developed two different reference thermal solutions to meet the cooling needs of the components under operating environments and specifications defined in this document. This chapter describes the overall requirements for the tall 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 specific system local-ambient operating conditions.

This reference thermal solution allows for the attachment of the torsional clip in one of two different orientations: A and B.

5.1 Operating Environment

The tall reference thermal solution was designed assuming both a max fan speed condition and an acoustic fan speed condition. The thermal designer must carefully select the location to measure airflow to obtain an accurate estimate.

5.1.1 Maximum Fan Speed Assumption

- Local-ambient temperature: 56.3°C (based on 35°C external-ambient temperature at sea level)
- Minimum airflow velocity through the cross-section of the heatsink fins: 2.2 m/s

Note: External-ambient refers to the environment external to the system.

5.1.2 Acoustics Fan Speed Assumption

- Local-ambient temperature: 54.9°C (based on 25°C external-ambient temperature at sea level)
- Minimum airflow velocity through the cross-section of the heatsink fins: > 0.8 m/s

Note: External-ambient refers to the environment external to the system.

5.2 Heatsink Performance

Figure 5-1 depicts the *simulated* thermal performance of the reference thermal solution versus approach air velocity. Since this data was modeled at sea level, a correction factor would be required to estimate thermal performance at other altitudes.

The following equation can be used to determine the thermal solution performance at a given altitude:

$$\theta_{ca} = \alpha + \beta \times Q_{alt}^{-\Upsilon}\left(\frac{\rho_{alt}}{\rho_o}\right)^{-\Upsilon}$$

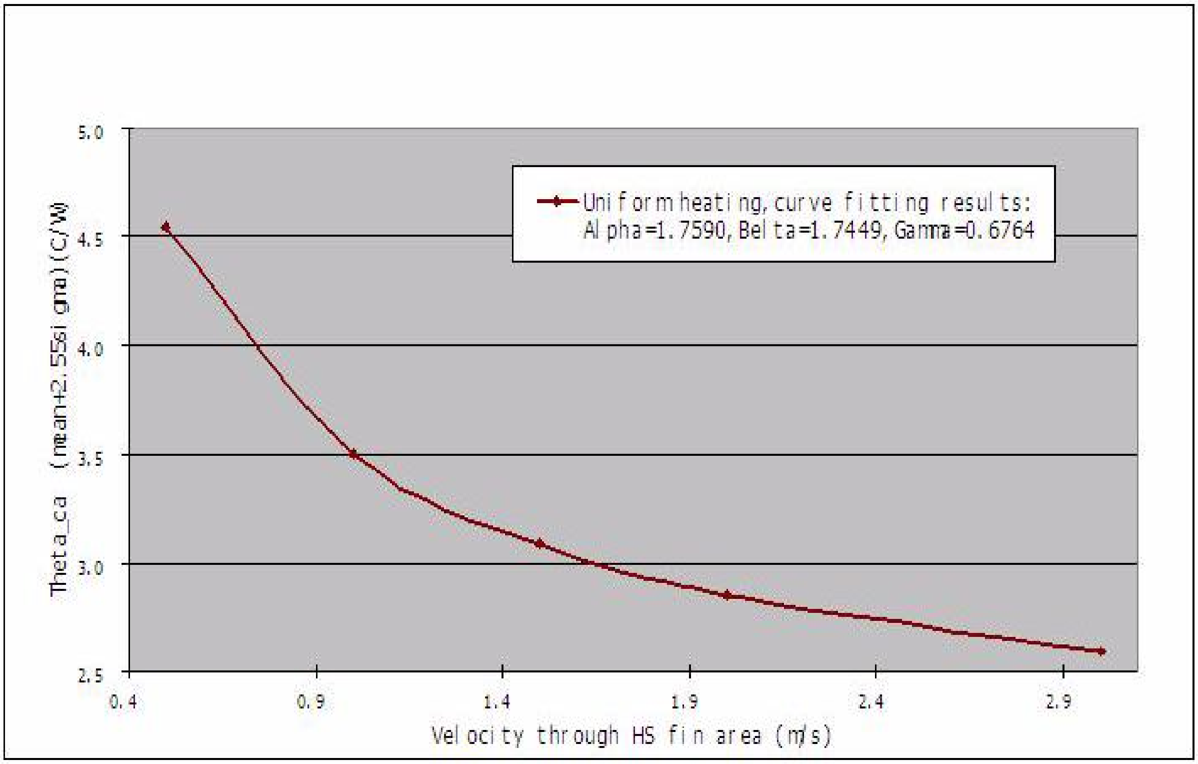
α, β and γ can be obtained from Figure 5-1.

Q - “velocity through heatsink fin area (m/s)”. Velocity is the value on X axis of Figure 5-1.

ρ_{alt} - Air density at given altitude

ρ_0 - Air density at sea level

Figure 5-1. Tall Torsional Clip Heatsink Measured Thermal Performance Versus Approach Velocity

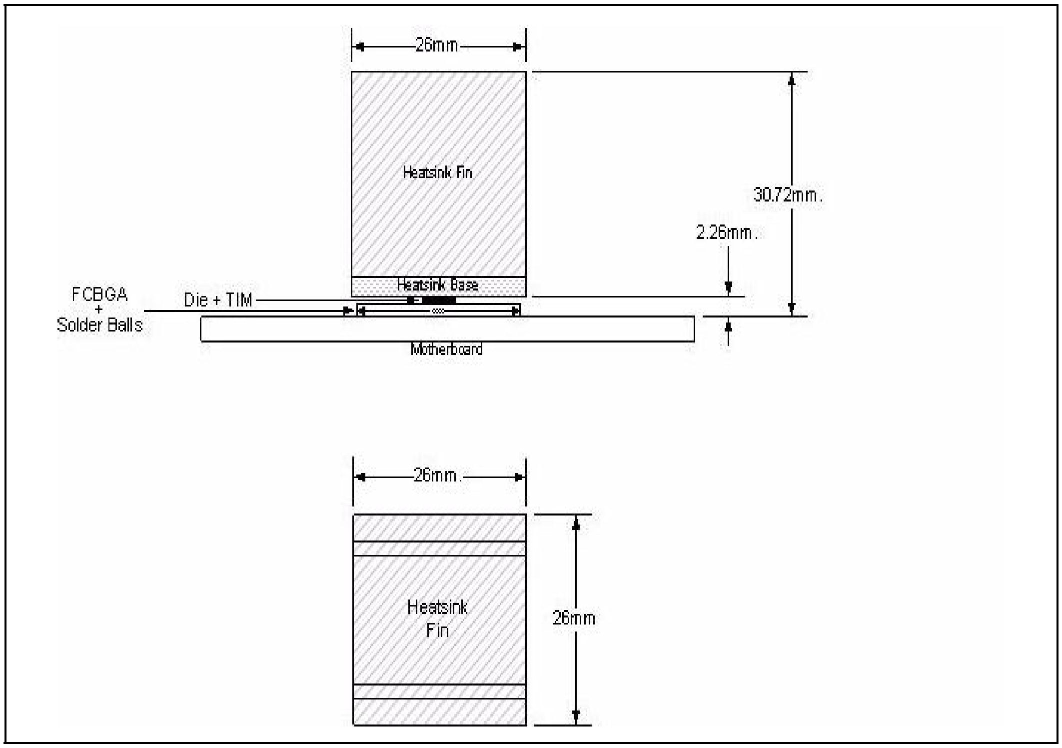


5.3 Mechanical Design Envelope

While each design may have unique mechanical volume and height restrictions or implementation requirements, the height, width, and depth constraints typically placed on the component thermal solution are shown in Figure 5-2.

Any motherboard components placed between the heatsink and motherboard cannot exceed 2 mm (0.07 in.) in height when using heatsinks that extend beyond the component reference heatsink envelope shown in Figure 5-2.

Figure 5-2. Tall Torsional Clip Heatsink Volumetric Envelope for the Intel® 7500 Scalable Memory Buffer



Note: All heights shown are maximum values.

5.4 Board-Level Components Keepout Dimensions

The location of hole patterns and keepout zones for the reference thermal solution are shown in Figure 5-3 and Figure 5-4.

