AMD

AMD Athlon™ 64 and AMD Opteron™ Processors Thermal Design Guide

AMD 64 Athlon™

AMD 64 Opteron™

Publication #	26633	Rev:	3.03
Issue Date:	September 2003		

Contents

Revision History **9**

Chapter 1 Introduction **11**

1.1 Summary of Requirements 11

Chapter 2 AMD Athlon™ 64 and AMD Opteron™ Processors Thermal Requirements **13**

2.1 AMD Athlon™ 64, AMD Athlon 64 FX, and AMD Opteron™ Processor Specifications 13

2.2 Socket Description 14

2.3 Motherboard Component Height Restrictions 16

2.4 Thermal Solution Design Requirements 18

2.5 Sample Heatsinks and Attachment Methods 19

2.5.1 Thermal Reference Design Solution 1 19

2.5.2 Thermal Reference Design Solution 2 22

2.6 Thermal Solution Design Considerations 25

2.6.1 Backplate Assembly 25

2.6.2 Spring Clip 25

2.6.3 Retention Frame 26

2.6.4 Heatsink 26

2.6.5 Fans 30

2.6.6 Thermal Interface Material 33

2.6.7 EMC Shield 33

Chapter 3 Conclusion **35**

A Appendix **37**

A.1 Thermocouple Instrumentation 37

A.1.1 Case Thermocouple Attachment 37

A.1.2 Heatsink Thermocouple Attachment 40

A.1.3 Ambient Thermocouple Attachment 40

A.2 Procedure for Clip Load Testing 41

A.2.1 Equipment 41

A.2.2 Procedure 45

A.3 Motherboard Component Keep-Out Areas and Height Restriction Drawings................ 47

A.4 Thermal Reference Design Solution Component Drawings 68

List of Figures

Figure 1. 754-pin µPGA Socket Used for the AMD Athlon™ 64 Processor....14
Figure 2. 940 pin µPGA Socket Used for the AMD Opteron™ Processor....15
Figure 3. Motherboard Component Height Restrictions for the AMD Athlon 64 Processor Thermal Solution....16
Figure 4. Motherboard Component Height Restrictions for the AMD Opteron Processor Thermal Solution....17
Figure 5. AMD Athlon 64 and AMD Opteron Processors Thermal Reference Design Solution 1....20
Figure 6. Thermal Reference Design Solution 1 Components Assembled for Shipment....21
Figure 7. View of an Installed Heatsink Utilizing the Thermal Reference Design Solution 1....21
Figure 8. Exploded View of the Components Utilized in the AMD Athlon 64 and AMD Opteron Processors Thermal Reference Design Solution 2....23
Figure 9. Thermal Reference Design Solution 2 Components Configured for Shipment....24
Figure 10. View of a Heatsink Installation Utilizing the Thermal Reference Design Solution 2....24
Figure 11. Example of a Low-Cost Heatsink Using Aluminum Extrusion Technology....27
Figure 12. High Performance Heatsink with Copper Slug Embedded in the Base....28
Figure 13. Required Exhaust Airflow Direction for Motherboard Voltage Regulator Cooling....29
Figure 14. Typical Temperature-Fan Speed Relation for Speed-Controlled Fan....31
Figure 15. Acoustic Noise from Sample Thermal Solutions with a 70x15 mm Fan....32
Figure 16. Diagonals Marked on Processor to Locate Center....37
Figure 17. Thermocouple Taped to Processor Lid....38
Figure 18. Thermocouple Attached to Processor with Strain Relief on Package and PCB....39
Figure 19. Heatsink with Thermocouple Relief Groove Machined into Base....39
Figure 20. Heatsink Thermocouple Relief Groove and Measurement Hole....40
Figure 21. An Entran ELW-D1 Load Cell....41
Figure 22. Load Cell Inserted into the Load Cell Fixture....42
Figure 23. Drawing of Load Cell Fixture for the Entran ELW-D1 Load Cell....43
Figure 24. Test Board with a Load Cell Fixture Installed in the Socket 754....45
Figure 25. Heatsink Installation over the Load Cell Fixture....46

List of Tables

Table 1. Mechanical and Thermal Specifications for the AMD Athlon™ 64 and AMD Opteron™ Processors 13

Table 2. Thermal Solution Design Requirements for the AMD Athlon 64 and AMD Opteron Processors 18

Table 3. Components for the AMD Athlon 64 and AMD Opteron Processors Thermal Reference Design Solution 1....... 19

Table 4. Components for the AMD Athlon 64 and AMD Opteron Processors Thermal Reference Design Solution 2....... 22

Table 5. Chemical Composition of SK7 Spring Steel 26

Table 6. Suggested Thermal Interface Materials 33

Revision History

Date	Rev	Description
September 2003	3.03	Revision 3.03 includes the addition of information for the AMD Opteron™ processor and the following changes: • In Chapter 2, added AMD Athlon™ 64 FX processor information in Section 2.1 on page 13, revised Table 1 on page 13, added Figure 2 on page 15, revised Figure 3 on page 16, added Figure 4 on page 17, revised Table 2 on page 18, revised Table 3 on page 19, revised Table 4 on page 22, revised Section 2.6 on page 25, added Section 2.6.4.3, “Required Exhaust Airflow Direction,” on page 29, added Figure 13 on page 29, revised Section 2.6.5 on page 30, added Figure 14 on page 31, added Figure 15 on page 32, and revised Table 6 on page 33. • In the Appendix , revised Socket 754 diagrams and added Socket 940 diagrams to Section A.3 on page 47. Revised diagrams in Section A.4 on page 68.
February 2003	3.02	Revised Figure 3, “Motherboard Component Height Restrictions for the AMD Athlon™ 64 Processor Thermal Solution,” on page 16, and the drawings in the Appendix, section A3, “Motherboard Component Keep-Out Areas and Height Restriction Drawings,” on pages 35–44.
November 2002	3.01	Title changed to “AMD Athlon™ 64 Processor Thermal Design Guide.”
October 2002	3.00	Public release

Chapter 1 Introduction

This document specifies performance requirements for the design of thermal and mechanical solutions for the AMD Athlon™ 64 and AMD Opteron™ processors, utilizing AMD64 architecture. Detailed drawings, descriptions, and design targets are provided to help manufacturers, suppliers, and engineers meet requirements for the AMD Athlon 64 and AMD Opteron processors.

1.1 Summary of Requirements

To allow optimal reliability of the AMD Opteron and AMD Athlon 64 processor-based systems, the thermal and cooling solution should dissipate heat from a processor operating at its maximum thermal power. The sections in this document specify required values for the thermal and mechanical parameters. This document provides two methods of creating a solution that satisfy the thermal and mechanical requirements for these processors. By setting a high-power target for the initial design, the thermal-design engineer may avoid redesign of the processor cooling solution for subsequent processors.

Chapter 2 AMD Athlon™ 64 and AMD Opteron™ Processors Thermal Requirements

This chapter describes thermal solutions for the AMD Athlon™ 64, AMD Athlon 64 FX, and AMD Opteron™ processors.

2.1 AMD Athlon™ 64, AMD Athlon 64 FX, and AMD Opteron™ Processor Specifications

The objective of thermal solutions, commonly referred to as heatsinks, is to maintain the processor temperature within specified limits. The main factors that must be considered during the design of a thermal solution are the thermal performance, physical mounting, acoustic noise, mass, reliability, and cost.

This document presents the thermal and mechanical specifications, and heatsink requirements for the AMD Athlon 64, AMD Athlon 64 FX, and AMD Opteron processors. The thermal and mechanical specifications for the 940-pin AMD Athlon 64 FX processor are the same as those for the AMD Opteron processor. For the thermal and mechanical requirements for the AMD Athlon 64 FX processor, refer to the AMD Opteron processor information presented in this document.

Table 1 lists the pertinent AMD Athlon 64 and AMD Opteron processor specifications for a thermal solution design.

Table 1. Mechanical and Thermal Specifications for the AMD Athlon™ 64 and AMD Opteron™ Processors

Symbol	Description	Maximum Value	Notes
T_{CASE}	Maximum case temperature	62–70°C	Case temperature will be defined in the processor datasheet
A_{CPU}	Processor contact area	1400 sq. mm	Interfaces with heatsink
Form factor	Processor form factor	µPGA	PGA Socket 754 form factor for AMD Athlon™ 64 processor
Form factor	Processor form factor	µPGA	PGA Socket 940 form factor for AMD Opteron™ processor

2.2 Socket Description

Figure 1 shows a three-dimensional view of the Socket 754, which is a socket based on surface mount technology. The pin array is 29x29 on a 1.27 mm pitch with a 9x9 depopulation in the center. In addition, three pins are removed from the A1 corner of the package, and a single pin is removed from the other three corners. The electrical and mechanical connection to the motherboard is made with a small solder ball at each socket contact. This type of connection does not allow for a large mass, like a heatsink, to be attached to the socket. Therefore, independent support structures are required for mounting the heatsink.

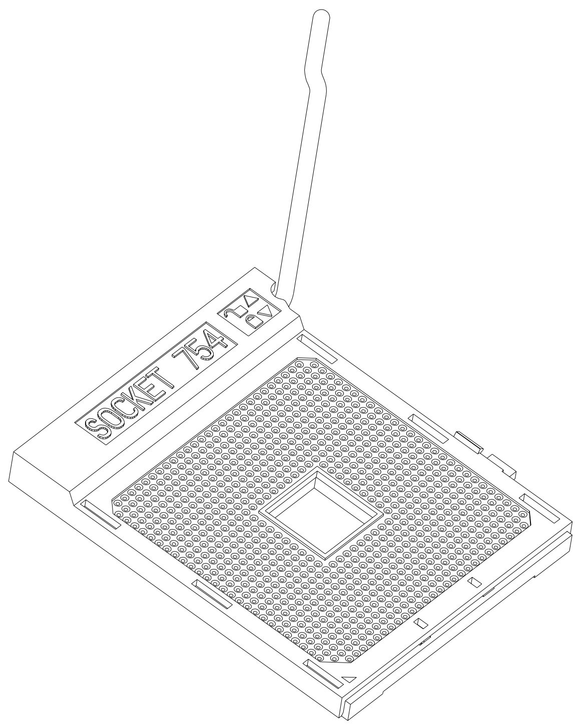


Figure 1. 754-pin µPGA Socket Used for the AMD Athlon™ 64 Processor

Figure 2 shows a three-dimensional view of the Socket 940, which is used for the AMD Opteron processor. As with the Socket 754, it has a 1.27 mm array pitch but has a 31x31 pin array with various pins removed from the package for keying and mechanical support.

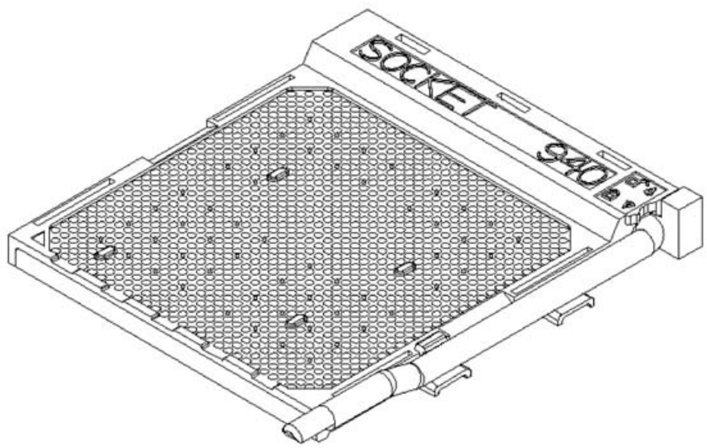


Figure 2. 940-pin μPGA Socket Used for the AMD Opteron™ Processor

2.3 Motherboard Component Height Restrictions

The mounting solution for the heatsink requires attachment to the motherboard. As such, this solution calls for a standard motherboard keepout region and mounting holes for the processor. An overview of the motherboard component restrictions for the AMD Athlon 64 is shown in Figure 3. A complete detailed set of drawings is shown in Appendix A.3 on page 47. Thermal-solution designers must adhere to these geometric restrictions to be compatible with the motherboards designed for the AMD Athlon 64 processor. Similarly, overview of the motherboard component restrictions for the AMD Opteron is shown in Figure 4 on page 17.

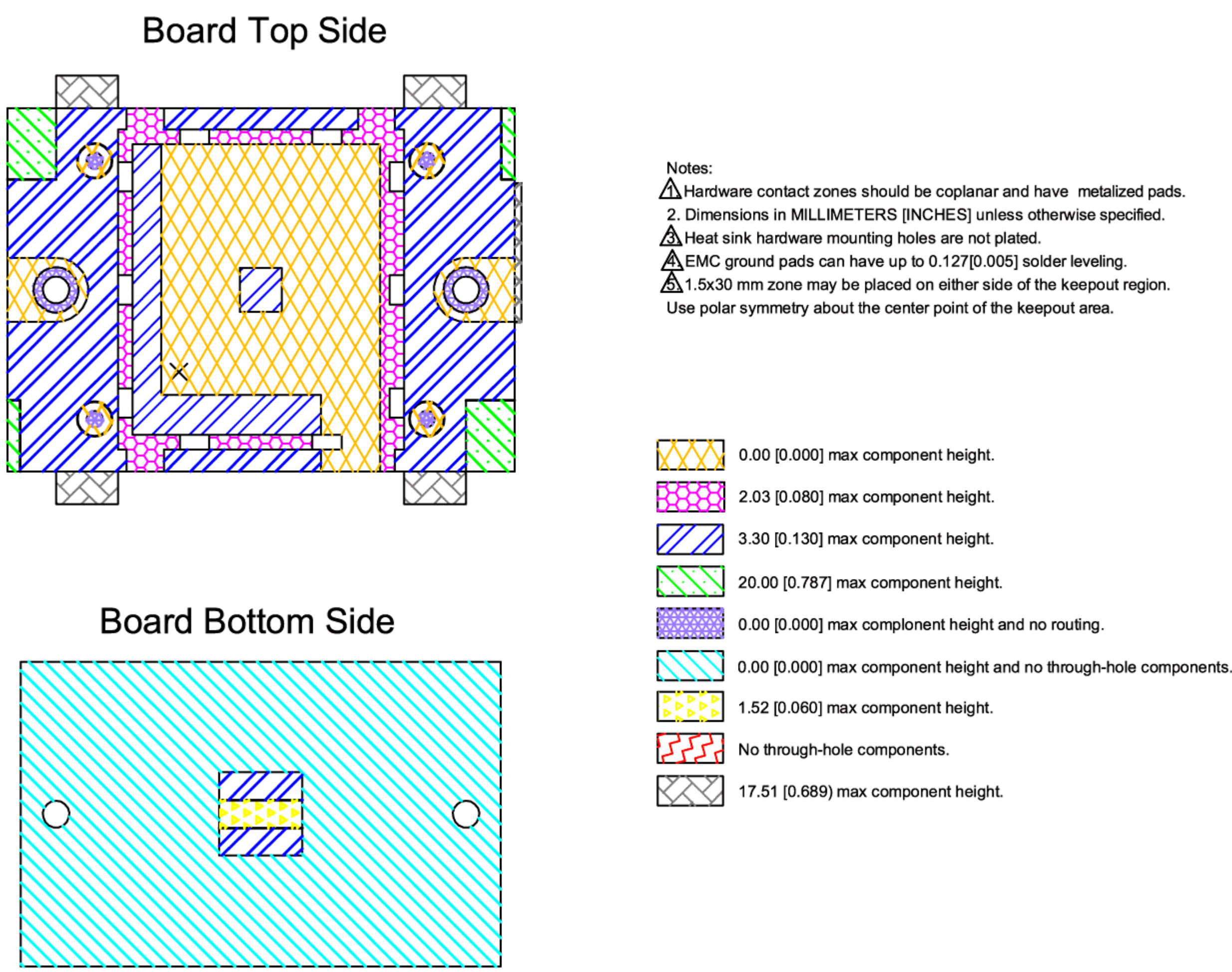


Figure 3. Motherboard Component Height Restrictions for the AMD Athlon™ 64 Processor Thermal Solution

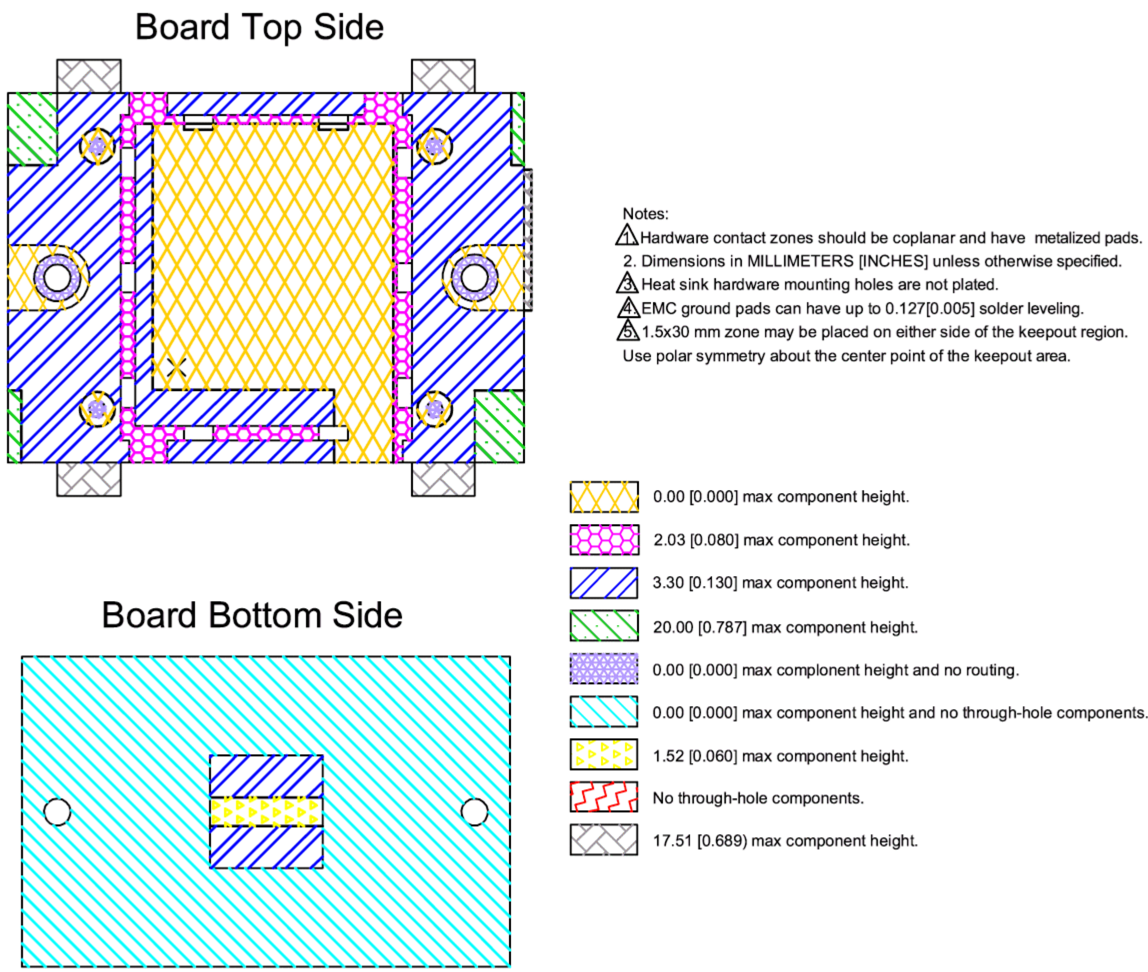


Figure 4. Motherboard Component Height Restrictions for the AMD Opteron™ Processor Thermal Solution

2.4 Thermal Solution Design Requirements

To maintain the case temperature of the processor below the maximum specification, certain heatsink design parameters must be considered. Table 2 provides the design-target specifications that must be met for the AMD Athlon 64 and AMD Opteron processors to operate reliably.

Table 2. Thermal Solution Design Requirements for the AMD Athlon™ 64 and AMD Opteron™ Processors

Symbol	Description	Minimum	Maximum	Notes
L	Length of heatsink	77 mm	77 mm	Measurements are for the entire assembly, including attached fan.
W	Width of heatsink	68 mm	68 mm	
H	Height of heatsink		60 mm	
θ_{CA}	Case-to-ambient thermal resistance	0.28°C/W		
m_{HS}	Mass of heatsink		450 g	
F_{CLIP}	Clip force	60 lb	90 lb	
T_A	Local ambient temperature near processor		42°C	
L_{PA}	Sound pressure measured 1 m from fan		32 dbA	The preferred level is to have no annoying tones.
			38 dbA	Maximum level is at room temperature with no annoying tones

2.5 Sample Heatsinks and Attachment Methods

The following sections provide two possible thermal design solutions and the specifics on their attachment to the motherboard.

2.5.1 Thermal Reference Design Solution 1

Table 3 lists the parts that comprise the thermal reference design solution 1 for the AMD Opteron and AMD Athlon 64 processors. The heatsink installers do not have to assemble each individual component. The heatsink suppliers package the parts with some of the components already assembled. The logical breakdown consists of the components that reside on the topside of the motherboard, the heatsink, and the components that reside on the bottom side of the motherboard, the backplate. An exploded view showing the components used in the thermal reference design solution 1 is shown in Figure 5 on page 20.

Due to the high load required to attach the heatsink to the processor, a backplate is used on the backside of the motherboard to minimize possible warping of the motherboard due to clip forces on the heatsink. Figure 6 on page 21 shows the assembly components grouped for shipment and how they are used during the final assembly of the system.

When developing the thermal reference design solution 1, AMD took into consideration the manufacturing and assembly ease of the solution. The thermal reference design solution 1 requires a screwdriver to install the heatsink. The mechanical advantage of the screw is that it applies a large force to the clip. Minimizing installation fatigue was a significant factor in selecting the use of screws in this thermal solution. During installation each screw is driven until it bottoms out on the retention frame. This may require a torque of 6 to 12 in-lbs. Figure 7 on page 21 shows a heatsink installed according to the thermal reference design solution 1.

Table 3. Components for the AMD Athlon™ 64 and AMD Opteron™ Processors Thermal Reference Design Solution 1

Part Description	Material	Quantity
Heatsink	Aluminum	1
Fan	Plastic	1
Mounting frame	Lexan, 20% glass filled	1
Spring clip	SK7 heat treated spring steel	1
6-32x1” pan head screw	Stainless steel	2
Backplate	Low carbon steel, anti-corrosive finish	1
Insulator	Formex GK-17	1
EMC shield	Stainless steel	1

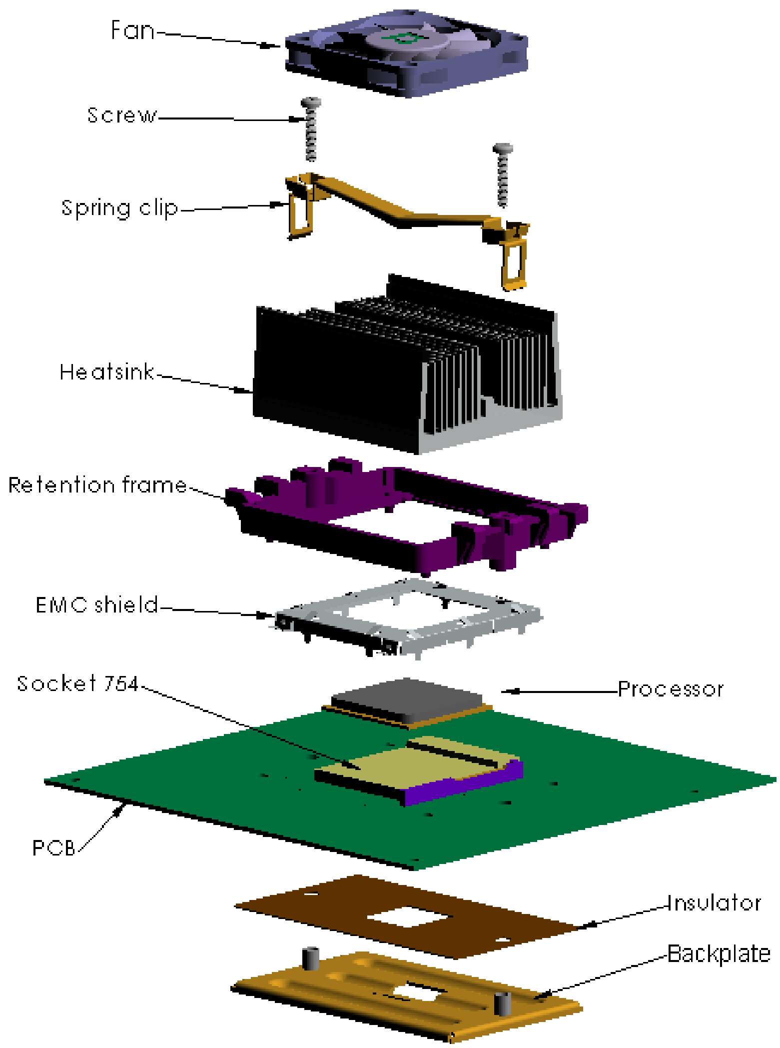


Figure 5. AMD Athlon™ 64 and AMD Opteron™ Processors Thermal Reference Design Solution 1

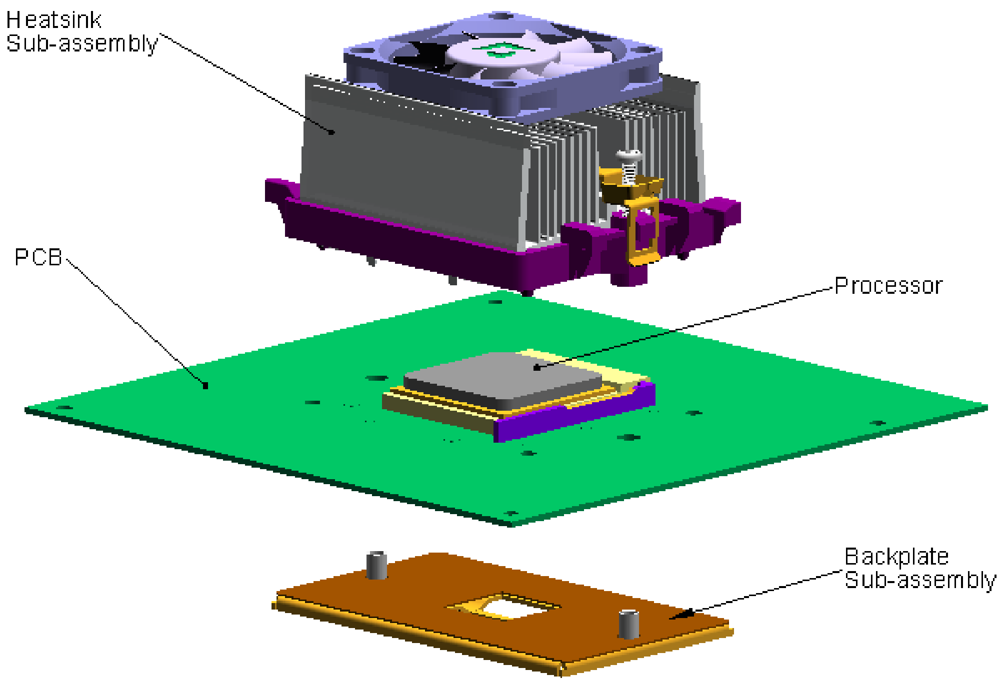


Figure 6. Thermal Reference Design Solution 1 Components Assembled for Shipment

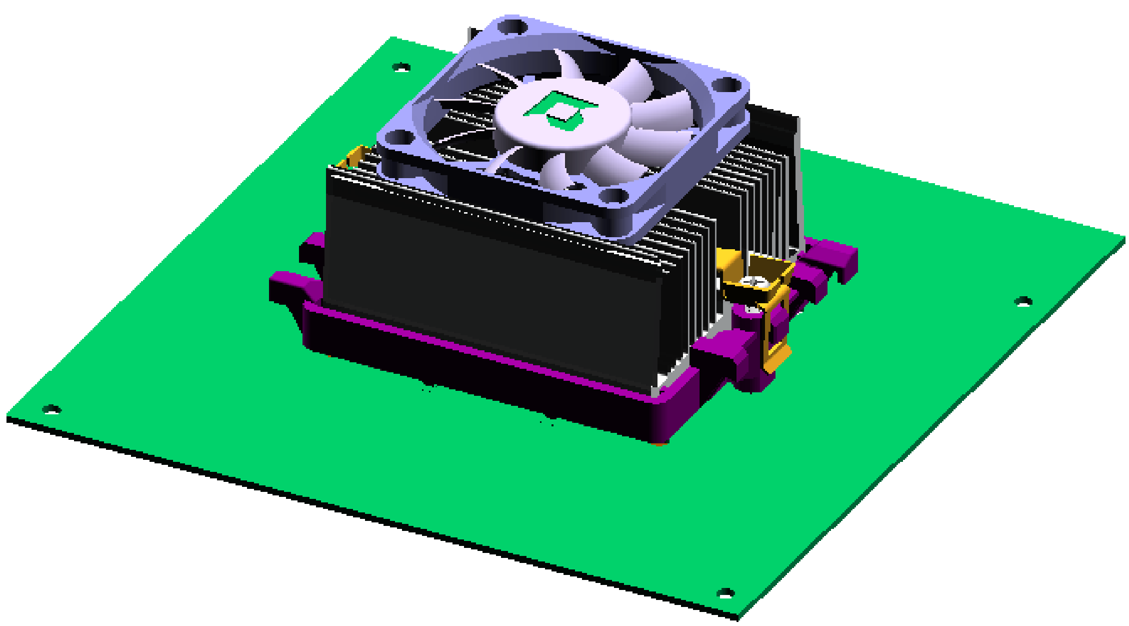


Figure 7. View of an Installed Heatsink Utilizing the Thermal Reference Design Solution 1

2.5.2 Thermal Reference Design Solution 2

Table 4 lists the parts used in the thermal reference design solution 2 for the AMD Athlon 64 and AMD Opteron processors. An exploded view of the components used for this thermal solution is shown in Figure 8 on page 23. The components are shipped as subassemblies so the heatsink installer does not have to assemble each individual component. The retention frame and backplate are shipped pre-installed on the motherboard as shown in Figure 9 on page 24. The heatsink unit has the components assembled so the installer can remove it from the packaging, remove any thermal interface material protection, hook the clip onto the retention frame, and then actuate the cam. For the thermal reference design solution 2, the installer needs no tools for the heatsink installation process. Figure 10 on page 24 shows an installed heatsink utilizing the thermal reference design solution 2.

