LGA1150 Socket

Application Guide

September 2013

Order No.: 328999-002

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Revision History

Revision Number	Description	Revision Date
001	• Initial release	June 2013
002	• Added Desktop Intel® Pentium processor family	September 2013

1.0 Introduction

This document covers the LGA1150 socket for Desktop systems using the Desktop 4th Generation Intel® Core™ processor family, Desktop Intel® Pentium® processor family, and for UP Server / Workstation systems using the Intel® Xeon® processor E3-1200 v3 product family.

The information in this document include:

- The thermal and mechanical specifications for the socket
- The mechanical interface requirements to properly integrate the socket into a board design

1.1 Related Documents

Material and concepts available in the following documents may be beneficial when reading this document.

Table 1. Related Documents

Title	Document Number / Location
Desktop 4th Generation Intel® Core™ Processor Family and Desktop Intel® Pentium® Processor Family Datasheet - Volume 1 of 2	328897
Desktop 4th Generation Intel® Core™ Processor Family and Desktop Intel® Pentium® Processor Family Datasheet - Volume 2 of 2	328898
Intel® Xeon® Processor E3-1200 v3 Product Family Datasheet - Volume 1 of 2	328907
Intel® Xeon® Processor E3-1200 v3 Product Family Datasheet - Volume 2 of 2	329000
Desktop 4th Generation Intel® Core™ Processor Family and Intel® Xeon® Processor E3-1200 v3 Product Family Thermal Mechanical Design Guidelines	328900
Intel® 8 Series / C220 Series Chipset Family Platform Controller Hub (PCH) Thermal Mechanical Specifications and Design Guidelines	328906

1.2 Definition of Terms

Table 2. Terms and Descriptions

Term	Description
Bypass	Bypass is the area between a passive heatsink and any object that can act to form a duct. For this example, it can be expressed as a dimension away from the outside dimension of the fins to the nearest surface.
CTE	Coefficient of Thermal Expansion. The relative rate a material expands during a thermal event.
DTS	Digital Thermal Sensor reports a relative die temperature as an offset from TCC activation temperature.

continued...

Term	Description
FSC	Fan Speed Control
IHS	Integrated Heat Spreader: a component of the processor package used to enhance the thermal performance of the package. Component thermal solutions interface with the processor at the IHS surface.
ILM	Independent Loading Mechanism provides the force needed to seat the LGA1150 land package onto the socket contacts.
MD	Metal Defined pad is one where a pad is individually etched into the PCB with a minimum width trace exiting it.
PCH	Platform Controller Hub. The PCH is connected to the processor using the Direct Media Interface (DMI) and Intel® Flexible Display Interface (Intel® FDI).
LGA1150 socket	The processor mates with the system board through this surface mount, 1150-land socket.
PECI	The Platform Environment Control Interface (PECI) is a one-wire interface that provides a communication channel between Intel processor and chipset components to external monitoring devices.
Ψ_{ca}	Case-to-ambient thermal characterization parameter (psi). A measure of thermal solution performance using total package power. Defined as ($T_{CASE} - T_{LA}$) / Total Package Power. The heat source should always be specified for Y measurements.
Ψ_{CS}	Case-to-sink thermal characterization parameter. A measure of thermal interface material performance using total package power. Defined as ($T_{CASE} - T_S$) / Total Package Power.
Ψ_{sa}	Sink-to-ambient thermal characterization parameter. A measure of heatsink thermal performance using total package power. Defined as ($T_S - T_{LA}$) / Total Package Power.
SMD	The Solder Mask Defined pad is typically a pad in a flood plane where the solder mask opening defines the pad size for soldering to the component to the printed circuit board.
T_{CASE} or T_C	The case temperature of the processor, measured at the geometric center of the topside of the TTV IHS.
T_{CASE_MAX}	The maximum case temperature as specified in a component specification.
TCC	Thermal Control Circuit: Thermal monitor uses the TCC to reduce the die temperature by using clock modulation and/or operating frequency and input voltage adjustment when the die temperature is very near its operating limits.
$T_{CONTROL}$	$T_{CONTROL}$ is a static value that is below the TCC activation temperature and used as a trigger point for fan speed control. When DTS > $T_{CONTROL}$, the processor must comply to the TTV thermal profile.
TDP	Thermal Design Power: Thermal solution should be designed to dissipate this target power level. TDP is not the maximum power that the processor can dissipate.
Thermal Monitor	A power reduction feature designed to decrease temperature after the processor has reached its maximum operating temperature.
Thermal Profile	Line that defines case temperature specification of the TTV at a given power level.
TIM	Thermal Interface Material: The thermally conductive compound between the heatsink and the processor case. This material fills the air gaps and voids, and enhances the transfer of the heat from the processor case to the heatsink.
TTV	Thermal Test Vehicle. A mechanically equivalent package that contains a resistive heater in the die to evaluate thermal solutions.
T_{LA}	The measured ambient temperature locally surrounding the processor. The ambient temperature should be measured just upstream of a passive heatsink or at the fan inlet for an active heatsink.
T_{SA}	The system ambient air temperature external to a system chassis. This temperature is usually measured at the chassis air inlets.

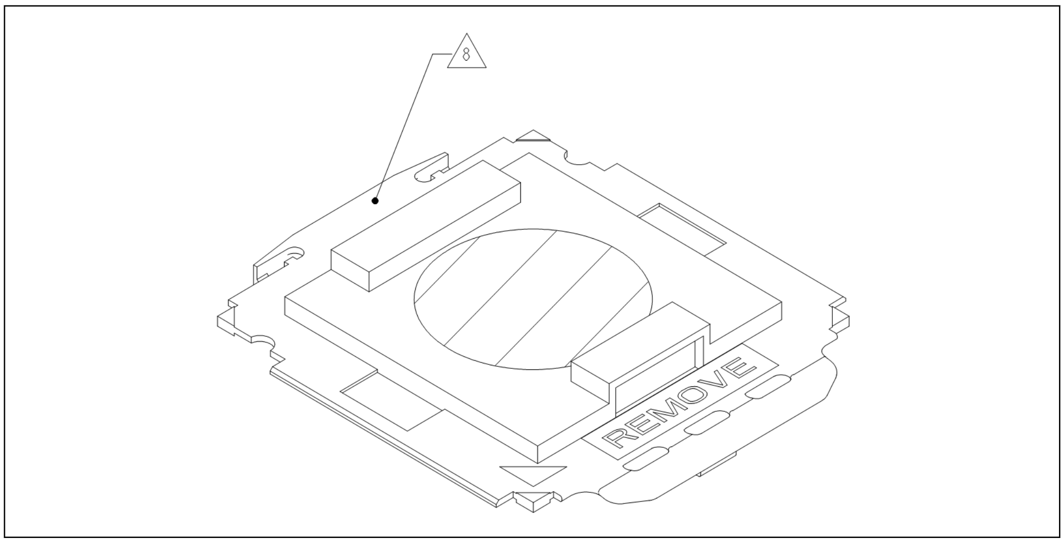
2.0 LGA1150 Socket

This chapter describes a surface mount, LGA (Land Grid Array) socket intended for the processors. The socket provides I/O, power and ground contacts. The socket contains 1150 contacts arrayed about a cavity in the center of the socket with lead-free solder balls for surface mounting on the motherboard.

The contacts are arranged in two opposing L-shaped patterns within the grid array. The grid array is 40 x 40 with 24 x 16 grid depopulation in the center of the array and selective depopulation elsewhere.

The socket must be compatible with the package (processor) and the Independent Loading Mechanism (ILM). The ILM design includes a back plate which is integral to having a uniform load on the socket solder joints. Socket loading specifications are listed in LGA1150 Socket and ILM Specifications on page 24.