Figure 5-3. Tall Torsional Clip Heatsink Board Component Keepout

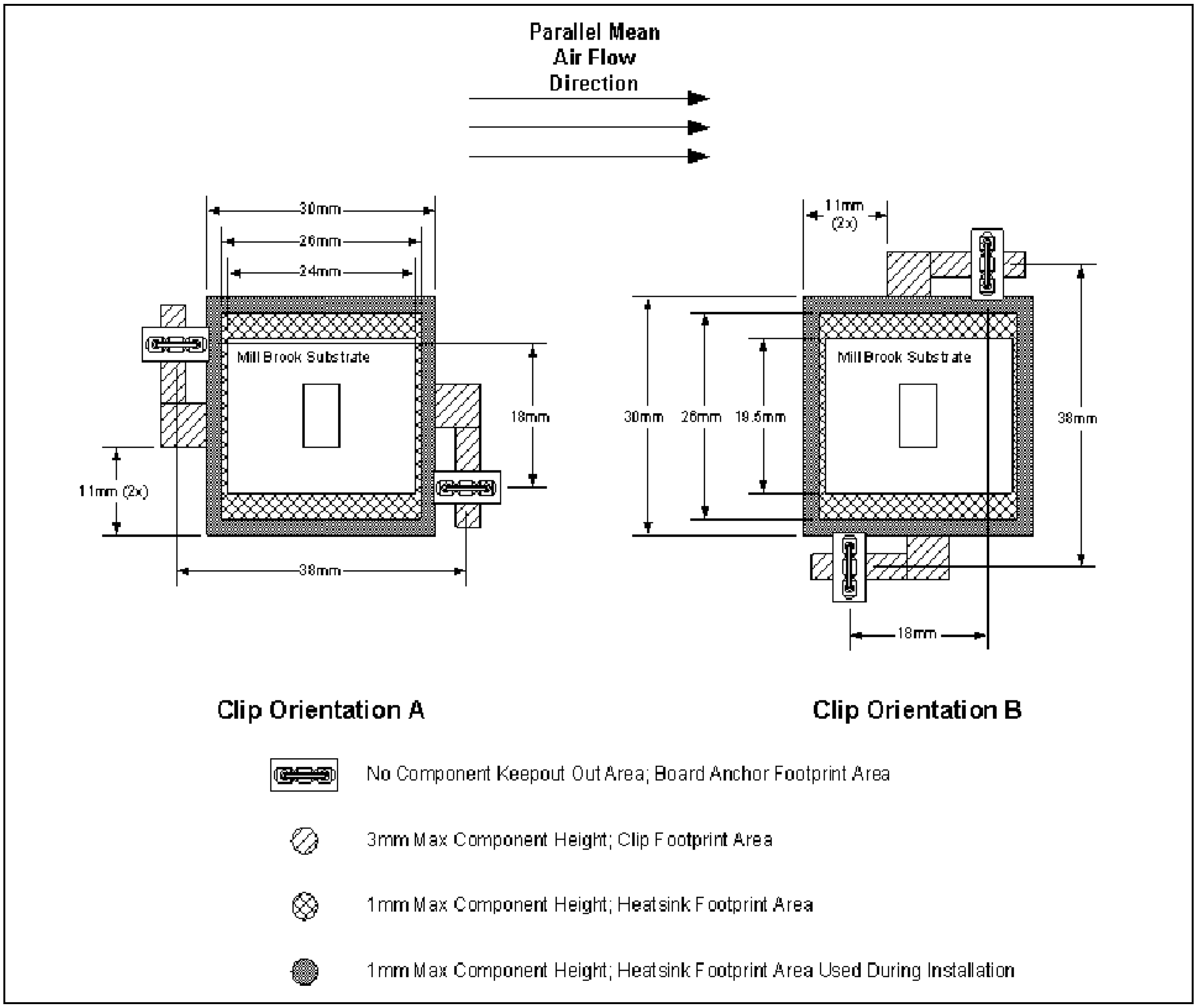
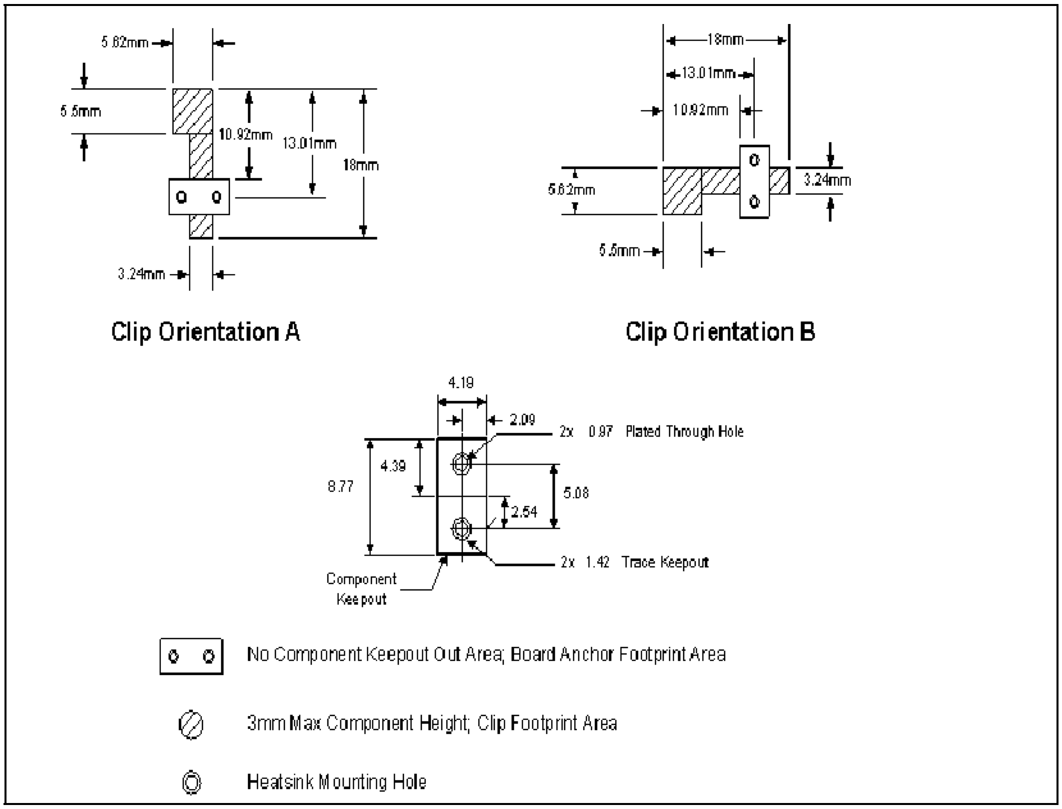


Figure 5-4. Retention Mechanism Component Keepout Zones

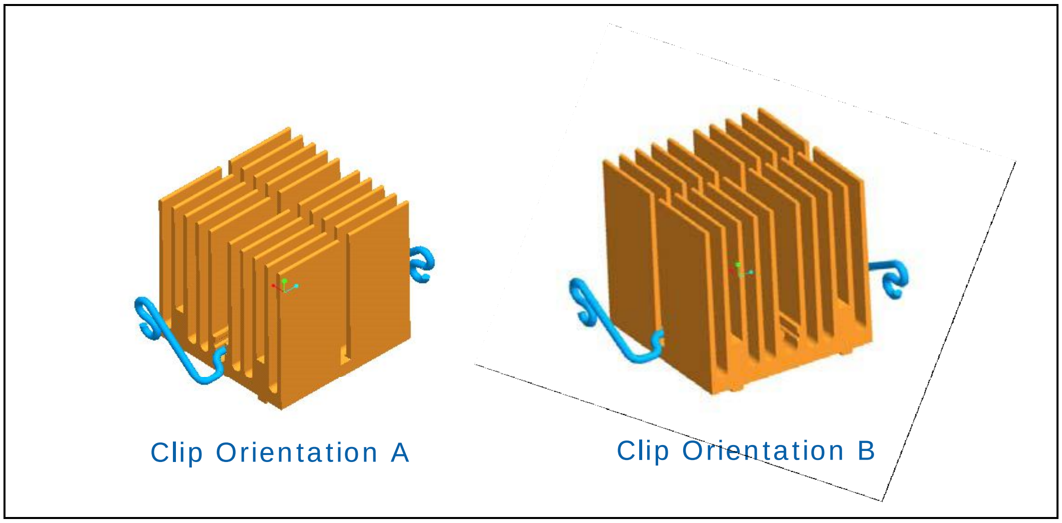


5.5 Tall Torsional Clip Heatsink Thermal Solution Assembly

The reference thermal solution for the components 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 5-5 shows the reference thermal solution assembly and associated components.