Table 4. Components for the AMD Athlon™ 64 and AMD Opteron™ Processors Thermal Reference Design Solution 2

Part Description	Material	Quantity
Components Installed by OEM, System Integrator, or End User		
Heatsink	Aluminum	1
Fan	Plastic	1
Spring clip	SK7 heat treated spring steel	1
Camshaft	Lexan, 20 % glass filled	1
Cam spacer	Lexan, 20 % glass filled	1
EMC shield	Stainless steel	1
Components Assembled on the Motherboard		
Retention frame	Lexan, 20% glass filled	1
Backplate	Low carbon steel, anti-corrosive finish	1
Insulator	Formex GK-17	1
6-32x 0.75” pan head screw	Stainless steel	2

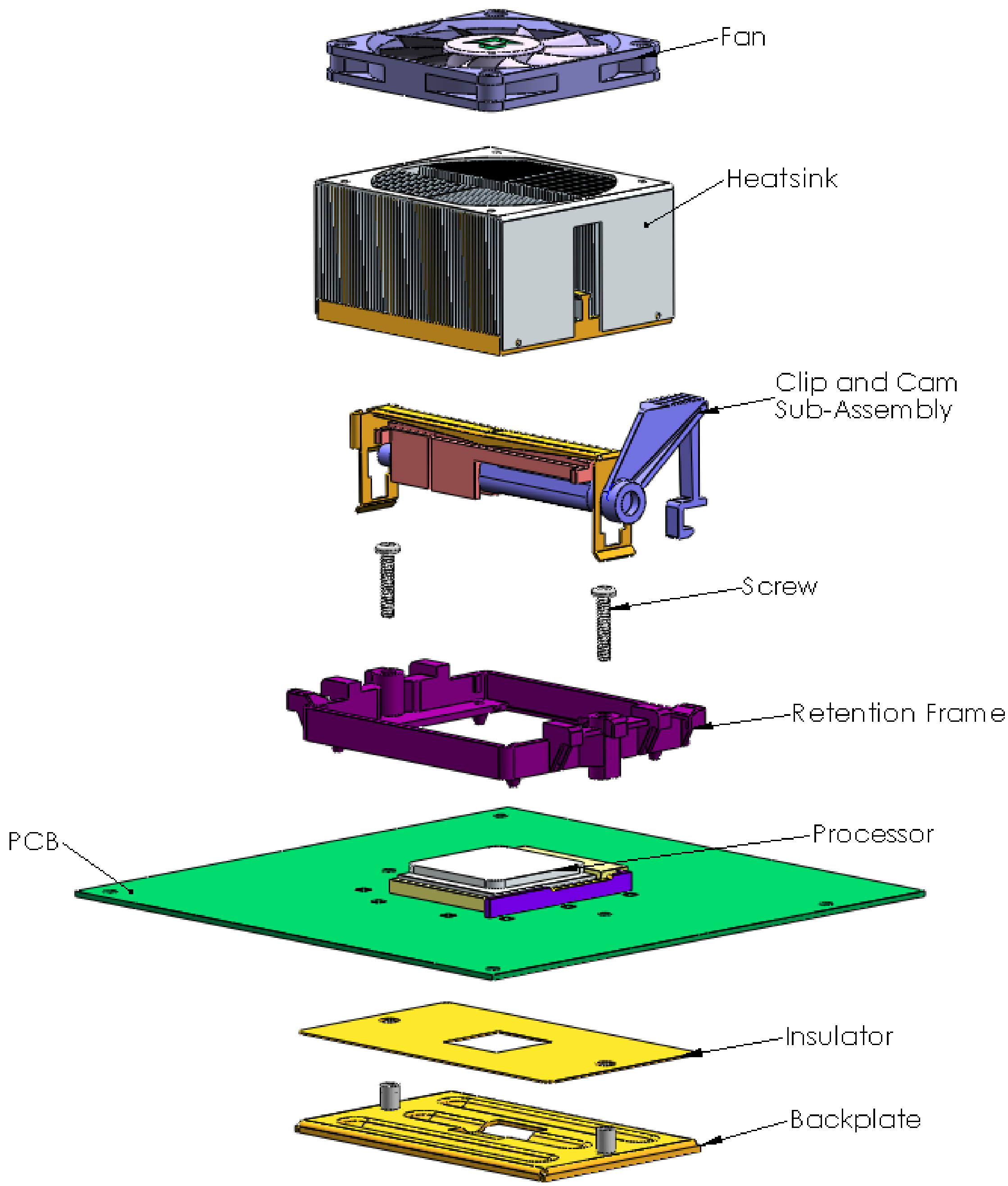


Figure 8. Exploded View of the Components Utilized in the AMD Athlon™ 64 and AMD Opteron™ Processors Thermal Reference Design Solution 2

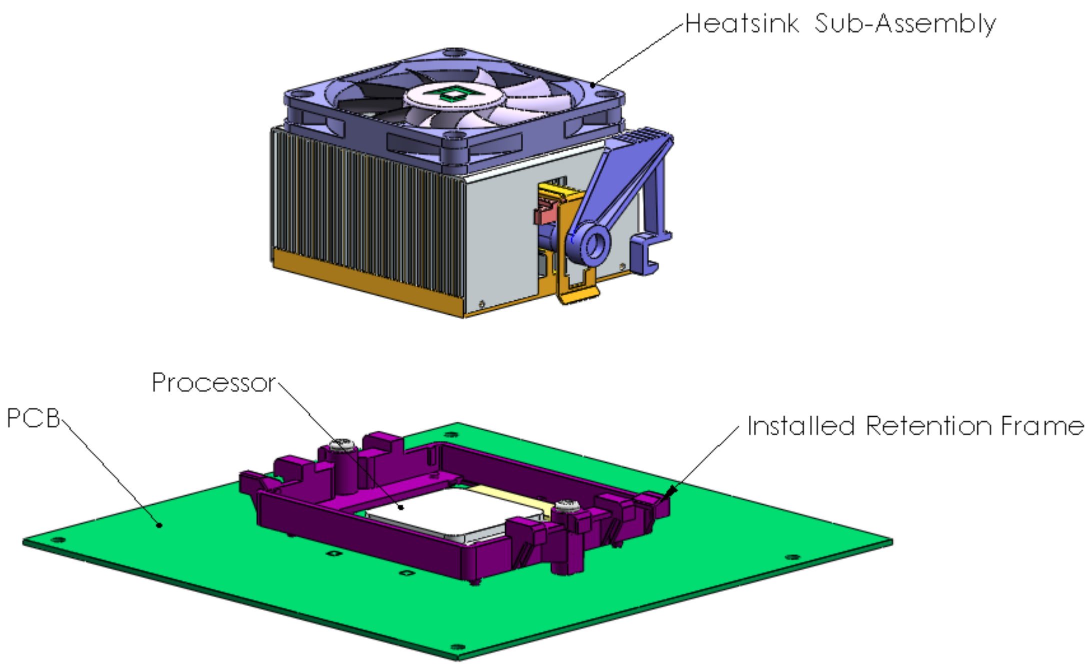


Figure 9. Thermal Reference Design Solution 2 Components Configured for Shipment

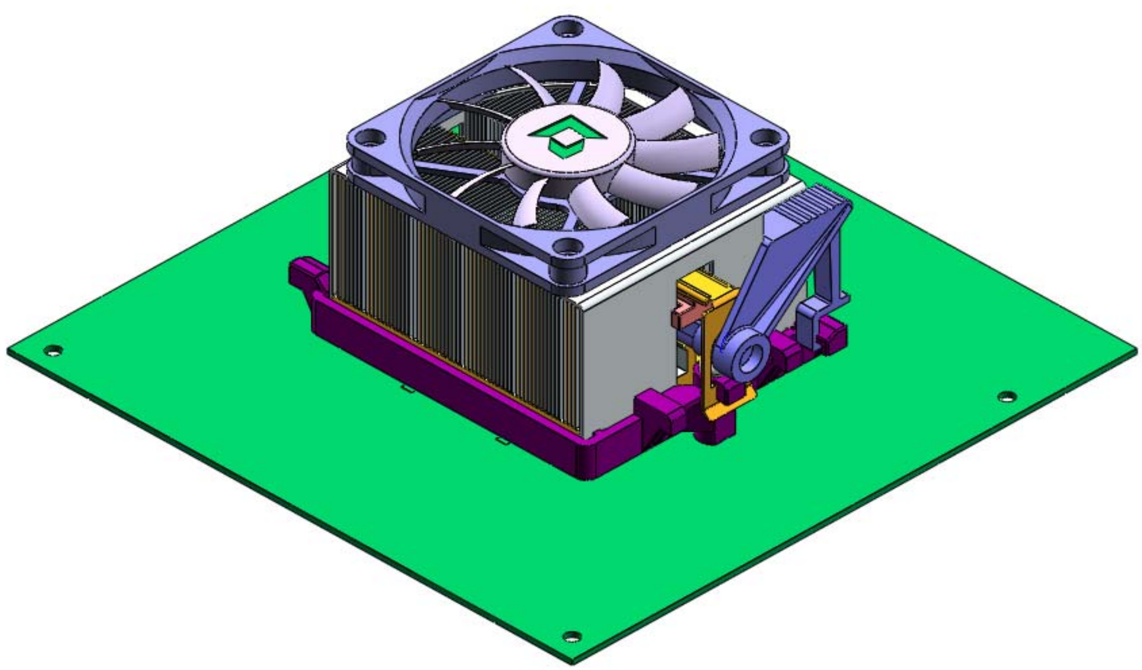


Figure 10. View of a Heatsink Installation Utilizing the Thermal Reference Design Solution 2

2.6 Thermal Solution Design Considerations

The two thermal reference design solutions shown in Figure 5 on page 20 and Figure 8 on page 23 contain several components that have specific functions. A complete set of drawings is shown in Appendix A.4 beginning on page 68. Because the µPGA processors have features that are significantly different from the previous generation of processors, some background is given in the following sections on the various aspects of the mechanical requirements for the thermal solution. Also, additional design considerations and requirements are given for improved thermal and acoustic performance.

2.6.1 Backplate Assembly

The backplate assembly is designed to prevent excessive motherboard warpage in the area near the processor. Without using a backplate, the warpage could cause serious damage to electrical connections of the processor socket and integrated circuit packages surrounding the processor.

The reference backplate is made from cold rolled steel and incorporates three stiffening ribs to meet stiffness requirements. The center rib is partially cut away by a square hole located in the center of the backplate. This region is for decoupling the capacitors on the backside of the motherboard. It is important to *not* cut entirely through the center rib, as that action would compromise the stiffness of the reference backplate. The size of the square hole differs according to the type of processor. The AMD Athlon 64 processor version has a 20 mm square hole while the AMD Opteron processor version has a 26 mm square hole. Using a 26-mm hole on both AMD Athlon 64 and AMD Opteron processors is being investigated, and the results will be included in an update of this document.

There are two PEM standoffs used in the plate. The standoffs serve multiple purposes, mainly as attachment points for the retention frame screws and for aligning the backplate easily and properly to the motherboard. The retention frame is made to slide over the standoffs and allow the screws to be installed with a minimum chance of cross threading.

The insulator also serves multiple purposes. The primary function of the insulator is to prevent the backplate from shorting to the motherboard. Additionally, a pressure-sensitive adhesive in the insulator keeps the backplate in place against the motherboard during assembly. The insulator is thick enough to prevent any significant capacitive coupling between the motherboard and backplate.

2.6.2 Spring Clip

The spring clips used for both thermal reference design solutions were designed to apply 75 lbs of force to the heatsink. This force is necessary to prevent a large-mass heatsink from lifting off the package during a shock or vibration-induced event. Any lifting of the heatsink away from the processor could result in damage to the processor pins, the socket contacts, or the socket solder ball joints. This spring force is greater than required in previous generations of AMD processors. Maintaining the spring force is important for the life of the processor and for repeated installations and upgrades of the processor.

The reference spring clip material is the heat-treatable spring steel, SK7. AMD strongly recommends using SK7 or an equivalent material for the spring clip. The clip should be plated after heat treatment for cosmetic and anti-corrosive reasons. Table 5 gives the chemical composition of SK7. The heat treatment used should bring the ultimate strength of the material to a minimum of 1,300 Mega-Pascals (Mpa) or 189 Kilo-pounds per square inch (Ksi) and a yield strength to 940 MPa (or 136 Ksi).

Other materials commonly used for heatsink spring clips have been shown to yield under the high load of the initial spring clip deflection, become deformed, and can no longer apply the same load.

Table 5. Chemical Composition of SK7 Spring Steel

Composition	Percentage of the Element
C	0.60–0.70
Si	Maximum 0.35
Mn	0.80–0.90
P	Maximum 0.030
S	Maximum 0.030
Fe	Remaining Balance

2.6.3 Retention Frame

The retention frame serves multiple purposes. During installation, the retention frame provides a stop for the spring clip ends used in the thermal reference design solution 1. The retention frame also aligns the heatsink and provides a stop for the heatsink in case of a large shock-force event. The retention frame serves to hold the solution 1 heatsink assembly together as a single unit for shipping and assembly, and aligns and helps to retain the EMC shield.

The retention frame serves the same function for the thermal reference design solution 2, but it is implemented in a different way. The retention frame and backplate are joined to the motherboard by the motherboard manufacturers. Two screws securely hold the backplate and retention frame together. The six mounting tabs on the retention frame serve as an attachment point for the heatsink spring clip. The thermal reference design solution 2 utilizes only two of the mounting tabs, but the flexibility of the design is increased with the additional mounting tabs.

2.6.4 Heatsink

The footprint of the reference design heatsink is 77x68 mm. The highest-power processors may require solutions incorporating copper in the base of the heatsink to dissipate heat, taller fins and greater fin density to increase surface area, and higher flow fans to increase cooling capacity.

Because the processor mounting surface extends above the surface of the cam box on the socket, the heatsink bottom must be flat. The heatsink must have a flat surface of at least 40x40 mm centered over the processor as specified in the reference design drawing.

2.6.4.1 Low-Cost Heatsink Example

Based on the thermal performance requirements of a particular processor, a low-cost heatsink may be appropriate for an application. An example of a low-cost heatsink utilizing extruded aluminum stock is shown in Figure 11.

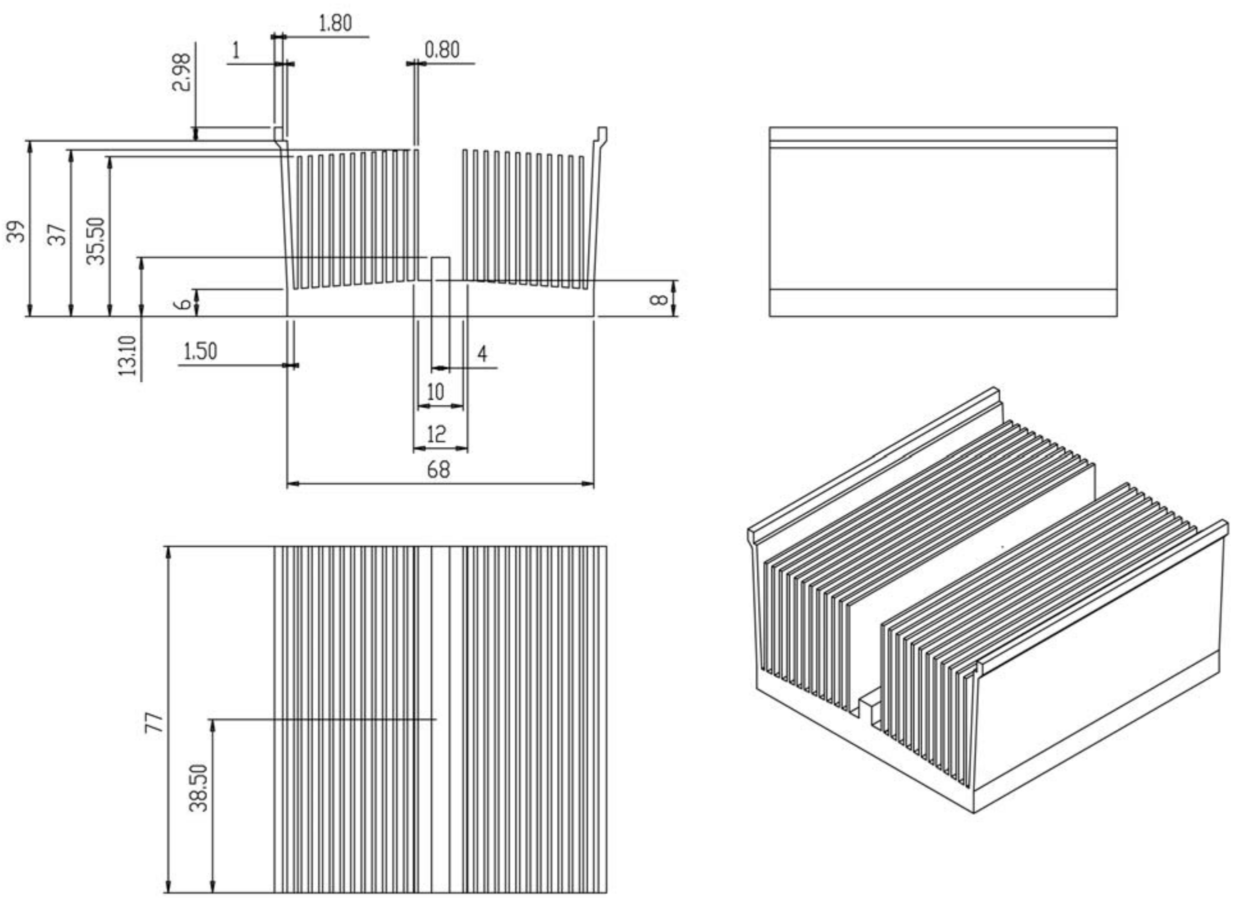


Figure 11. Example of a Low-Cost Heatsink Using Aluminum Extrusion Technology

2.6.4.2 High Performance Heatsink Example

When a high performance heatsink is needed to meet thermal or acoustic requirements, other manufacturing technologies can be used. These technologies combine high-density fin pitches with thin fins. They may also incorporate copper into the heatsinks. Copper and aluminum are commonly used together in the same heatsink. Figure 12 shows an example of a heatsink that would perform better than the low-cost extrusion heatsink The heatsink shown in Figure 12 is based on high-aspect ratio extrusion manufacturing technology. An example of a high performance heatsink using a high-density fin technology is shown in Section A.4 on page 64.

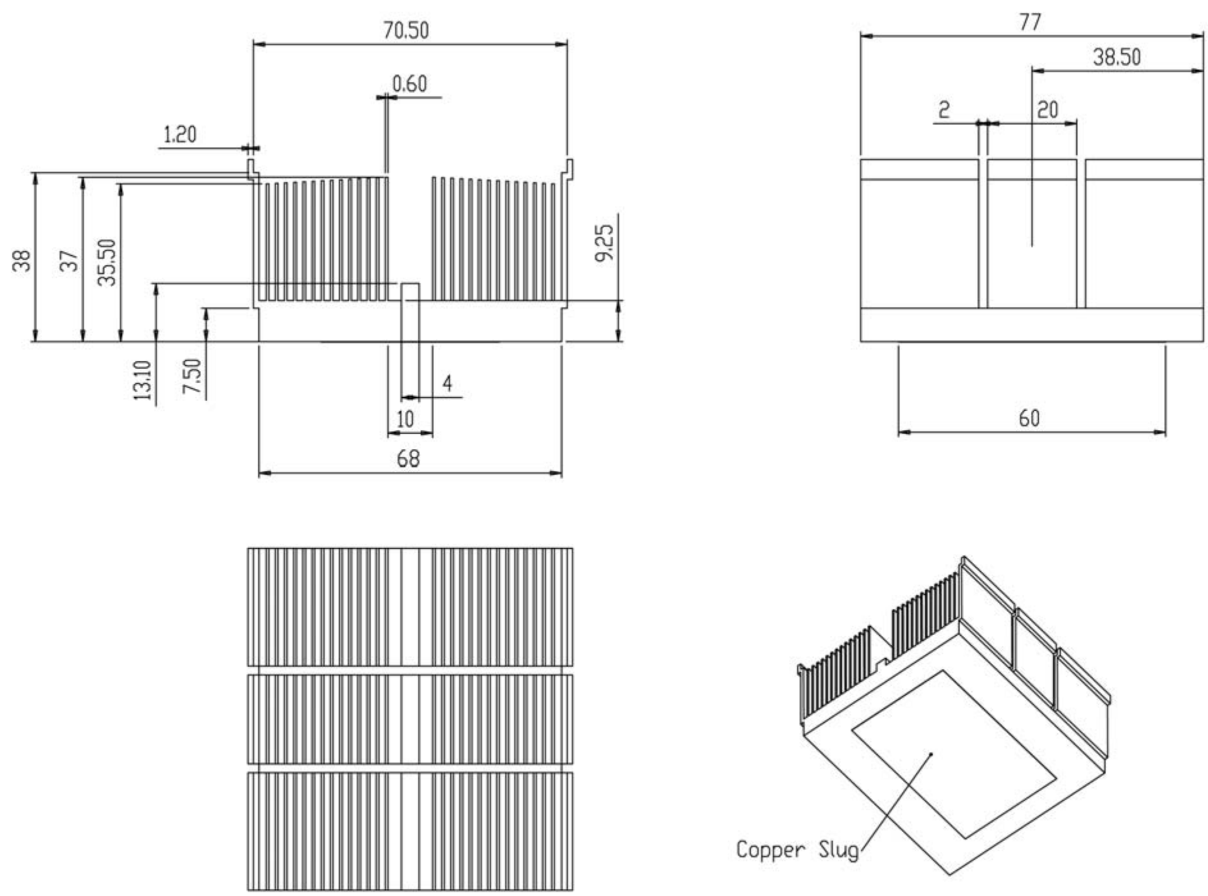


Figure 12. High Performance Heatsink with Copper Slug Embedded in the Base

2.6.4.3 Required Exhaust Airflow Direction

The current that a motherboard must supply to the AMD Athlon 64 and AMD Opteron processors has increased during the development of these processors. The increase in current requires that air exhausting from the heatsink be directed across the motherboard processor voltage regulator. Motherboard suppliers have designed their motherboards to have voltage regulators located along the long side of the heatsink. Therefore, heatsinks should be designed to have aiflow exit the long side of the heatsink as shown in Figure 13. Alternatively, airflow may exit the heatsink on all sides.

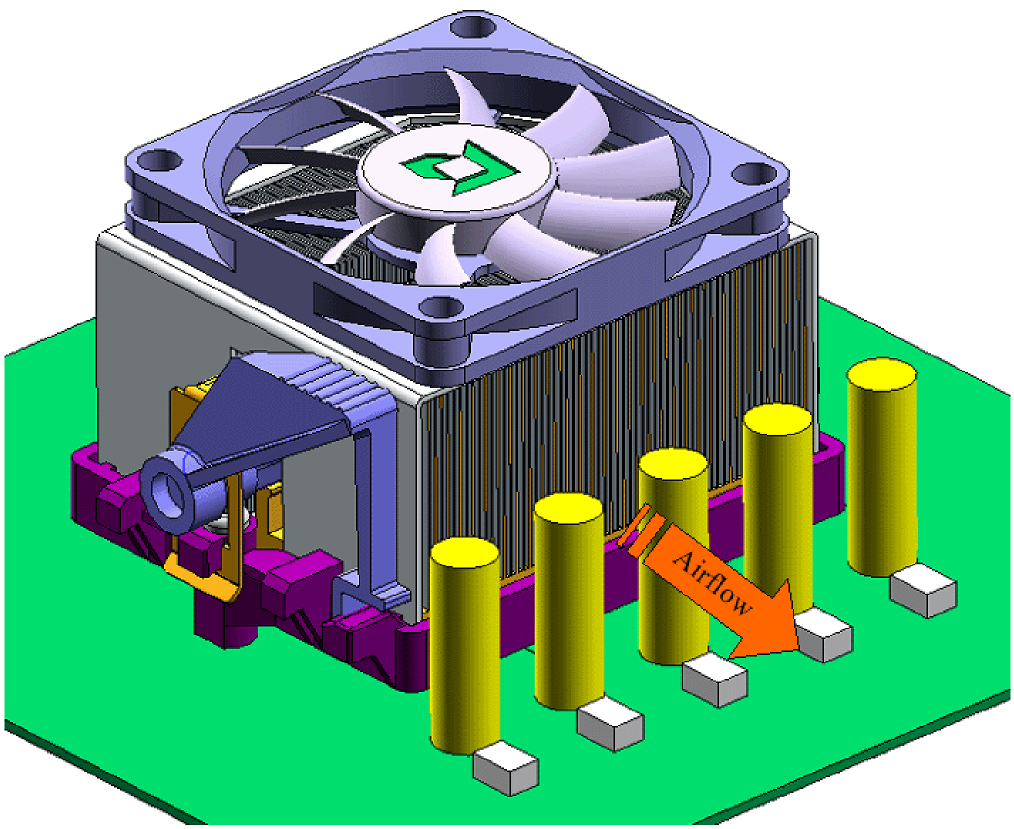


Figure 13. Required Exhaust Airflow Direction for Motherboard Voltage Regulator Cooling

2.6.5 Fans

Improvements in fan technology have increased the range of flow capacity available to thermal solution designers. However, increased flow may often occur at the expense of causing increased acoustic noise. Larger fans can move more air at lower rotational speeds than smaller fans. The recent increase in availability of 70-mm body fans allows them to be used for high-volume thermal solutions. AMD recommends using 70-mm body fans for the AMD Athlon 64 and AMD Opteron and processors.

Because the thermal solutions are used on a variety of motherboard designs with the fan power connector in different locations, AMD recommends a minimum fan power cable length of 200 mm. This length should allow the thermal solution to be mounted in any orientation while maintaining the ability to power the fan.

Because the thermal solution must meet the processor thermal requirements at elevated ambient temperatures, a single fan speed solution results in a high fan speed to meet these requirements.

Acoustic noise is a concern for both system builders and AMD. Systems with high levels of acoustic noise can generate customer complaints and can influence the acceptance of a product. Therefore, AMD recommends using fans that have speed control implemented on the fan.

Usually, a thermistor is used to sense the airflow temperature at the fan to determine the fan speed. A fan with variable speed capability can meet the thermal requirement at multiple ambient conditions.

The significant temperatures for the AMD Athlon 64 and AMD Opteron processor systems are 32°C and 42°C. These temperatures correspond to room temperatures of 25°C and 35°C, respectively, with an additional 7°C allowed for the temperature rise from the system external temperature to the system internal temperature at the processor location.

At 25°C (normal room temperature), the thermal solution has an additional 10°C added to to the system thermal budget. The required thermal resistance increases, for example, from 0.31°C/W to 0.40°C/W. While the fan speed and heatsink performance are closely coupled, the fan speed can be significantly reduced with the additional 10°C in the thermal budget.

Figure 14 shows a typical fan speed curve. The actual fan speed can depend on the heatsink, but the speed versus temperature ramping should be implemented as shown in the figure.

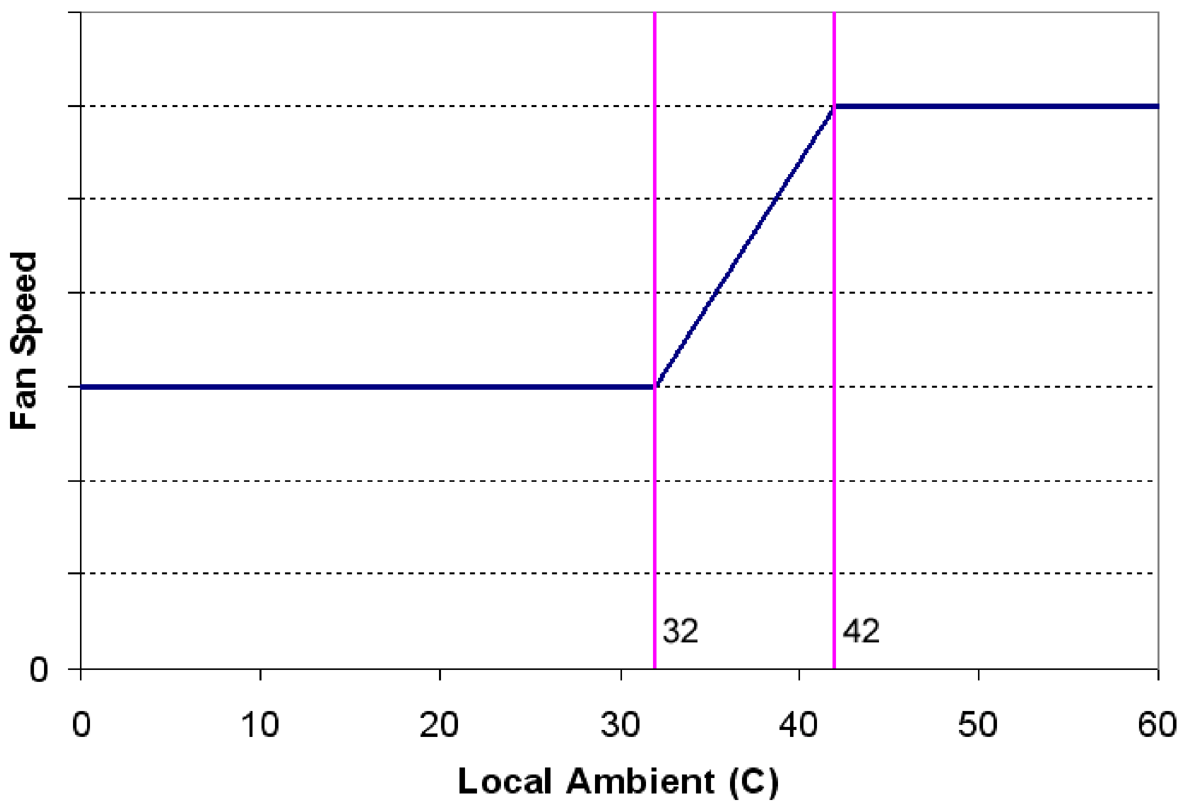


Figure 14. Typical Temperature-Fan Speed Relation for Speed-Controlled Fan

Figure 15 shows the impact of fan speed on the acoustic noise emitted from sample solution 2 thermal solutions. The fans used in those measurements were 70x15 mm and nominally varied speed from 3000 RPM to 6000 RPM over the temperature range of 32°C to 42°C. Lower speeds were investigated for additional reductions in acoustic noise. However, the thermal solutions did not meet required thermal performance levels below 3000 rpm.

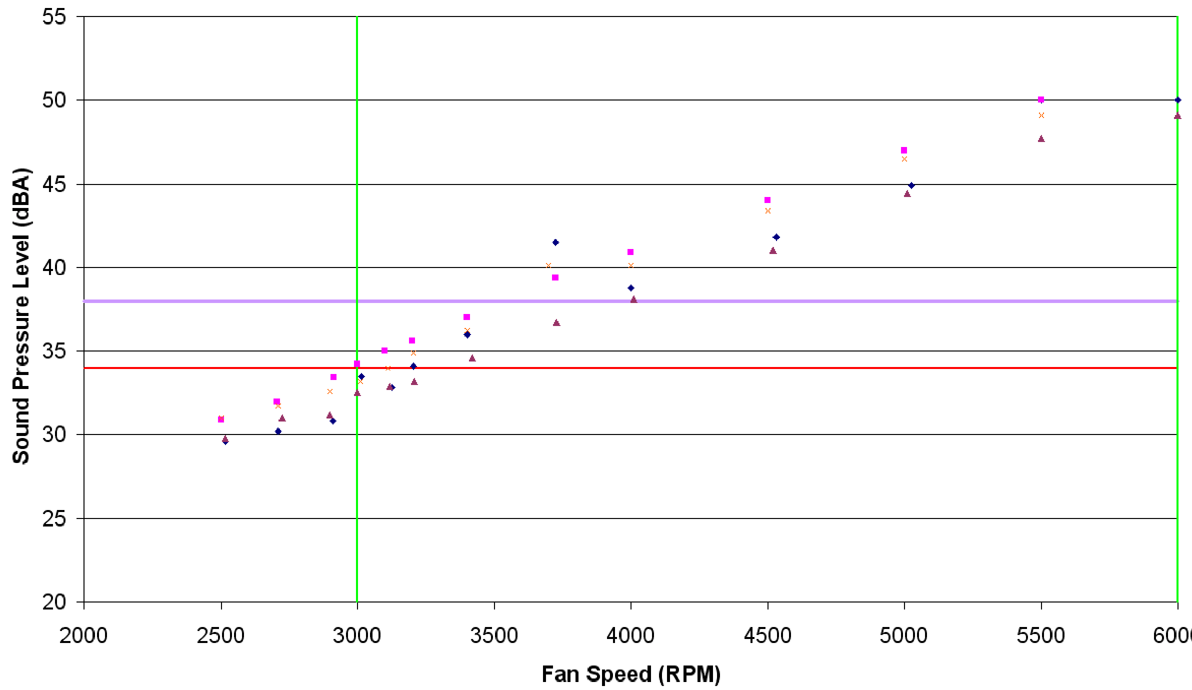


Figure 15. Acoustic Noise from Sample Thermal Solutions with a 70x15 mm Fan

2.6.6 Thermal Interface Material

AMD evaluates thermal interface materials for use with its processors. A list of suggested materials is provided in Table 6.

Table 6. Suggested Thermal Interface Materials

Manfufacturer	Interface Material	Material Type	Application
Bergquist	TIC-3000	Grease	Processor to heatsink
Shin Etsu	G751	Grease	Processor to heatsink
Shin Etsu	X23-7762	Grease	Processor to heatsink
Shin Etsu	X23-7783D	Grease	Processor to heatsink
Thermoset, Lord CPD	TC-350	Grease	Processor to heatsink

The heatsink makes contact with the top surface of the processor package utilizing the thermal interface material between the processor lid and the heatsink. AMD recommends using a high-performance grease such as those listed in Table 6. AMD does not recommend using phase-change materials between the heatsink and the processor.

Phase-change materials develop high adhesion forces between the heatsink and processor when the material is in the solid phase. This strong adhesive force may cause the processor to stick to the heatsink. During heatsink removal, this strong adhesive force may cause the processor to be removed from the socket while it is locked, and this action may result in damage to the socket or to the processor pins.

The heatsink manufacturer may apply the grease to the heatsink. If this procedure is done, a protective cover should be used to prevent contamination of the interface material. Additionally, most grease should be applied in a 34–35 mm square that is 0.06–0.08 mm thick. This amount of grease has provided good coverage of the processor lid while not being excessive. Grease may flow over the edges of the processor and reach the socket if excessive amounts are applied. This is not desirable.

2.6.7 EMC Shield

Because of the high clock frequencies of the AMD Opteron and AMD Athlon 64 processors, an EMC shield has been designed and incorporated into the thermal solution. This shielding is a component that may or may not be necessary for meeting regulatory agency requirements, depending on the system. However, the shielding has been designed as a component that can be added to the heatsink assembly either during assembly of the heatsink components or during final assembly of the system. The heatsink retention frame has features for aligning and retaining the EMC shield.

Chapter 3 Conclusion

The AMD Opteron™ and AMD Athlon™ 64 processor thermal reference design solutions 1 and 2 have been presented in this document. These thermal solutions should provide the thermal engineer the design information to either implement the thermal reference design solutions presented or to design a solution that meets the thermal and mechanical requirements of the AMD Athlon 64 and AMD Opteron processors

A Appendix

This section describes thermocouple instrumentation and the procedure for clip load testing.

A.1 Thermocouple Instrumentation

Thermocouples measure the three necessary temperatures that are used for a detailed thermal-performance analysis. The case temperature requires a thermocouple to be attached to the heatsink lid surface with high thermal conductivity epoxy, such as Omega Engineering's Omegabond 101. The heatsink base temperature requires drilling a hole in the heatsink base and inserting a thermocouple inside the hole. The ambient temperature is measured by fixing a thermocouple with the bead in the fan inlet air stream 25 mm above the surface of the fan.

A.1.1 Case Thermocouple Attachment

Instructions for attaching the case-temperature thermocouple are as follows:

1) Draw lines on the diagonals of the package as shown in Figure 16. Check that the intersection lies on the center of the package by using calipers.