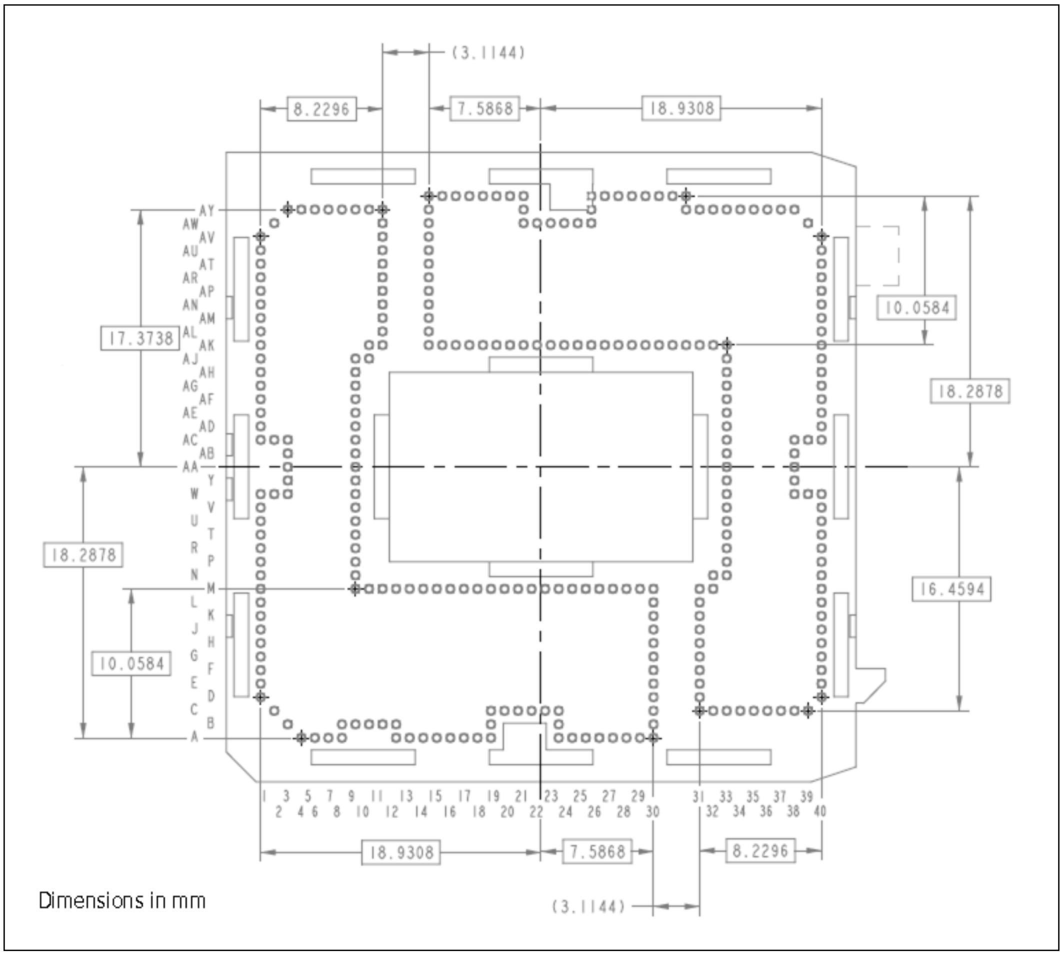
Figure 1. LGA1150 Pick and Place Cover



2.1 Board Layout

The land pattern for the LGA1150 socket is 36 mils X 36 mils (X by Y) within each of the two L-shaped sections. There is no round-off (conversion) error between socket pitch (0.9144 mm) and board pitch (36 mil) as these values are equivalent. The two L-sections are offset by 0.9144 mm (36 mil) in the x direction and 3.114 mm (122.6 mil) in the y direction see Figure 2 on page 10. This was to achieve a common package land to PCB land offset that ensures a single PCB layout for socket designs from the multiple vendors.

Figure 2. LGA1150 Socket Land Pattern

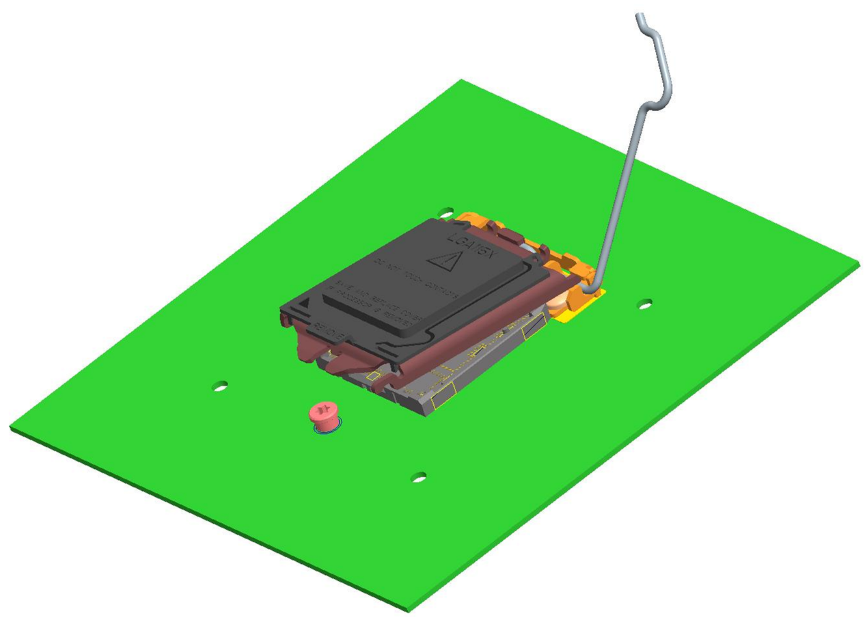


2.2 Attachment to Motherboard

The socket is attached to the motherboard by 1150 solder balls. There are no additional external methods (that is, screw, extra solder, adhesive, and so on) to attach the socket.

As indicated in Figure 1 on page 9, the Independent Loading Mechanism (ILM) is not present during the attach (reflow) process.

Figure 3. Attachment to Motherboard



2.3 Socket Components

The socket has two main components, the socket body and Pick and Place (PnP) cover, and is delivered as a single integral assembly. Refer to Socket Mechanical Drawings for detailed drawings.

Socket Body Housing

The housing material is thermoplastic or equivalent with UL 94 V-0 flame rating capable of withstanding 260 °C for 40 seconds, which is compatible with typical reflow/rework profiles. The socket coefficient of thermal expansion (in the XY plane) and creep properties must be such that the integrity of the socket is maintained for the conditions listed in LGA1150 Socket and ILM Specifications on page 24.

The color of the housing will be dark as compared to the solder balls to provide the contrast needed for pick and place vision systems.

Solder Balls

A total of 1150 solder balls corresponding to the contacts are on the bottom of the socket for surface mounting with the motherboard. The socket solder ball has the following characteristics:

- Lead free SAC (SnAgCu) 305 solder alloy with a silver (Ag) content between 3% and 4% and a melting temperature of approximately 217 °C. The alloy is compatible with immersion silver (ImAg) and Organic Solderability Protectant (OSP) motherboard surface finishes and a SAC alloy solder paste.
- Solder ball diameter 0.6 mm ± 0.02 mm, before attaching to the socket lead.

The co-planarity (profile) and true position requirements are defined in Socket Mechanical Drawings.

Contacts

Base material for the contacts is high strength copper alloy.

For the area on socket contacts where processor lands will mate, there is a 0.381 μm [15 μinches] minimum gold plating over 1.27 μm [50 minches] minimum nickel underplate.

No contamination by solder in the contact area is allowed during solder reflow.