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 5-5. Tall Torsional Clip Heatsink Assembly



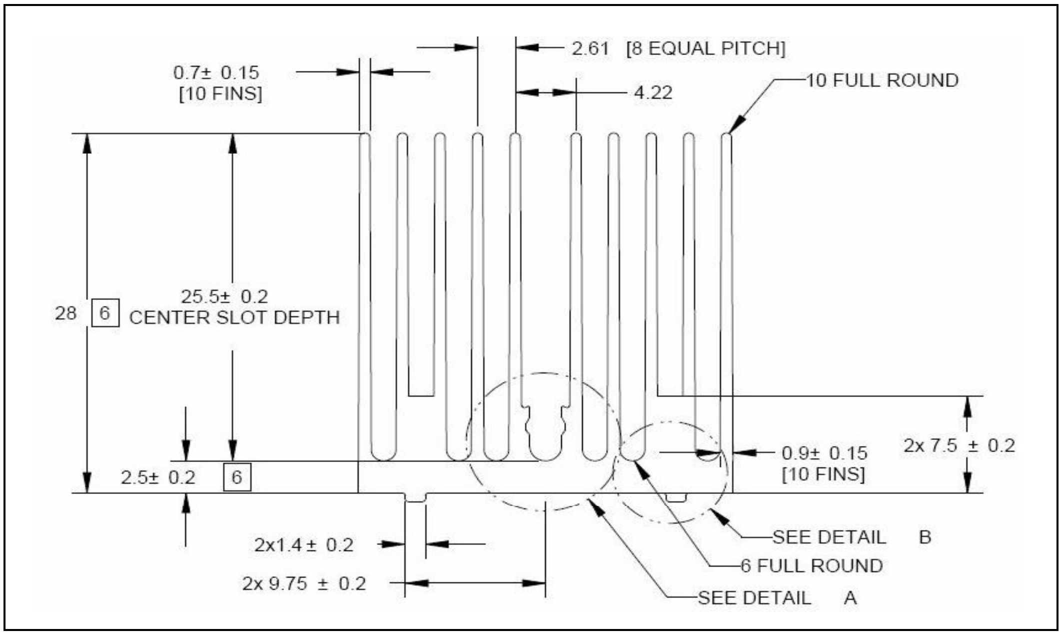
5.5.1 Heatsink Orientation

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

5.5.2 Extruded Heatsink Profiles

The reference thermal solution uses an extruded heatsink for cooling the components. Figure 5-6 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 drawings of this heatsink are provided in Appendix B.

Figure 5-6. Tall Torsional Clip Heatsink Extrusion Profile



5.5.3 Mechanical Interface Material

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

5.5.4 Thermal Interface Material

A thermal interface material (TIM) provides improved conductivity between the die and heatsink. The reference thermal solution uses Honeywell PCM45 F*, 0.25 mm (0.010 in.) thick, 15 mm x 15 mm (0.6 in. x 0.6 in.) square.

Note: Unflowed or “dry” Honeywell PCM45 F* has a material thickness of 0.010 in. The flowed or “wet” Honeywell PCM45 F has a material thickness of ~0.003 in. after it reaches its phase change temperature.

5.5.4.1 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 the heatsink. The effect of pressure on the thermal resistance of the Honeywell PCM45 F* TIM is shown in Table 5-1.

Intel provides both End of Line and End of Life TIM thermal resistance values for Honeywell PCM45 F. End of Line and End of Life TIM thermal resistance values are obtained through measurement on a Test Vehicle similar to the component’s physical attributes using an extruded aluminum heatsink. The End of Line value represents the TIM performance post heatsink assembly while the End of Life value is the predicted TIM performance when the product and TIM reaches its end of life. The heatsink clip provides enough pressure for the TIM to achieve an End of Line thermal resistance of 0.19°C in^2/W and an End of Life thermal resistance of 0.39°C in^2/W.

Table 5-1. Honeywell PCM45 F* TIM Performance as a Function of Attach Pressure

Pressure on Thermal solution and package interface (PSI)	Thermal Resistance (°C × in^2) / W	
	End of Line	End of Life
40	0.19	0.391

5.5.5 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.

5.5.6 Clip Retention Anchors

For Intel 7500, 7510, and 7512 Scalable Memory Buffer-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 part number and supplier information.

Figure 5-7. Anchors for Tall and Short Heatsink Retention

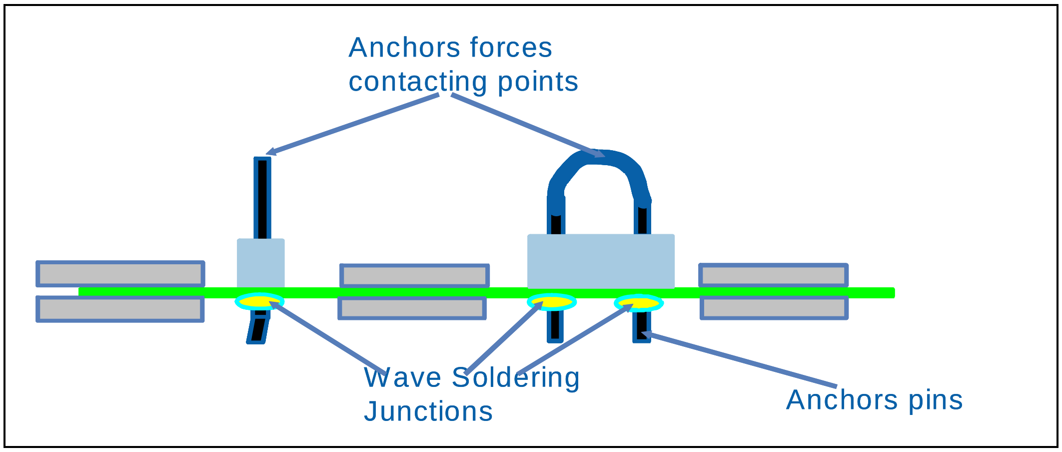


Table 5-2. Anchor Bend Angle and Maximum Pullout Force as a Function of Board Thickness

Intel Part Number	Foxconn Part Number	MB Thickness (Inches)	Anchor Bend Angle (degrees)	Max Pullout Force For Each Anchor
A13494-008	HB9703E-DW	0.062	45	10 lbf
	HB9703E-M3W	0.085	45	10 lbf

5.6 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. The reference solution is to be mounted to a fully configured system. Some general recommendations are shown in Table 5-3.

Table 5-3. Reliability Guidelines

Test[1]	Objective	Inspection Guidelines[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, check points 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

Notes:
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 inspection guidelines may be added at the discretion of the user.

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6 Reference Thermal Solution 2

Intel has developed two different reference thermal solutions to meet the cooling needs of the components under operating environments and specifications defined in this document. This chapter describes the overall requirements for the short 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 specific system local-ambient operating conditions.

This reference thermal solution allows for the attachment of the torsional clip in one of two different orientations: A and B.

6.1 Operating Environment

The short reference thermal solution was designed assuming both a max fan speed condition and an acoustic fan speed condition. The thermal designer must carefully select the location to measure airflow to obtain an accurate estimate.

6.1.1 Maximum Fan Speed Assumption

- Local-ambient temperature: 56.3°C (based on 35°C external-ambient temperature at sea level)
- Minimum airflow velocity through the cross-section of the heatsink fins: 3 m/s

Note: External-ambient refers to the environment external to the system.

6.1.2 Acoustics Fan Speed Assumption

- Local-ambient temperature: 54.9°C (based on 25°C external-ambient temperature at sea level)
- Minimum airflow velocity through the cross-section of the heatsink fins: 2.3 m/s

Note: External-ambient refers to the environment external to the system.