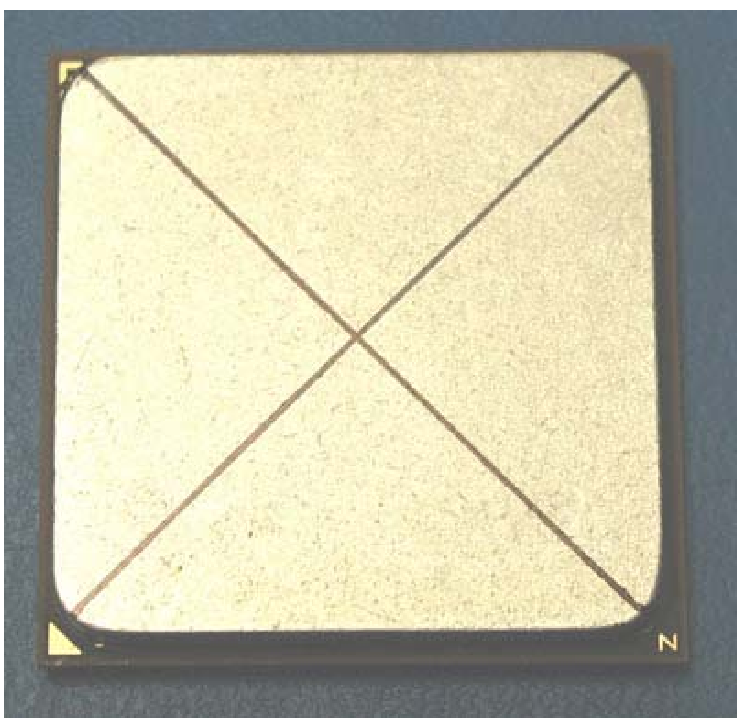


Figure 16. Diagonals Marked on Processor to Locate Center

2) Tape down the thermocouple such that the bead is centered on the package as indicated by the intersection of the diagonals. Be sure to have the thermocouple oriented to align it properly with the relief groove in the heatsink as shown in Figure 17.

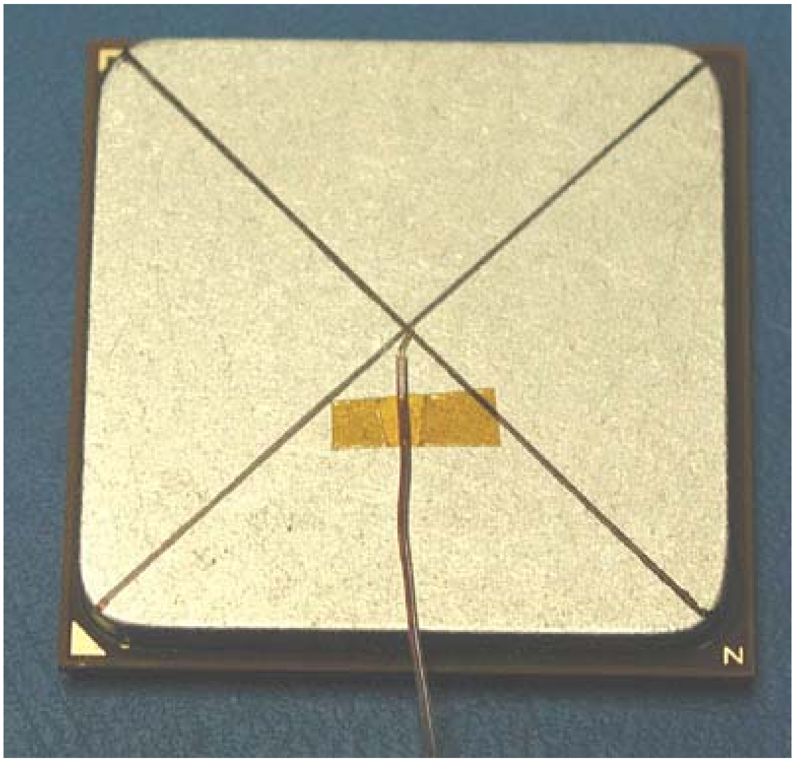


Figure 17. Thermocouple Taped to Processor Lid

3) Place a slight downward bend in the bare wire near the thermocouple bead. This ensures optimal thermal contact between the lid and thermocouple.

4) Clean the contact area to achieve good adhesion and apply a small amount of high thermal conductivity epoxy, such as Omegabond 101, to glue down the thermocouple bead and about 2 mm of lead wire. This step provides strain relief for the package as shown in Figure 18 on page 39. Check between the package lid and thermocouple plug for electrical continuity. Without electrical continuity, good thermal contact is not ensured and the attachment procedure must be repeated.

5) The heatsink must have a strain relief for the thermocouple bead and wire as shown in Figure 19 on page 39. A 5-mm diameter hole is machined to a depth of 0.75 to 1.0 mm for the epoxy bead. A 1.5-mm width slot is machined to a depth of 0.75 mm for the thermocouple wire.

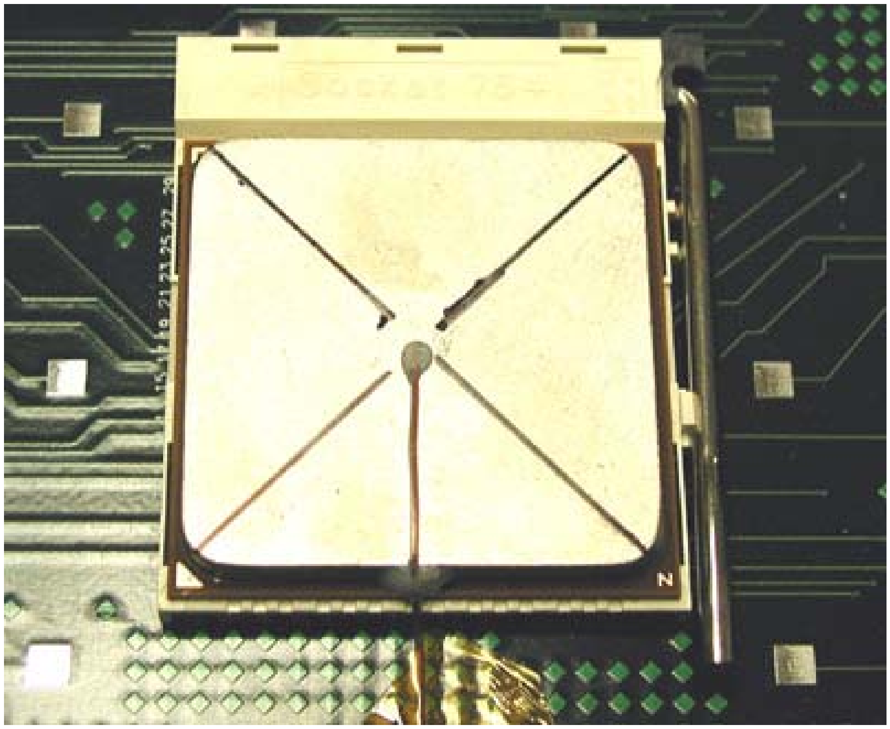


Figure 18. Thermocouple Attached to Processor with Strain Relief on Package and PCB.

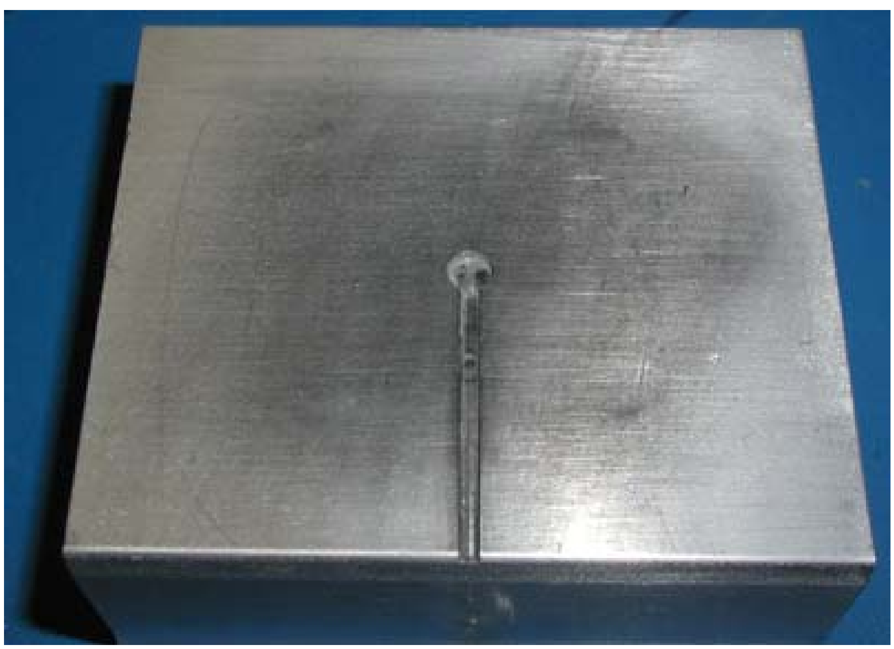


Figure 19. Heatsink with Thermocouple Relief Groove Machined into Base

A.1.2 Heatsink Thermocouple Attachment

1) Drill a 1.5-mm diameter hole in the heatsink base as shown in Figure 20.

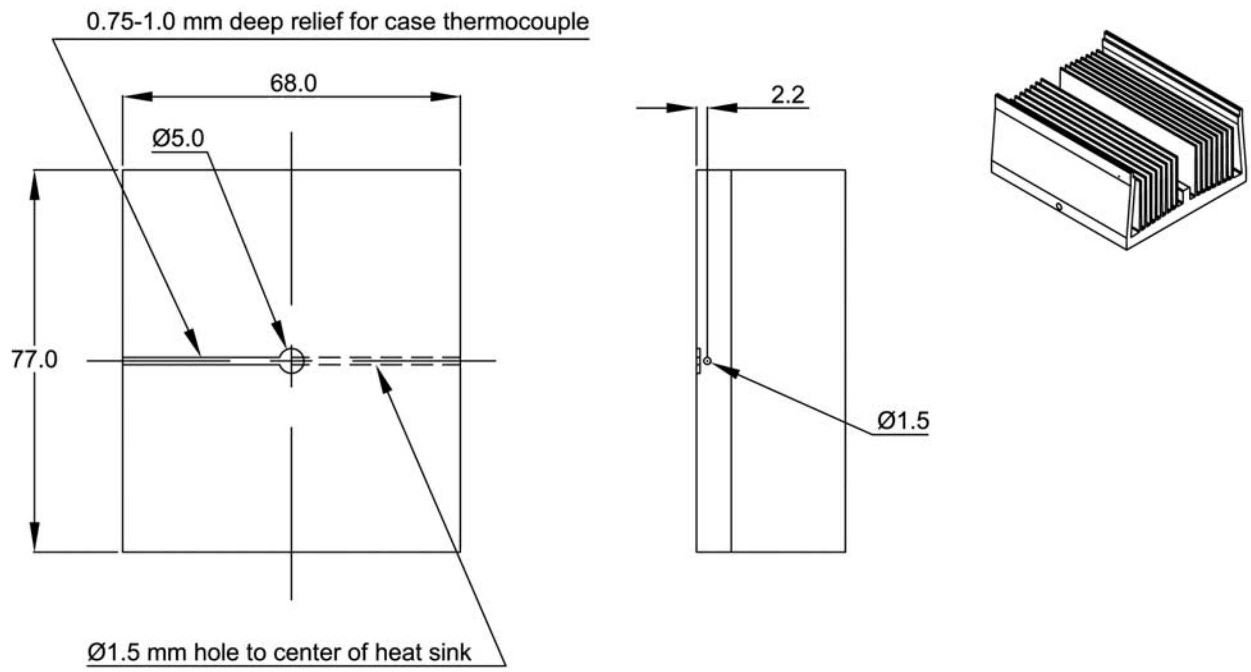


Figure 20. Heatsink Thermocouple Relief Groove and Measurement Hole

2) Inject thermal grease, such as Dow Corning 340, into the hole with a needle.
3) Insert thermocouple into hole until the bead touches the bottom of the hole.
4) Tape the thermocouple wire in place to prevent removal and add strain relief.

A.1.3 Ambient Thermocouple Attachment

The ambient thermocouple should be placed such that it captures the temperature of the air entering the heatsink. The placement for active heatsinks (fan attached) should be about 25 mm away from the fan inlet and centered over the fan.

For passive heatsinks, place the thermocouple about 25 mm upstream from the heatsink and about 50 mm above the motherboard surface.

A.2 Procedure for Clip Load Testing

This section provides the necessary information to measure the force applied by a heatsink clip to the AMD Athlon™ 64 processor. This force is known as the clip load.

A.2.1 Equipment

The following sections detail the equipment needed to measure the clip load.

A.2.1.1 Load Cell

The load cell made by Entran, part number ELW-D1 is designed to work with the load cell fixture. See Figure 21 for an example of this load cell. For more information about the load cell, see *http://www.entran.com/elw.htm*.

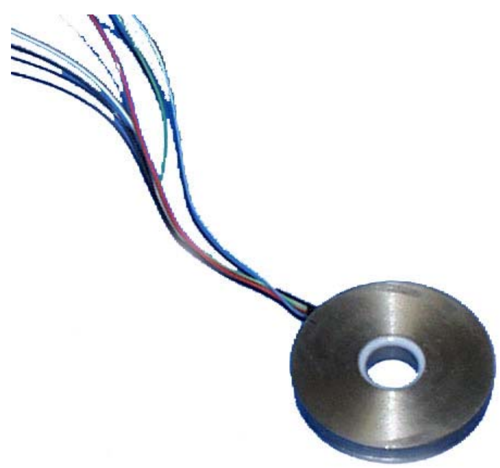


Figure 21. An Entran ELW-D1 Load Cell

A.2.1.2 Load Cell Fixture

The load cell fixture is designed to be used on any motherboard with a Socket 754 installed. The fixture with the load cell installed should be the same thickness as the nominal package height of 4.37mm. Figure 22 on page 42 shows the nominal height of the load cell and the fixture. The square boss on the bottom of the fixture fits in the socket window on Socket 754. Be sure there are no components in the board used for load testing that would interfere with this feature.

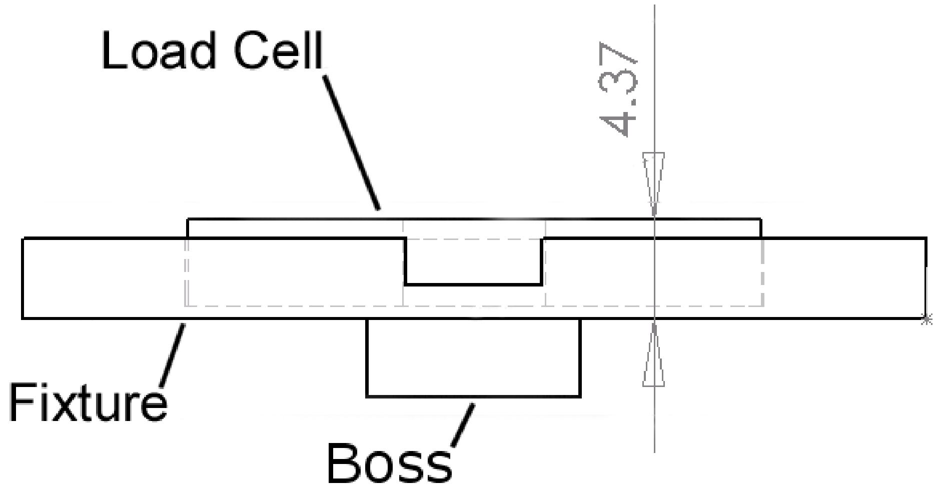


Figure 22. Load Cell Inserted into the Load Cell Fixture

The load cell fixture should be machined from a stainless steel material. A drawing of the fixture is shown in Figure 23 on page 43. The drawing is proportioned for the nominal dimensions of the processor and the load cell. For the most precise measurements, a fixture should be made for each load cell so that the overall height of the fixture and load cell is 4.37 mm.

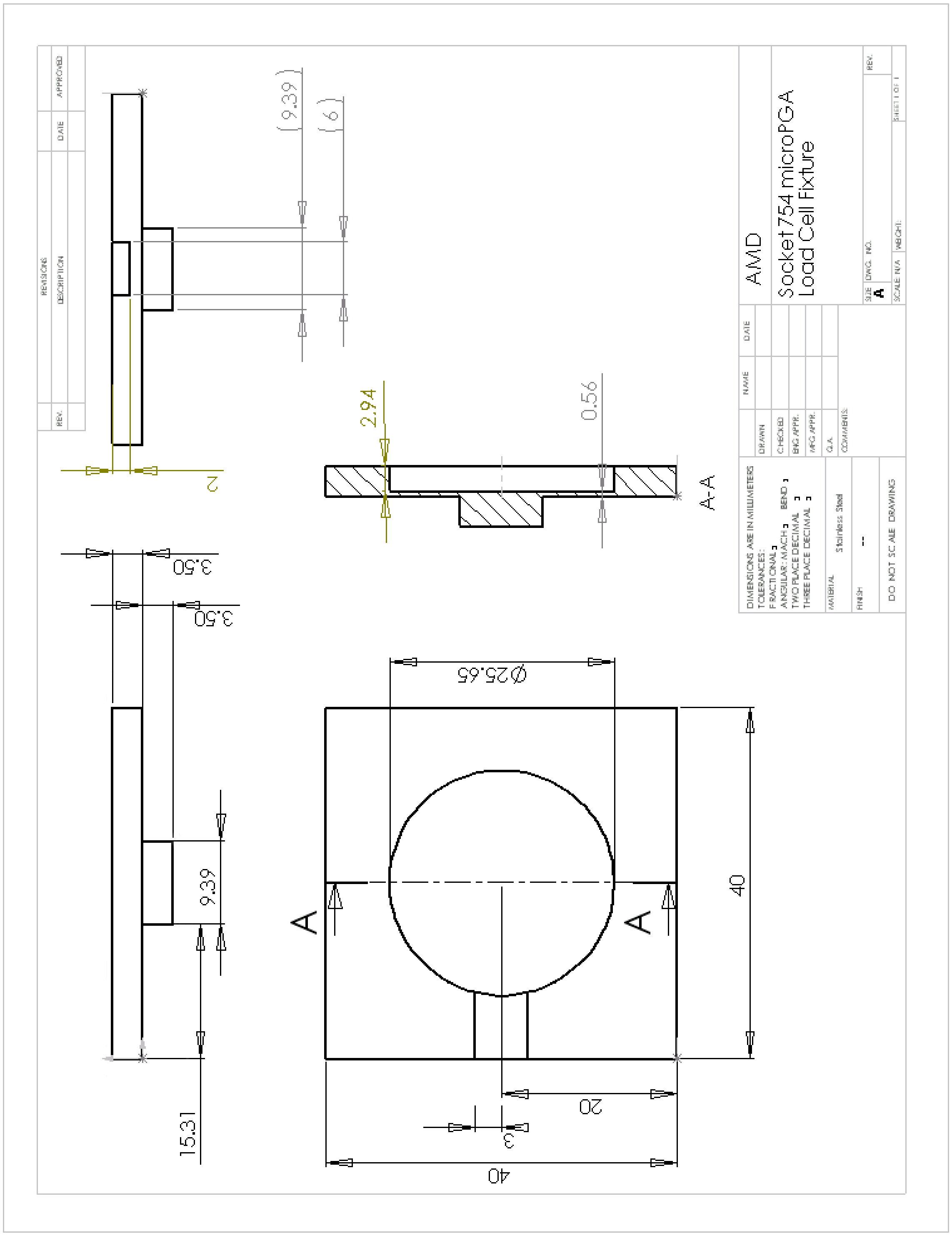


Figure 23. Drawing of Load Cell Fixture for the Entran ELW-D1 Load Cell

A.2.1.3 Test Board

Any printed circuit board made for use with the Socket 754 processor family should be able to accept clip load testing. Be sure the fixture does not interfere with any components that may be mounted to the PCB in the socket window. Additionally, allowance for the mounting hole pattern and component keepout areas must be followed to avoid tainted load measurements.

A.2.1.4 Voltage Source

A precision voltage source should be used to power the load cell. The Entran ELW-series load cells require 15 V excitation. Make the connections between the voltage source and the red and black wires on the load cell.

A.2.1.5 Voltmeter

A precision voltmeter or multimeter is needed to measure the output from the load cell. Connect the meter to the green and white wires on the load cell. Each load cell will have a unique calibration coefficient to convert the millivolt reading into force. The Entran ELW-D1 typically has a value near 1 mV/lb.

A.2.2 Procedure

The following procedure details how to obtain the clip load using the load cell fixture assembly:

1. Set the voltage output on the voltage source to 15.00 V and connect the load cell as indicated by the manufacturer.
2. With nothing touching the load cell and fixture assembly, record the zero load output voltage in millivolts since the load measurement is based on change in voltage from no load to the measured load.
3. Position the backplate onto the test board.
4. Place the load cell fixture in the socket.
5. Place the load cell into the fixture as shown in Figure 24.

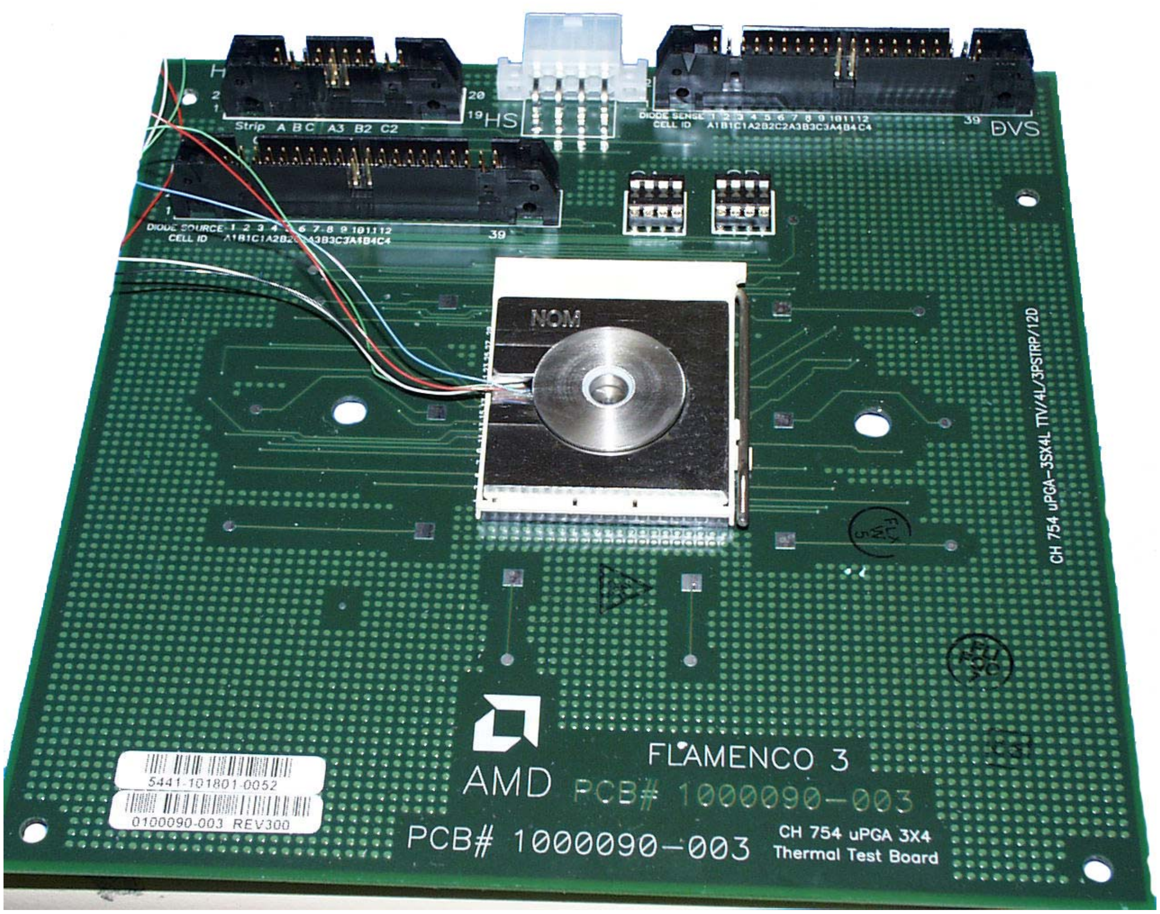


Figure 24. Test Board with a Load Cell Fixture Installed in the Socket 754

6. Place the retention frame onto the board and align it with the backplate standoffs.
7. Place the heatsink on the load cell assembly.
8. Install clip and tighten screws until the clip is fully installed as shown in Figure 25.

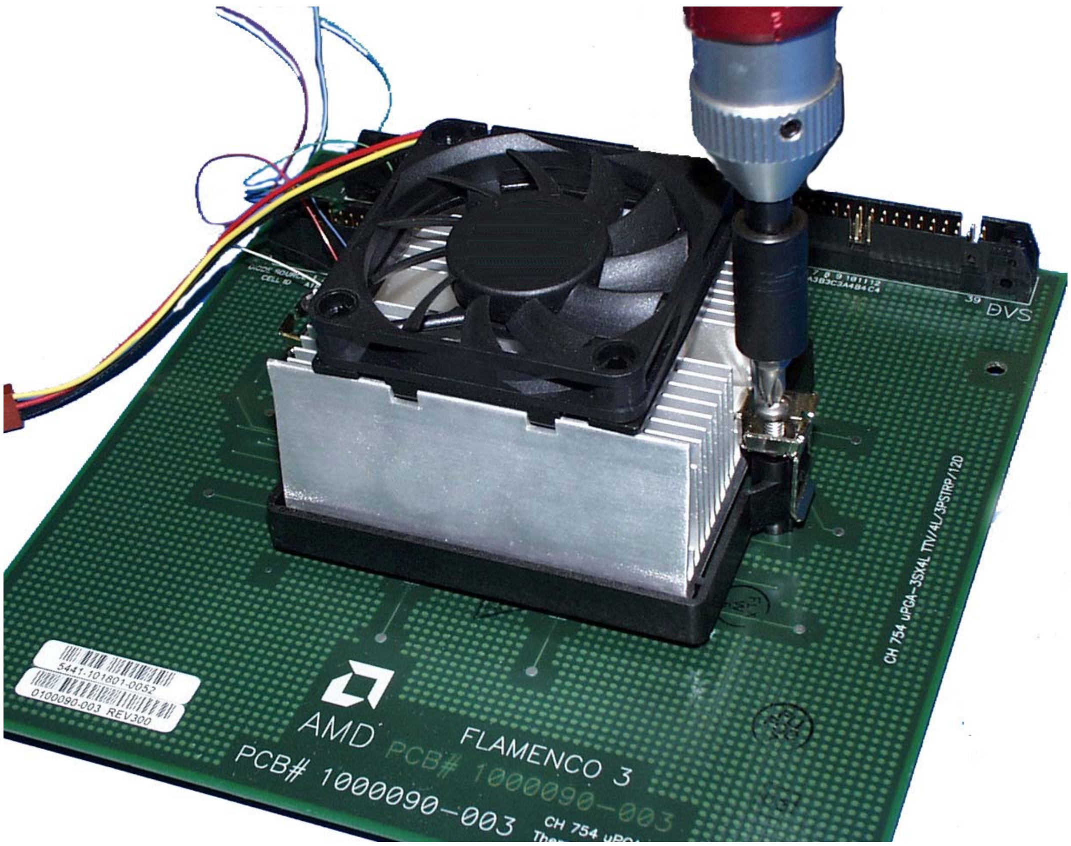


Figure 25. Heatsink Installation over the Load Cell Fixture

9. Allow the output voltage to settle (~1min) and take the voltage reading.
10. Use the load cell calibration factor to obtain the force applied by the clip. An example measurement follows:

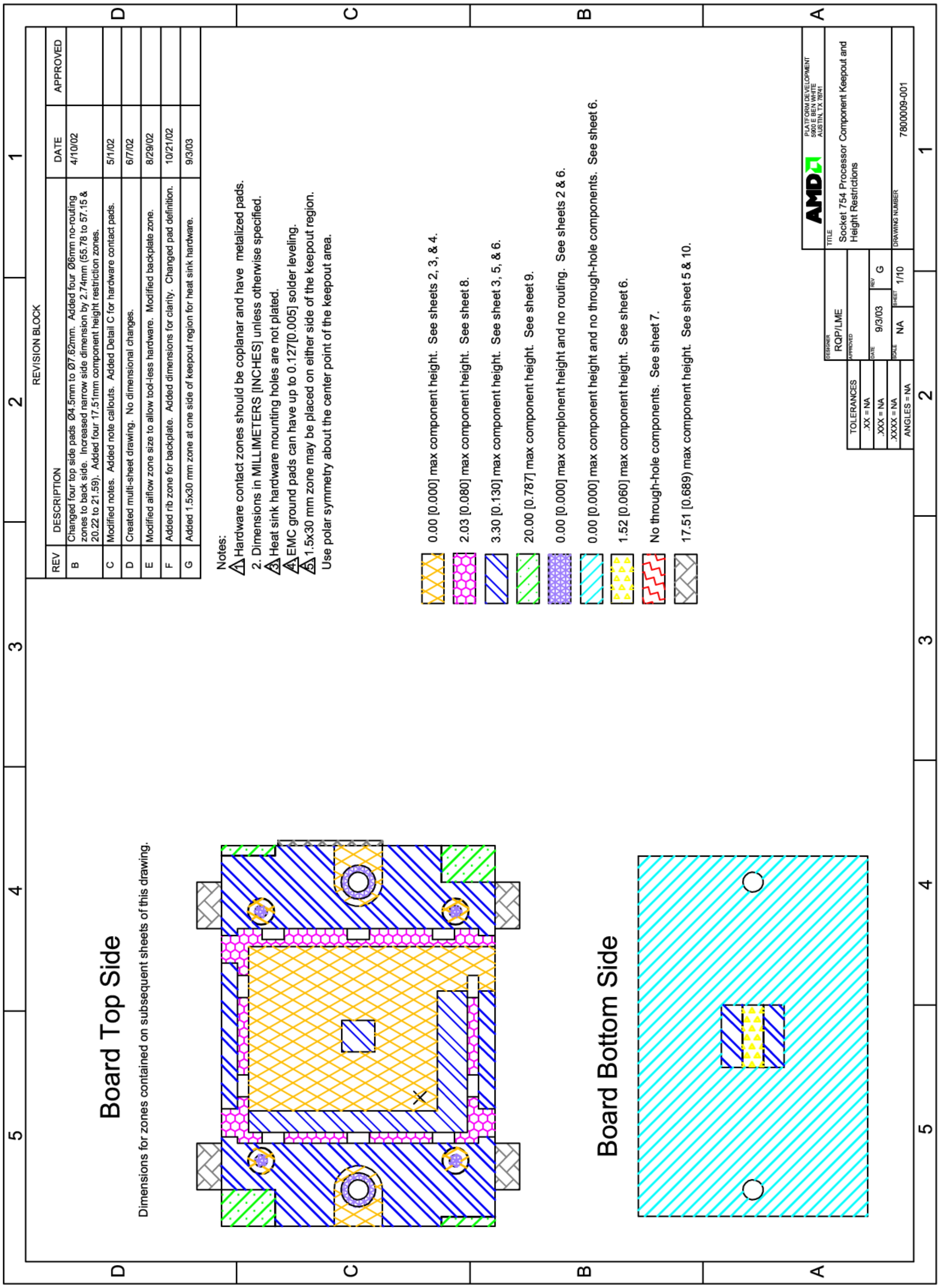
Initial reading:	34.5 mV
Final reading:	129.4 mV
Load cell calibration factor:	1.29 mV/lb