Pick and Place Cover

The cover provides a planar surface for vacuum pick up used to place components in the Surface Mount Technology (SMT) manufacturing line. The cover remains on the socket during reflow to help prevent contamination during reflow. The cover can withstand 260 °C for 40 seconds (typical reflow/rework profile) and the conditions listed in LGA1150 Socket and ILM Specifications on page 24 without degrading.

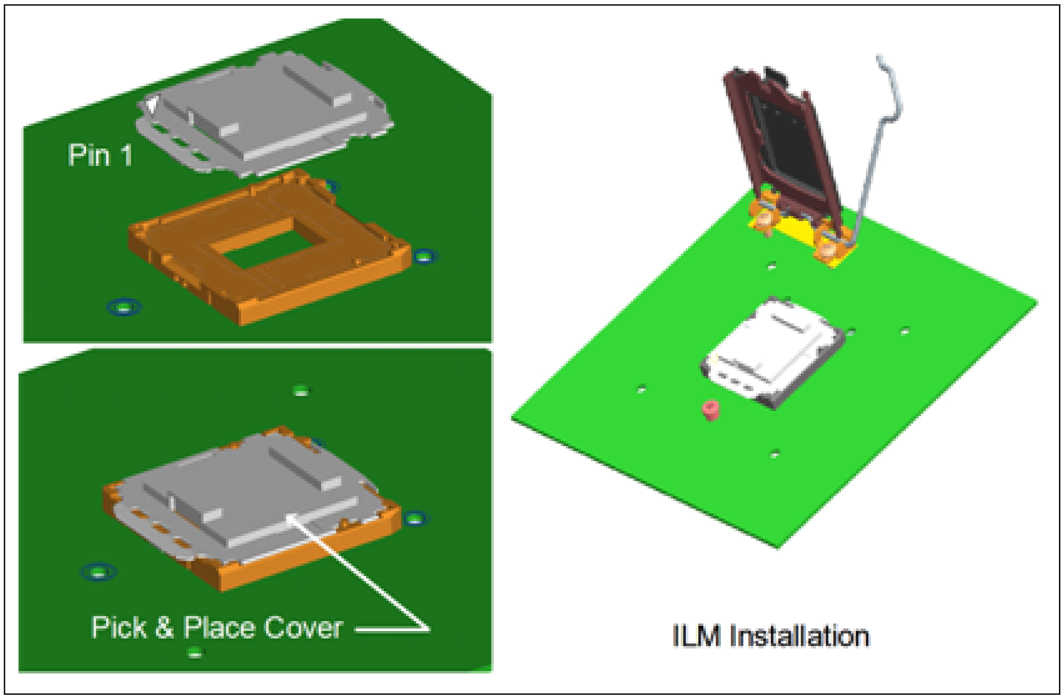
As indicated in Figure 4 on page 13, the cover remains on the socket during ILM installation, and should remain on whenever possible to help prevent damage to the socket contacts.

Cover retention must be sufficient to support the socket weight during lifting, translation, and placement (board manufacturing), and during board and system shipping and handling. PnP Cover should only be removed with tools, to prevent the cover from falling into the contacts.

The socket vendors have a common interface on the socket body where the PnP cover attaches to the socket body. This should allow the PnP covers to be compatible between socket suppliers.

As indicated in Figure 4 on page 13, a Pin 1 indicator on the cover provides a visual reference for proper orientation with the socket.

Figure 4. Pick and Place Cover



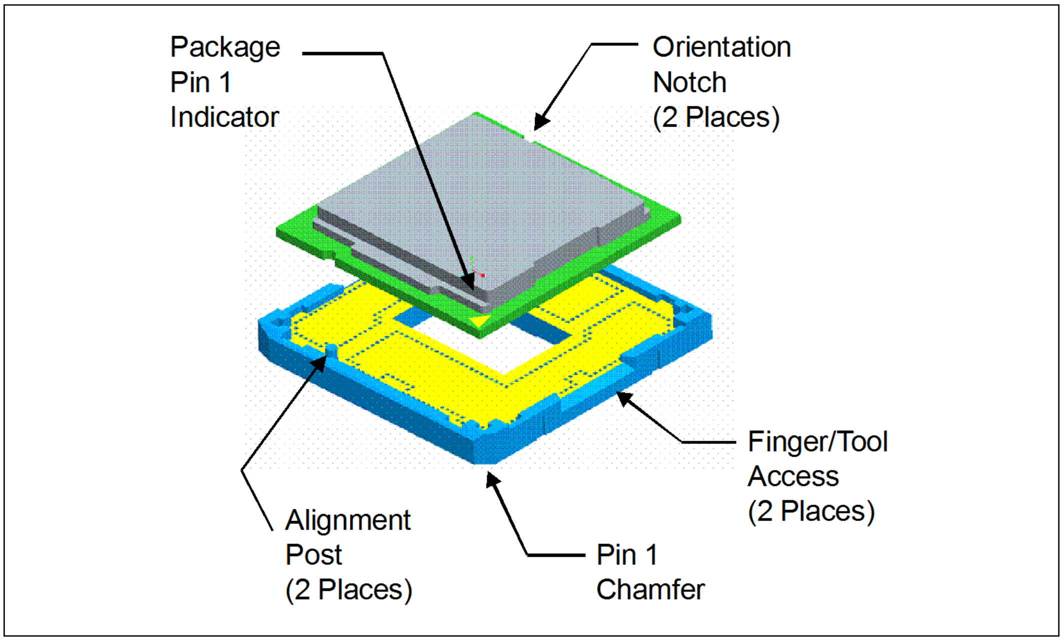
2.4 Package Installation / Removal

As indicated in Figure 5 on page 14, access is provided to facilitate manual installation and removal of the package.

To assist in package orientation and alignment with the socket:

- The package Pin 1 triangle and the socket Pin 1 chamfer provide visual reference for proper orientation.
- The package substrate has orientation notches along two opposing edges of the package, offset from the centerline. The socket has two corresponding orientation posts to physically prevent mis-orientation of the package. These orientation features also provide initial rough alignment of package to socket.
- The socket has alignment walls at the four corners to provide final alignment of the package.

Figure 5. Package Installation / Removal Features



Socket Standoffs and Package Seating Plane

Standoffs on the bottom of the socket base establish the minimum socket height after solder reflow and are specified in Socket Mechanical Drawings.

Similarly, a seating plane on the topside of the socket establishes the minimum package height. See Package / Socket Stackup Height on page 24 for the calculated IHS height above the motherboard.

2.5 Durability

The socket must withstand 20 cycles of processor insertion and removal. The maximum chain contact resistance from Table 6 on page 26 must be met when mated in the 1st and 20th cycles.

The socket Pick and Place cover must withstand 15 cycles of insertion and removal.

2.6 Markings

There are three markings on the socket:

- LGA1150: Font type is Helvetica Bold - minimum 6 point (2.125 mm). This mark will also appear on the pick and place cap.
- Manufacturer's insignia (font size at supplier discretion).
- Lot identification code (allows traceability of manufacturing date and location).

All markings must withstand 260 °C for 40 seconds (typical reflow/rework profile) without degrading, and must be visible after the socket is mounted on the motherboard.

LGA1150 and the manufacturer's insignia are molded or laser marked on the side wall.

2.7 Component Insertion Forces

Any actuation must meet or exceed SEMI S8-95 Safety Guidelines for Ergonomics/ Human Factors Engineering of Semiconductor Manufacturing Equipment, example Table R2-7 (Maximum Grip Forces). The socket must be designed so that it requires no force to insert the package into the socket.

2.8 Socket Size

Socket information needed for motherboard design is given in Appendix C.