6.2 Heatsink Performance

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

The following equation can be used to determine the thermal solution performance at a given altitude:

$$\theta_{ca} = \alpha + \beta \times Q_{alt}^{-\Upsilon}\left(\frac{\rho_{alt}}{\rho_o}\right)^{-\Upsilon}$$

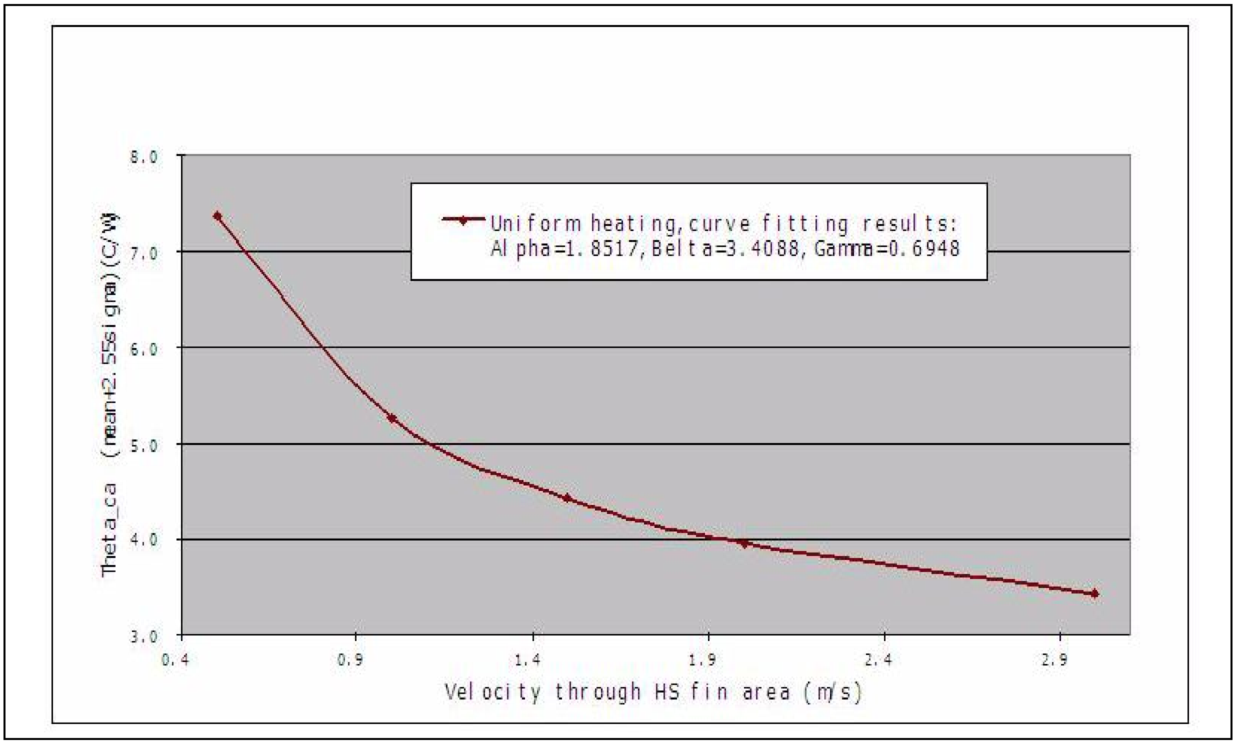
α, β and γ can be obtained from Figure 6-1.

Q - “velocity through heatsink fin area (m/s)”. Velocity is the value on X axis of Figure 6-1.

ρ_{alt} - Air density at given altitude

ρ_0 - Air density at sea level

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

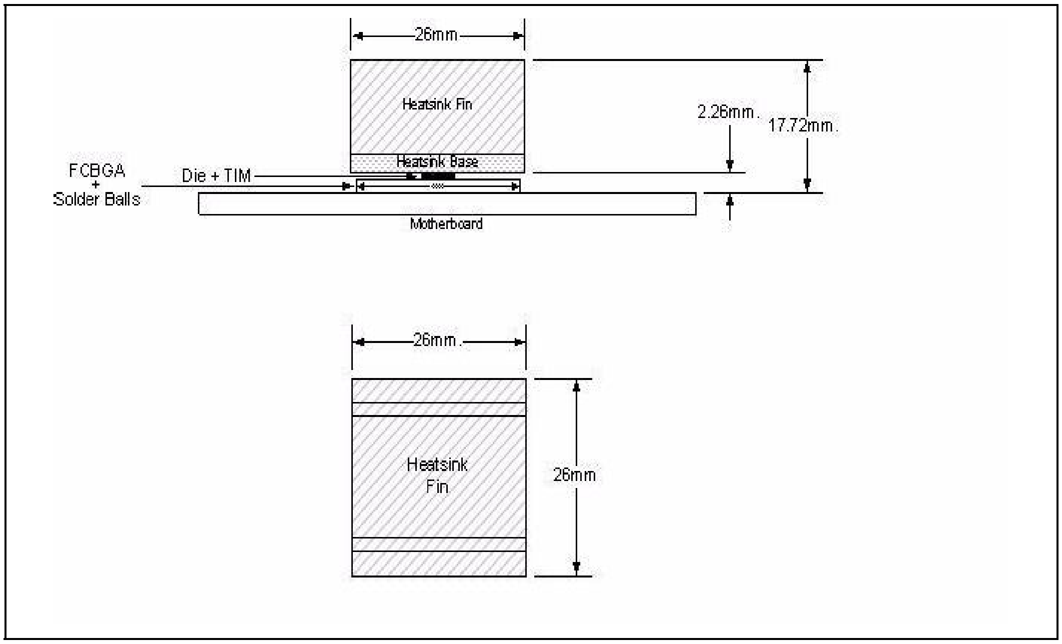


6.3 Mechanical Design Envelope

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

Any motherboard components placed between the heatsink and motherboard cannot exceed 2 mm (0.07 in.) in height when using heatsinks that extend beyond the reference heatsink envelope shown in Figure 6-2.

Figure 6-2. Short Torsional Clip Heatsink Volumetric Envelope



Note: All heights shown above are maximum values.

6.4 Board-Level Components Keepout Dimensions

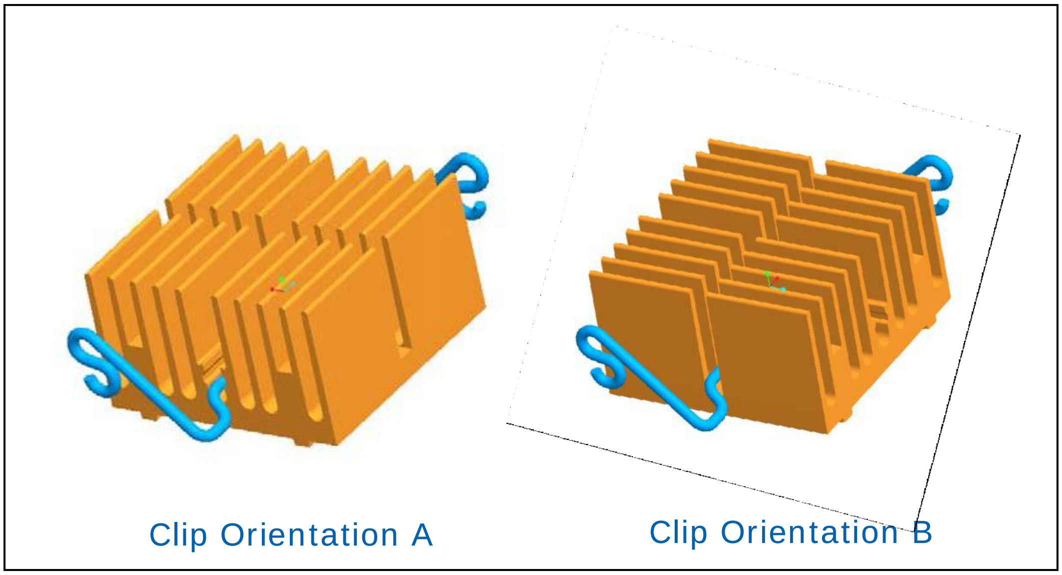
This short reference thermal solution has the same components keepout as the tall reference thermal solution. Refer to Section 5.4 for details.

6.5 Short Torsional Clip Heatsink Thermal Solution Assembly

The reference thermal solution for components 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 6-3 shows the reference thermal solution assembly and associated components.