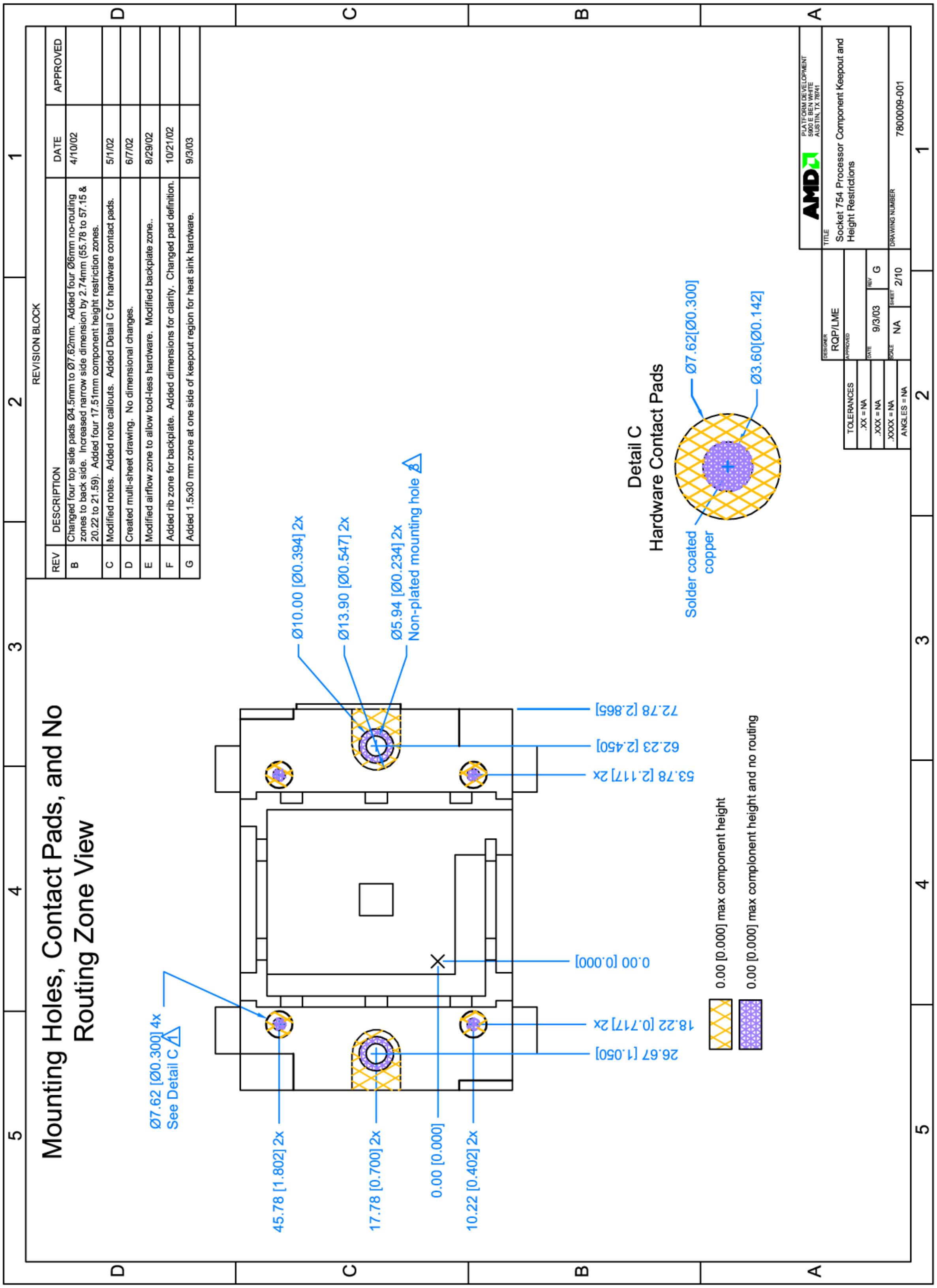
(129.4 – 34.5) / 1.29 = 73.6 lb

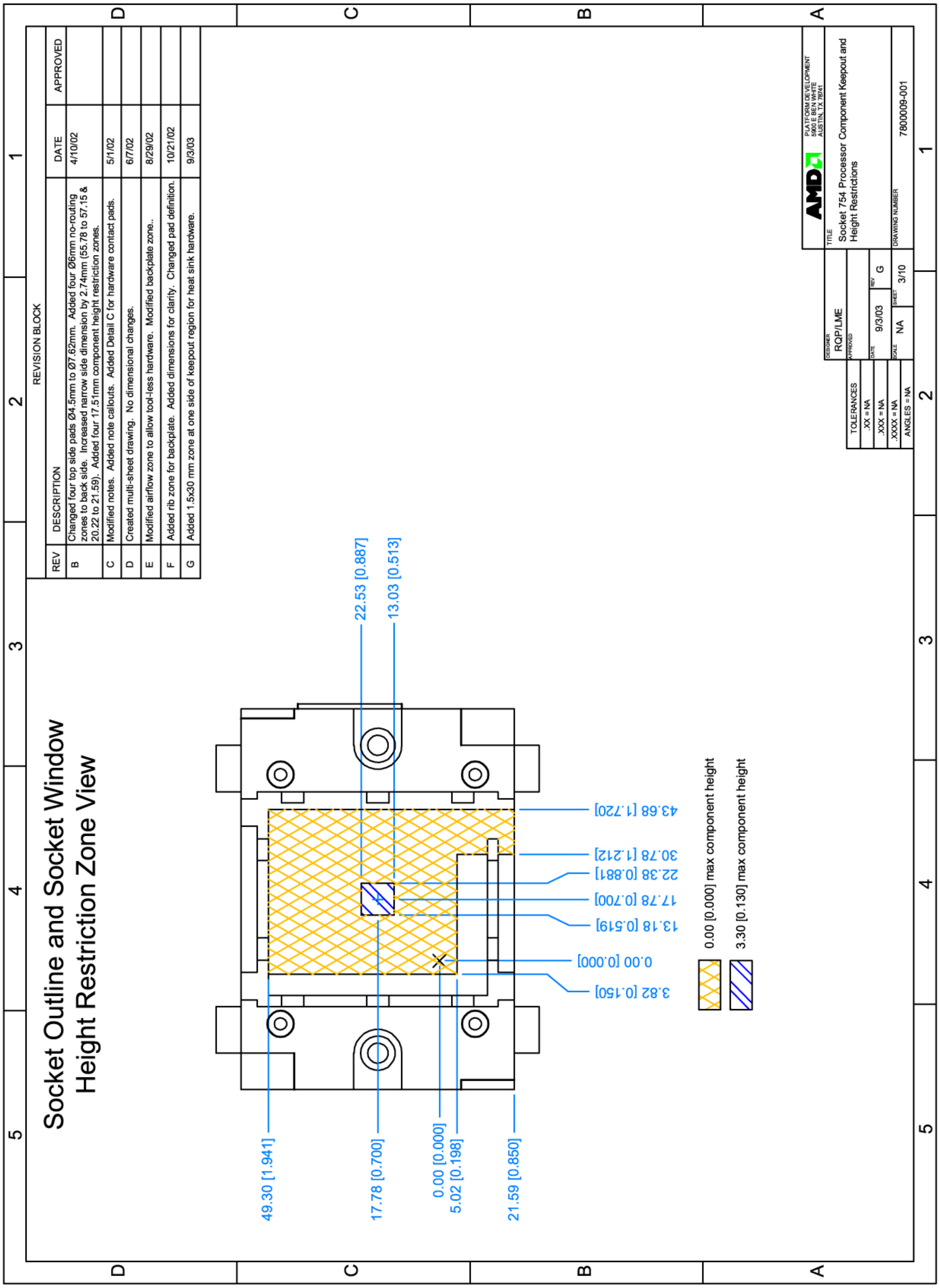
A.3 Motherboard Component Keep-Out Areas and Height Restriction Drawings

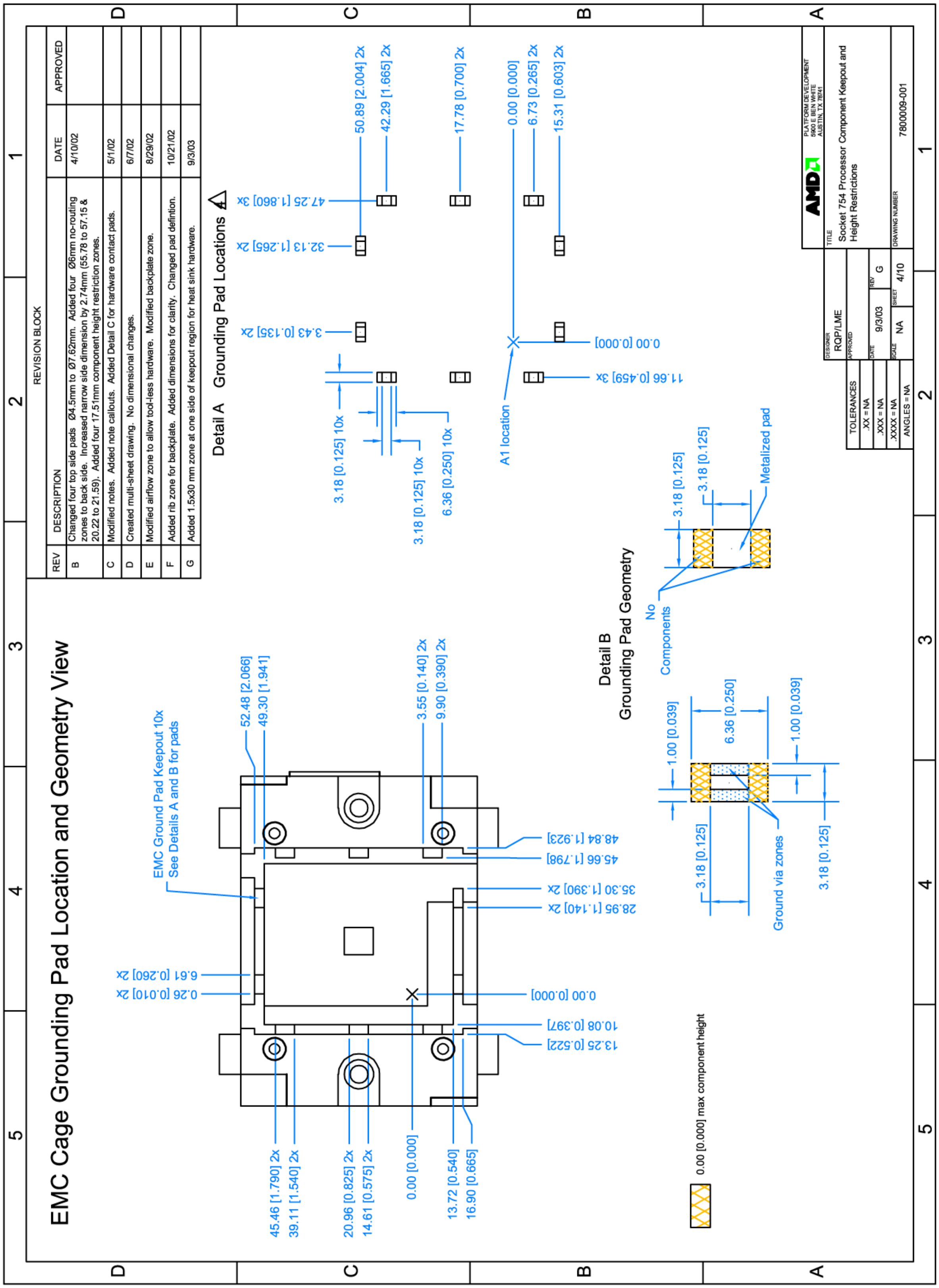
The ten drawing sheets in this section from page 48 through page 57 provide information for the motherboard component keep-out areas and height restrictions for the AMD Athlon 64 processor based on the 754-pin socket.

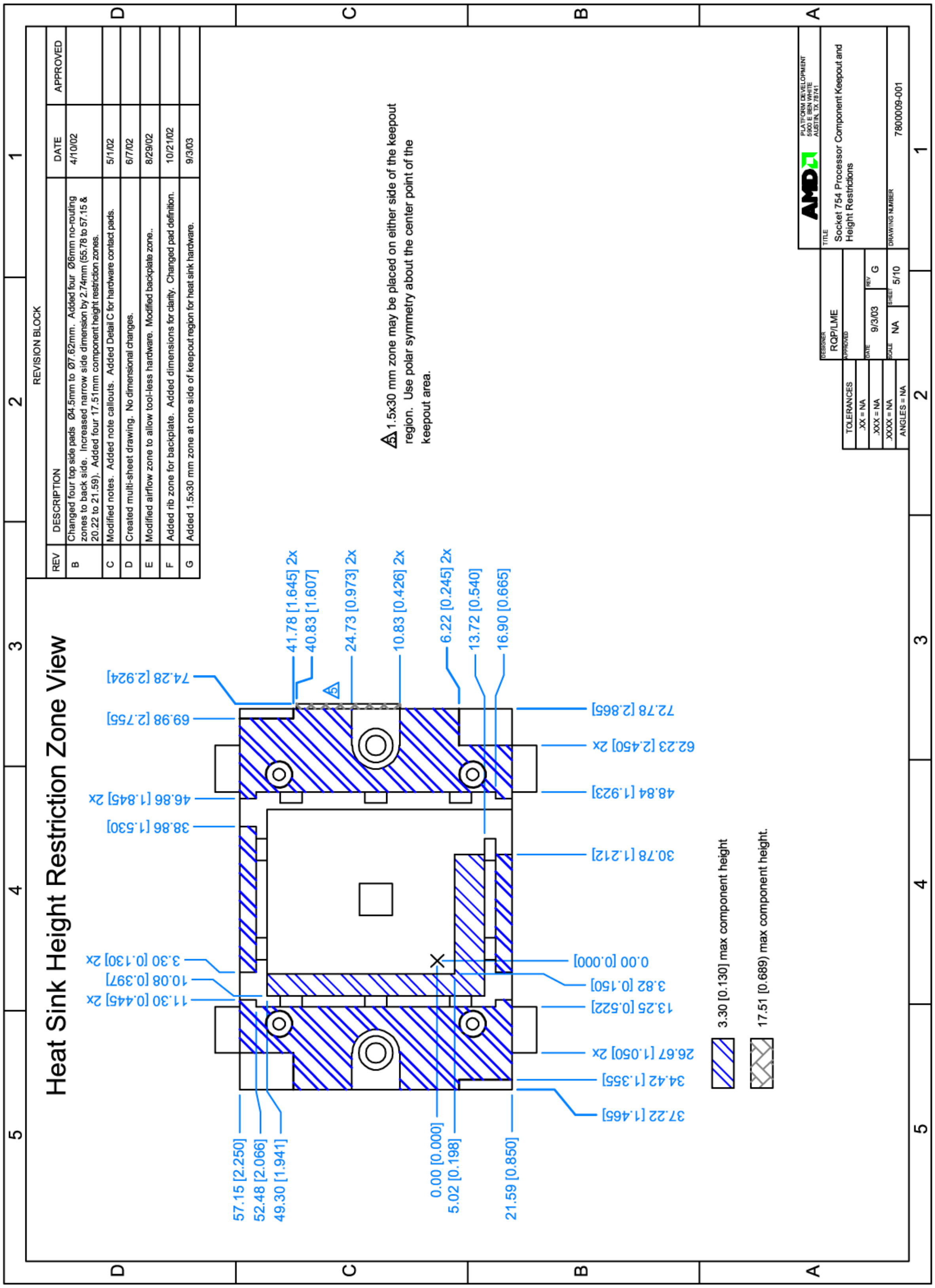
The ten drawing sheets in this section from page 58 through page 67 provide information for the motherboard component keep-out areas and height restrictions for the AMD Opteron processor based on the 940-pin socket.

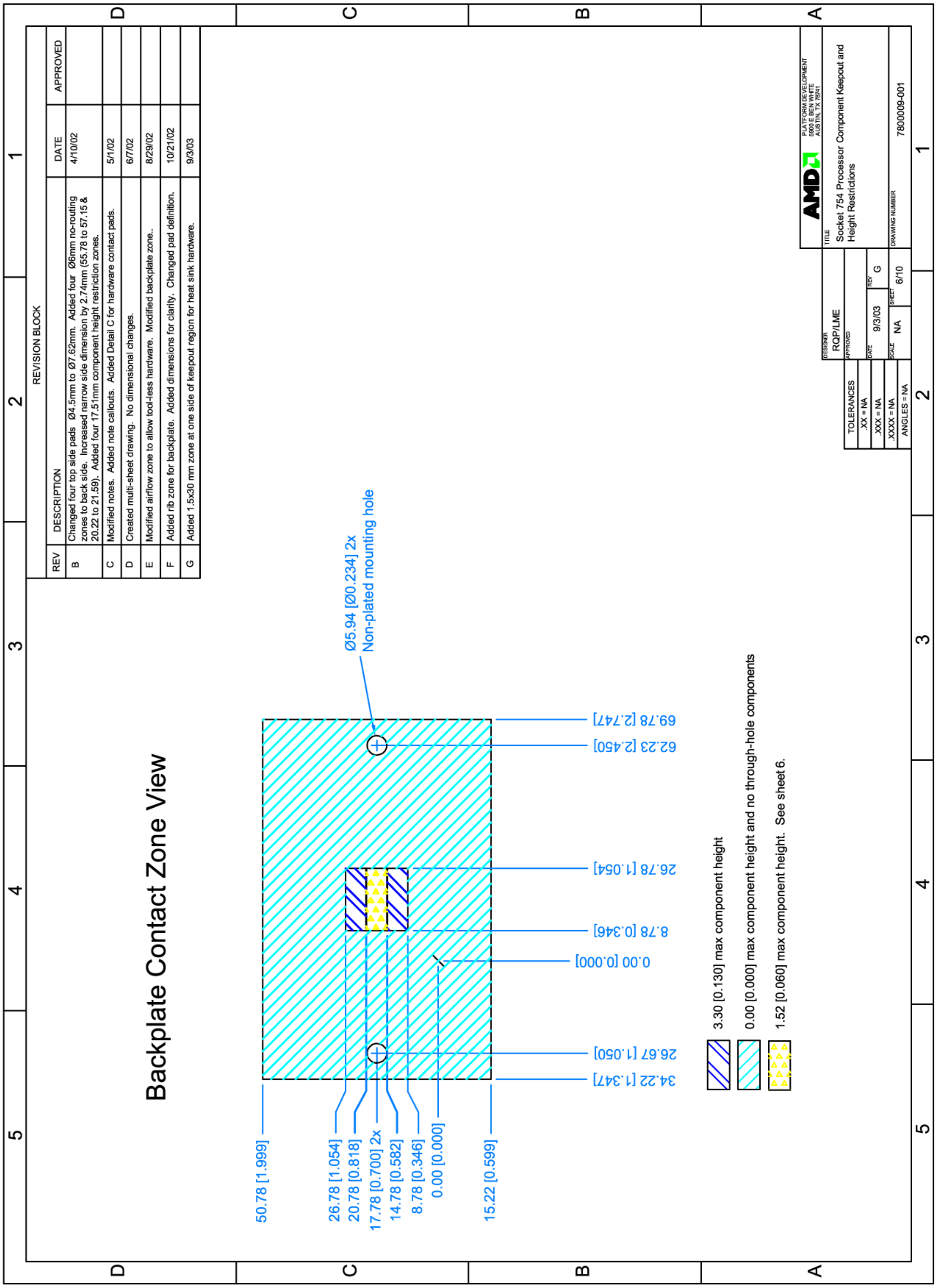

REVISION BLOCK
REV | DESCRIPTION | DATE | APPROVED
B | Changed four top side pads Ø4.5mm to Ø7.62mm. Added four Ø6mm no-routing zones to back side. Increased narrow side dimension by 2.74mm (55.78 to 57.15 & 20.22 to 21.59). Added four 17.51mm component height restriction zones. | 4/10/02
C | Modified notes. Added note callouts. Added Detail C for hardware contact pads. | 5/1/02
D | Created multi-sheet drawing. No dimensional changes. | 6/7/02
E | Modified airflow zone size to allow tool-less hardware. Modified backplate zone. | 8/29/02
F | Added rib zone for backplate. Added dimensions for clarity. Changed pad definition. | 10/21/02
G | Added 1.5x30 mm zone at one side of keepout region for heat sink hardware. | 9/3/03
Notes:
1. Hardware contact zones should be coplanar and have metalized pads.
2. Dimensions in MILLIMETERS [INCHES] unless otherwise specified.
3. Heat sink hardware mounting holes are not plated.
4. EMC ground pads can have up to 0.127[0.005] solder leveling.
5. 1.5x30 mm zone may be placed on either side of the keepout region. Use polar symmetry about the center point of the keepout area.
0.00 [0.000] max component height. See sheets 2, 3, & 4.
2.03 [0.080] max component height. See sheet 8.
3.30 [0.130] max component height. See sheets 3, 5, & 6.
20.00 [0.787] max component height. See sheet 9.
0.00 [0.000] max component height and no routing. See sheets 2 & 6.
0.00 [0.000] max component height and no through-hole components. See sheet 6.
1.52 [0.060] max component height. See sheet 6.
No through-hole components. See sheet 7.
17.51 [0.689] max component height. See sheet 5 & 10.
Board Top Side
Dimensions for zones contained on subsequent sheets of this drawing.
Board Bottom Side
TOLERANCES
.XX = NA
.XXX = NA
.XXXX = NA
ANGLES = NA
DESIGNER RQP/LME
APPROVED
DATE 9/3/03
SCALE NA
REV G
SHEET 1/10
AMD
PLATFORM DEVELOPMENT
5900 E BEN WHITE
AUSTIN, TX 78741
TITLE Socket 754 Processor Component Keepout and Height Restrictions
DRAWING NUMBER 7800009-001
A
B
C
D
1
2
3
4
5

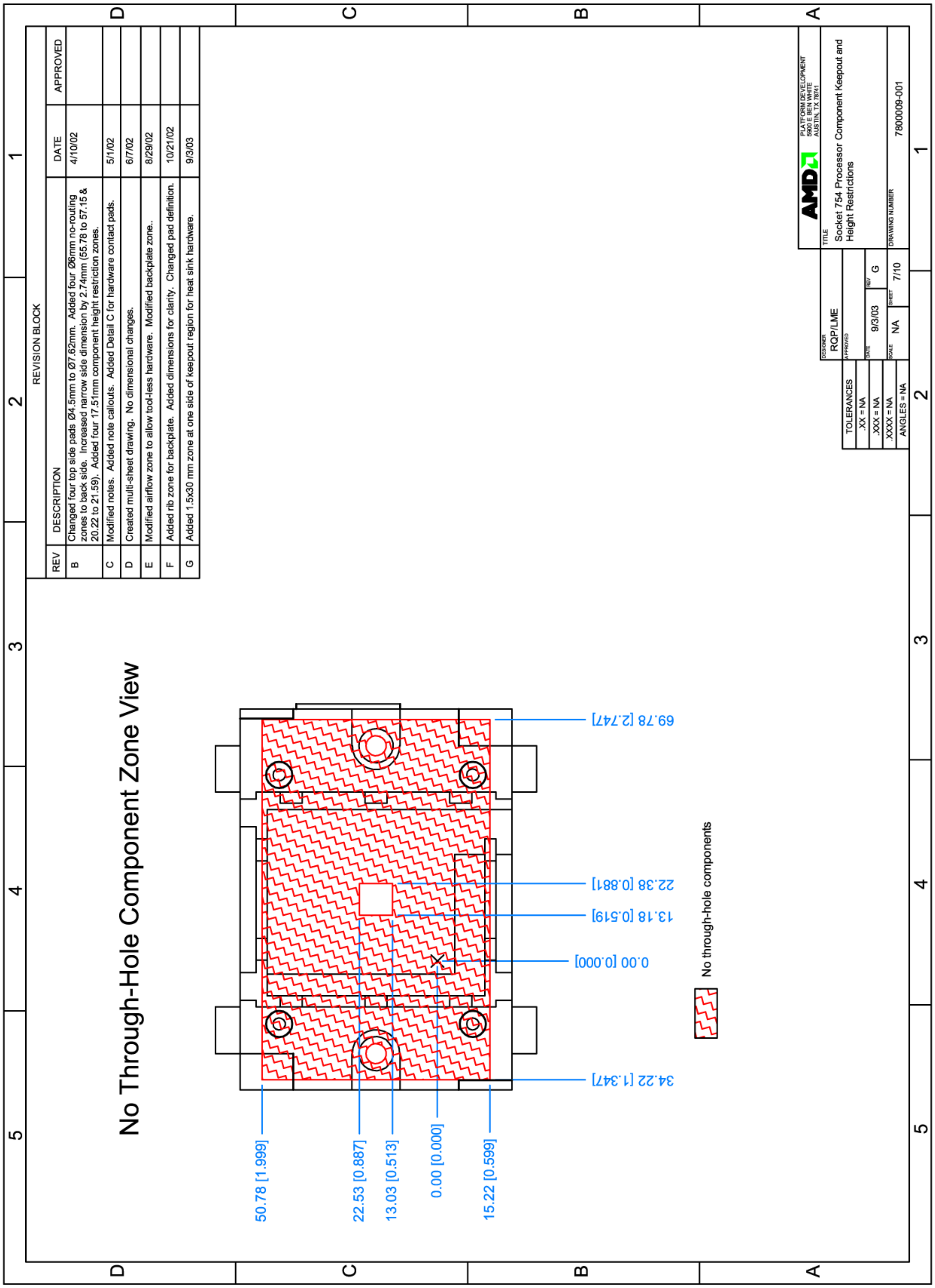

Mounting Holes, Contact Pads, and No Routing Zone View
REVISION BLOCK
REV | DESCRIPTION | DATE | APPROVED
B | Changed four top side pads Ø4.5mm to Ø7.62mm. Added four Ø6mm no-routing zones to back side. Increased narrow side dimension by 2.74mm (55.78 to 57.15 & 20.22 to 21.59). Added four 17.51mm component height restriction zones. | 4/10/02
C | Modified notes. Added note callouts. Added Detail C for hardware contact pads. | 5/1/02
D | Created multi-sheet drawing. No dimensional changes. | 6/7/02
E | Modified airflow zone to allow tool-less hardware. Modified backplate zone.. | 8/29/02
F | Added rib zone for backplate. Added dimensions for clarity. Changed pad definition. | 10/21/02
G | Added 1.5x30 mm zone at one side of keepout region for heat sink hardware. | 9/3/03
Ø10.00 [Ø0.394] 2x
Ø13.90 [Ø0.547] 2x
Ø5.94 [Ø0.234] 2x
Non-plated mounting hole
Ø7.62 [Ø0.300] 4x
See Detail C
72.78 [2.865]
62.23 [2.450]
53.78 [2.117] 2x
0.00 [0.000]
18.22 [0.717] 2x
26.67 [1.050]
45.78 [1.802] 2x
17.78 [0.700] 2x
0.00 [0.000]
10.22 [0.402] 2x
0.00 [0.000] max component height
0.00 [0.000] max complonent height and no routing
Detail C
Hardware Contact Pads
Ø7.62[Ø0.300]
Ø3.60[Ø0.142]
Solder coated copper
PLATFORM DEVELOPMENT
5900 E. BEN WHITE
AUSTIN, TX 78741
TITLE
Socket 754 Processor Component Keepout and Height Restrictions
DRAWING NUMBER
7800009-001
TOLERANCES
.XX = NA
.XXX = NA
.XXXX = NA
ANGLES = NA
DESIGNER
RQP/LME
APPROVED
DATE
9/3/03
REV
G
SCALE
NA
SHEET
2/10

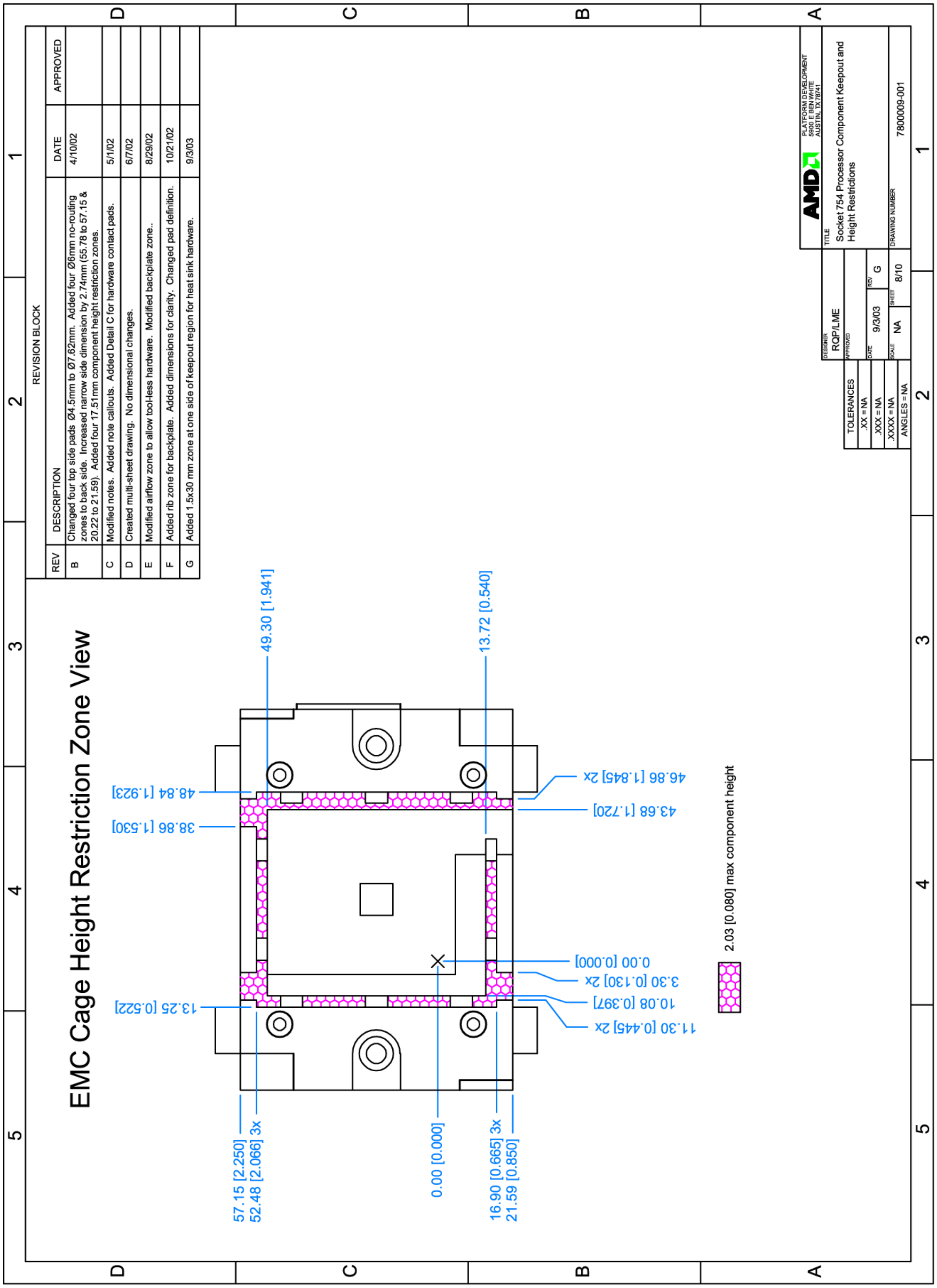

Socket Outline and Socket Window
Height Restriction Zone View
REVISION BLOCK
REV | DESCRIPTION | DATE | APPROVED
B | Changed four top side pads Ø4.5mm to Ø7.62mm. Added four Ø6mm no-routing zones to back side. Increased narrow side dimension by 2.74mm (55.78 to 57.15 & 20.22 to 21.59). Added four 17.51mm component height restriction zones. | 4/10/02
C | Modified notes. Added note callouts. Added Detail C for hardware contact pads. | 5/1/02
D | Created multi-sheet drawing. No dimensional changes. | 6/7/02
E | Modified airflow zone to allow tool-less hardware. Modified backplate zone.. | 8/29/02
F | Added rib zone for backplate. Added dimensions for clarity. Changed pad definition. | 10/21/02
G | Added 1.5x30 mm zone at one side of keepout region for heat sink hardware. | 9/3/03
22.53 [0.887]
13.03 [0.513]
43.68 [1.720]
30.78 [1.212]
22.38 [0.881]
17.78 [0.700]
13.18 [0.519]
0.00 [0.000]
3.82 [0.150]
49.30 [1.941]
17.78 [0.700]
0.00 [0.000]
5.02 [0.198]
21.59 [0.850]
0.00 [0.000] max component height
3.30 [0.130] max component height
PLATFORM DEVELOPMENT
5900 E BEN WHITE
AUSTIN, TX 78741
TITLE
Socket 754 Processor Component Keepout and Height Restrictions
DESIGNER RQP/LME
APPROVED
DATE 9/3/03
REV G
SCALE NA
SHEET 3/10
DRAWING NUMBER 7800009-001
TOLERANCES
.XX = NA
.XXX = NA
.XXXX = NA
ANGLES = NA