This information should be used in conjunction with the reference motherboard keep-out drawings provided in Appendix B to ensure compatibility with the reference thermal mechanical components.

3.0 Independent Loading Mechanism (ILM)

The ILM has two critical functions – deliver the force to seat the processor onto the socket contacts and distribute the resulting compressive load evenly through the socket solder joints.

The mechanical design of the ILM is integral to the overall functionality of the LGA1150 socket. Intel performs detailed studies on integration of processor package, socket and ILM as a system. These studies directly impact the design of the ILM. The Intel reference ILM will be "build to print" from Intel controlled drawings. Intel recommends using the Intel Reference ILM. Custom non-Intel ILM designs do not benefit from Intel's detailed studies and may not incorporate critical design parameters.

Note: There is a single ILM design for the LGA1150 socket, LGA1156 socket, and LGA1155 socket.

3.1 Design Concept

The ILM consists of two assemblies that will be procured as a set from the enabled vendors. These two components are ILM assembly and back plate. To secure the two assemblies, two types of fasteners are required – a pair (2) of standard 6-32 thread screws and a custom 6-32 thread shoulder screw. The reference design incorporates a T-20 Torx* head fastener. The Torx* head fastener was chosen to ensure end users do not inadvertently remove the ILM assembly and for consistency with the LGA1366 socket ILM. The Torx* head fastener is also less susceptible to driver slippage. Once assembled the ILM is not required to be removed to install / remove the motherboard from a chassis.

ILM Assembly Design Overview

The ILM assembly consists of 4 major pieces – ILM cover, load lever, load plate, and the hinge frame assembly.

All of the pieces in the ILM assembly except the hinge frame and the screws used to attach the back plate are fabricated from stainless steel. The hinge frame is plated. The frame provides the hinge locations for the load lever and load plate. An insulator is pre-applied to the bottom surface of the hinge frame.

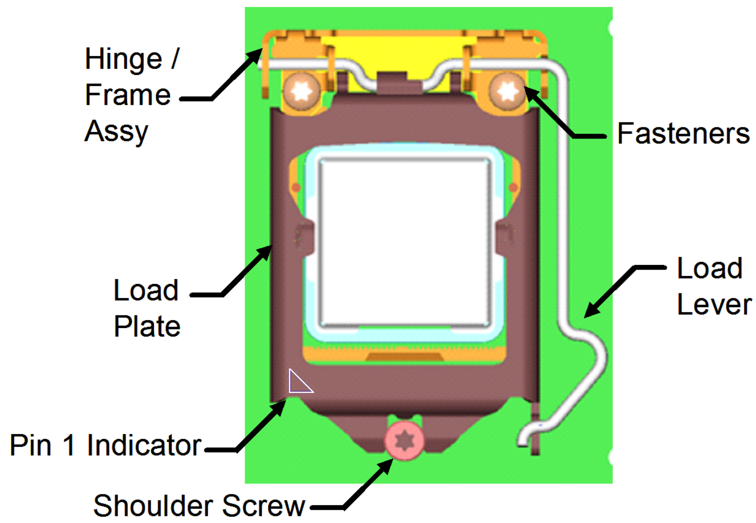
Figure 14 on page 30 through Figure 17 on page 33 list the applicable keep-out zones of the socket and ILM. Figure 14 on page 30 describes recommended maximum heights of neighboring components on the primary side of the board to avoid interference with the Intel® reference thermal solution. The keep-out zone in Figure 14 on page 30 does not prevent incidental contact with the ILM load plate and ILM cover while it is open for insertion/removal of the processor. In designs requiring no cosmetic marks to be made on capacitors along the hinge side of the ILM, the recommendation is for the location of the capacitors to be against the keep-out zone boundary closest to the hinge of the ILM. This location does not prevent contact between the ILM and the capacitors; however it minimizes the load applied by the ILM to the capacitors.

The ILM assembly design ensures that, once assembled to the back plate, the only features touching the board are the shoulder screw and the insulated hinge frame assembly. The nominal gap of the load plate to the board is ~1 mm.

When closed, the load plate applies two point loads onto the IHS at the "dimpled" features shown in Figure 6 on page 17. The reaction force from closing the load plate is transmitted to the hinge frame assembly and through the fasteners to the back plate. Some of the load is passed through the socket body to the board, inducing a slight compression on the solder joints.

A pin 1 indicator will be marked on the ILM assembly.

Figure 6. ILM Assembly with Installed Processor



Independent Loading Mechanism (ILM) Back Plate Design Overview

The back plate is a flat steel back plate with pierced and extruded features for ILM attach. A clearance hole is located at the center of the plate to allow access to test points and backside capacitors if required. An insulator is pre-applied. A notch is placed in one corner to assist in orienting the back plate during assembly.

Note: The Server ILM back plate is different from the Desktop design. Since Server secondary-side clearance of 3.0 mm [0.118 inch] is generally available for leads and backside components, so Server ILM back plate is designed with 1.8 mm thickness and 2.2 mm entire height including punch protrusion length.

Caution: Intel does NOT recommend using the server back plate for high-volume desktop applications at this time as the server back plate test conditions cover a limited envelope. Back plates and screws are similar in appearance. To prevent mixing, different levels of differentiation between server and desktop back plate and screws have been implemented.

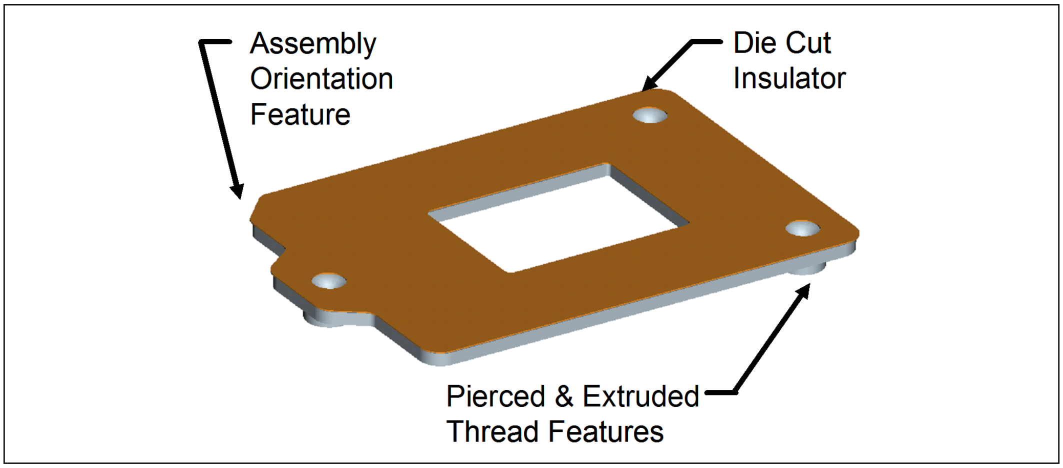
For ILM back plate, three levels of differentiation have been implemented:

- Unique part numbers, please refer to part numbers listed in Table 7 on page 28.
- Desktop ILM back plate to use black lettering for marking versus server ILM back plate to use yellow lettering for marking.

- Desktop ILM back plate using marking "115XDBP" versus server ILM back plate using marking "115XSBP".

Note: When reworking a BGA component or the socket that the heatsink, battery, ILM and ILM back plate are removed prior to rework. The ILM back plate should also be removed when reworking through hole mounted components in a mini-wave or solder pot). The maximum temperature for the pre-applied insulator on the ILM is approximately 106 °C.