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. Short Torsional Clip Heatsink Assembly



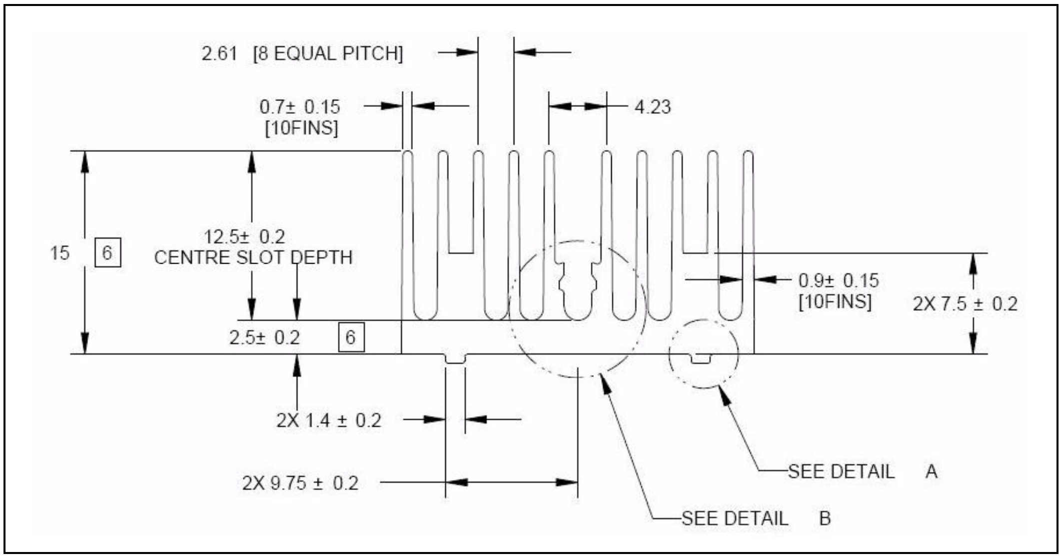
6.5.1 Heatsink Orientation

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

6.5.2 Extruded Heatsink Profiles

The reference thermal solution uses an extruded heatsink for cooling the components. Figure 6-4 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. Full mechanical drawings of this heatsink are provided in Appendix B.

Figure 6-4. Short Torsional Clip Heatsink Extrusion Profile



6.5.3 Mechanical Interface Material

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

6.5.4 Thermal Interface Material

Refer to Section 5.5.4 for details.

6.5.5 Heatsink Clip

Refer to Section 5.5.5 for details.

6.5.6 Clip Retention Anchors

Refer to Section 5.5.6 for details.

6.6 Reliability Guidelines

Refer to Section 5.6 for details.

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A Thermal Solution Component Suppliers

A.1 Tall Torsional Clip Heatsink Thermal Solution

Part	Intel Part Number	Supplier (Part Number)	Contact Information
Heatsink Assembly includes: • Heatsink • Thermal Interface Material • Torsional Clip	E20446-003 E21902-003	Chaun-Choung Technology Corp (CCI) (00C95340103) (00C95350103)	Harry Lin (USA) 714-739-5797 hlinack@aol.com Monica Chih (Taiwan) 866-2-29952666, x131 monica_chih@ccic.com.tw
Heatsink (26.0 x 26.0 x 28.0 mm)	E20442-003	Chaun-Choung Technology Corp (CCI) (NA)	Harry Lin (USA) 714-739-5797 hlinack@aol.com Monica Chih (Taiwan) 866-2-29952666, x131 monica_chih@ccic.com.tw
Thermal Interface (PCM45F)		Honeywell PCM45 F* (H245F15X15MMS)	Honeywell International, Inc. Judy Oles (Customer Service) (509)252-8605 judy.oles@honeywell.com Andrew S.K. Ho (APAC) (852)9095-4593 andrew.ho@honeywell.com Andy Delano (Technical) (509)252-2224 andrew.delano@honey-well.com
Heatsink Attach Clip	E20444-003	Chaun-Choung Technology Corp (CCI) (NA)	Harry Lin (USA) 714-739-5797 hlinack@aol.com Monica Chih (Taiwan) 866-2-29952666, x131 monica_chih@ccic.com.tw
Solder-Down Anchor	A13494-008	Foxconn (HB9703E-W for 0.062 inches thick motherboard) (HB9703E-M3W for 0.085 inches thick motherboard)	Hon Hai Precision Industry Co., Ltd. 288 Mayo Ave. City of Industry, CA 91789 USA Attn: Katie Wang (USA) katie.wang@foxconn.com Tel:(909)978-6499 Fax:(909)978-6515

Notes:
1. Contact the supplier directly to verify time of component availability.
2. Anchor is independent of heatsink assembly. Proper Anchor selection will protect the chipset heatsink from shock and vibration.

A.2 Short Torsional Clip Heatsink Thermal Solution

Part	Intel Part Number	Supplier (Part Number)	Contact Information
Heatsink Assembly includes: • Heatsink • Thermal Interface Material • Torsional Clip • Insulator	E30593-003 E30595-003	Chaun-Choung Technology Corp (CCI) (00C96250103) (00C96260103)	Harry Lin (USA) 714-739-5797 hlinack@aol.com Monica Chih (Taiwan) 866-2-29952666, x131 monica_chih@ccic.com.tw
Heatsink (26.0 x 26.0 x 15.0 mm)	E30596-003	Chaun-Choung Technology Corp (CCI) (NA)	Harry Lin (USA) 714-739-5797 hlinack@aol.com Monica Chih (Taiwan) 866-2-29952666, x131 monica_chih@ccic.com.tw
Thermal Interface (PCM45F)		Honeywell PCM45 F* (H245F15X15MMS)	Honeywell International, Inc. Judy Oles (Customer Service) (509)252-8605 judy.oles@honeywell.com Andrew S.K. Ho (APAC) (852)9095-4593 andrew.ho@honeywell.com Andy Delano (Technical) (509)252-2224 andrew.delano@honey-well.com
Heatsink Attach Clip	E20444-003	Chaun-Choung Technology Corp (CCI) (NA)	Harry Lin (USA) 714-739-5797 hlinack@aol.com Monica Chih (Taiwan) 866-2-29952666, x131 monica_chih@ccic.com.tw
Solder-Down Anchor	A13494-008	Foxconn (HB9703E-W for 0.062 inches thick motherboard) (HB9703E-M3W for 0.085 inches thick motherboard)	Katie Wang (USA) 909-978-6499 katie.wang@foxconn.com

Notes:
1. Contact the supplier directly to verify time of component availability.
2. Anchor is independent of heatsink assembly. Proper Anchor selection will protect the chipset heatsink from shock and vibration.

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B Mechanical Drawings

Table B-1 lists the mechanical drawings included in this appendix.

Table B-1. Mechanical Drawing List

Drawing Description	Figure Number
Tall Torsional Clip Heatsink Assembly Orientation A Drawing	Figure B-1
Tall Torsional Clip Heatsink Assembly Orientation B Drawing	Figure B-2
Tall Torsional Clip Heatsink Drawing	Figure B-3
Tall/Short Torsional Clip Heatsink Clip Drawing	Figure B-4
Short Torsional Clip Heatsink Assembly Orientation A Drawing	Figure B-5
Short Torsional Clip Heatsink Assembly Orientation B Drawing	Figure B-6
Short Torsional Clip Heatsink Drawing	Figure B-7