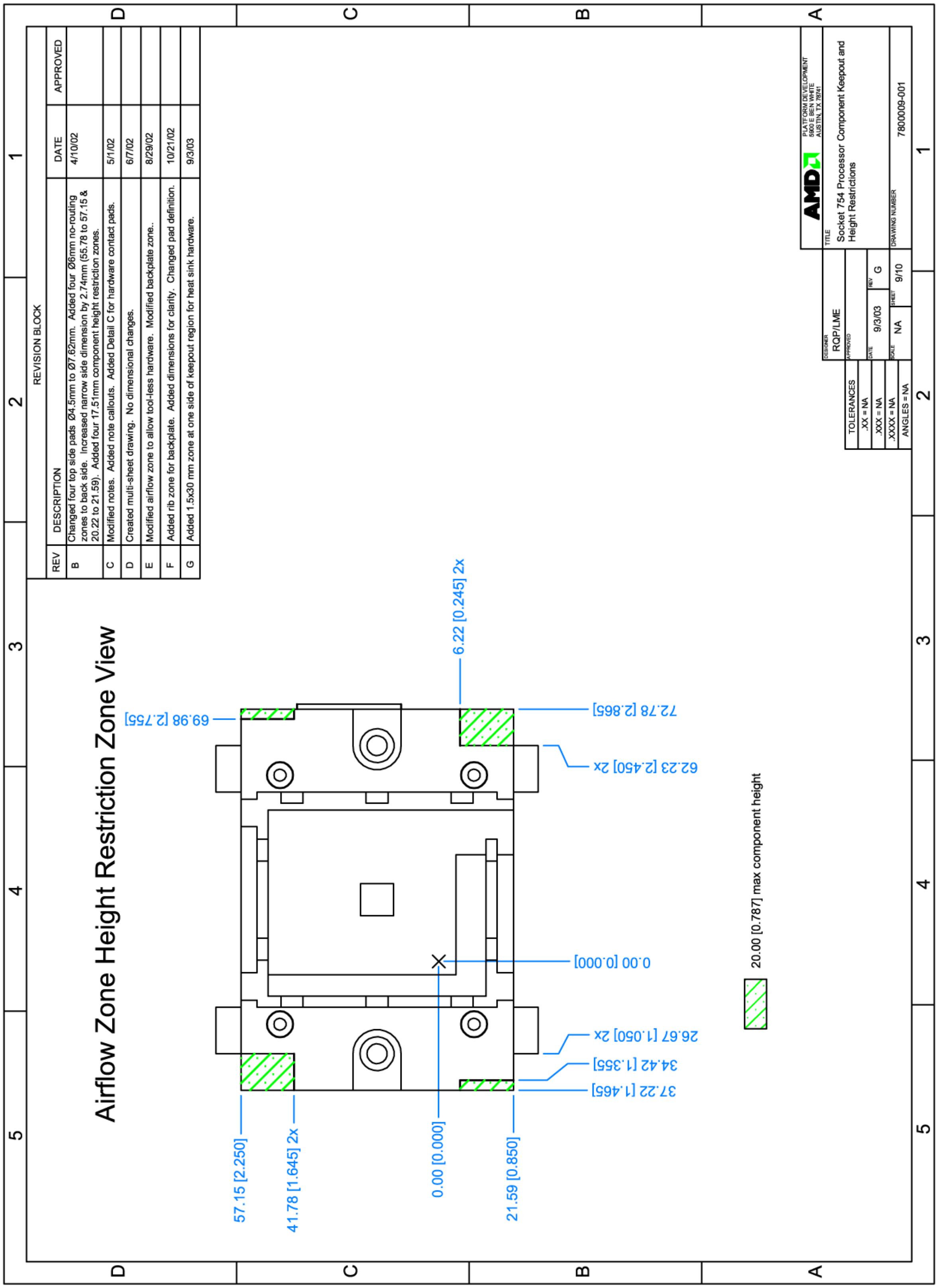

EMC Cage Grounding Pad Location and Geometry View
REVISION BLOCK
REV | DESCRIPTION | DATE | APPROVED
B | Changed four top side pads Ø4.5mm to Ø7.62mm. Added four Ø6mm no-routing zones to back side. Increased narrow side dimension by 2.74mm (55.78 to 57.15 & 20.22 to 21.59). Added four 17.51mm component height restriction zones. | 4/10/02
C | Modified notes. Added note callouts. Added Detail C for hardware contact pads. | 5/1/02
D | Created multi-sheet drawing. No dimensional changes. | 6/7/02
E | Modified airflow zone to allow tool-less hardware. Modified backplate zone. | 8/29/02
F | Added rib zone for backplate. Added dimensions for clarity. Changed pad defintion. | 10/21/02
G | Added 1.5x30 mm zone at one side of keepout region for heat sink hardware. | 9/3/03
EMC Ground Pad Keepout 10x
See Details A and B for pads
52.48 [2.066]
49.30 [1.941]
3.55 [0.140] 2x
9.90 [0.390] 2x
6.61 [0.260] 2x
0.26 [0.010] 2x
48.84 [1.923]
45.66 [1.798]
35.30 [1.390] 2x
28.95 [1.140] 2x
0.00 [0.000]
10.08 [0.397]
13.25 [0.522]
45.46 [1.790] 2x
39.11 [1.540] 2x
20.96 [0.825] 2x
14.61 [0.575] 2x
0.00 [0.000]
13.72 [0.540]
16.90 [0.665]
Detail A Grounding Pad Locations
50.89 [2.004] 2x
42.29 [1.665] 2x
17.78 [0.700] 2x
0.00 [0.000]
6.73 [0.265] 2x
15.31 [0.603] 2x
47.25 [1.860] 3x
32.13 [1.265] 2x
3.43 [0.135] 2x
0.00 [0.000]
11.66 [0.459] 3x
3.18 [0.125] 10x
3.18 [0.125] 10x
6.36 [0.250] 10x
A1 location
Detail B
Grounding Pad Geometry
No Components
3.18 [0.125]
3.18 [0.125]
Metalized pad
1.00 [0.039]
6.36 [0.250]
1.00 [0.039]
3.18 [0.125]
Ground via zones
3.18 [0.125]
0.00 [0.000] max component height
TOLERANCES
.XX = NA
.XXX = NA
.XXXX = NA
ANGLES = NA
DESIGNER RQP/LME
DATE 9/3/03
SCALE NA
REV G
SHEET 4/10
AMD
PLATFORM DEVELOPMENT
5900 E BEN WHITE
AUSTIN, TX 78741
TITLE Socket 754 Processor Component Keepout and Height Restrictions
DRAWING NUMBER 7800009-001

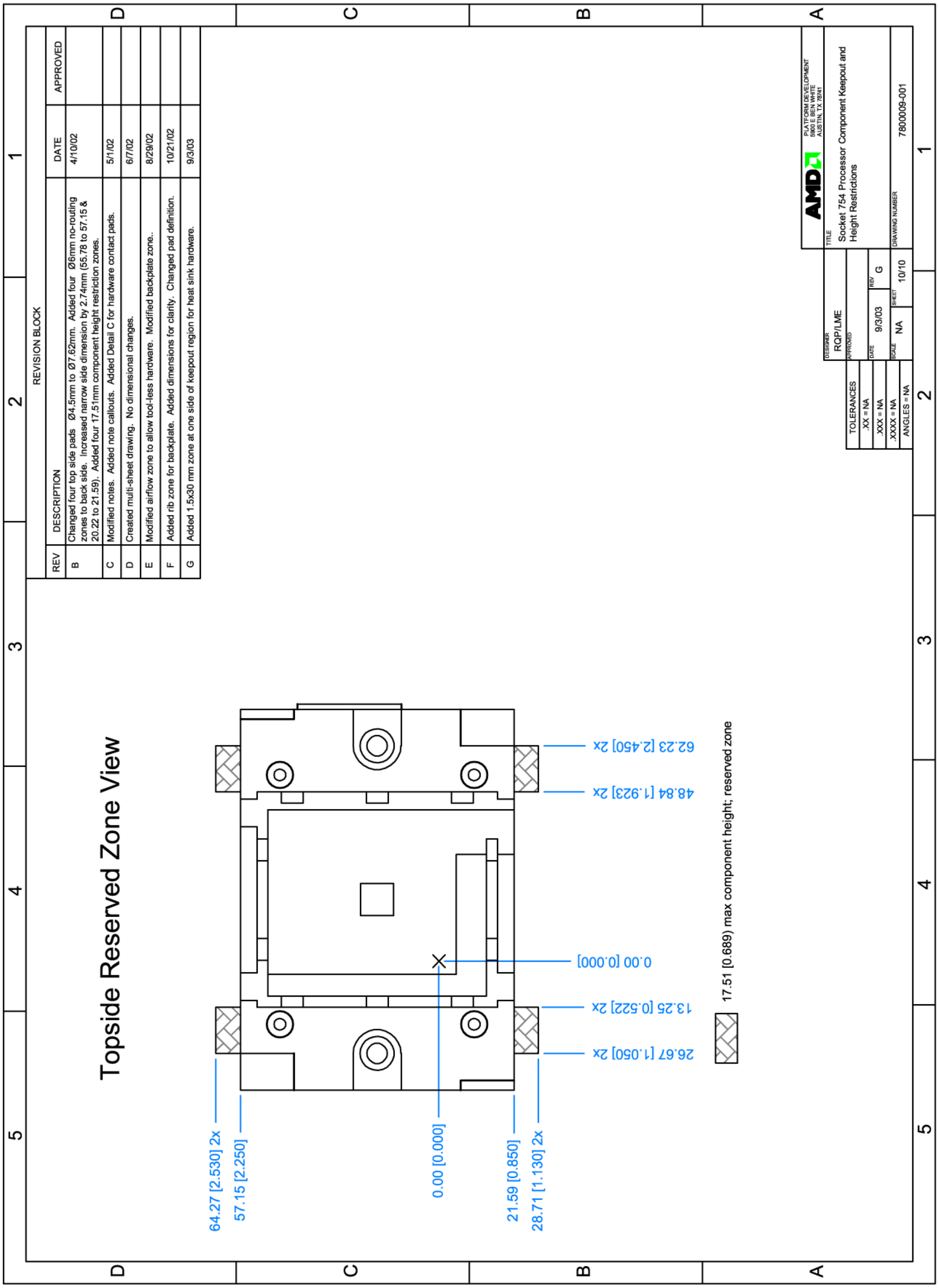

Heat Sink Height Restriction Zone View
REVISION BLOCK
REV DESCRIPTION DATE APPROVED
B Changed four top side pads Ø4.5mm to Ø7.62mm. Added four Ø6mm no-routing zones to back side. Increased narrow side dimension by 2.74mm (55.78 to 57.15 & 20.22 to 21.59). Added four 17.51mm component height restriction zones. 4/10/02
C Modified notes. Added note callouts. Added Detail C for hardware contact pads. 5/1/02
D Created multi-sheet drawing. No dimensional changes. 6/7/02
E Modified airflow zone to allow tool-less hardware. Modified backplate zone.. 8/29/02
F Added rib zone for backplate. Added dimensions for clarity. Changed pad definition. 10/21/02
G Added 1.5x30 mm zone at one side of keepout region for heat sink hardware. 9/3/03
1.5x30 mm zone may be placed on either side of the keepout region. Use polar symmetry about the center point of the keepout area.
41.78 [1.645] 2x
40.83 [1.607]
24.73 [0.973] 2x
10.83 [0.426] 2x
6.22 [0.245] 2x
13.72 [0.540]
16.90 [0.665]
74.28 [2.924]
69.98 [2.755]
46.86 [1.845] 2x
38.86 [1.530]
3.30 [0.130] 2x
10.08 [0.397]
11.30 [0.445] 2x
72.78 [2.865]
62.23 [2.450] 2x
48.84 [1.923]
30.78 [1.212]
0.00 [0.000]
3.82 [0.150]
13.25 [0.522]
26.67 [1.050] 2x
34.42 [1.355]
37.22 [1.465]
57.15 [2.250]
52.48 [2.066]
49.30 [1.941]
0.00 [0.000]
5.02 [0.198]
21.59 [0.850]
3.30 [0.130] max component height
17.51 [0.689] max component height.
TOLERANCES
.XX = NA
.XXX = NA
.XXXX = NA
ANGLES = NA
DESIGNER RQP/LME
APPROVED
DATE 9/3/03
REV G
SCALE NA
SHEET 5/10
PLATFORM DEVELOPMENT
5900 E BEN WHITE
AUSTIN, TX 78741
TITLE
Socket 754 Processor Component Keepout and Height Restrictions
DRAWING NUMBER
7800009-001

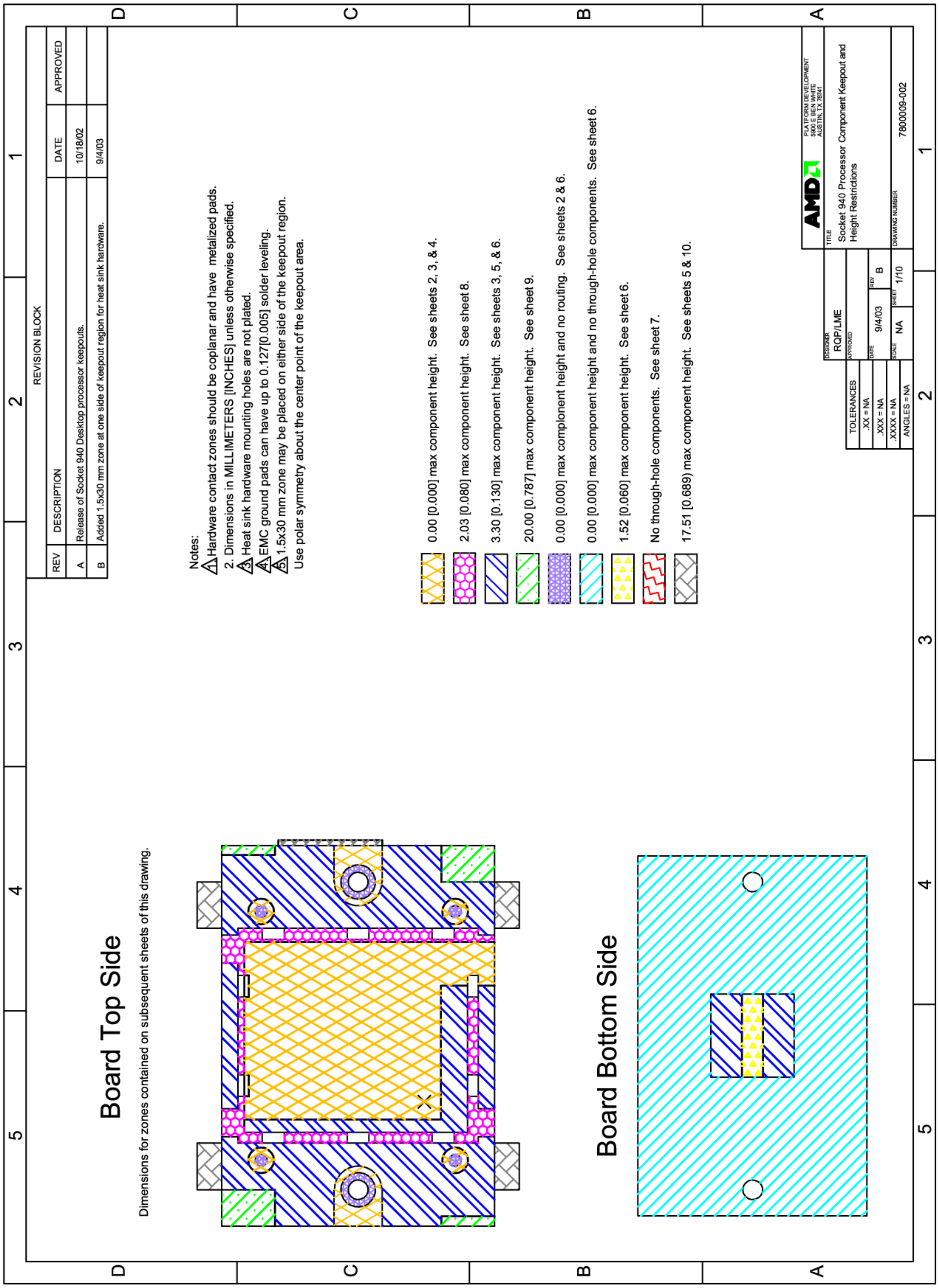

REVISION BLOCK
REV DESCRIPTION DATE APPROVED
B Changed four top side pads Ø4.5mm to Ø7.62mm. Added four Ø6mm no-routing zones to back side. Increased narrow side dimension by 2.74mm (55.78 to 57.15 & 20.22 to 21.59). Added four 17.51mm component height restriction zones. 4/10/02
C Modified notes. Added note callouts. Added Detail C for hardware contact pads. 5/1/02
D Created multi-sheet drawing. No dimensional changes. 6/7/02
E Modified airflow zone to allow tool-less hardware. Modified backplate zone.. 8/29/02
F Added rib zone for backplate. Added dimensions for clarity. Changed pad definition. 10/21/02
G Added 1.5x30 mm zone at one side of keepout region for heat sink hardware. 9/3/03
Backplate Contact Zone View
Ø5.94 [Ø0.234] 2x
Non-plated mounting hole
69.78 [2.747]
62.23 [2.450]
26.78 [1.054]
8.78 [0.346]
0.00 [0.000]
26.67 [1.050]
34.22 [1.347]
50.78 [1.999]
26.78 [1.054]
20.78 [0.818]
17.78 [0.700] 2x
14.78 [0.582]
8.78 [0.346]
0.00 [0.000]
15.22 [0.599]
3.30 [0.130] max component height
0.00 [0.000] max component height and no through-hole components
1.52 [0.060] max component height. See sheet 6.
PLATFORM DEVELOPMENT
5900 E BEN WHITE
AUSTIN, TX 78741
TITLE
Socket 754 Processor Component Keepout and Height Restrictions
DESIGNER RQP/LME
DATE 9/3/03
REV G
SCALE NA
SHEET 6/10
DRAWING NUMBER 7800009-001
TOLERANCES
.XX = NA
.XXX = NA
.XXXX = NA
ANGLES = NA

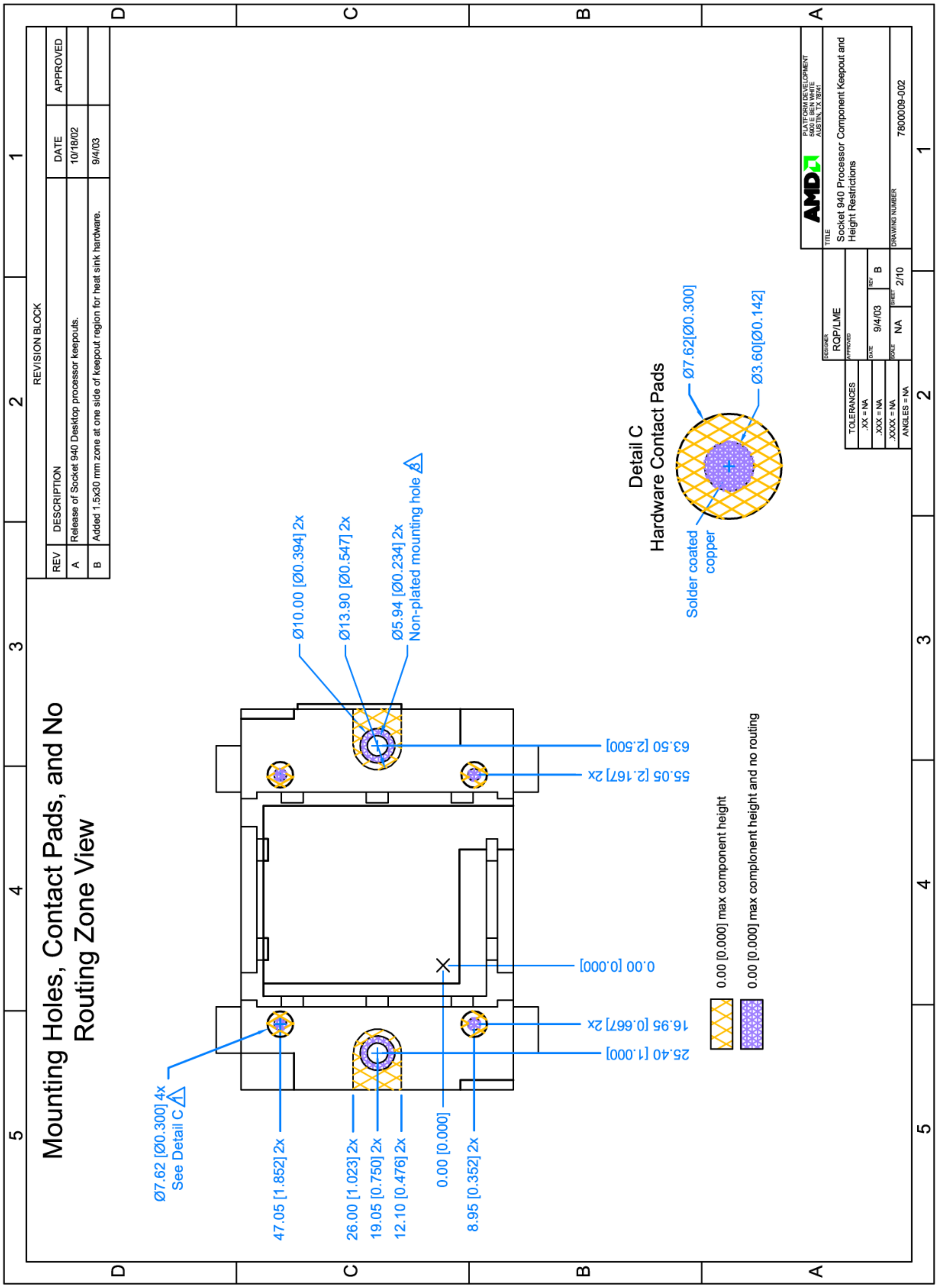

No Through-Hole Component Zone View
REVISION BLOCK
REV
DESCRIPTION
DATE
APPROVED
B
Changed four top side pads Ø4.5mm to Ø7.62mm. Added four Ø6mm no-routing zones to back side. Increased narrow side dimension by 2.74mm (55.78 to 57.15 & 20.22 to 21.59). Added four 17.51mm component height restriction zones.
4/10/02
C
Modified notes. Added note callouts. Added Detail C for hardware contact pads.
5/1/02
D
Created multi-sheet drawing. No dimensional changes.
6/7/02
E
Modified airflow zone to allow tool-less hardware. Modified backplate zone..
8/29/02
F
Added rib zone for backplate. Added dimensions for clarity. Changed pad definition.
10/21/02
G
Added 1.5x30 mm zone at one side of keepout region for heat sink hardware.
9/3/03
69.78 [2.747]
22.38 [0.881]
13.18 [0.519]
0.00 [0.000]
34.22 [1.347]
50.78 [1.999]
22.53 [0.887]
13.03 [0.513]
0.00 [0.000]
15.22 [0.599]
No through-hole components
PLATFORM DEVELOPMENT
5900 E BEN WHITE
AUSTIN, TX 78741
TITLE
Socket 754 Processor Component Keepout and Height Restrictions
DESIGNER
RQP/LME
APPROVED
DATE
9/3/03
REV
G
SCALE
NA
SHEET
7/10
DRAWING NUMBER
7800009-001
TOLERANCES
.XX = NA
.XXX = NA
.XXXX = NA
ANGLES = NA
A
B
C
D
1
2
3
4
5

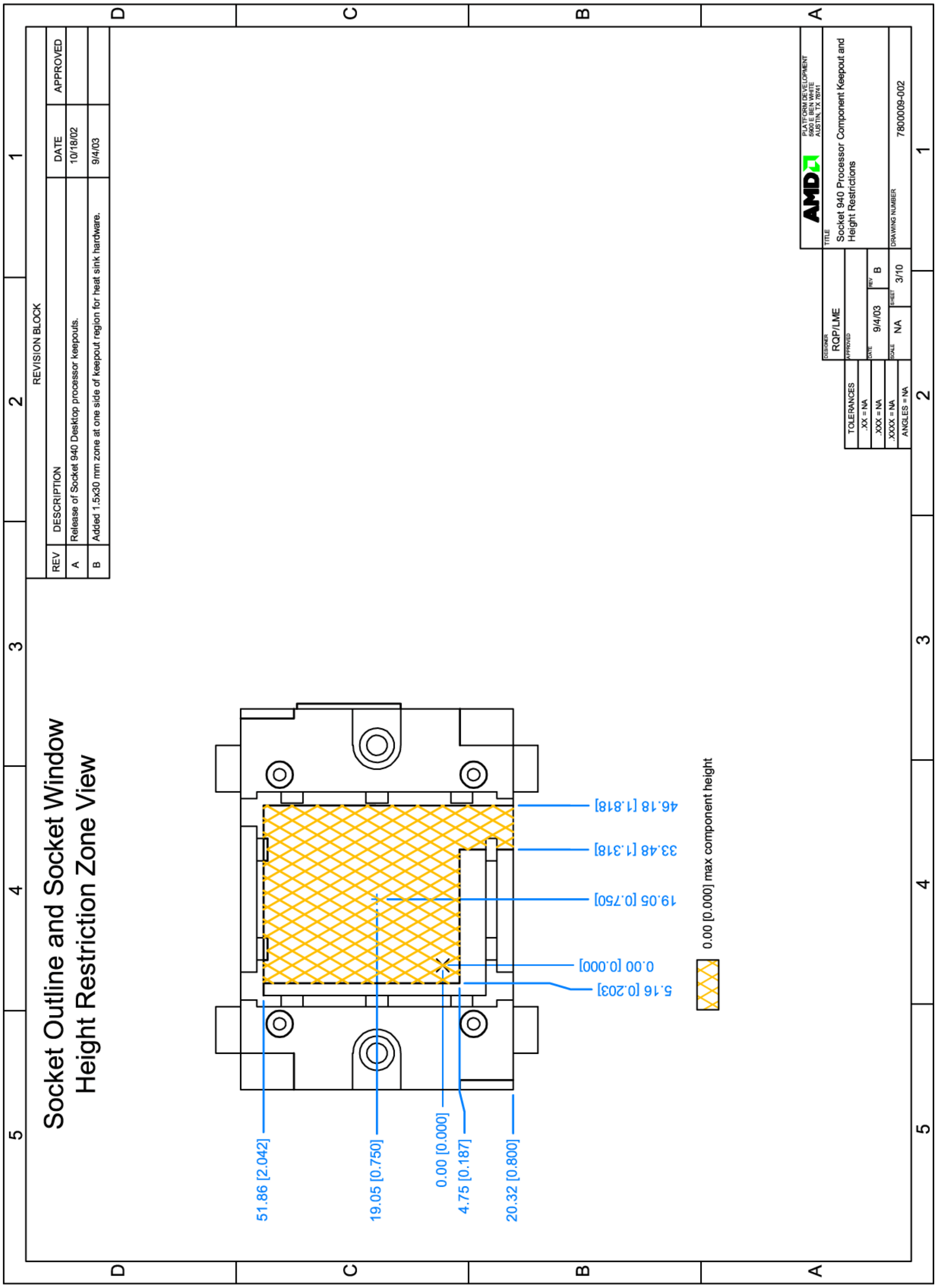

EMC Cage Height Restriction Zone View
REVISION BLOCK
REV | DESCRIPTION | DATE | APPROVED
B | Changed four top side pads Ø4.5mm to Ø7.62mm. Added four Ø6mm no-routing zones to back side. Increased narrow side dimension by 2.74mm (55.78 to 57.15 & 20.22 to 21.59). Added four 17.51mm component height restriction zones. | 4/10/02
C | Modified notes. Added note callouts. Added Detail C for hardware contact pads. | 5/1/02
D | Created multi-sheet drawing. No dimensional changes. | 6/7/02
E | Modified airflow zone to allow tool-less hardware. Modified backplate zone.. | 8/29/02
F | Added rib zone for backplate. Added dimensions for clarity. Changed pad definition. | 10/21/02
G | Added 1.5x30 mm zone at one side of keepout region for heat sink hardware. | 9/3/03
13.25 [0.522]
38.86 [1.530]
48.84 [1.923]
57.15 [2.250]
52.48 [2.066] 3x
49.30 [1.941]
0.00 [0.000]
16.90 [0.665] 3x
21.59 [0.850]
13.72 [0.540]
11.30 [0.445] 2x
10.08 [0.397]
3.30 [0.130] 2x
0.00 [0.000]
43.68 [1.720]
46.86 [1.845] 2x
2.03 [0.080] max component height
TOLERANCES
.XX = NA
.XXX = NA
.XXXX = NA
ANGLES = NA
DESIGNER RQP/LME
APPROVED
DATE 9/3/03
REV G
SCALE NA
SHEET 8/10
PLATFORM DEVELOPMENT
5900 E BEN WHITE
AUSTIN, TX 78741
TITLE
Socket 754 Processor Component Keepout and Height Restrictions
DRAWING NUMBER 7800009-001

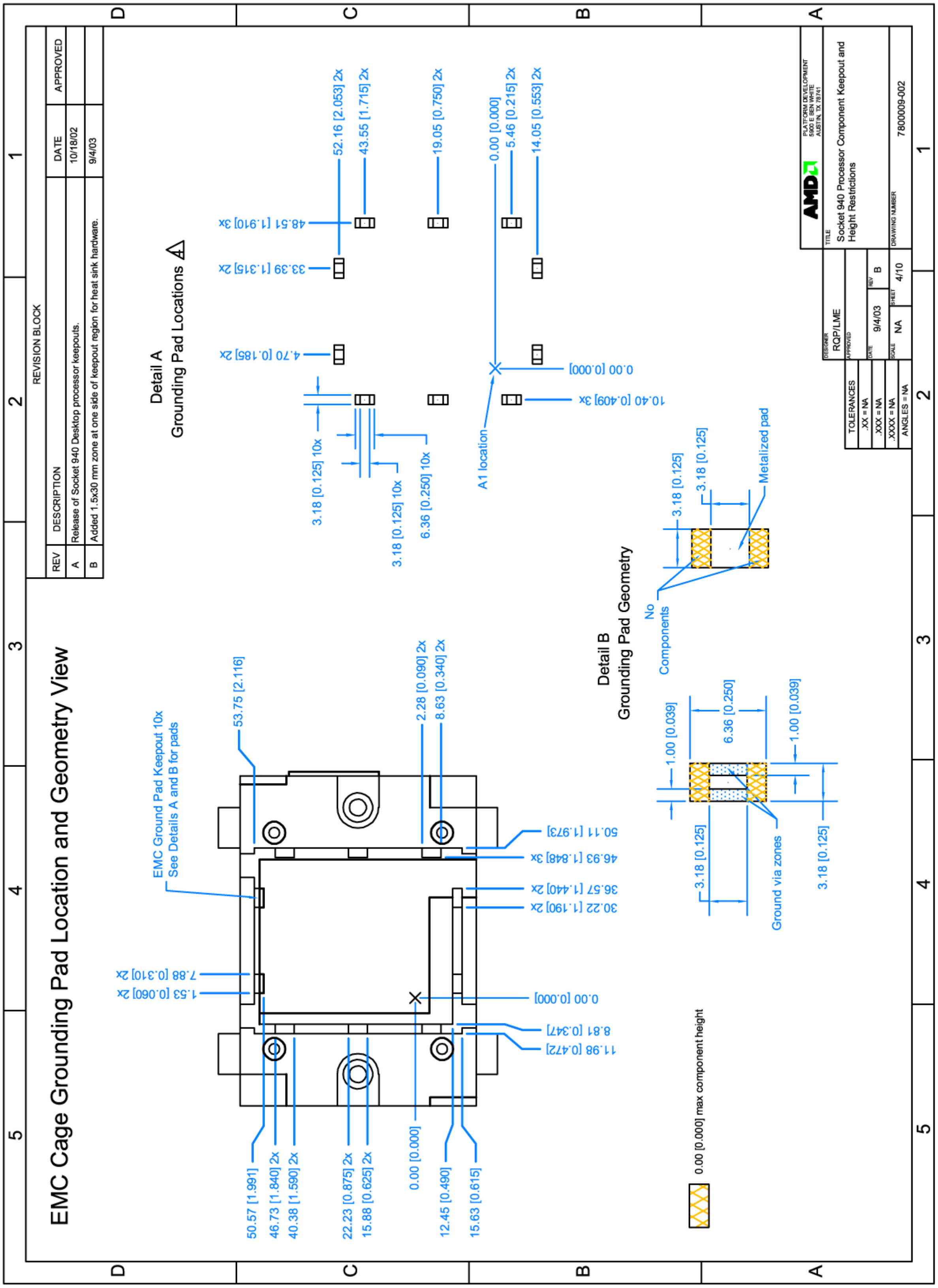

Airflow Zone Height Restriction Zone View
57.15 [2.250]
41.78 [1.645] 2x
0.00 [0.000]
21.59 [0.850]
69.98 [2.755]
6.22 [0.245] 2x
37.22 [1.465]
34.42 [1.355]
26.67 [1.050] 2x
0.00 [0.000]
62.23 [2.450] 2x
72.78 [2.865]
20.00 [0.787] max component height
REVISION BLOCK
REV DESCRIPTION DATE APPROVED
B Changed four top side pads Ø4.5mm to Ø7.62mm. Added four Ø6mm no-routing zones to back side. Increased narrow side dimension by 2.74mm (55.78 to 57.15 & 20.22 to 21.59). Added four 17.51mm component height restriction zones. 4/10/02
C Modified notes. Added note callouts. Added Detail C for hardware contact pads. 5/1/02
D Created multi-sheet drawing. No dimensional changes. 6/7/02
E Modified airflow zone to allow tool-less hardware. Modified backplate zone.. 8/29/02
F Added rib zone for backplate. Added dimensions for clarity. Changed pad definition. 10/21/02
G Added 1.5x30 mm zone at one side of keepout region for heat sink hardware. 9/3/03
TOLERANCES
.XX = NA
.XXX = NA
.XXXX = NA
ANGLES = NA
DESIGNER RQP/LME
APPROVED
DATE 9/3/03
REV G
SCALE NA
SHEET 9/10
PLATFORM DEVELOPMENT
5900 E BEN WHITE
AUSTIN, TX 78741
TITLE Socket 754 Processor Component Keepout and Height Restrictions
DRAWING NUMBER 7800009-001