Figure 7. Back Plate



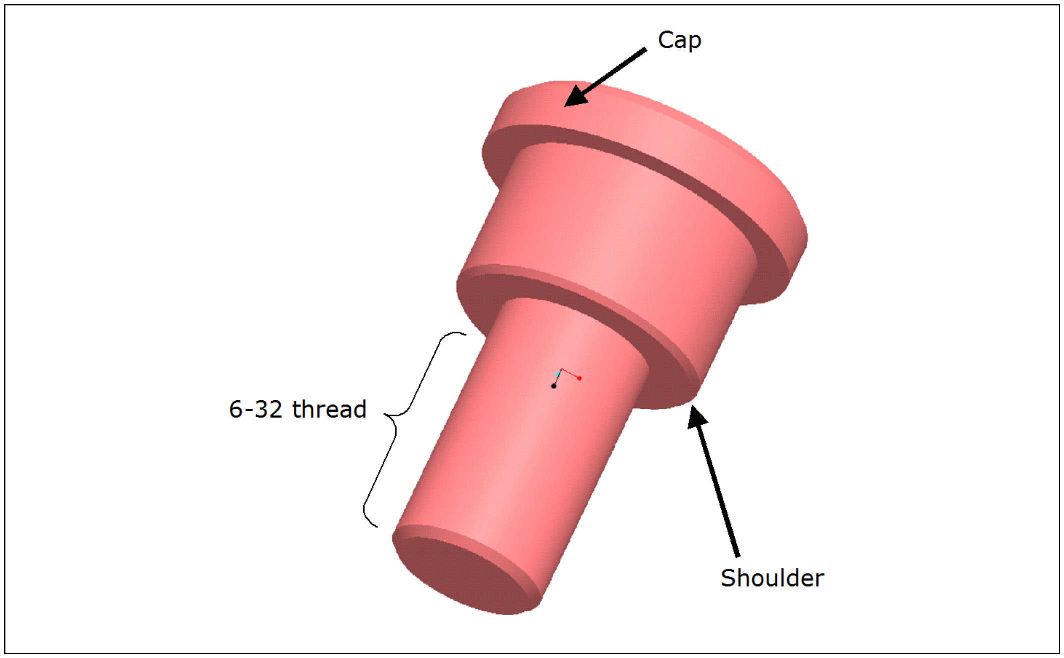
Shoulder Screw and Fasteners Design Overview

The shoulder screw is fabricated from carbonized steel rod. The shoulder height and diameter are integral to the mechanical performance of the ILM. The diameter provides alignment of the load plate. The height of the shoulder ensures the proper loading of the IHS to seat the processor on the socket contacts. The design assumes the shoulder screw has a minimum yield strength of 235 MPa.

The screws for Server ILM are different from Desktop design. The length of Server ILM screws are shorter than the Desktop screw length to satisfy Server secondary-side clearance limitation. Server ILM back plate to use black nickel plated screws, whereas desktop ILM back plate to use clear plated screws. Unique part numbers, please refer to Table 7 on page 28.

Note: The reference design incorporates a T-20 Torx* head fastener. The Torx* head fastener was chosen to ensure end users do not inadvertently remove the ILM assembly and for consistency with the LGA1366 socket ILM.

Figure 8. Shoulder Screw



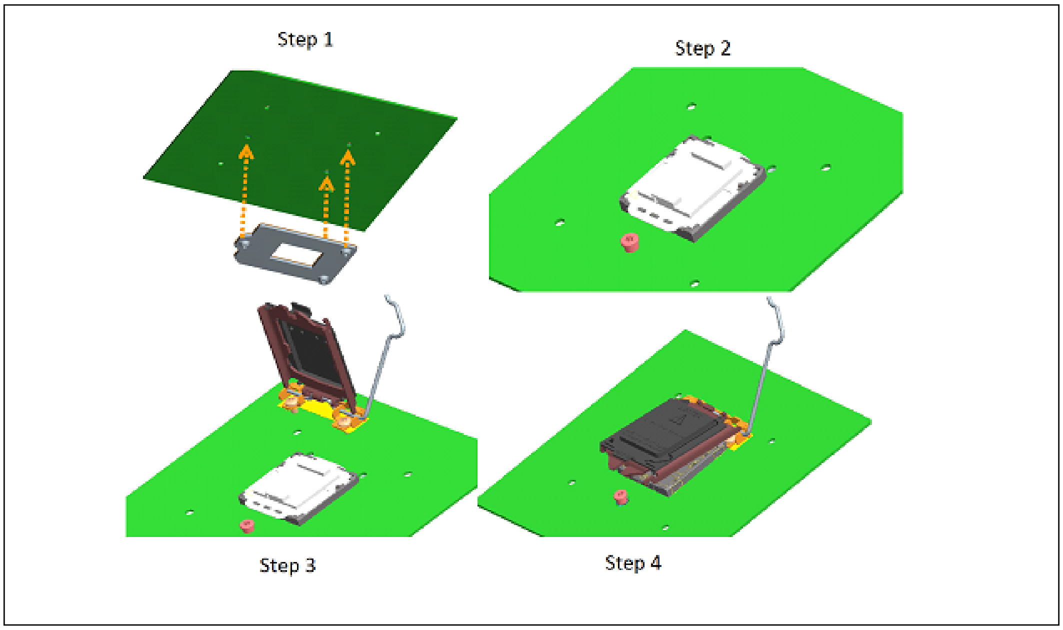
3.2 Assembly of Independent Loading Mechanism (ILM) to a Motherboard

The ILM design allows a bottoms up assembly of the components to the board. See Figure 9 on page 20 for step by step assembly sequence.

1. Place the back plate in a fixture. The motherboard is aligned with the fixture.
2. Install the shoulder screw in the single hole near Pin 1 of the socket. Torque to a minimum and recommended 8 inch-pounds, but not to exceed 10 inch-pounds.
3. Install two (2) 6–32 fasteners. Torque to a minimum and recommended 8 inch-pounds, but not to exceed 10 inch-pounds.
4. Remove pick and place cover and close ILM leaving the ILM cover in place.

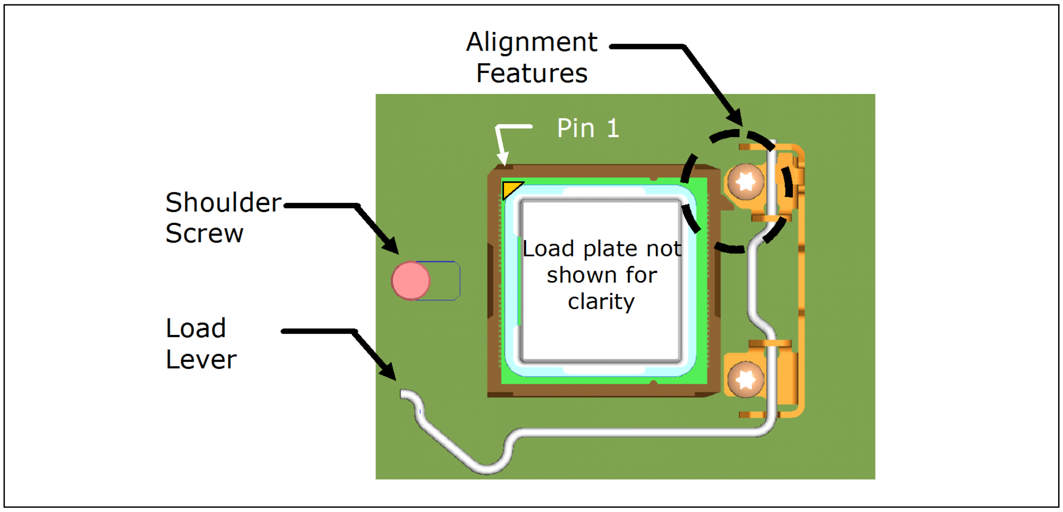
The thread length of the shoulder screw accommodates a nominal board thicknesses of 0.062”.