Figure B-1. Tall Torsional Clip Heatsink Assembly Orientation A Drawing

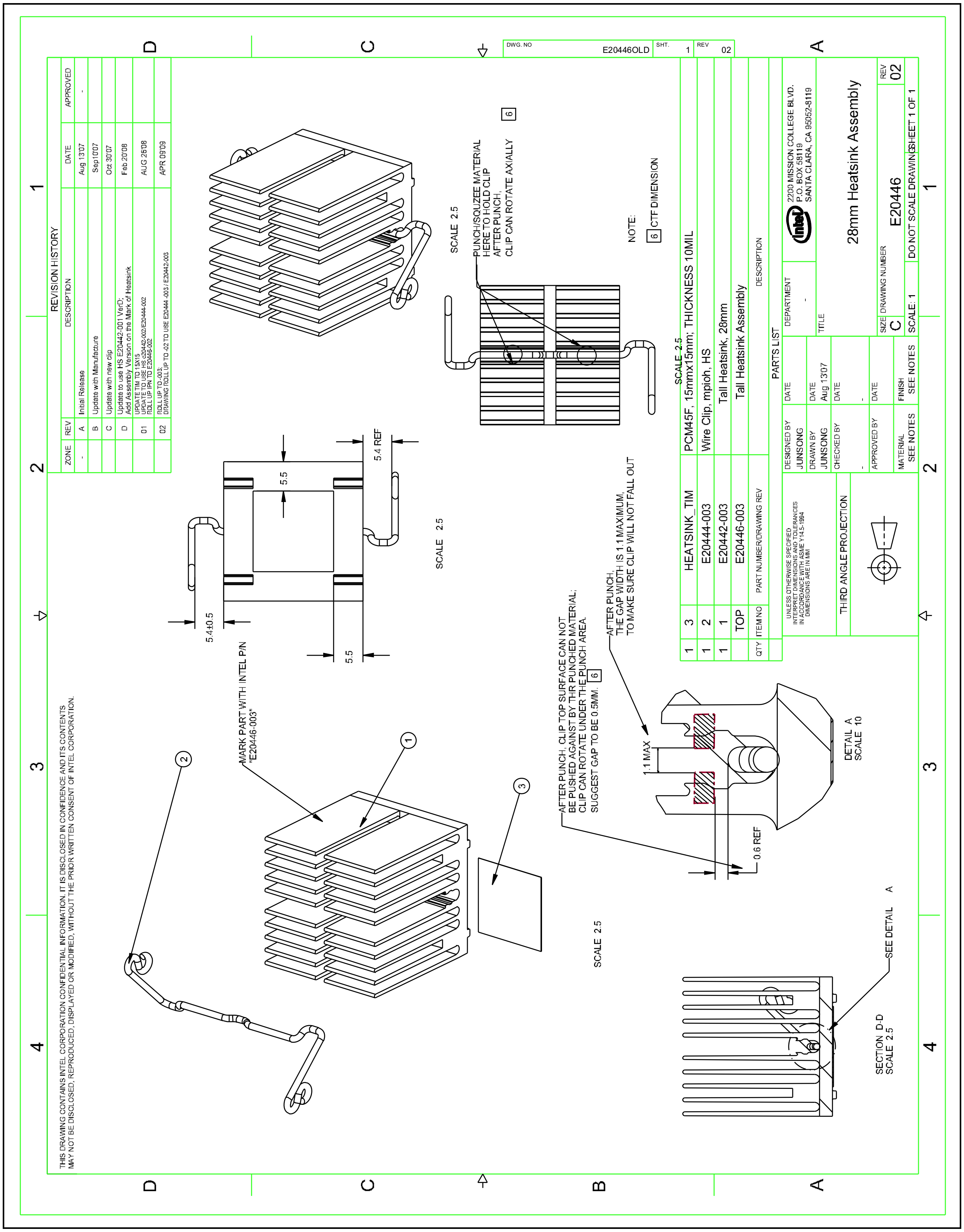


Figure B-2. Tall Torsional Clip Heatsink Assembly Orientation B Drawing

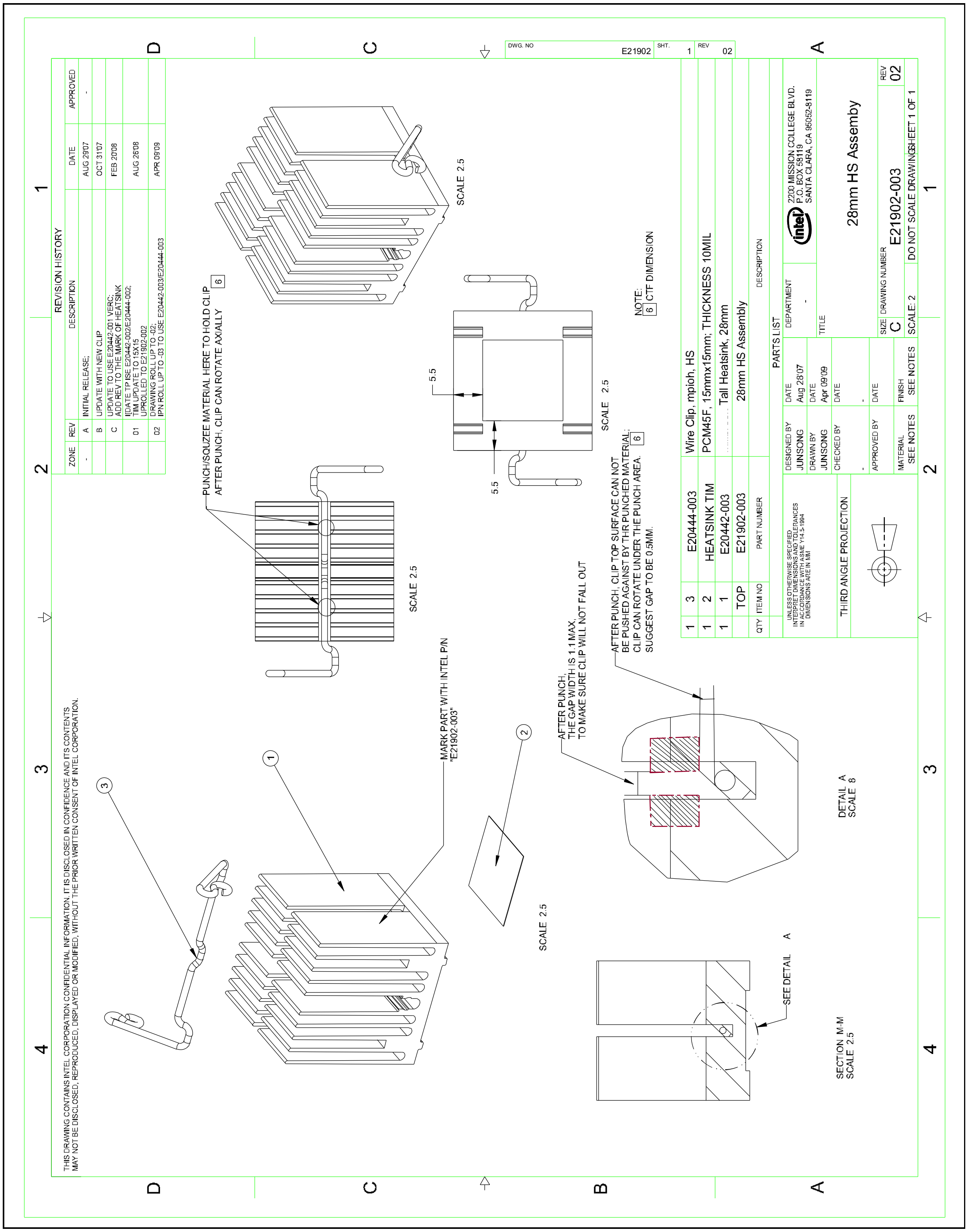


Figure B-3. Tall Torsional Clip Heatsink Drawing