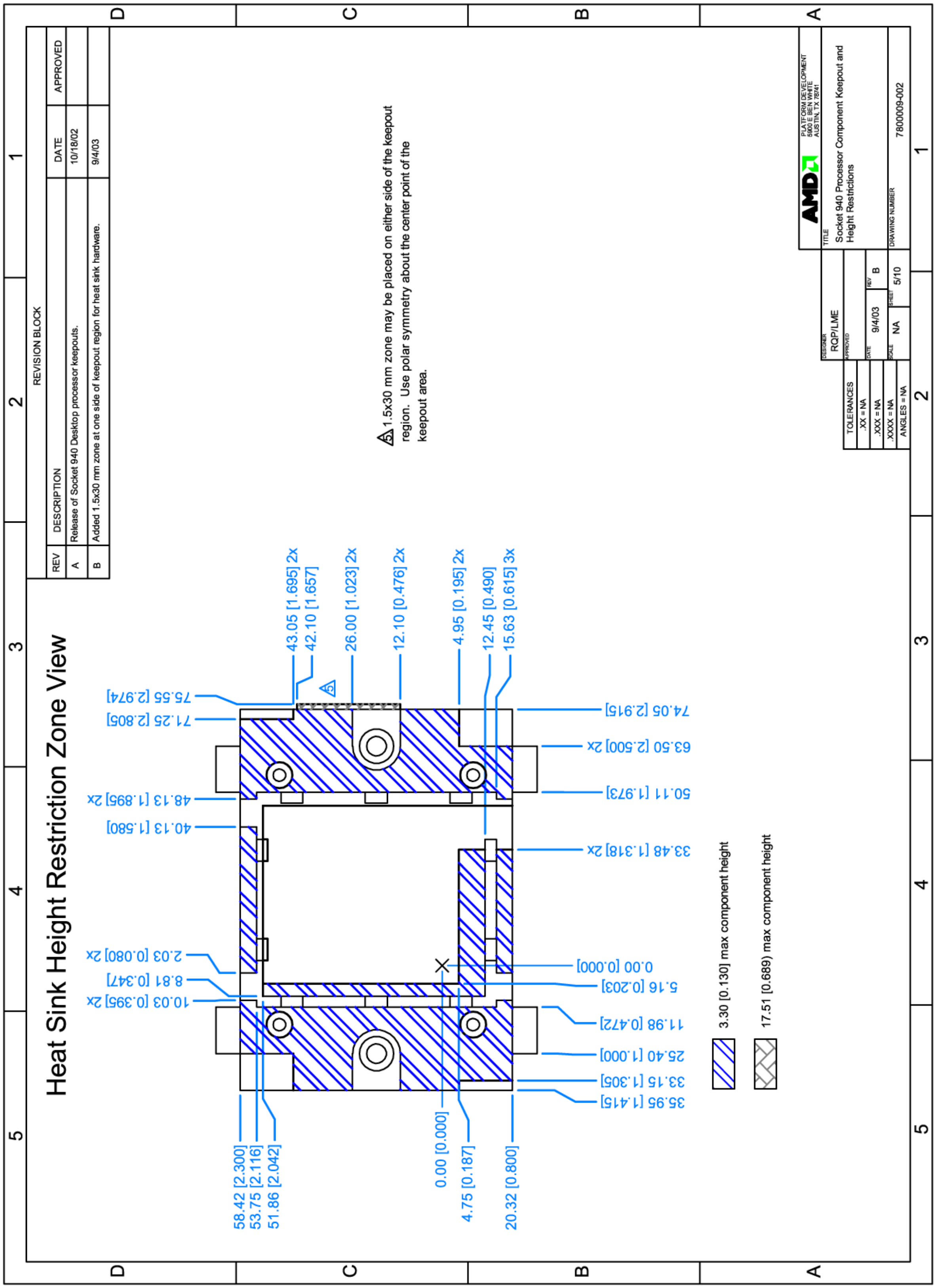

REVISION BLOCK
REV DESCRIPTION DATE APPROVED
B Changed four top side pads Ø4.5mm to Ø7.62mm. Added four Ø6mm no-routing zones to back side. Increased narrow side dimension by 2.74mm (55.78 to 57.15 & 20.22 to 21.59). Added four 17.51mm component height restriction zones. 4/10/02
C Modified notes. Added note callouts. Added Detail C for hardware contact pads. 5/1/02
D Created multi-sheet drawing. No dimensional changes. 6/7/02
E Modified airflow zone to allow tool-less hardware. Modified backplate zone.. 8/29/02
F Added rib zone for backplate. Added dimensions for clarity. Changed pad definition. 10/21/02
G Added 1.5x30 mm zone at one side of keepout region for heat sink hardware. 9/3/03
Topside Reserved Zone View
62.23 [2.450] 2x
48.84 [1.923] 2x
0.00 [0.000]
13.25 [0.522] 2x
26.67 [1.050] 2x
64.27 [2.530] 2x
57.15 [2.250]
0.00 [0.000]
21.59 [0.850]
28.71 [1.130] 2x
17.51 [0.689] max component height; reserved zone
TOLERANCES
.XX = NA
.XXX = NA
.XXXX = NA
ANGLES = NA
DESIGNER RQP/LME
APPROVED
DATE 9/3/03
REV G
SCALE NA
SHEET 10/10
TITLE Socket 754 Processor Component Keepout and Height Restrictions
DRAWING NUMBER 7800009-001
A B C D
1 2 3 4 5

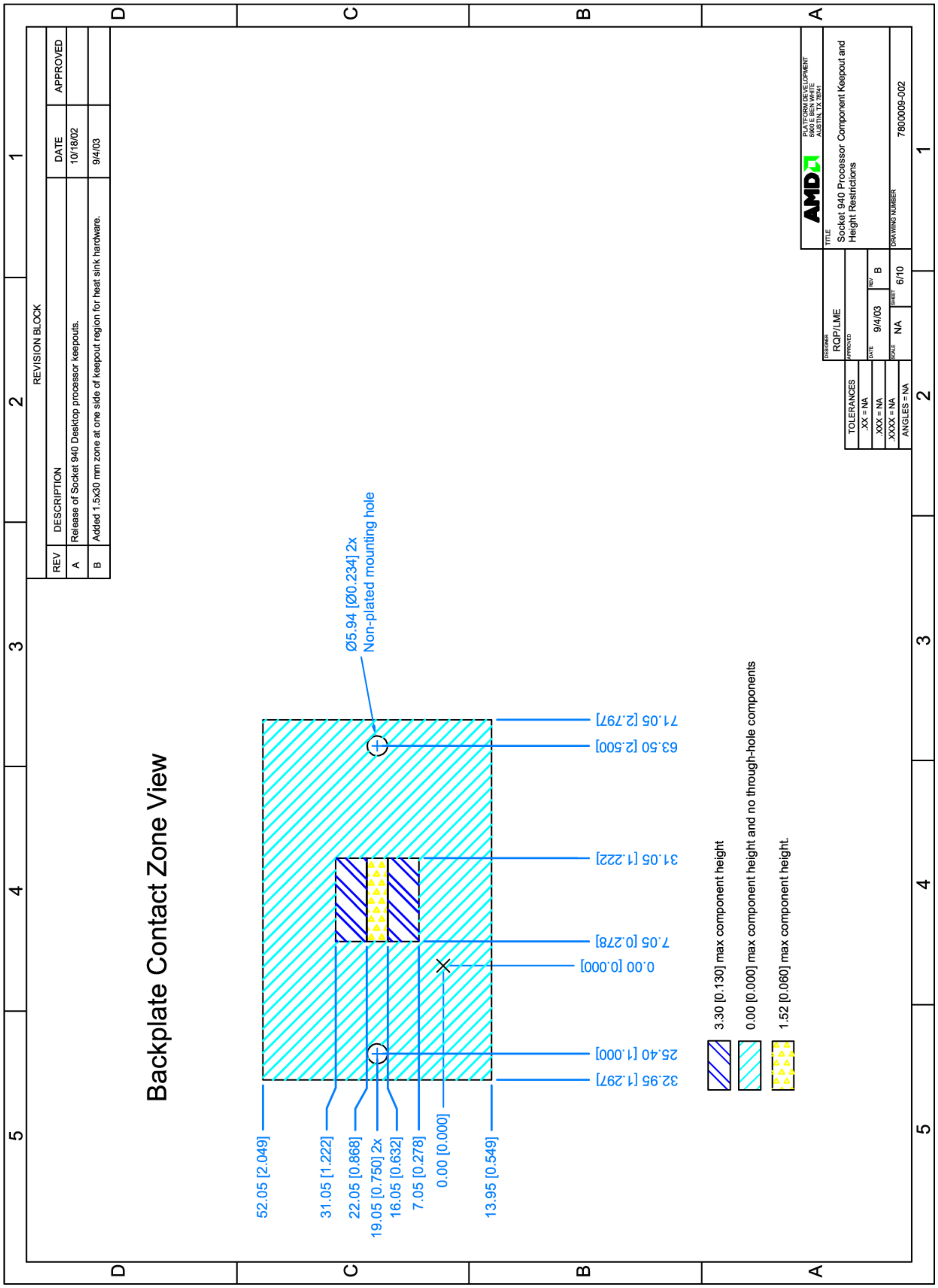

REVISION BLOCK
REV | DESCRIPTION | DATE | APPROVED
A | Release of Socket 940 Desktop processor keepouts. | 10/18/02
B | Added 1.5x30 mm zone at one side of keepout region for heat sink hardware. | 9/4/03
Notes:
1. Hardware contact zones should be coplanar and have metalized pads.
2. Dimensions in MILLIMETERS [INCHES] unless otherwise specified.
3. Heat sink hardware mounting holes are not plated.
4. EMC ground pads can have up to 0.127[0.005] solder leveling.
5. 1.5x30 mm zone may be placed on either side of the keepout region.
Use polar symmetry about the center point of the keepout area.
0.00 [0.000] max component height. See sheets 2, 3, & 4.
2.03 [0.080] max component height. See sheet 8.
3.30 [0.130] max component height. See sheets 3, 5, & 6.
20.00 [0.787] max component height. See sheet 9.
0.00 [0.000] max complonent height and no routing. See sheets 2 & 6.
0.00 [0.000] max component height and no through-hole components. See sheet 6.
1.52 [0.060] max component height. See sheet 6.
No through-hole components. See sheet 7.
17.51 [0.689] max component height. See sheets 5 & 10.
Board Top Side
Dimensions for zones contained on subsequent sheets of this drawing.
Board Bottom Side
TOLERANCES
.XX = NA
.XXX = NA
.XXXX = NA
ANGLES = NA
DESIGNER RQP/LME
APPROVED
DATE 9/4/03
REV B
SCALE NA
SHEET 1/10
AMD
PLATFORM DEVELOPMENT
5900 E BEN WHITE
AUSTIN, TX 78741
TITLE Socket 940 Processor Component Keepout and Height Restrictions
DRAWING NUMBER 7800009-002
A B C D
1 2 3 4 5

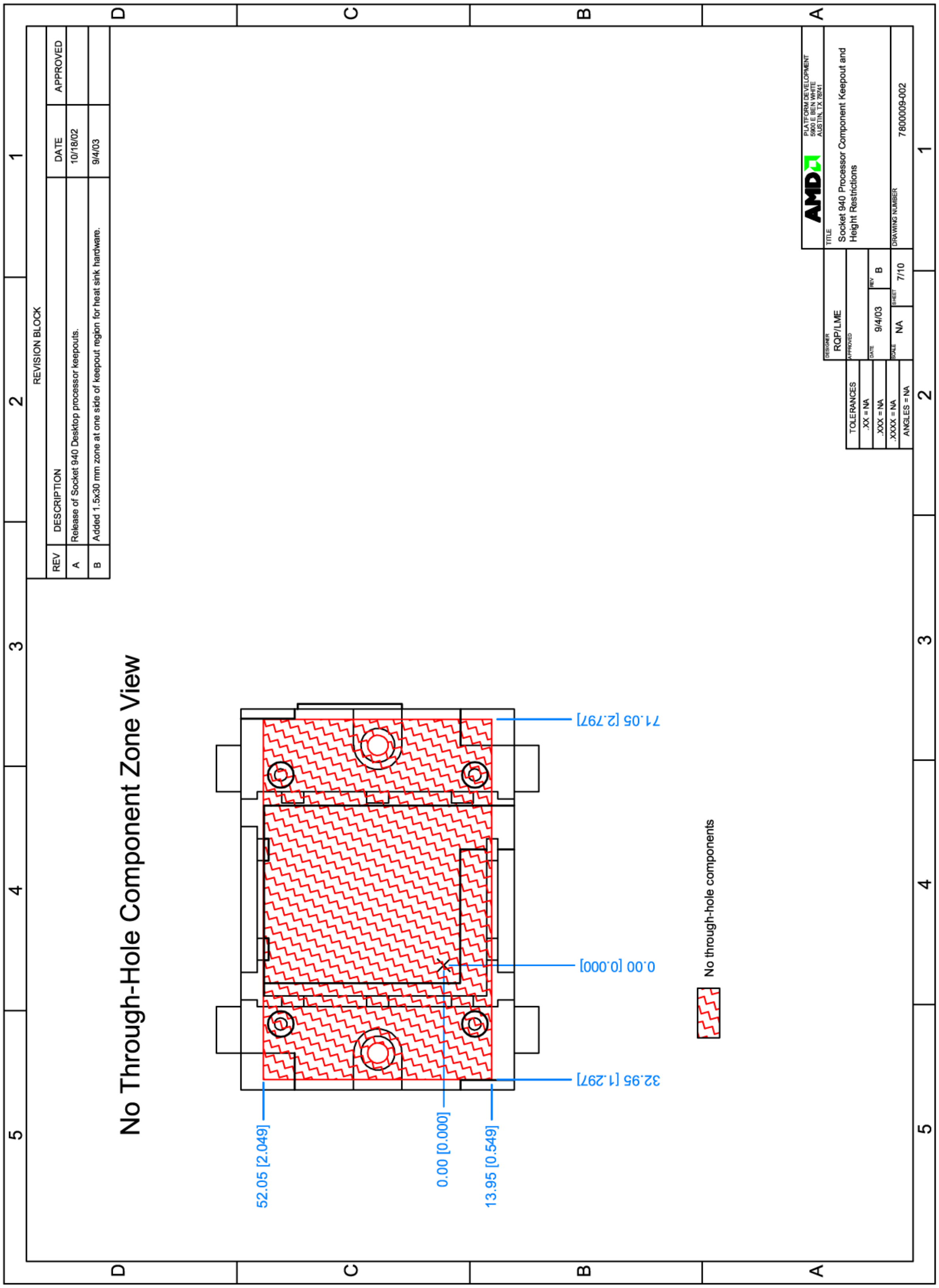

Mounting Holes, Contact Pads, and No Routing Zone View
REVISION BLOCK
REV
DESCRIPTION
DATE
APPROVED
A
Release of Socket 940 Desktop processor keepouts.
10/18/02
B
Added 1.5x30 mm zone at one side of keepout region for heat sink hardware.
9/4/03
Ø7.62 [Ø0.300] 4x
See Detail C
Ø10.00 [Ø0.394] 2x
Ø13.90 [Ø0.547] 2x
Ø5.94 [Ø0.234] 2x
Non-plated mounting hole
63.50 [2.500]
55.05 [2.167] 2x
0.00 [0.000]
16.95 [0.667] 2x
25.40 [1.000]
47.05 [1.852] 2x
26.00 [1.023] 2x
19.05 [0.750] 2x
12.10 [0.476] 2x
0.00 [0.000]
8.95 [0.352] 2x
Detail C
Hardware Contact Pads
Ø7.62[Ø0.300]
Ø3.60[Ø0.142]
Solder coated copper
0.00 [0.000] max component height
0.00 [0.000] max complonent height and no routing
PLATFORM DEVELOPMENT
5900 E BEN WHITE
AUSTIN, TX 78741
TITLE
Socket 940 Processor Component Keepout and Height Restrictions
DRAWING NUMBER
7800009-002
TOLERANCES
.XX = NA
.XXX = NA
.XXXX = NA
ANGLES = NA
DESIGNER
RQP/LME
APPROVED
DATE
9/4/03
REV
B
SCALE
NA
SHEET
2/10

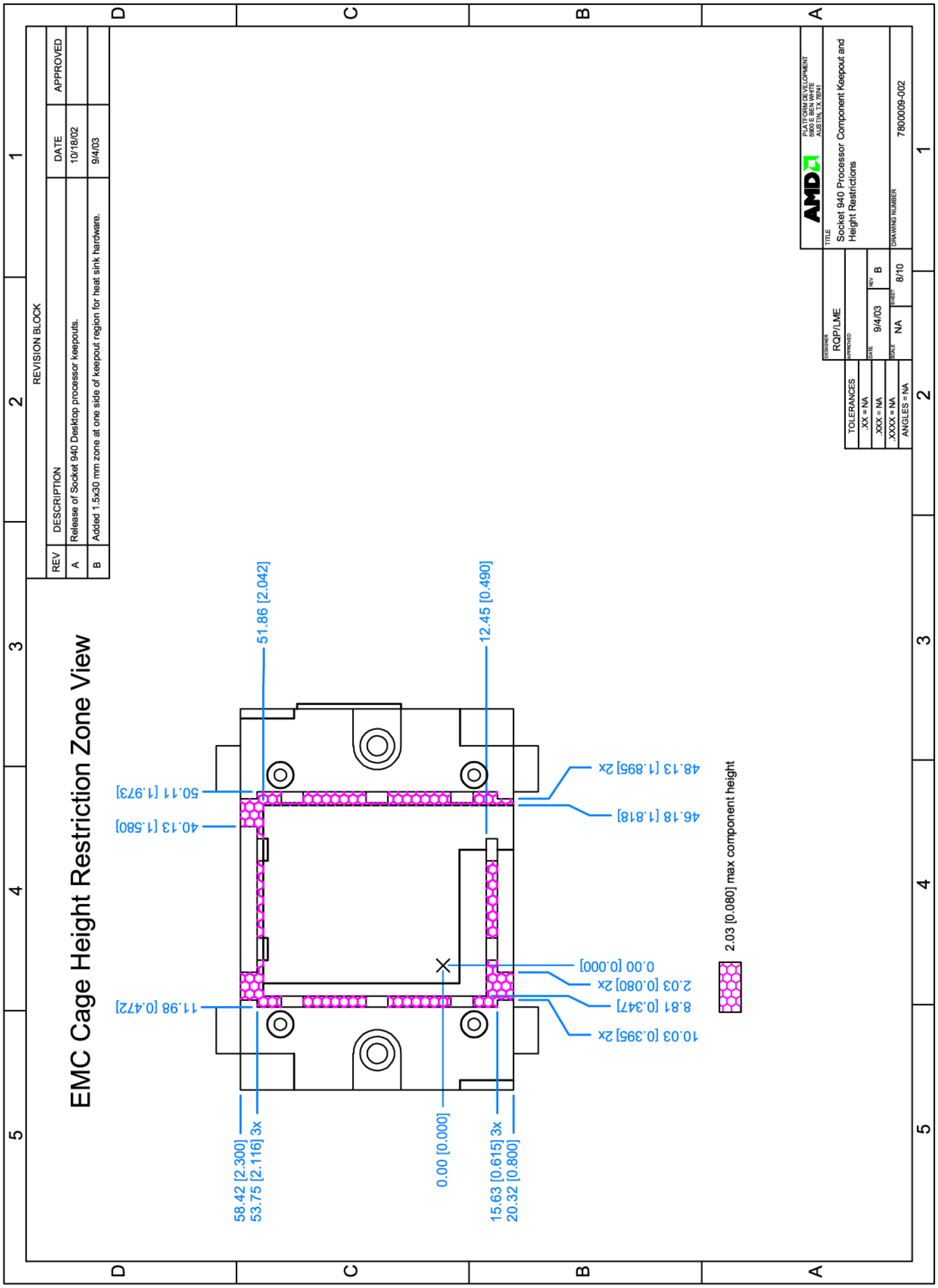

Socket Outline and Socket Window
Height Restriction Zone View
REVISION BLOCK
REV
DESCRIPTION
DATE
APPROVED
A
Release of Socket 940 Desktop processor keepouts.
10/18/02
B
Added 1.5x30 mm zone at one side of keepout region for heat sink hardware.
9/4/03
46.18 [1.818]
33.48 [1.318]
19.05 [0.750]
0.00 [0.000]
5.16 [0.203]
51.86 [2.042]
19.05 [0.750]
0.00 [0.000]
4.75 [0.187]
20.32 [0.800]
0.00 [0.000] max component height
PLATFORM DEVELOPMENT
5900 E BEN WHITE
AUSTIN, TX 78741
TITLE
Socket 940 Processor Component Keepout and Height Restrictions
DRAWING NUMBER
7800009-002
DESIGNER
RQP/LME
APPROVED
DATE
9/4/03
REV
B
SCALE
NA
SHEET
3/10
TOLERANCES
.XX = NA
.XXX = NA
.XXXX = NA
ANGLES = NA

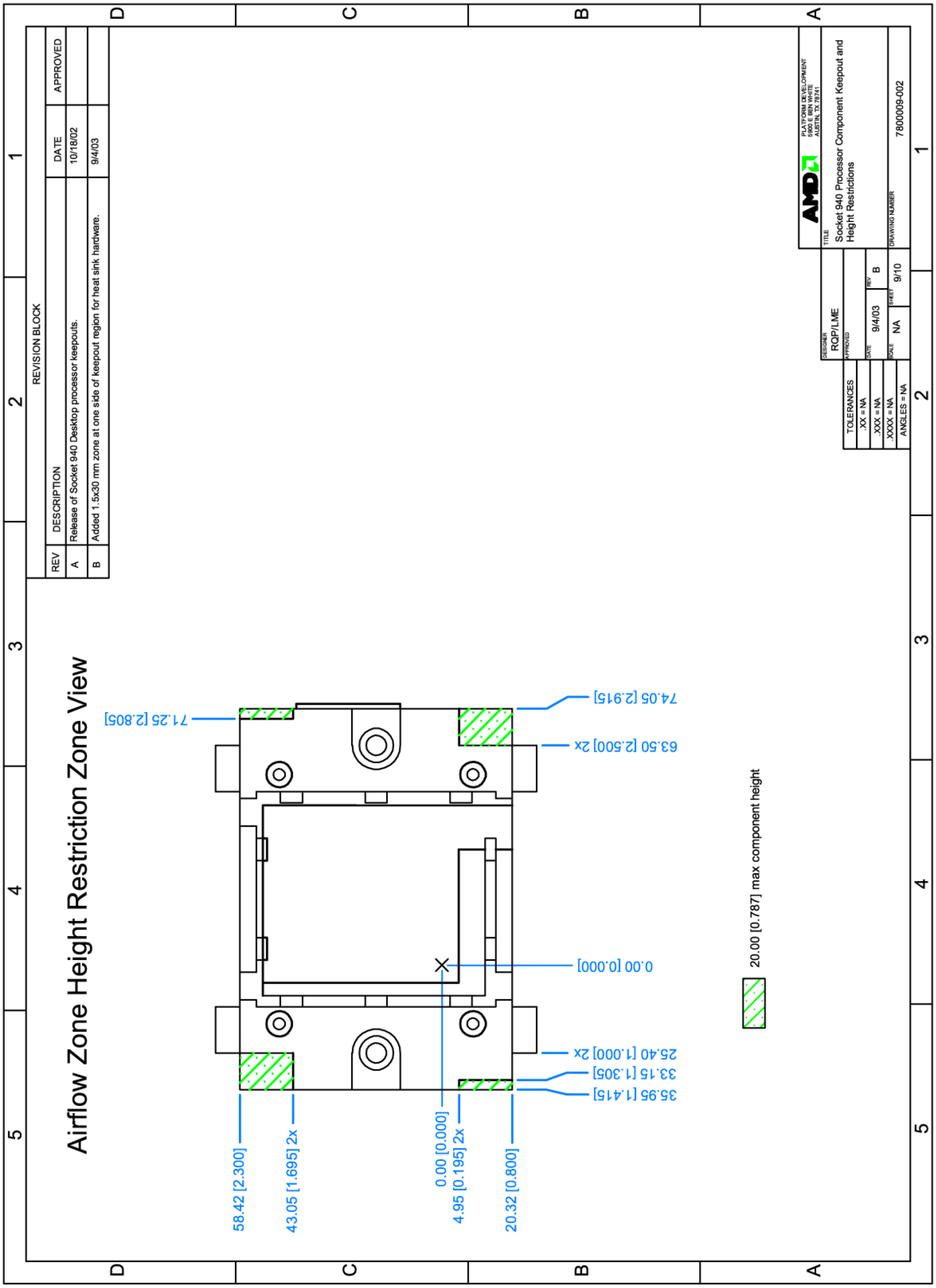

EMC Cage Grounding Pad Location and Geometry View
REVISION BLOCK
REV
DESCRIPTION
DATE
APPROVED
A
Release of Socket 940 Desktop processor keepouts.
10/18/02
B
Added 1.5x30 mm zone at one side of keepout region for heat sink hardware.
9/4/03
Detail A
Grounding Pad Locations
52.16 [2.053] 2x
43.55 [1.715] 2x
19.05 [0.750] 2x
0.00 [0.000]
5.46 [0.215] 2x
14.05 [0.553] 2x
48.51 [1.910] 3x
33.39 [1.315] 2x
4.70 [0.185] 2x
0.00 [0.000]
10.40 [0.409] 3x
3.18 [0.125] 10x
3.18 [0.125] 10x
6.36 [0.250] 10x
A1 location
EMC Ground Pad Keepout 10x
See Details A and B for pads
53.75 [2.116]
2.28 [0.090] 2x
8.63 [0.340] 2x
50.11 [1.973]
46.93 [1.848] 3x
36.57 [1.440] 2x
30.22 [1.190] 2x
7.88 [0.310] 2x
1.53 [0.060] 2x
0.00 [0.000]
8.81 [0.347]
11.98 [0.472]
50.57 [1.991]
46.73 [1.840] 2x
40.38 [1.590] 2x
22.23 [0.875] 2x
15.88 [0.625] 2x
0.00 [0.000]
12.45 [0.490]
15.63 [0.615]
Detail B
Grounding Pad Geometry
No Components
3.18 [0.125]
3.18 [0.125]
Metalized pad
1.00 [0.039]
6.36 [0.250]
1.00 [0.039]
3.18 [0.125]
3.18 [0.125]
Ground via zones
0.00 [0.000] max component height
TOLERANCES
.XX = NA
.XXX = NA
.XXXX = NA
ANGLES = NA
DESIGNER
RQP/LME
DATE
9/4/03
REV
B
SCALE
NA
SHEET
4/10
TITLE
Socket 940 Processor Component Keepout and Height Restrictions
PLATFORM DEVELOPMENT
5900 E. BEN WHITE
AUSTIN, TX 78741
DRAWING NUMBER
7800009-002

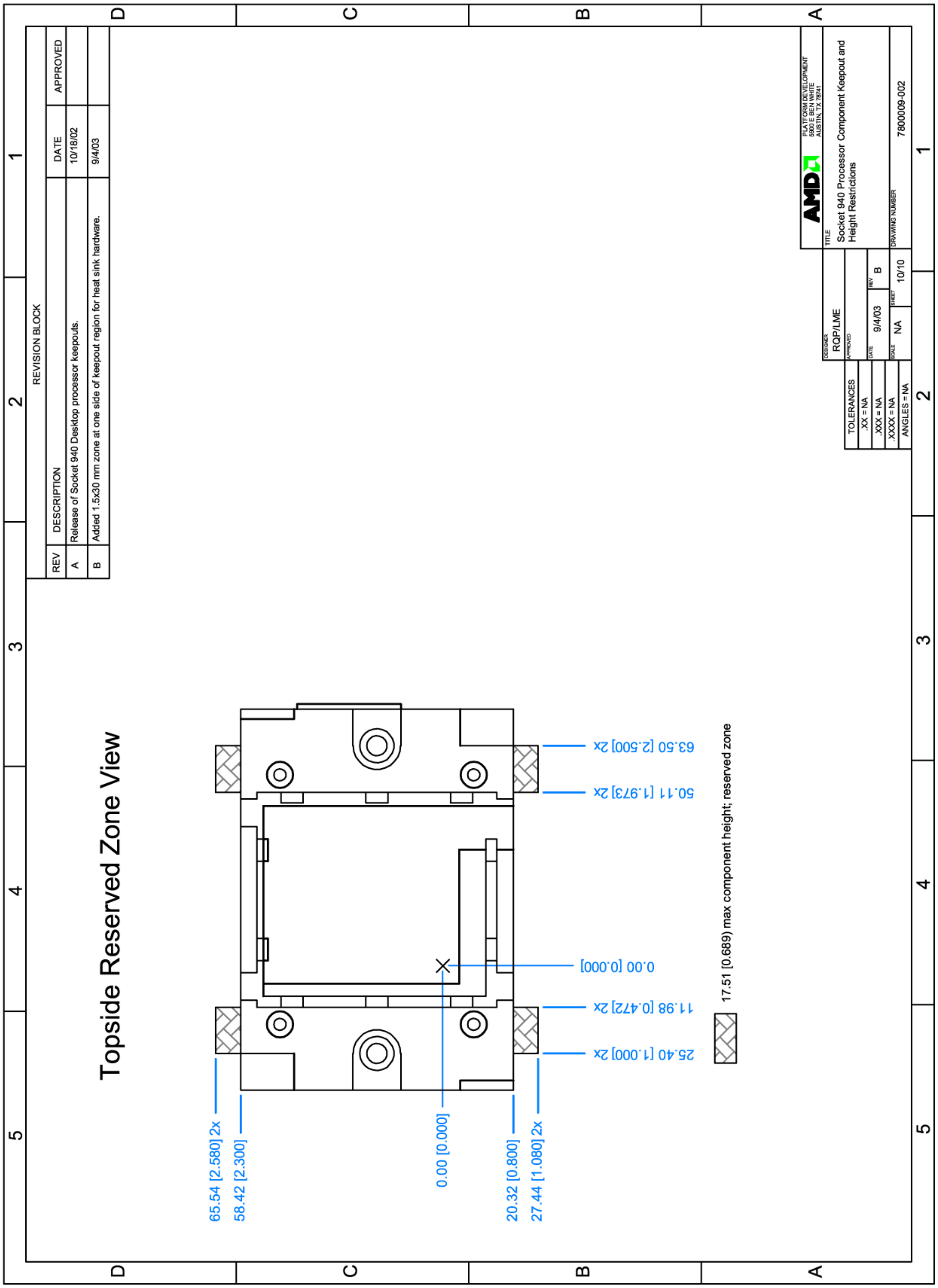

Heat Sink Height Restriction Zone View
REVISION BLOCK
REV
DESCRIPTION
DATE
APPROVED
A
Release of Socket 940 Desktop processor keepouts.
10/18/02
B
Added 1.5x30 mm zone at one side of keepout region for heat sink hardware.
9/4/03
1.5x30 mm zone may be placed on either side of the keepout region. Use polar symmetry about the center point of the keepout area.
43.05 [1.695] 2x
42.10 [1.657]
26.00 [1.023] 2x
12.10 [0.476] 2x
4.95 [0.195] 2x
12.45 [0.490]
15.63 [0.615] 3x
75.55 [2.974]
71.25 [2.805]
48.13 [1.895] 2x
40.13 [1.580]
2.03 [0.080] 2x
8.81 [0.347]
10.03 [0.395] 2x
74.05 [2.915]
63.50 [2.500] 2x
50.11 [1.973]
33.48 [1.318] 2x
0.00 [0.000]
5.16 [0.203]
11.98 [0.472]
25.40 [1.000]
33.15 [1.305]
35.95 [1.415]
58.42 [2.300]
53.75 [2.116]
51.86 [2.042]
0.00 [0.000]
4.75 [0.187]
20.32 [0.800]
3.30 [0.130] max component height
17.51 [0.689] max component height
TOLERANCES
.XX = NA
.XXX = NA
.XXXX = NA
ANGLES = NA
DESIGNER
RQP/LME
APPROVED
DATE
9/4/03
REV
B
SCALE
NA
SHEET
5/10
PLATFORM DEVELOPMENT
5900 E BEN WHITE
AUSTIN, TX 78741
TITLE
Socket 940 Processor Component Keepout and Height Restrictions
DRAWING NUMBER
7800009-002


REVISION BLOCK
REV
DESCRIPTION
DATE
APPROVED
A
Release of Socket 940 Desktop processor keepouts.
10/18/02
B
Added 1.5x30 mm zone at one side of keepout region for heat sink hardware.
9/4/03
Backplate Contact Zone View
Ø5.94 [Ø0.234] 2x
Non-plated mounting hole
71.05 [2.797]
63.50 [2.500]
31.05 [1.222]
7.05 [0.278]
0.00 [0.000]
25.40 [1.000]
32.95 [1.297]
52.05 [2.049]
31.05 [1.222]
22.05 [0.868]
19.05 [0.750] 2x
16.05 [0.632]
7.05 [0.278]
0.00 [0.000]
13.95 [0.549]
3.30 [0.130] max component height
0.00 [0.000] max component height and no through-hole components
1.52 [0.060] max component height.
TOLERANCES
.XX = NA
.XXX = NA
.XXXX = NA
ANGLES = NA
DESIGNER
RQP/LME
DATE
9/4/03
SCALE
NA
REV
B
SHEET
6/10
TITLE
Socket 940 Processor Component Keepout and Height Restrictions
DRAWING NUMBER
7800009-002


REVISION BLOCK
REV
DESCRIPTION
DATE
APPROVED
A
Release of Socket 940 Desktop processor keepouts.
10/18/02
B
Added 1.5x30 mm zone at one side of keepout region for heat sink hardware.
9/4/03
No Through-Hole Component Zone View
71.05 [2.797]
0.00 [0.000]
32.95 [1.297]
52.05 [2.049]
0.00 [0.000]
13.95 [0.549]
No through-hole components
PLATFORM DEVELOPMENT
5900 E. BEN WHITE
AUSTIN, TX 78741
TITLE
Socket 940 Processor Component Keepout and Height Restrictions
DRAWING NUMBER
7800009-002
DESIGNER
RQP/LME
APPROVED
DATE
9/4/03
REV
B
SCALE
NA
SHEET
7/10
TOLERANCES
.XX = NA
.XXX = NA
.XXXX = NA
ANGLES = NA