Figure 9. Independent Loading Mechanism (ILM) Assembly



As indicated in Figure 10 on page 20, the shoulder screw, socket protrusion and ILM key features prevent 180 degree rotation of ILM cover assembly with respect to socket. The result is a specific Pin 1 orientation with respect to ILM lever.

Figure 10. Pin1 and Independent Loading Mechanism (ILM) Lever



3.3 Independent Loading Mechanism (ILM) Interchangeability

ILM assembly and ILM back plate built from the Intel controlled drawings are intended to be interchangeable. Interchangeability is defined as an ILM from Vendor A will demonstrate acceptable manufacturability and reliability with a socket body from Vendor A, B or C. ILM assembly and ILM back plate from all vendors are also interchangeable.

The ILM are an integral part of the socket validation testing. ILMs from each vendor will be matrix tested with the socket bodies from each of the current vendors. The tests would include: manufacturability, bake and thermal cycling.

See Component Suppliers on page 28 for vendor part numbers that were tested.

Note: ILMs that are not compliant to the Intel controlled ILM drawings can not be assured to be interchangeable.

3.4 Markings

There are four markings on the ILM:

- 115XLM: Font type is Helvetica Bold - minimum 6 point (2.125 mm).
- Manufacturer's insignia (font size at supplier's discretion).
- Lot identification code (allows traceability of manufacturing date and location).
- Pin 1 indicator on the load plate.

All markings must be visible after the ILM is assembled on the motherboard.

115XLM and the manufacturer's insignia can be ink stamped or laser marked on the side wall.

3.5 Independent Loading Mechanism (ILM) Cover

Intel has developed an ILM Cover that will snap onto the ILM for the LGA115x socket family. The ILM cover is intended to reduce the potential for socket contact damage from operator and customer fingers being close to the socket contacts to remove or install the pick and place cap. The ILM Cover concept is shown in Figure 11 on page 22.

The ILM Cover is intended to be used in place of the pick and place cover once the ILM is assembled to the motherboard. The ILM will be offered with the ILM Cover pre-assembled as well as offered as a discrete component.

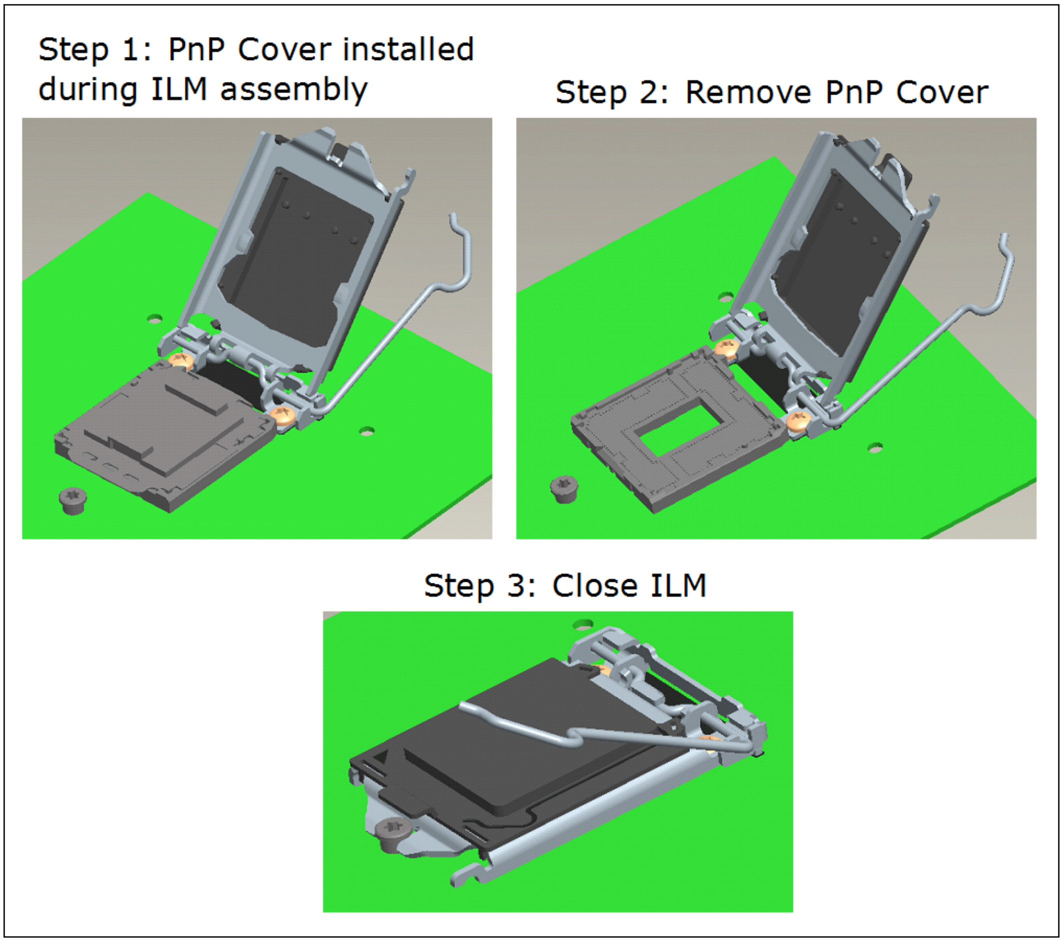
ILM Cover features:

- Pre-assembled by the ILM vendors to the ILM load plate. It will also be offered as a discrete component.
- The ILM cover will pop off if a processor is installed in the socket, and the ILM Cover and ILM are from the same manufacturer.
- ILM Cover can be installed while the ILM is open.
- Maintain inter-changeability between validated ILM vendors for LGA115x socket, with the exception noted below.

- The ILM cover for the LGA115x socket will have a flammability rating of V-2 per UL 60950-1.

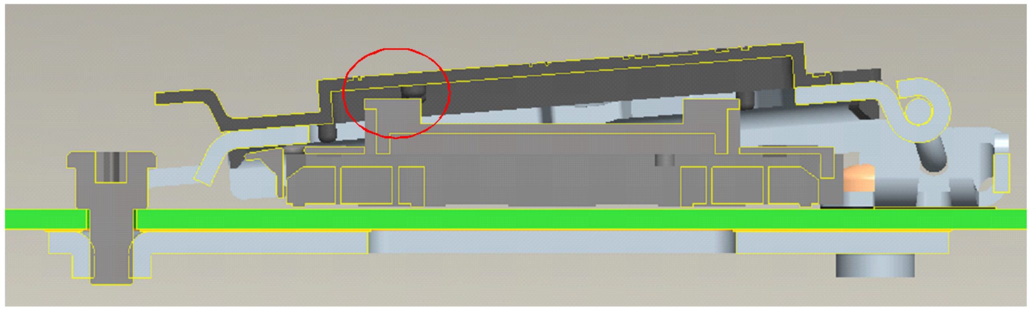
Note: The ILM Cover pop off feature is not supported if the ILM Covers are interchanged on different vendor's ILMs.

Figure 11. Independent Loading Mechanism (ILM) Cover



As indicated in Figure 11 on page 22, the pick and place cover should remain installed during ILM assembly to the motherboard. After assembly the pick and place cover is removed, the ILM Cover installed and the ILM mechanism closed. The ILM Cover is designed to pop off if the pick and place cover is accidentally left in place and the ILM closed with the ILM Cover installed. This is shown in Figure 12 on page 23.

Figure 12. ILM Cover and PnP Cover Interference



As indicated in Figure 12 on page 23, the pick and place cover cannot remain in place and used in conjunction with the ILM Cover. The ILM Cover is designed to interfere and pop off if the pick and place cover is unintentionally left in place. The ILM cover will also interfere and pop off if the ILM is closed with a processor in place in the socket.