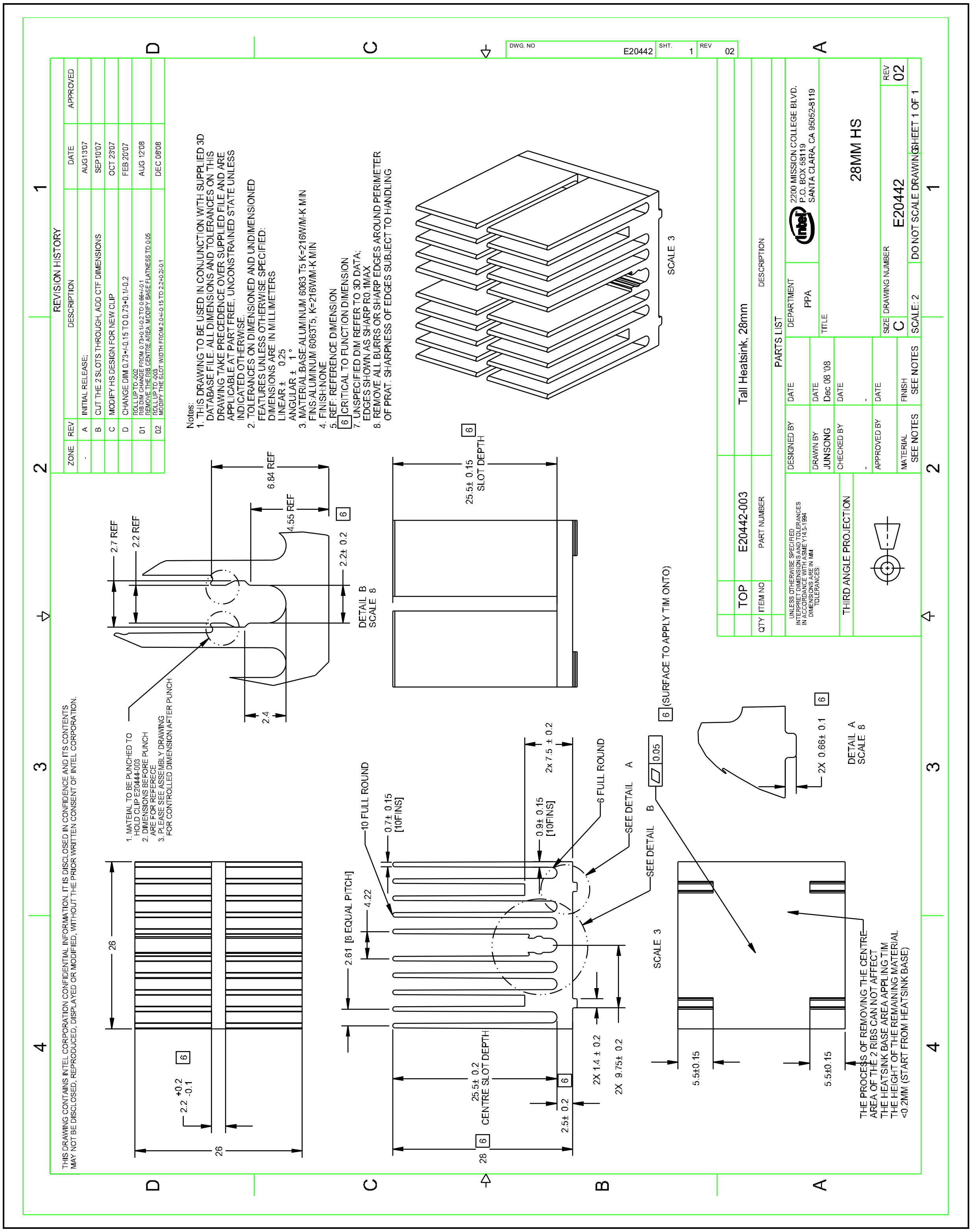


Figure B-4. Tall / Short Torsional Clip Heatsink Clip Drawing

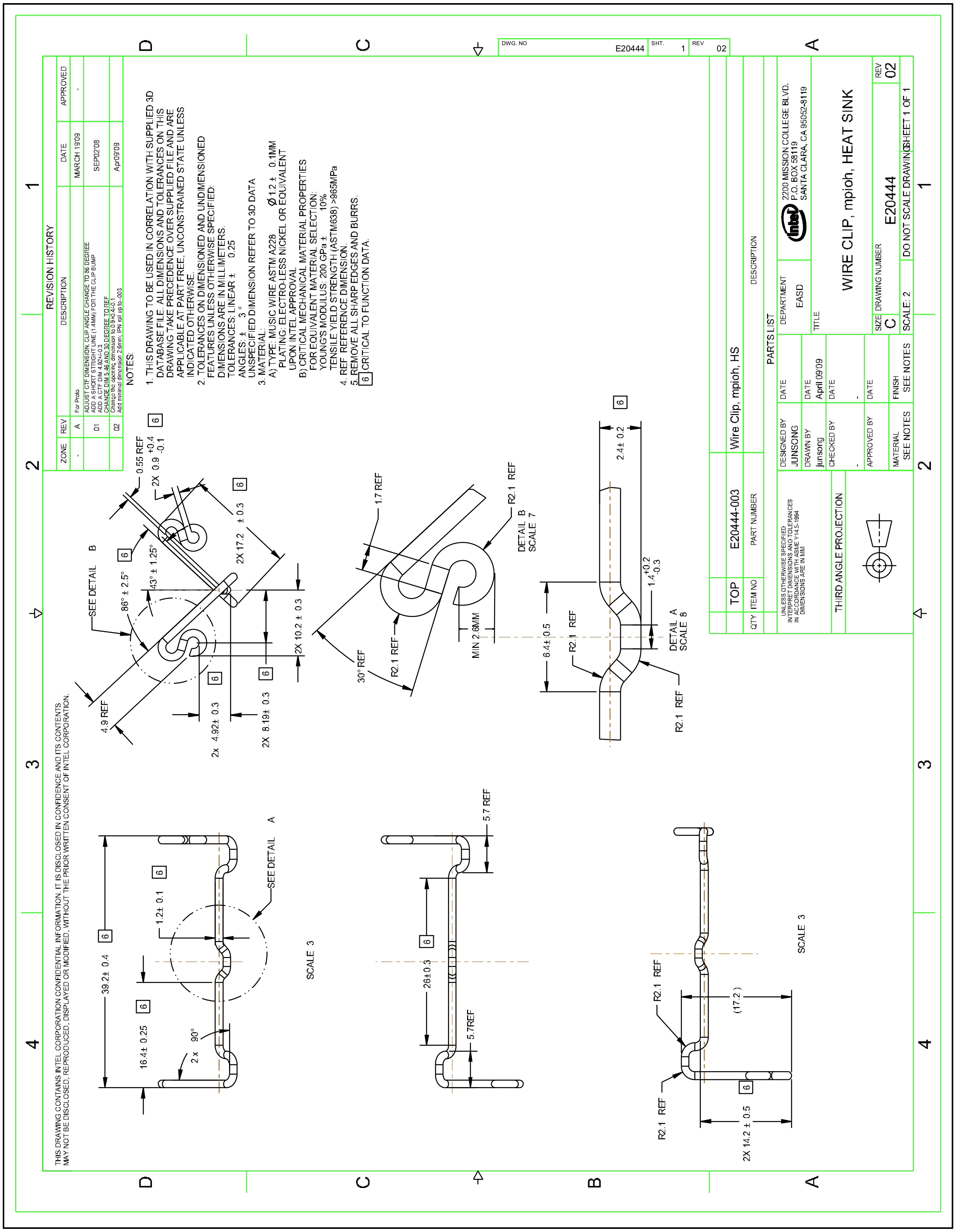


Figure B-5. Short Torsional Clip Heatsink Assembly Orientation A Drawing

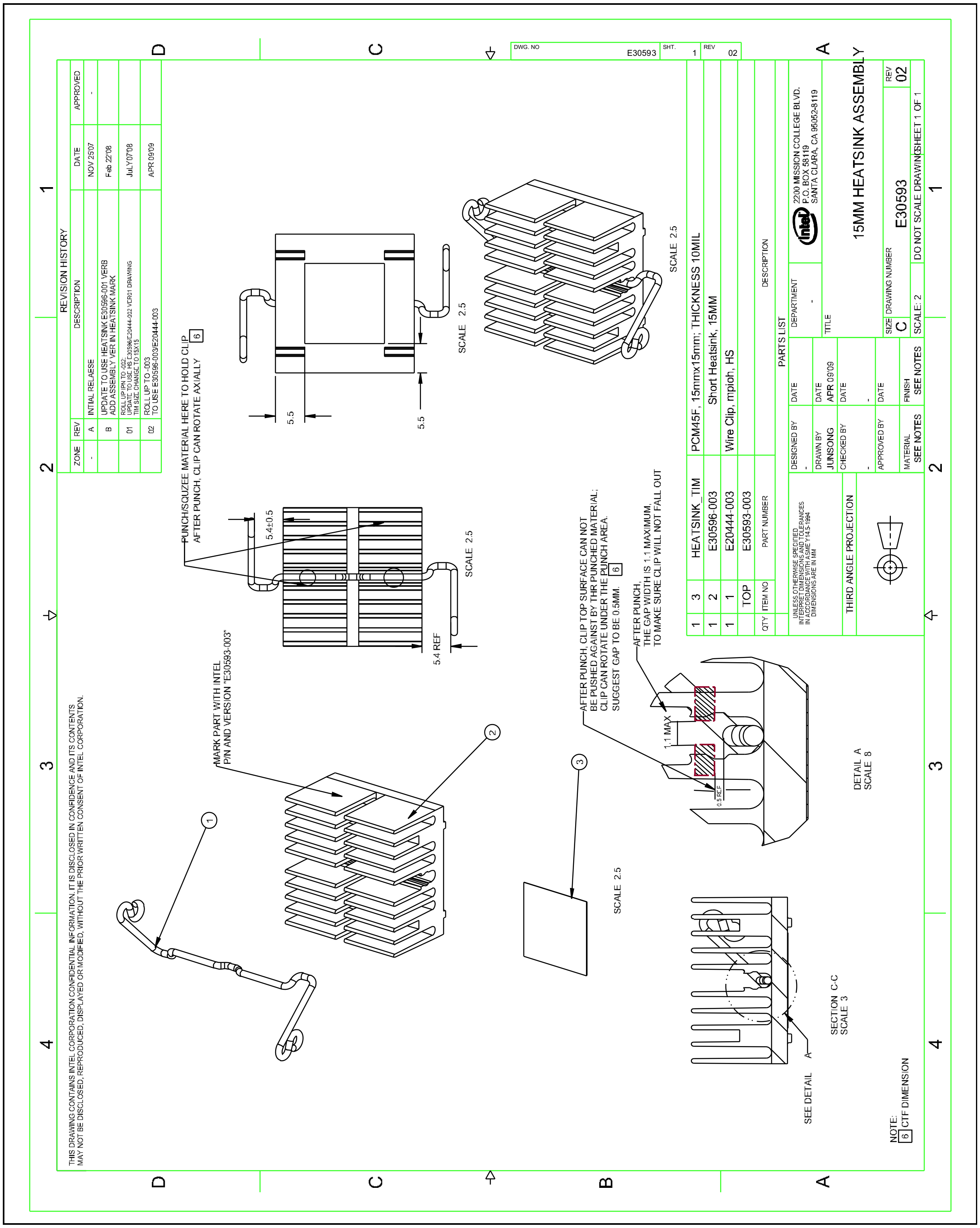