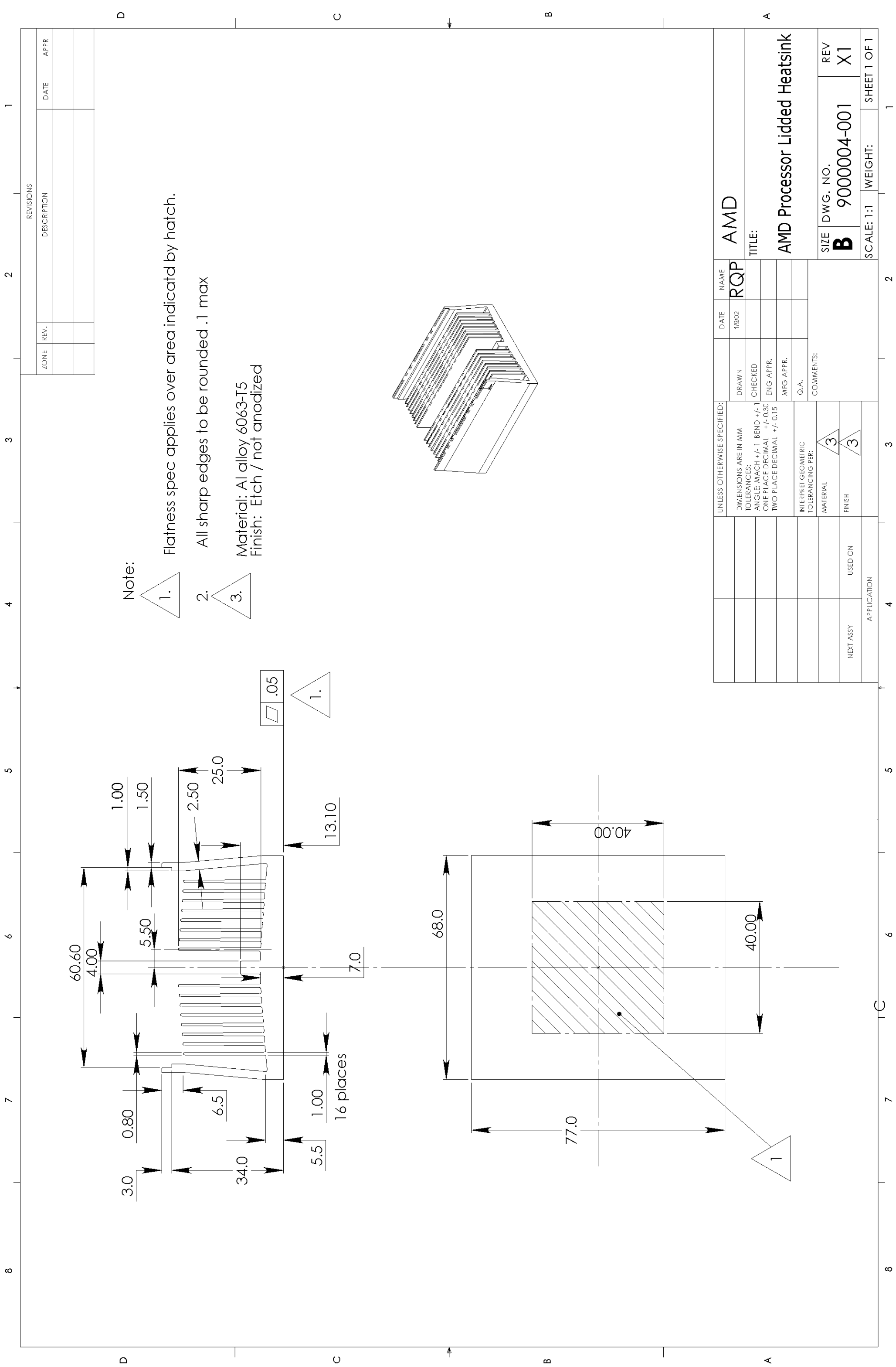

EMC Cage Height Restriction Zone View
REVISION BLOCK
REV
DESCRIPTION
DATE
APPROVED
A
Release of Socket 940 Desktop processor keepouts.
10/18/02
B
Added 1.5x30 mm zone at one side of keepout region for heat sink hardware.
9/4/03
51.86 [2.042]
12.45 [0.490]
50.11 [1.973]
40.13 [1.580]
11.98 [0.472]
48.13 [1.895] 2x
46.18 [1.818]
0.00 [0.000]
2.03 [0.080] 2x
8.81 [0.347]
10.03 [0.395] 2x
58.42 [2.300]
53.75 [2.116] 3x
0.00 [0.000]
15.63 [0.615] 3x
20.32 [0.800]
2.03 [0.080] max component height
PLATFORM DEVELOPMENT
5900 E BEN WHITE
AUSTIN, TX 78741
TITLE
Socket 940 Processor Component Keepout and
Height Restrictions
DESIGNER
RQP/LME
APPROVED
DATE
9/4/03
REV
B
SCALE
NA
SHEET
8/10
DRAWING NUMBER
7800009-002
TOLERANCES
.XX = NA
.XXX = NA
.XXXX = NA
ANGLES = NA

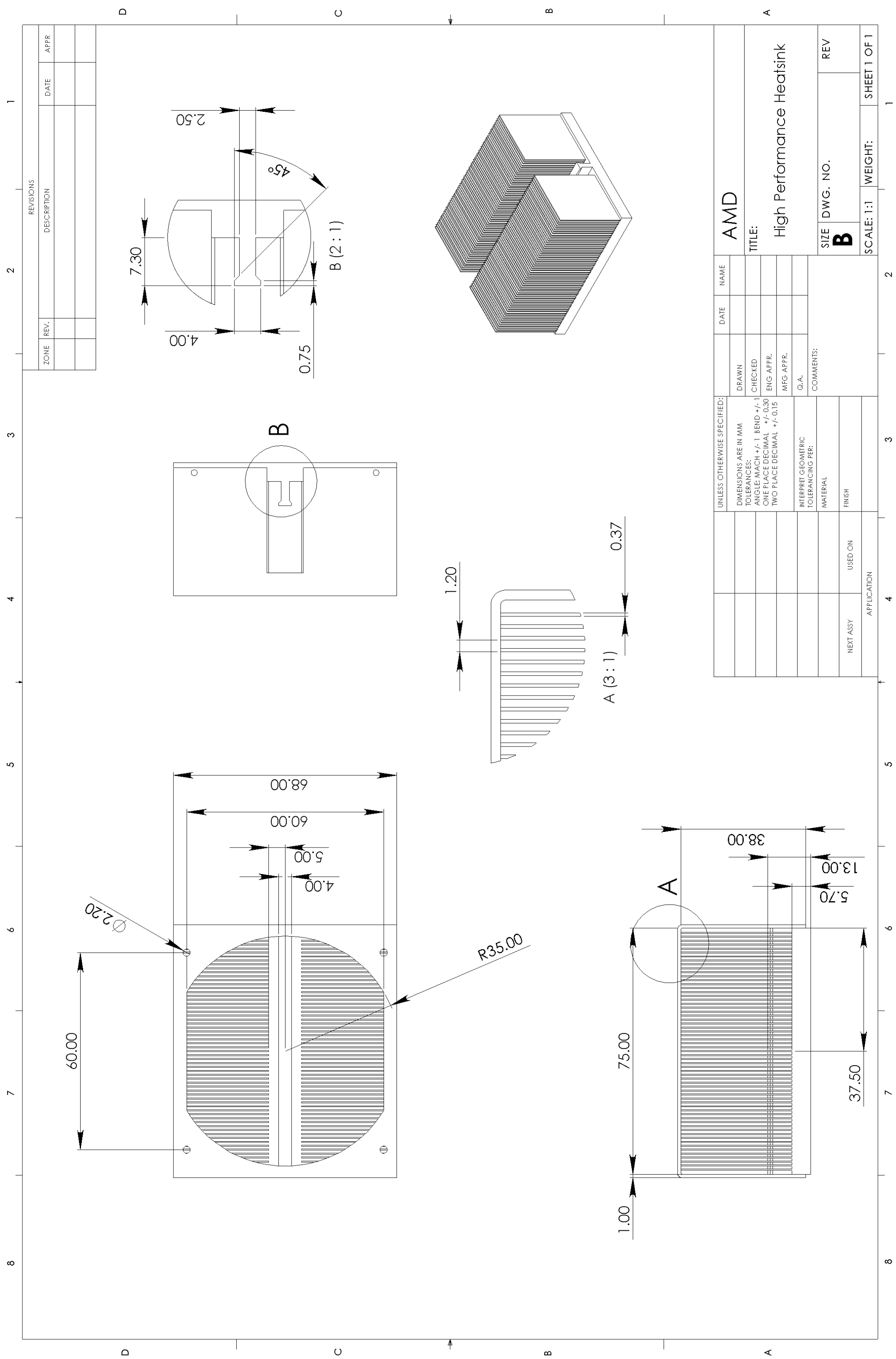

Airflow Zone Height Restriction Zone View
REVISION BLOCK
REV
DESCRIPTION
DATE
APPROVED
A
Release of Socket 940 Desktop processor keepouts.
10/18/02
B
Added 1.5x30 mm zone at one side of keepout region for heat sink hardware.
9/4/03
71.25 [2.805]
74.05 [2.915]
63.50 [2.500] 2x
0.00 [0.000]
25.40 [1.000] 2x
33.15 [1.305]
35.95 [1.415]
58.42 [2.300]
43.05 [1.695] 2x
0.00 [0.000]
4.95 [0.195] 2x
20.32 [0.800]
20.00 [0.787] max component height
PLATFORM DEVELOPMENT
5900 E BEN WHITE
AUSTIN, TX 78741
Socket 940 Processor Component Keepout and Height Restrictions
7800009-002
TOLERANCES
.XX = NA
.XXX = NA
.XXXX = NA
ANGLES = NA
RQP/LME
9/4/03
NA
B
9/10

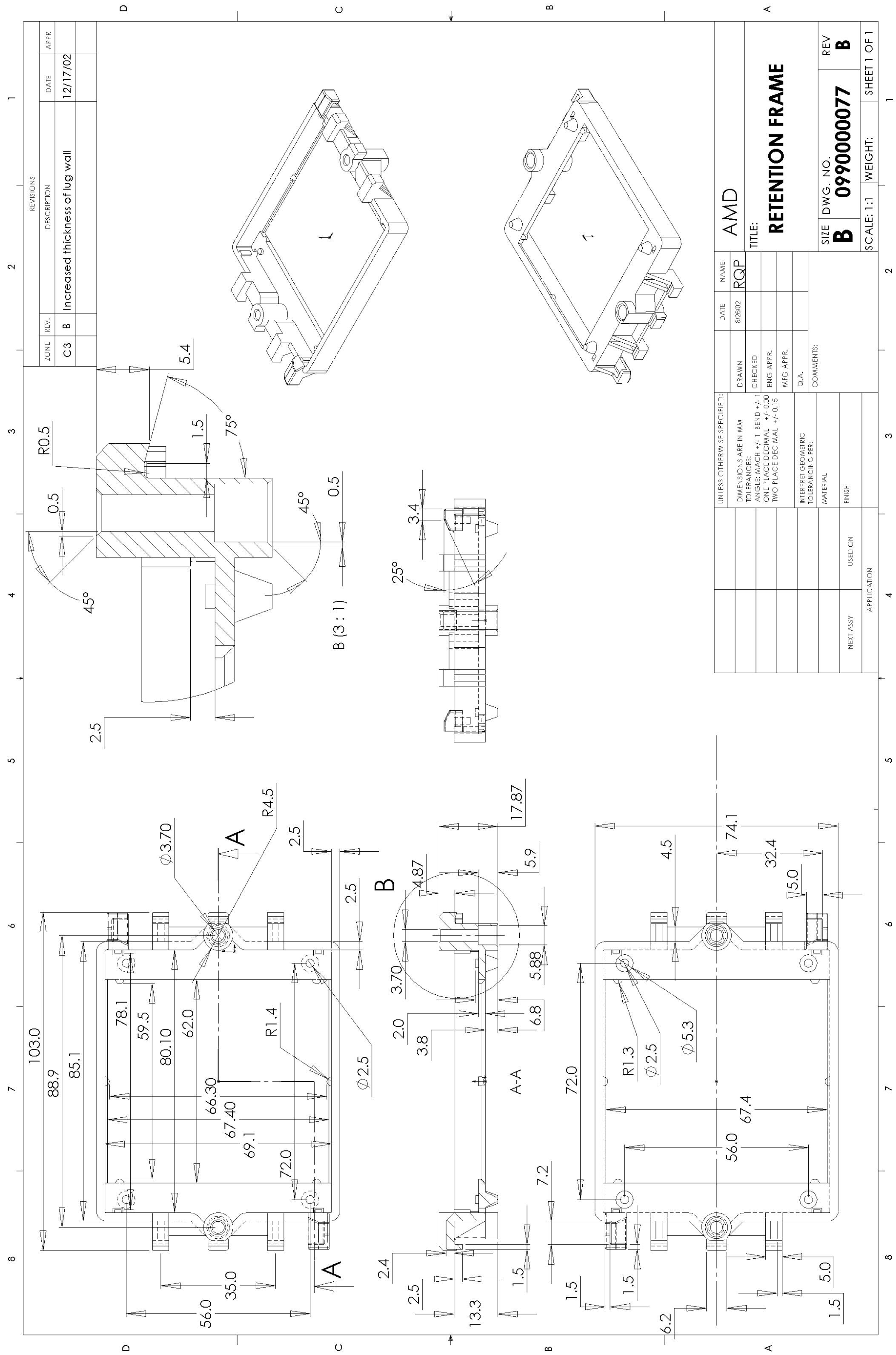

Topside Reserved Zone View
REVISION BLOCK
REV | DESCRIPTION | DATE | APPROVED
A | Release of Socket 940 Desktop processor keepouts. | 10/18/02
B | Added 1.5x30 mm zone at one side of keepout region for heat sink hardware. | 9/4/03
65.54 [2.580] 2x
58.42 [2.300]
0.00 [0.000]
20.32 [0.800]
27.44 [1.080] 2x
63.50 [2.500] 2x
50.11 [1.973] 2x
0.00 [0.000]
11.98 [0.472] 2x
25.40 [1.000] 2x
17.51 [0.689) max component height; reserved zone
TOLERANCES
.XX = NA
.XXX = NA
.XXXX = NA
ANGLES = NA
DESIGNER RQP/LME
DATE 9/4/03
REV B
SCALE NA
SHEET 10/10
TITLE Socket 940 Processor Component Keepout and Height Restrictions
DRAWING NUMBER 7800009-002

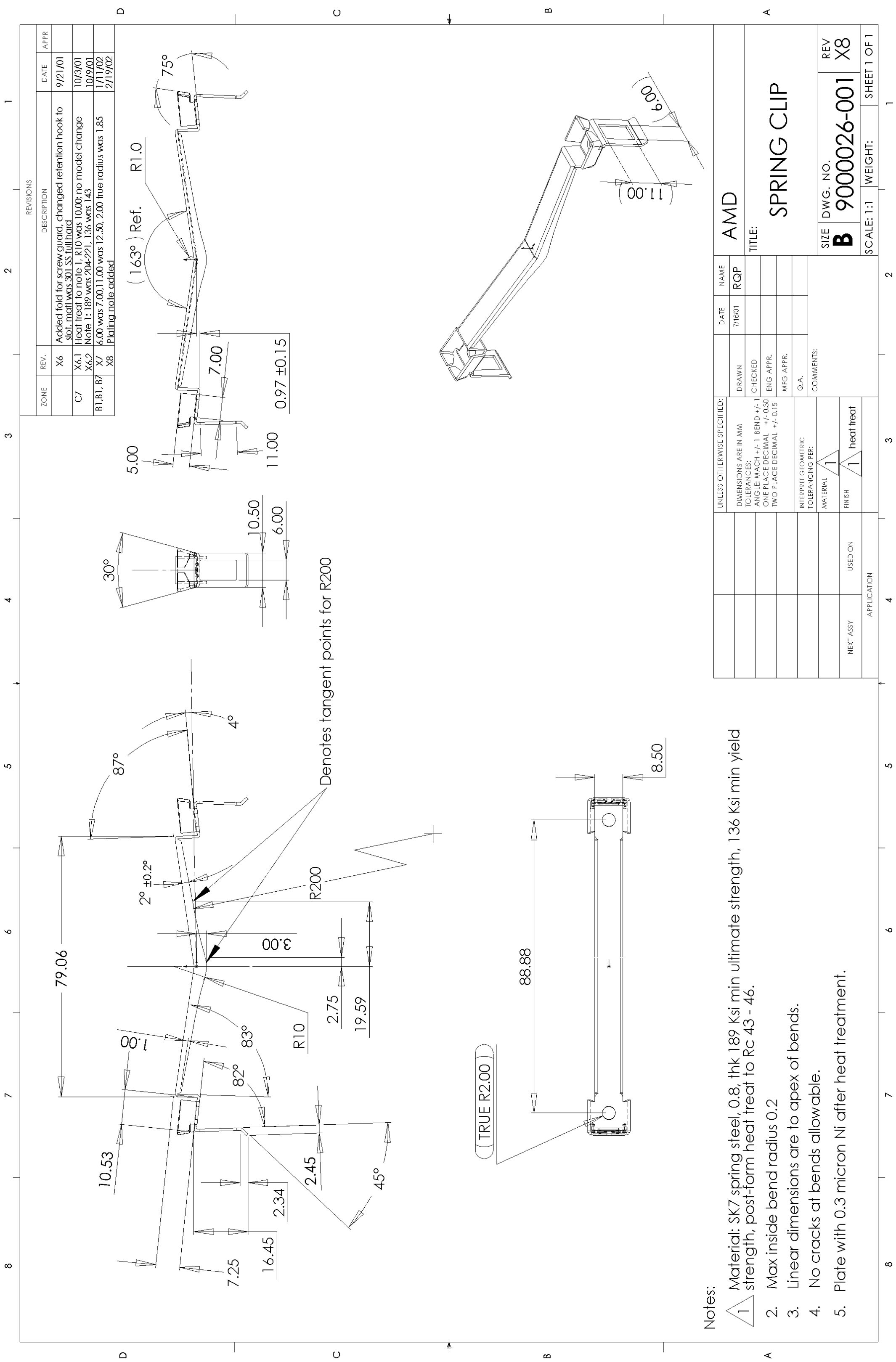
A.4 Thermal Reference Design Solution Component Drawings

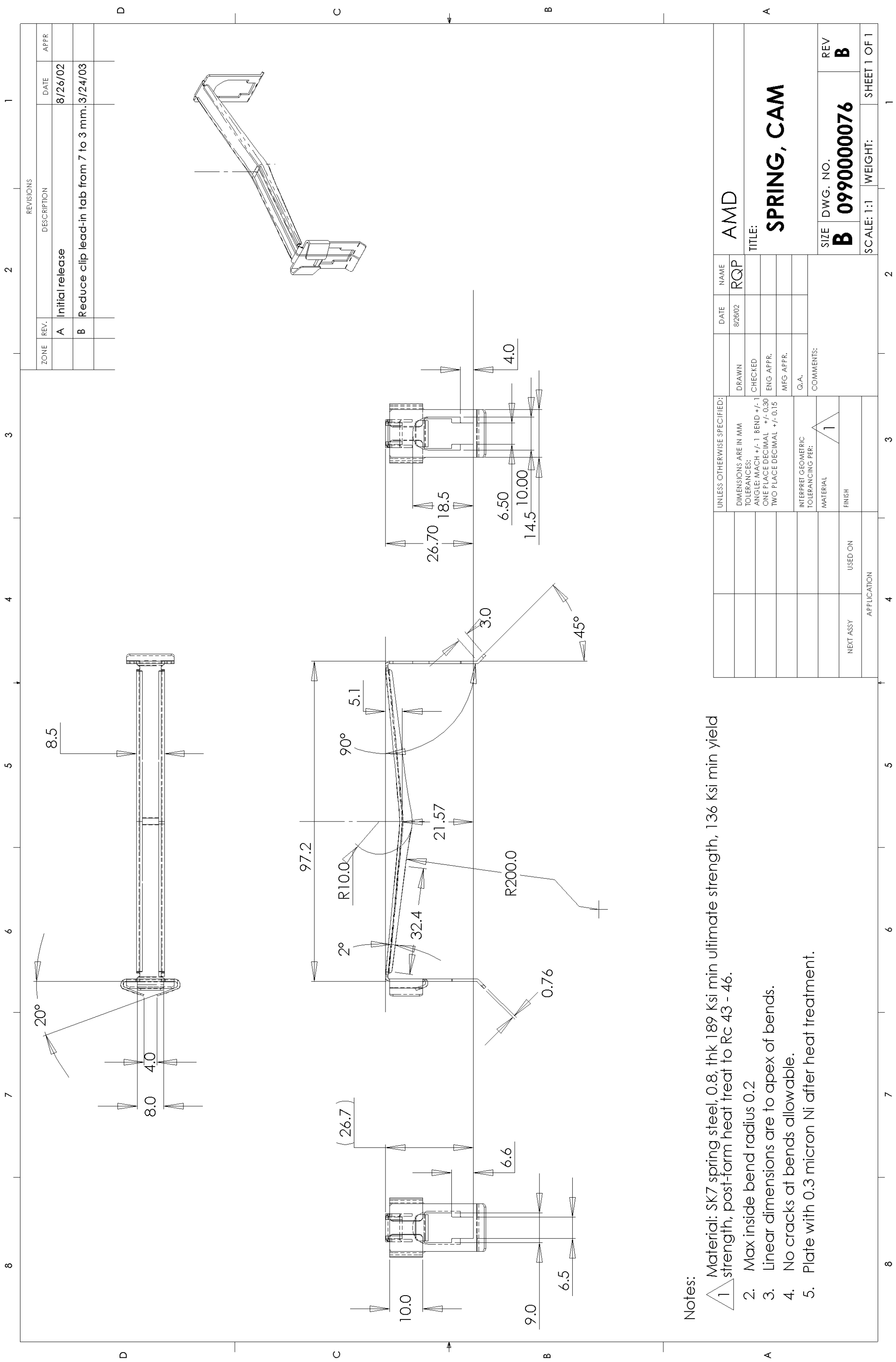
Pages 69 through 82 contain drawings for the components of the thermal reference design solutions 1 and 2.

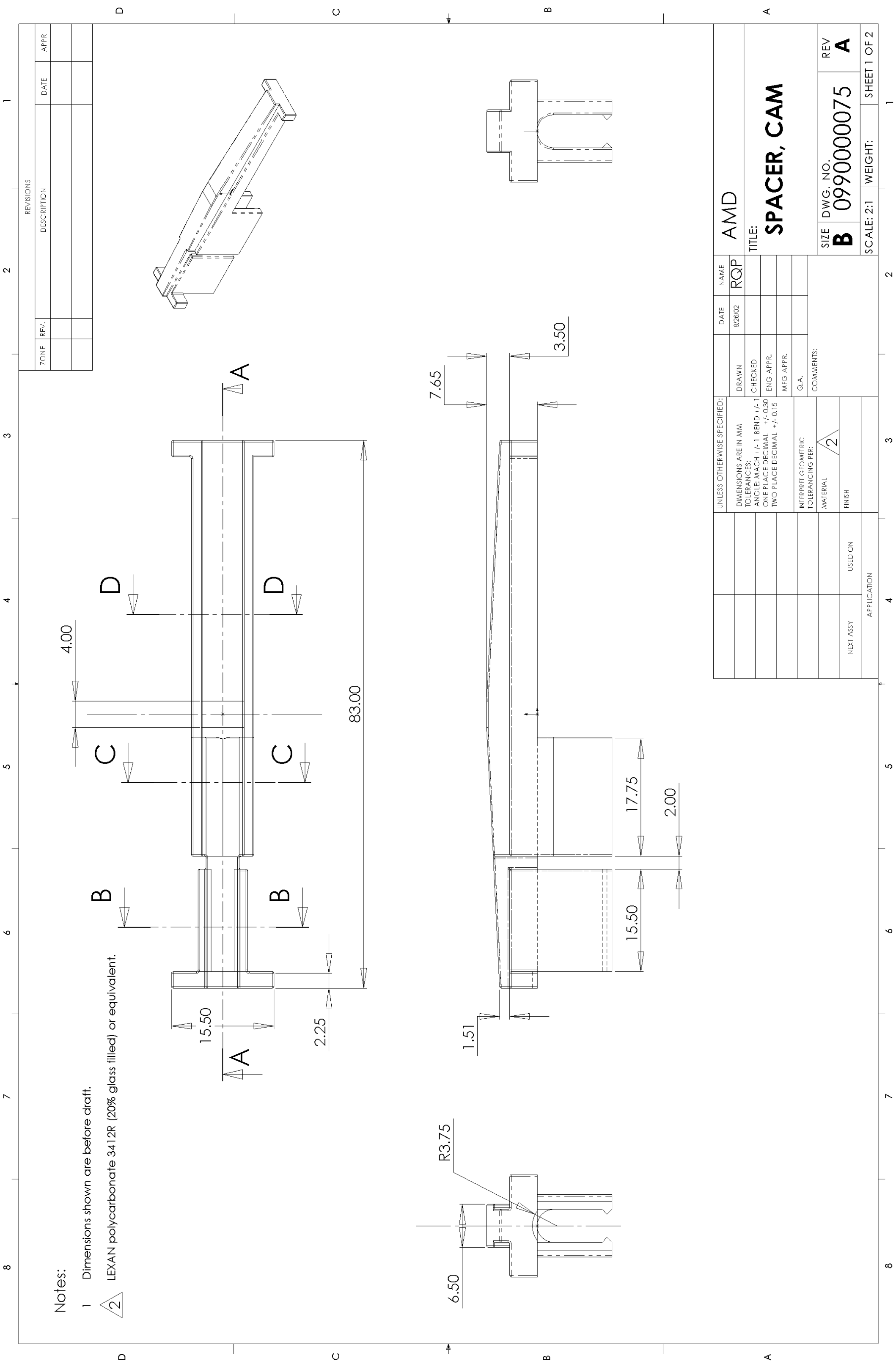

Note:
1. Flatness spec applies over area indicatd by hatch.
2. All sharp edges to be rounded .1 max
3. Material: Al alloy 6063-T5
Finish: Etch / not anodized
AMD
TITLE:
AMD Processor Lidded Heatsink
SIZE B
DWG. NO. 9000004-001
REV X1
SCALE: 1:1
WEIGHT:
SHEET 1 OF 1
RQP
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MM
DRAWN
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:
MATERIAL
FINISH
NEXT ASSY
USED ON
APPLICATION
REVISIONS
ZONE
REV.
DESCRIPTION
DATE
APPR
60.60
4.00
5.50
1.00
1.50
2.50
25.0
13.10
7.0
68.0
40.00
77.0
0.80
3.0
34.0
6.5
5.5
1.00
16 places
.05

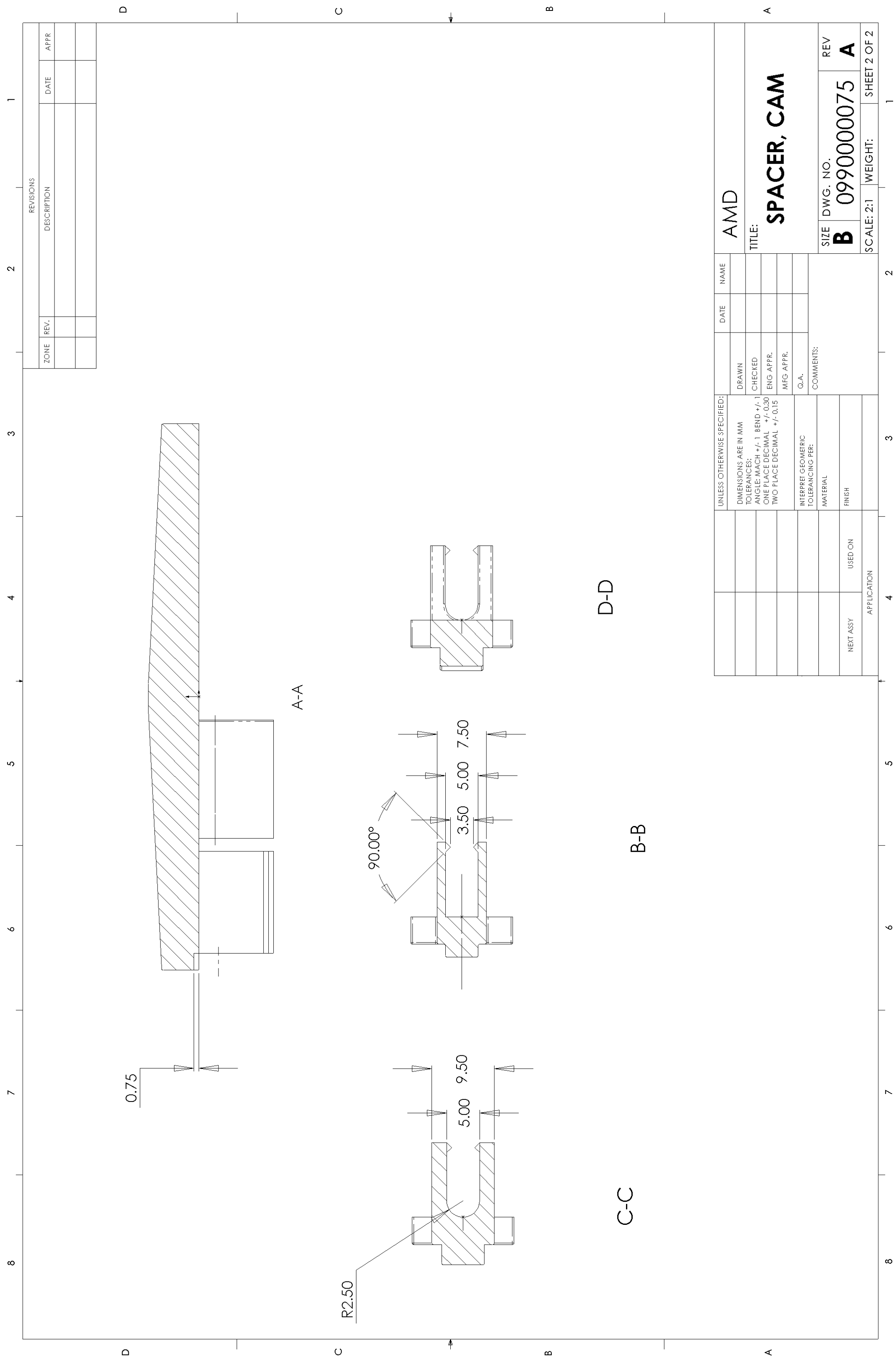

AMD
TITLE:
High Performance Heatsink
SIZE B
DWG. NO.
REV
SCALE: 1:1
WEIGHT:
SHEET 1 OF 1
UNLESS OTHERWISE SPECIFIED:
DRAWN
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:
REVISIONS
B (2 : 1)
A (3 : 1)
68.00
60.00
5.00
4.00
R35.00
60.00
75.00
1.00
38.00
13.00
5.70
37.50
2.50
45°
7.30
0.75
1.20
0.37

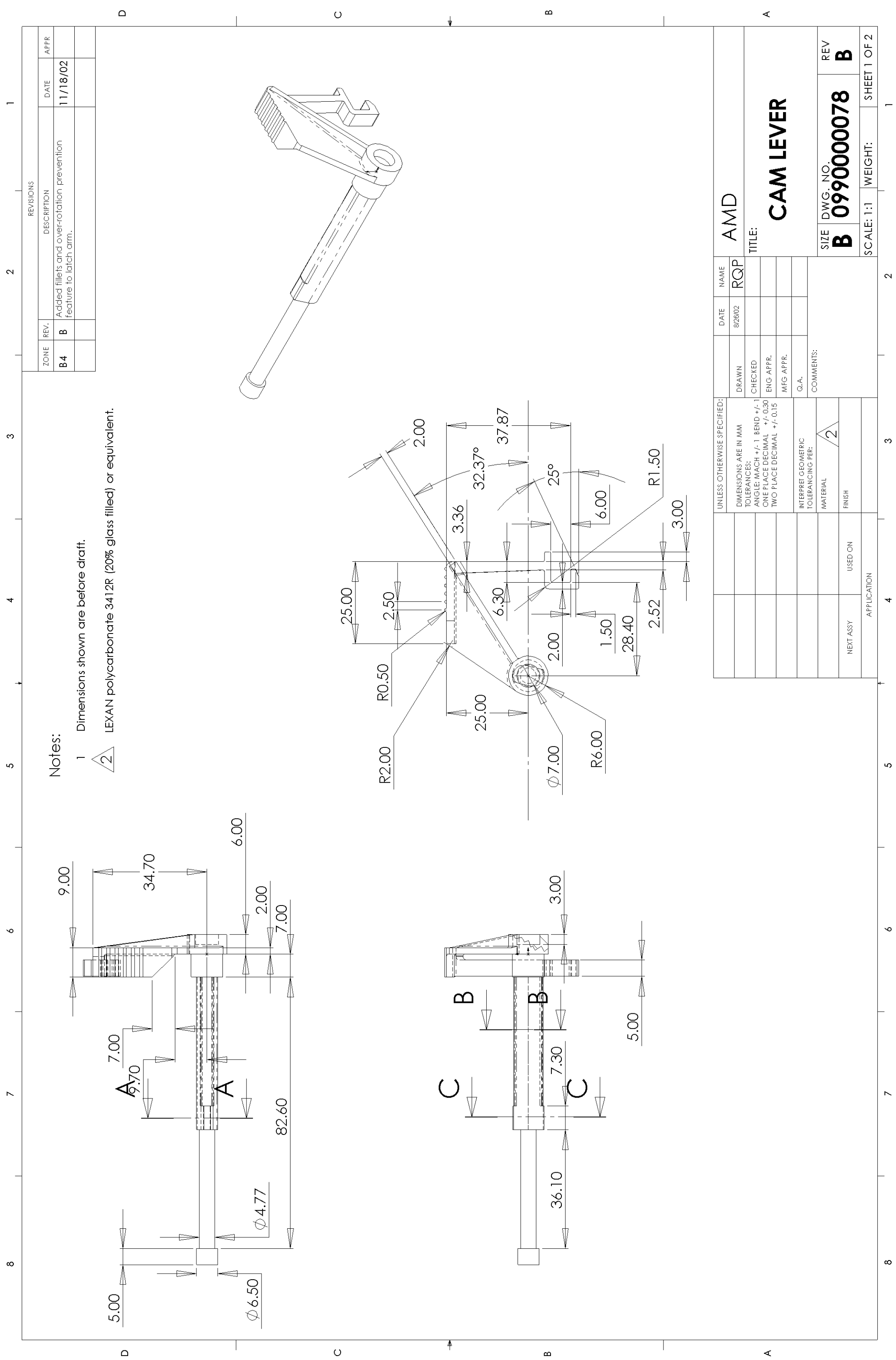

REVISIONS
ZONE REV. DESCRIPTION DATE APPR
C3 B Increased thickness of lug wall 12/17/02
B (3 : 1)
A-A
AMD
TITLE:
RETENTION FRAME
SIZE B
DWG. NO. 0990000077
REV B
SCALE: 1:1
SHEET 1 OF 1