4.0 LGA1150 Socket and ILM Specifications

This chapter describes the following specifications and requirements:

- Mechanical Specifications on page 24
- Electrical Requirements on page 25
- Environmental Requirements on page 26

4.1 Mechanical Specifications

Component Mass

Table 3. Socket Component Mass

Component	Mass
Socket Body, Contacts and PnP Cover	10 g
ILM Cover	29 g
ILM Back Plate	38 g

Package / Socket Stackup Height

The following table provides the stackup height of a processor in the 1150-land LGA package and LGA1150 socket with the ILM closed and the processor fully seated in the socket.

Table 4. 1150-land Package and LGA1150 Socket Stackup Height

Component	Stackup Height	Note
Integrated Stackup Height (mm) From Top of Board to Top of IHS	7.781 ± 0.335 mm	2
Socket Nominal Seating Plane Height	3.4 ± 0.2 mm	1
Package Nominal Thickness (lands to top of IHS)	4.381 ± 0.269 mm	1

Note:
1. This data is provided for information only, and should be derived from: (a) the height of the socket seating plane above the motherboard after reflow, given in Socket Mechanical Drawings, (b) the height of the package, from the package seating plane to the top of the IHS, and accounting for its nominal variation and tolerances that are given in the corresponding processor datasheet.
2. The integrated stackup height value is a RSS calculation based on current and planned processors that will use the ILM design.

Loading Specifications

The socket will be tested against the conditions listed in Thermal Solution Quality and Reliability Requirements Chapter of the Processor Thermal Mechanical Design Guidelines (see Related Documents section) with heatsink and the ILM attached, under the loading conditions outlined in this section.

Table 5 on page 25 provides load specifications for the LGA1150 socket with the ILM installed. The maximum limits should not be exceeded during heatsink assembly, shipping conditions, or standard use condition. Exceeding these limits during test may result in component failure. The socket body should not be used as a mechanical reference or load-bearing surface for thermal solutions.

Table 5. Socket and ILM Mechanical Specifications

Parameter	Minimum	Maximum	Notes
ILM static compressive load on processor IHS	311 N [70 lbf]	600 N [135 lbf]	3, 4, 7, 8
Heatsink static compressive load	0 N [0 lbf]	222 N [50 lbf]	1, 2, 3
Total static compressive Load (ILM plus Heatsink)	311 N [70 lbf]	822 N [185 lbf]	3, 4, 7, 8
Dynamic Compressive Load (with heatsink installed)	N/A	712 N [160 lbf]	1, 3, 5, 6
Pick & Place cover insertion force	N/A	10.2 N [2.3 lbf]	–
Pick & Place cover removal force	2.2N [0.5 lbf]	7.56 N [1.7 lbf]	9
Load lever actuation force	N/A	20.9N [4.7lbf] in the vertical direction 10.2 N [2.3 lbf] in the lateral direction.	–
Maximum heatsink mass	N/A	500g	10

Notes:
1. These specifications apply to uniform compressive loading in a direction perpendicular to the IHS top surface.
2. This is the minimum and maximum static force that can be applied by the heatsink and its retention solution to maintain the heatsink to IHS interface. This does not imply the Intel reference TIM is validated to these limits.
3. Loading limits are for the LGA1150 socket.
4. This minimum limit defines the static compressive force required to electrically seat the processor onto the socket contacts. The minimum load is a beginning of life load.
5. Dynamic loading is defined as a load a 4.3 m/s [170 in/s] minimum velocity change average load superimposed on the static load requirement.
6. Test condition used a heatsink mass of 500 gm [1.102 lb.] with 50 g acceleration (table input) and an assumed 2X Dynamic Acceleration Factor (DAF). The dynamic portion of this specification in the product application can have flexibility in specific values. The ultimate product of mass times acceleration plus static heatsink load should not exceed this limit.
7. The maximum BOL value and must not be exceeded at any point in the product life.
8. The minimum value is a beginning of life loading requirement based on load degradation over time.
9. The maximum removal force is the flick up removal upwards thumb force (measured at 45°), not applicable to SMT operation for system assembly. Only the minimum removal force is applicable to vertical removal in SMT operation for system assembly.
10. The maximum heatsink mass includes the core, extrusion, fan and fasteners. This mass limit is evaluated using the POR heatsink attach to the PCB.

4.2 Electrical Requirements

LGA1150 socket electrical requirements are measured from the socket-seating plane of the processor to the component side of the socket PCB to which it is attached. All specifications are maximum values (unless otherwise stated) for a single socket contact, but includes effects of adjacent contacts where indicated.

Table 6. Electrical Requirements for LGA1150 Socket

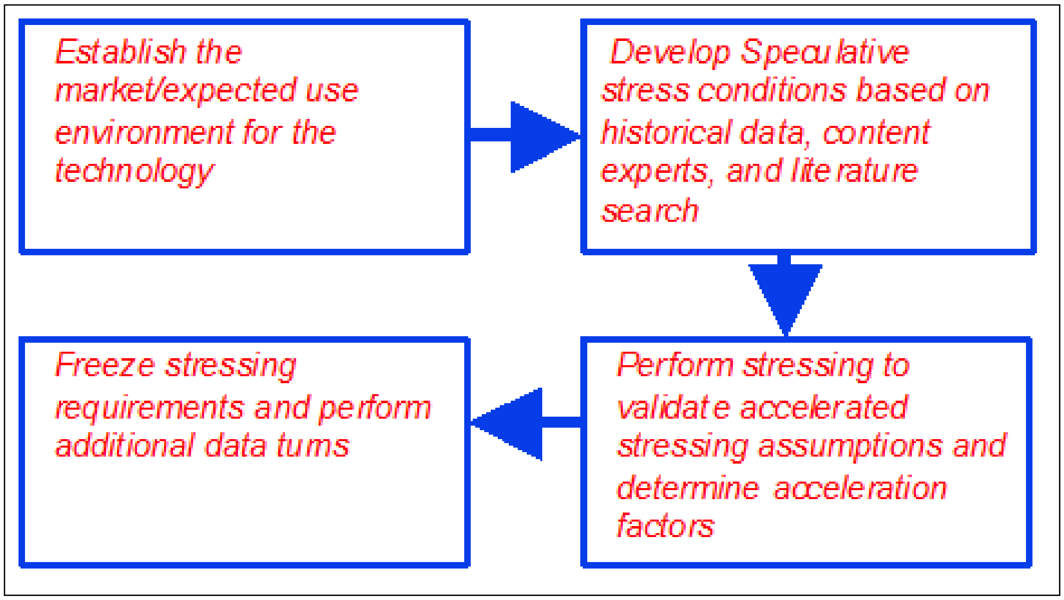
Parameter	Value	Comment
Mated loop inductance, Loop	<3.6nH	The inductance calculated for two contacts, considering one forward conductor and one return conductor. These values must be satisfied at the worst-case height of the socket.
Socket Average Contact Resistance (EOL)	19 mOhm	The socket average contact resistance target is calculated from the following equation: sum (Ni X LLCRi) / sum (Ni) • LLCRi is the chain resistance defined as the resistance of each chain minus resistance of shorting bars divided by number of lands in the daisy chain. • Ni is the number of contacts within a chain. • I is the number of daisy chain, ranging from 1 to 119 (total number of daisy chains). The specification listed is at room temperature and has to be satisfied at all time.
Max Individual Contact Resistance (EOL)	100 mOhm	The specification listed is at room temperature and has to be satisfied at all time. Socket Contact Resistance: The resistance of the socket contact, solderball, and interface resistance to the interposer land; gaps included.
Bulk Resistance Increase	≤3 mΩ	The bulk resistance increase per contact from 25 °C to 100 °C.
Dielectric Withstand Voltage	360 Volts RMS	
Insulation Resistance	800 MΩ	

4.3 Environmental Requirements

Design, including materials, shall be consistent with the manufacture of units that meet the following environmental reference points.