Figure B-6. Short Torsional Clip Heatsink Assembly Orientation B Drawing

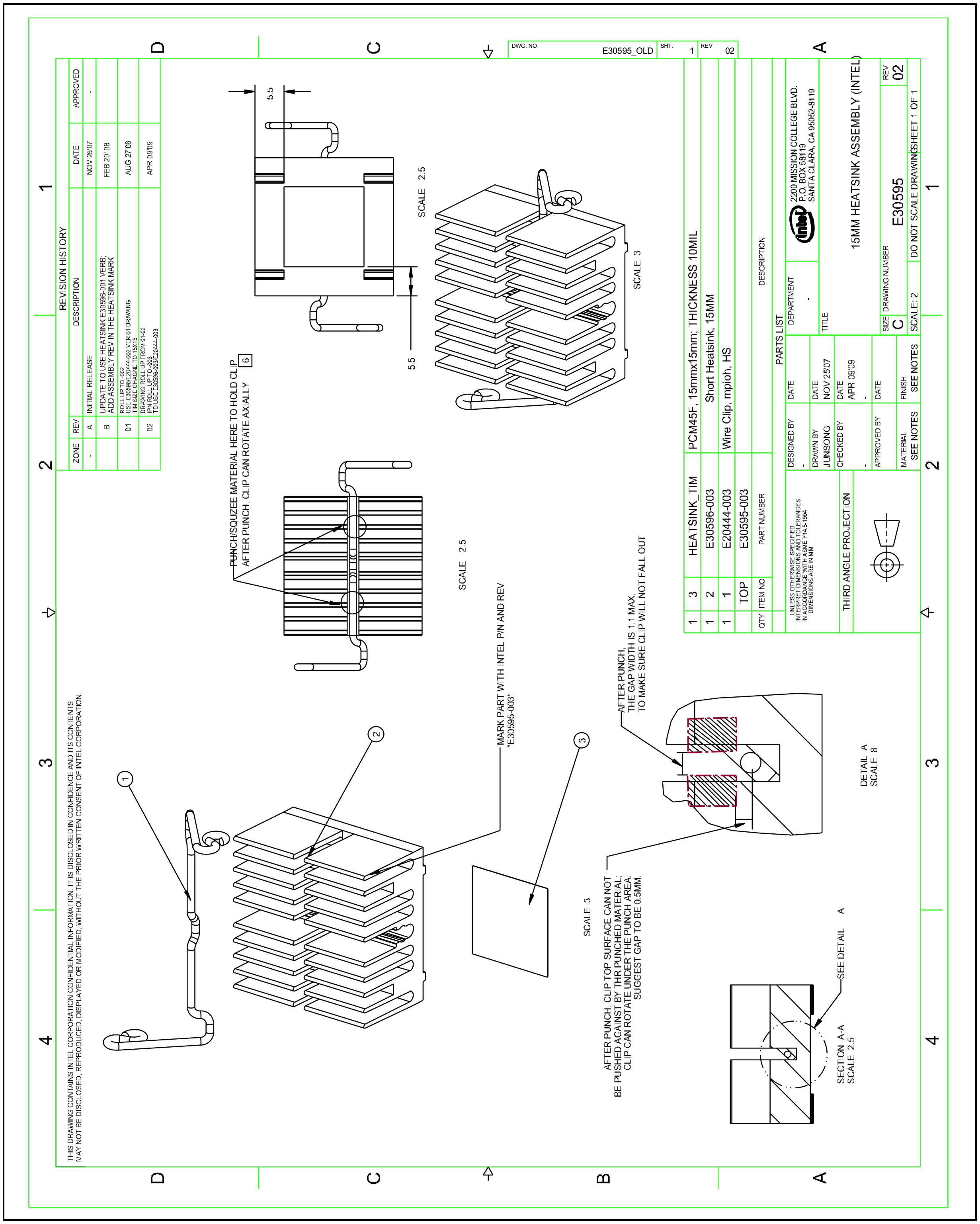
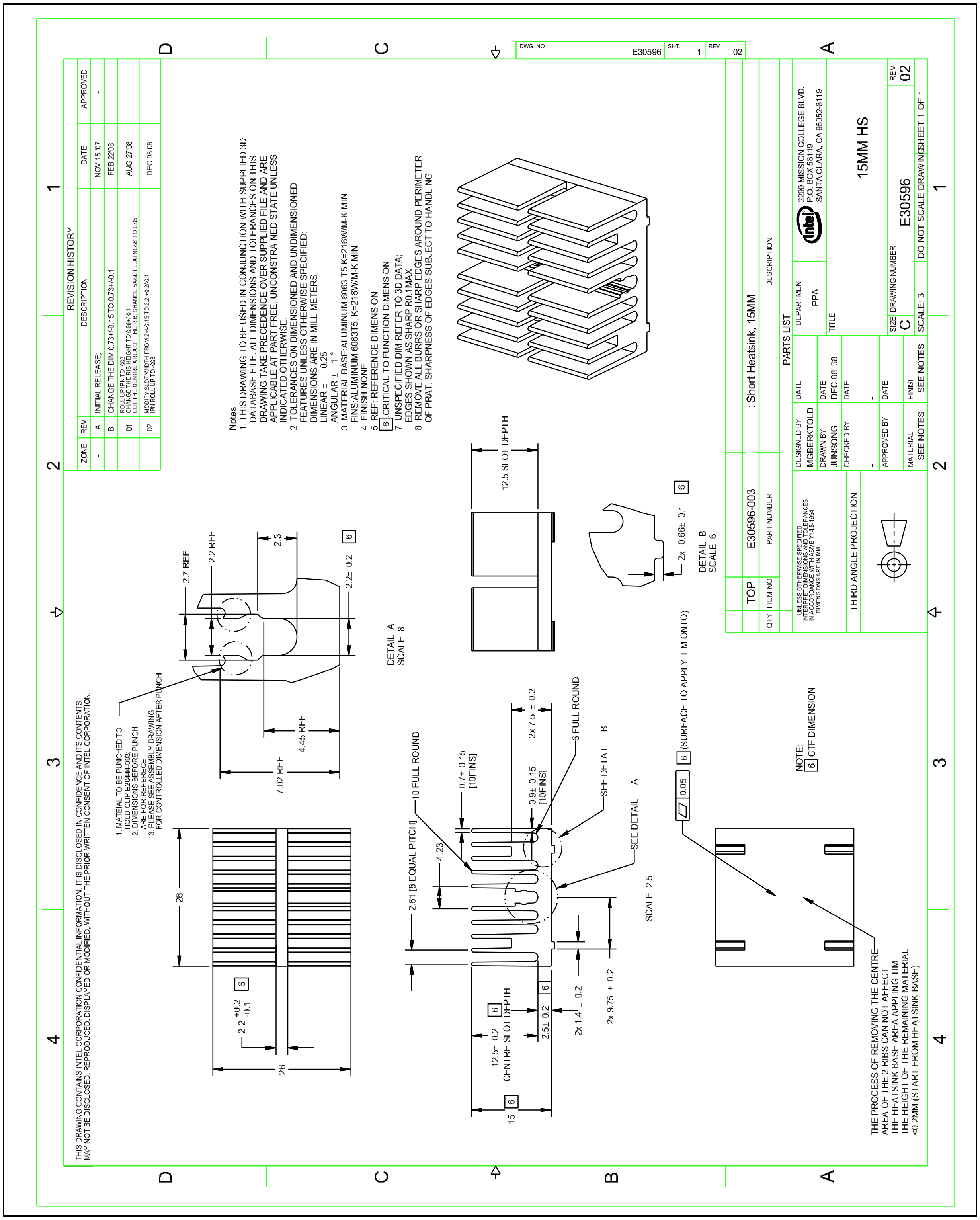


Figure B-7. Short Torsional Clip Heatsink Assembly



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