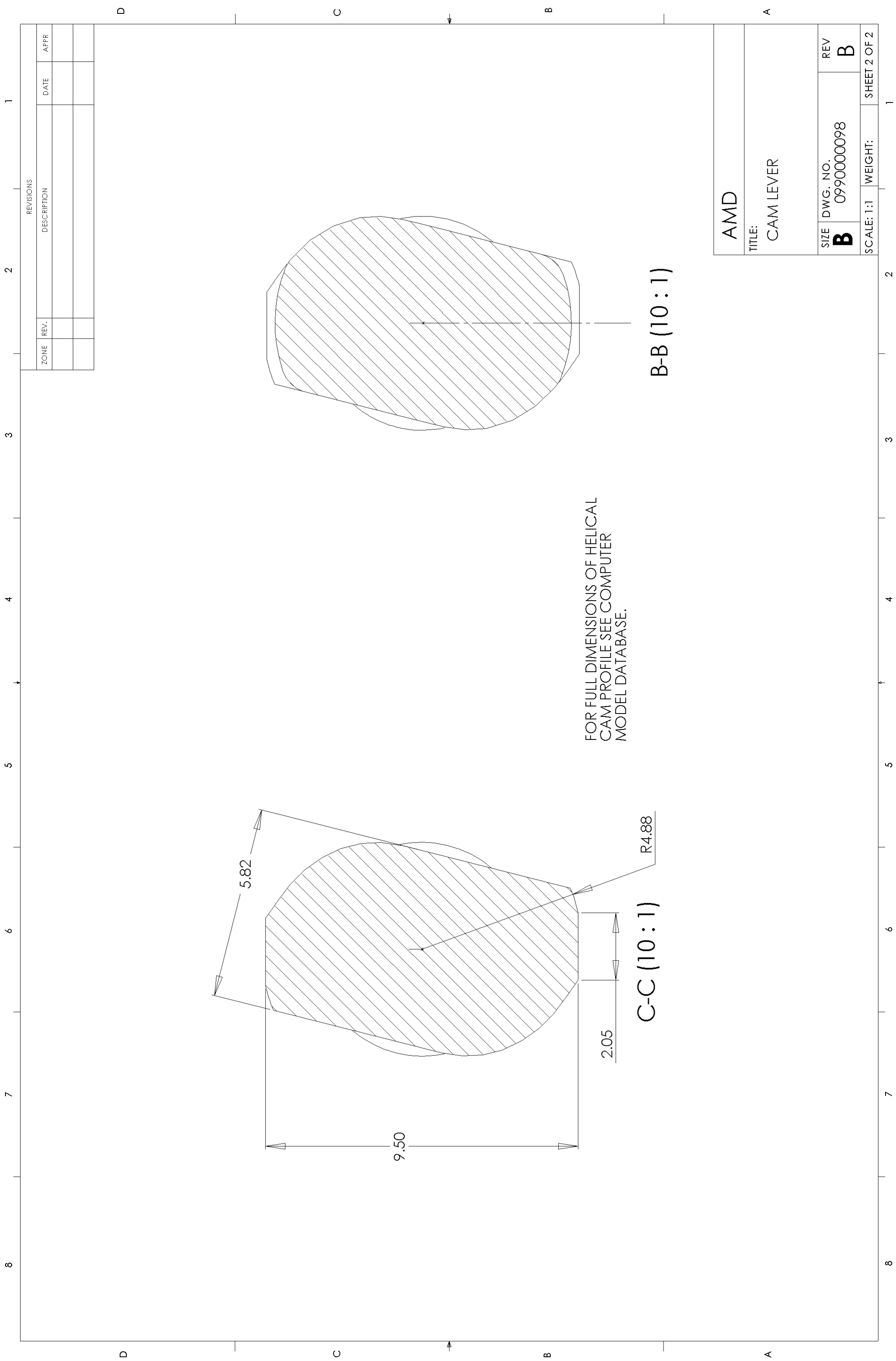

AMD
TITLE:
SPRING CLIP
SIZE B
DWG. NO. 9000026-001
REV X8
SCALE: 1:1
WEIGHT:
SHEET 1 OF 1
Denotes tangent points for R200
TRUE R2.00
Notes:
1 Material: SK7 spring steel, 0.8, thk 189 Ksi min ultimate strength, 136 Ksi min yield strength, post-form heat treat to Rc 43 - 46.
2. Max inside bend radius 0.2
3. Linear dimensions are to apex of bends.
4. No cracks at bends allowable.
5. Plate with 0.3 micron Ni after heat treatment.

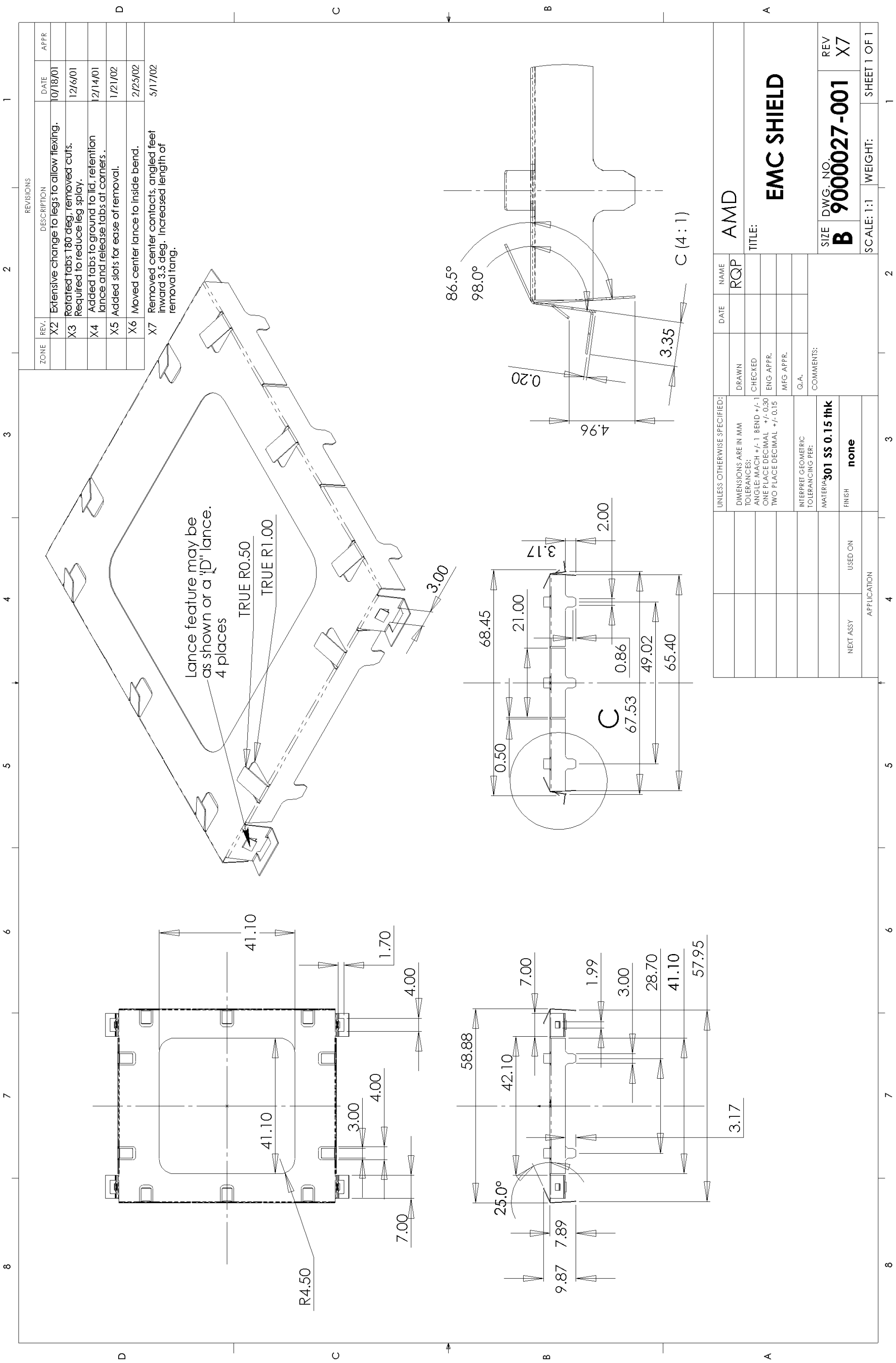

REVISIONS
ZONE REV. DESCRIPTION DATE APPR
A Initial release 8/26/02
B Reduce clip lead-in tab from 7 to 3 mm. 3/24/03
Notes:
1 Material: SK7 spring steel, 0.8, thk 189 Ksi min ultimate strength, 136 Ksi min yield strength, post-form heat treat to Rc 43 - 46.
2. Max inside bend radius 0.2
3. Linear dimensions are to apex of bends.
4. No cracks at bends allowable.
5. Plate with 0.3 micron Ni after heat treatment.
AMD
TITLE:
SPRING, CAM
SIZE B
DWG. NO. 0990000076
REV B
SCALE: 1:1
WEIGHT:
SHEET 1 OF 1
DRAWN 8/26/02 RQP

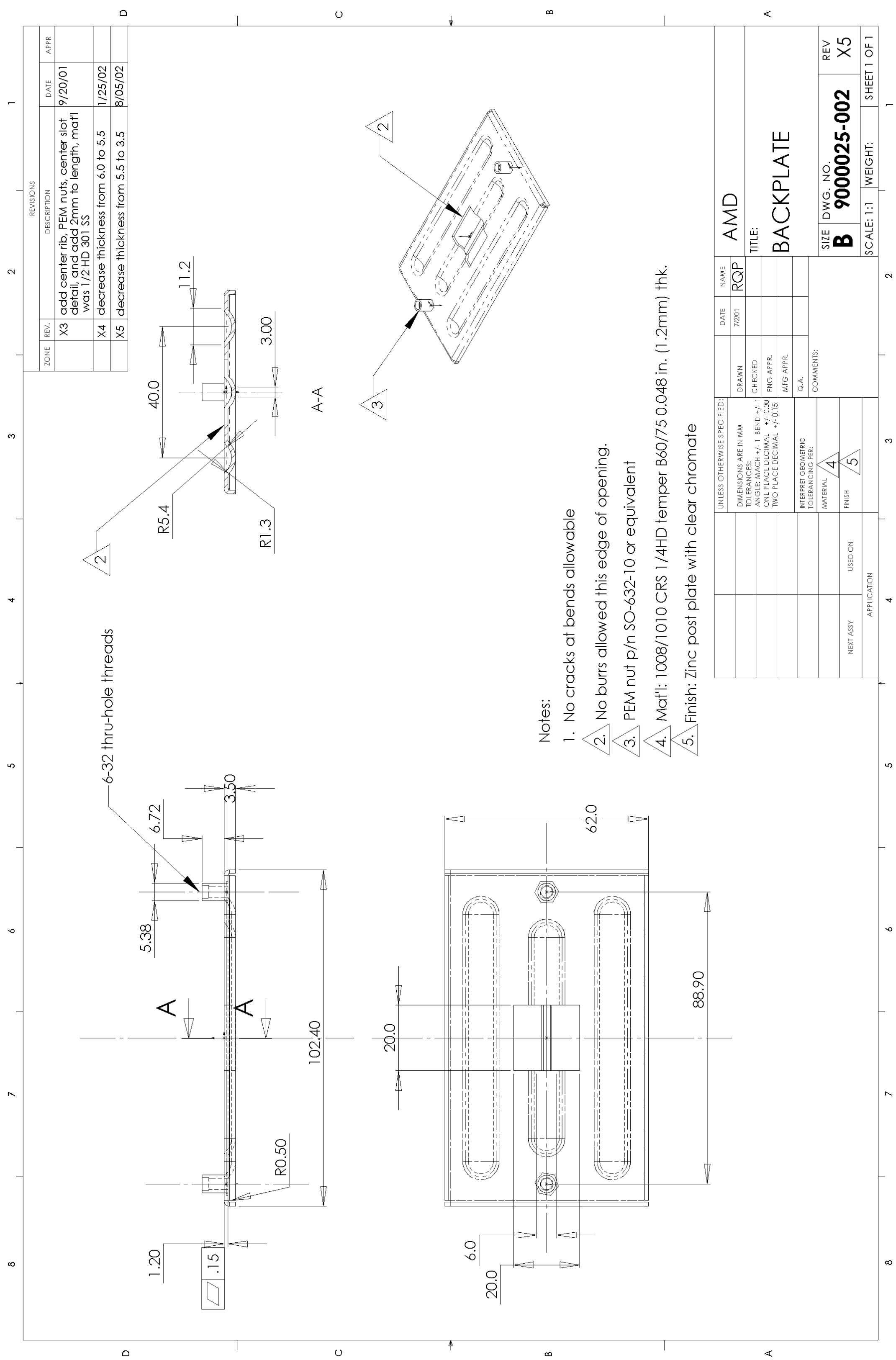

AMD
TITLE:
SPACER, CAM
SIZE B
DWG. NO. 0990000075
REV A
SCALE: 2:1
WEIGHT:
SHEET 1 OF 2
DRAWN
RQP
8/26/02
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MM
MATERIAL
FINISH
83.00
15.50
2.25
4.00
7.65
3.50
17.75
2.00
15.50
1.51
R3.75
6.50
Notes:
1 Dimensions shown are before draft.
2 LEXAN polycarbonate 3412R (20% glass filled) or equivalent.

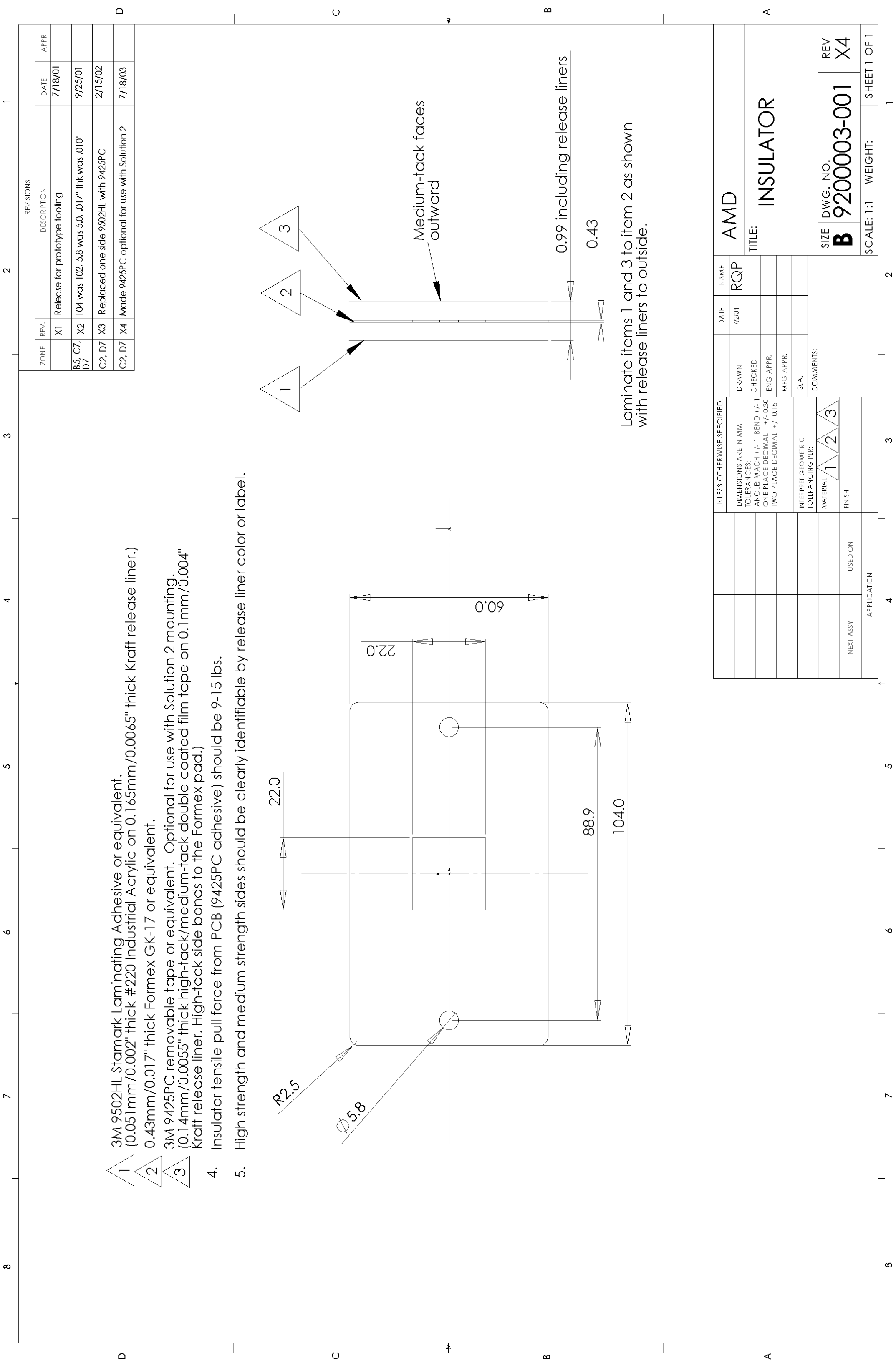

AMD
TITLE:
SPACER, CAM
SIZE B
DWG. NO. 0990000075
REV A
SCALE: 2:1
WEIGHT:
SHEET 2 OF 2
A-A
B-B
C-C
D-D
0.75
7.50
5.00
3.50
90.00°
9.50
5.00
R2.50

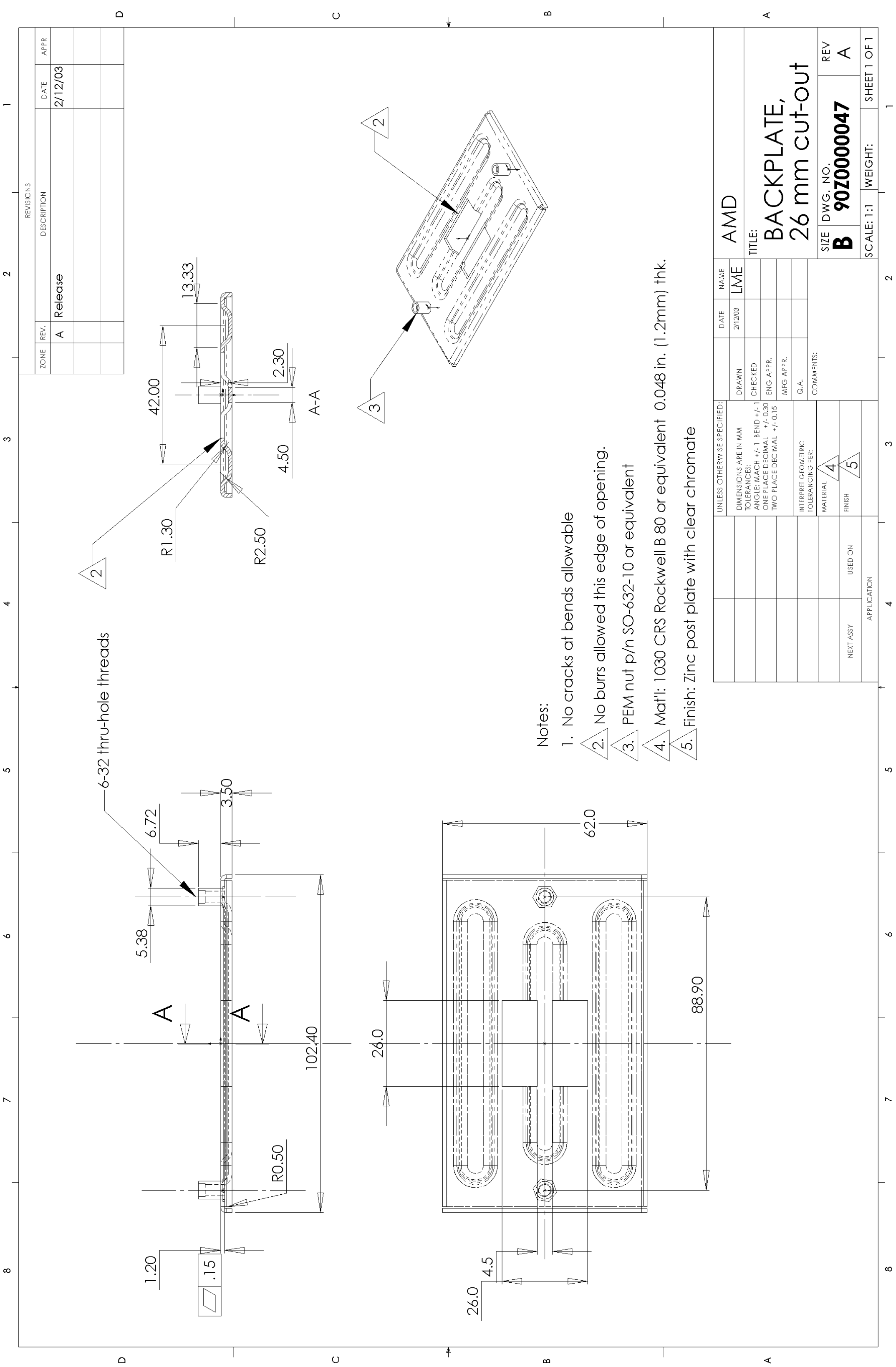

REVISIONS
ZONE REV. DESCRIPTION DATE APPR
B4 B Added fillets and over-rotation prevention feature to latch arm. 11/18/02
Notes:
1 Dimensions shown are before draft.
2 LEXAN polycarbonate 3412R (20% glass filled) or equivalent.
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MM
DRAWN 8/26/02 RQP
AMD
TITLE:
CAM LEVER
SIZE B
DWG. NO. 0990000078
REV B
SCALE: 1:1
SHEET 1 OF 2

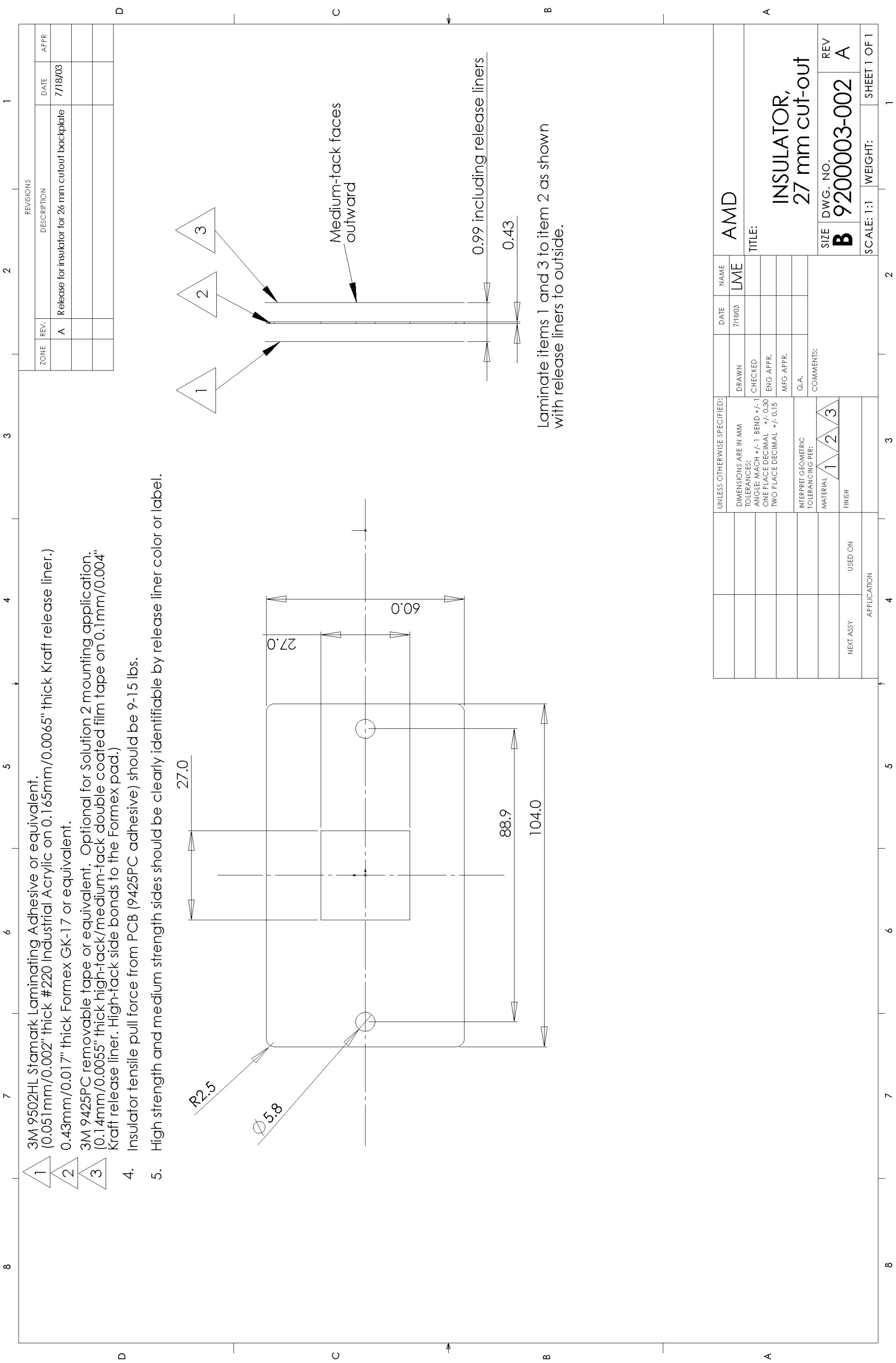

B-B (10 : 1)
C-C (10 : 1)
FOR FULL DIMENSIONS OF HELICAL CAM PROFILE SEE COMPUTER MODEL DATABASE.
5.82
R4.88
2.05
9.50
AMD
TITLE:
CAM LEVER
SIZE B
DWG. NO. 0990000098
REV B
SCALE: 1:1
WEIGHT:
SHEET 2 OF 2
REVISIONS
ZONE
REV.
DESCRIPTION
DATE
APPR


REVISIONS
ZONE
REV.
DESCRIPTION
DATE
APPR
X2 Extensive change to legs to allow flexing. 10/18/01
X3 Rotated tabs 180 deg, removed cuts. Required to reduce leg splay. 12/6/01
X4 Added tabs to ground to lid, retention lance and release tabs at corners. 12/14/01
X5 Added slots for ease of removal. 1/21/02
X6 Moved center lance to inside bend. 2/25/02
X7 Removed center contacts, angled feet inward 3.5 deg. Increased length of removal tang. 5/17/02
Lance feature may be as shown or a "D" lance. 4 places
TRUE R0.50
TRUE R1.00
3.00
86.5°
98.0°
C (4 : 1)
3.35
0.20
4.96
2.00
3.17
68.45
21.00
0.86
49.02
65.40
C
67.53
0.50
41.10
1.70
4.00
41.10
3.00
4.00
7.00
R4.50
7.00
1.99
3.00
28.70
41.10
57.95
58.88
42.10
3.17
25.0°
7.89
9.87
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MM
TOLERANCES:
ANGLE: MACH +/- 1 BEND +/- 1
ONE PLACE DECIMAL +/- 0.30
TWO PLACE DECIMAL +/- 0.15
INTERPRET GEOMETRIC TOLERANCING PER:
MATERIAL 301 SS 0.15 thk
FINISH none
NEXT ASSY
USED ON
APPLICATION
DRAWN
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:
NAME
DATE
RQP
AMD
TITLE:
EMC SHIELD
SIZE B
DWG. NO. 9000027-001
REV X7
SCALE: 1:1
WEIGHT:
SHEET 1 OF 1


REVISIONS
ZONE REV. DESCRIPTION DATE APPR
X3 add center rib, PEM nuts, center slot detail, and add 2mm to length, mat'l was 1/2 HD 301 SS 9/20/01
X4 decrease thickness from 6.0 to 5.5 1/25/02
X5 decrease thickness from 5.5 to 3.5 8/05/02
11.2
3.00
40.0
A-A
R5.4
R1.3
6-32 thru-hole threads
6.72
3.50
5.38
A
A
102.40
R0.50
1.20
.15
62.0
88.90
20.0
6.0
20.0
Notes:
1. No cracks at bends allowable
2. No burrs allowed this edge of opening.
3. PEM nut p/n SO-632-10 or equivalent
4. Mat'l: 1008/1010 CRS 1/4HD temper B60/75 0.048 in. (1.2mm) thk.
5. Finish: Zinc post plate with clear chromate
UNLESS OTHERWISE SPECIFIED:
DRAWN 7/2/01 RQP
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:
MATERIAL 4
FINISH 5
NEXT ASSY
USED ON
APPLICATION
AMD
TITLE:
BACKPLATE
SIZE B
DWG. NO. 9000025-002
REV X5
SCALE: 1:1
WEIGHT:
SHEET 1 OF 1


REVISIONS
ZONE
REV.
DESCRIPTION
DATE
APPR
X1 Release for prototype tooling 7/18/01
B5, C7, D7 X2 104 was 102, 5.8 was 5.0, .017" thk was .010" 9/25/01
C2, D7 X3 Replaced one side 9502HL with 9425PC 2/15/02
C2, D7 X4 Made 9425PC optional for use with Solution 2 7/18/03
Medium-tack faces outward
0.99 including release liners
0.43
Laminate items 1 and 3 to item 2 as shown with release liners to outside.
60.0
22.0
22.0
88.9
104.0
R2.5
⌀5.8
1 3M 9502HL Stamark Laminating Adhesive or equivalent. (0.051mm/0.002" thick #220 Industrial Acrylic on 0.165mm/0.0065" thick Kraft release liner.)
2 0.43mm/0.017" thick Formex GK-17 or equivalent.
3 3M 9425PC removable tape or equivalent. Optional for use with Solution 2 mounting. (0.14mm/0.0055" thick high-tack/medium-tack double coated film tape on 0.1mm/0.004" Kraft release liner. High-tack side bonds to the Formex pad.)
4. Insulator tensile pull force from PCB (9425PC adhesive) should be 9-15 lbs.
5. High strength and medium strength sides should be clearly identifiable by release liner color or label.
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MM
DRAWN 7/2/01 RQP
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:
MATERIAL
FINISH
NEXT ASSY
USED ON
APPLICATION
AMD
TITLE: INSULATOR
SIZE B
DWG. NO. 9200003-001
REV X4
SCALE: 1:1
WEIGHT:
SHEET 1 OF 1


REVISIONS
ZONE | REV. | DESCRIPTION | DATE | APPR
A | Release | 2/12/03
13.33
42.00
2.30
A-A
4.50
R1.30
R2.50
6-32 thru-hole threads
3.50
6.72
5.38
A
A
102.40
R0.50
1.20
.15
62.0
88.90
26.0
4.5
26.0
Notes:
1. No cracks at bends allowable
2. No burrs allowed this edge of opening.
3. PEM nut p/n SO-632-10 or equivalent
4. Mat'l: 1030 CRS Rockwell B 80 or equivalent 0.048 in. (1.2mm) thk.
5. Finish: Zinc post plate with clear chromate
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MM
DRAWN 2/12/03 LME
AMD
TITLE:
BACKPLATE,
26 mm cut-out
SIZE B
DWG. NO. 90Z0000047
REV A
SCALE: 1:1
WEIGHT:
SHEET 1 OF 1


REVISIONS
ZONE
REV.
DESCRIPTION
DATE
APPR
A
Release for insulator for 26 mm cutout backplate
7/18/03
Medium-tack faces outward
0.99 including release liners
0.43
Laminate items 1 and 3 to item 2 as shown with release liners to outside.
1
2
3
60.0
27.0
27.0
88.9
104.0
R2.5
⌀5.8
1 3M 9502HL Stamark Laminating Adhesive or equivalent. (0.051mm/0.002" thick #220 Industrial Acrylic on 0.165mm/0.0065" thick Kraft release liner.)
2 0.43mm/0.017" thick Formex GK-17 or equivalent.
3 3M 9425PC removable tape or equivalent. Optional for Solution 2 mounting application. (0.14mm/0.0055" thick high-tack/medium-tack double coated film tape on 0.1mm/0.004" Kraft release liner. High-tack side bonds to the Formex pad.)
4. Insulator tensile pull force from PCB (9425PC adhesive) should be 9-15 lbs.
5. High strength and medium strength sides should be clearly identifiable by release liner color or label.
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MM
TOLERANCES:
ANGLE: MACH +/- 1 BEND +/- 1
ONE PLACE DECIMAL +/- 0.30
TWO PLACE DECIMAL +/- 0.15
INTERPRET GEOMETRIC TOLERANCING PER:
MATERIAL
FINISH
NEXT ASSY
USED ON
APPLICATION
DRAWN
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:
DATE
7/18/03
NAME
LME
AMD
TITLE:
INSULATOR, 27 mm cut-out
SIZE
B
DWG. NO.
9200003-002
REV
A
SCALE: 1:1
WEIGHT:
SHEET 1 OF 1