The reliability targets in this section are based on the expected field use environment for these products. The test sequence for new sockets will be developed using the knowledge-based reliability evaluation methodology, which is acceleration factor dependent. A simplified process flow of this methodology can be seen in Figure 13 on page 27.

Figure 13. Flow Chart of Knowledge-Based Reliability Evaluation Methodology



A detailed description of this methodology can be found at:

ftp://download.intel.com/technology/itj/q32000/pdf/reliability.pdf.

Appendix A Component Suppliers

Note: The part numbers listed below identifies the reference components. End-users are responsible for the verification of the Intel enabled component offerings with the supplier. These vendors and devices are listed by Intel as a convenience to Intel's general customer base, but Intel does not make any representations or warranties whatsoever regarding quality, reliability, functionality, or compatibility of these devices. Customers are responsible for thermal, mechanical, and environmental validation of these solutions. This list and/or these devices may be subject to change without notice.

Table 7. LGA1150 Socket and ILM Components

Item	Intel PN	Foxconn	Molex	Tyco	Lotes	ITW
LGA1150 Socket	G27433-002	PE115027-4041-01F	475963032	2134930-1	ACA-ZIF-138-P01	NA
LGA115X ILM with cover	G11449-002	PT44L61-6411	N/A	2013882-8	ACA-ZIF-078-Y28	FT1002-A-F
LGA115X ILM without cover	E36142-002	PT44L61-6401	475968855	2013882-3	ACA-ZIF-078-Y19	FT1002-A
LGA115X ILM cover only	G12451-001	012-1000-5377	N/A	1-2134503-1	ACA-ZIF-127-P01	FT1002-F
Desktop Backplate with screws	E36143-002	PT44P19-6401	475969930	2069838-2	DCA-HSK-144-Y09	FT1002-B-CD
1U Backplate (with screws)	E66807-001	PT44P18-6401	N/A	N/A	DCA-HSK-157-Y03	NA

Notes:
1. The 1U Back Plate is a point solution for uP servers. This has not been validated for desktop design. This should be used only were the clearance between the back of the motherboard and chassis is limited such as 1U rack servers.
2. Individual ILM covers are made available for post-sales support

Table 8. Supplier Contact Information

Supplier	Contact	Phone	Email
Foxconn	Eric Ling	+1 503 693 3509 x225	eric.ling@foxconn.com
ITW Fastex	Chak Chakir	+1 512 989 7771	Chak.chakir@itweba.com
Lotes Co., Ltd.	Windy Wang	+1 604 721 1259	windy@lotestech.com
Molex	Carol Liang	+86 21 504 80889 x3301	carol.liang@molex.com
Tyco	Alex Yeh (primary contact)	+886 2 21715280	alex.yeh@te.com
	Stanley Yen (secondary contact)	+886 2 21715291	stanley.yen@te.com

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

Appendix B Mechanical Drawings

The following table lists the mechanical drawings included in this appendix.

Table 9. Mechanical Drawing List

Drawing Description	Figure Number / Location
Socket / Heatsink / ILM Keep-out Zone Primary Side (Top)	Figure 14 on page 30
Socket / Heatsink / ILM Keep-out Zone Secondary Side (Bottom)	Figure 15 on page 31
Socket / Processor / ILM Keep-out Zone Primary Side (Top)	Figure 16 on page 32
Socket / Processor / ILM Keep-out Zone Secondary Side (Bottom)	Figure 17 on page 33

Figure 14. Socket/Heatsink / ILM Keep-out Zone Primary Side (Top)

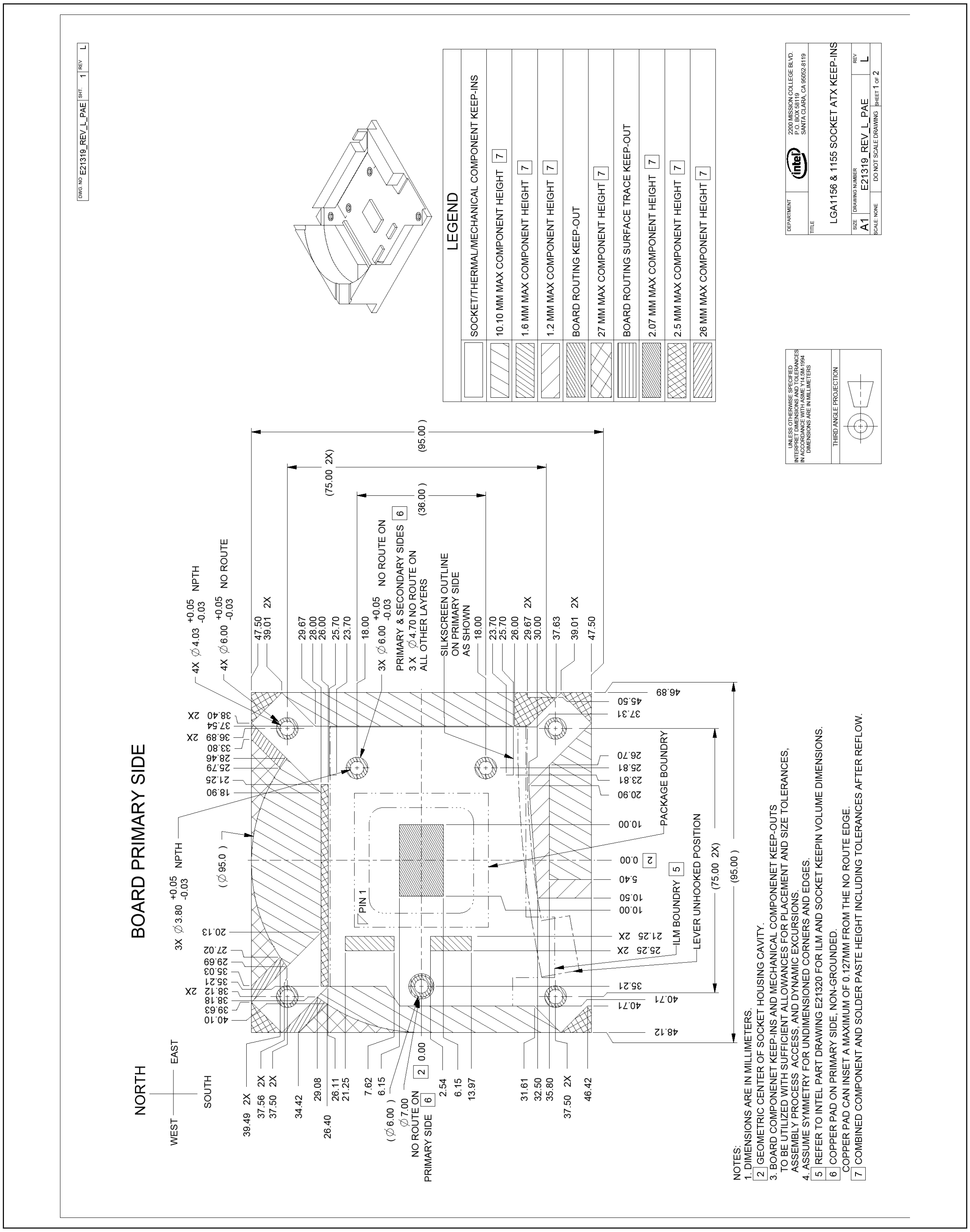


Figure 15. Socket / Heatsink / ILM Keep-out Zone Secondary Side (Bottom)

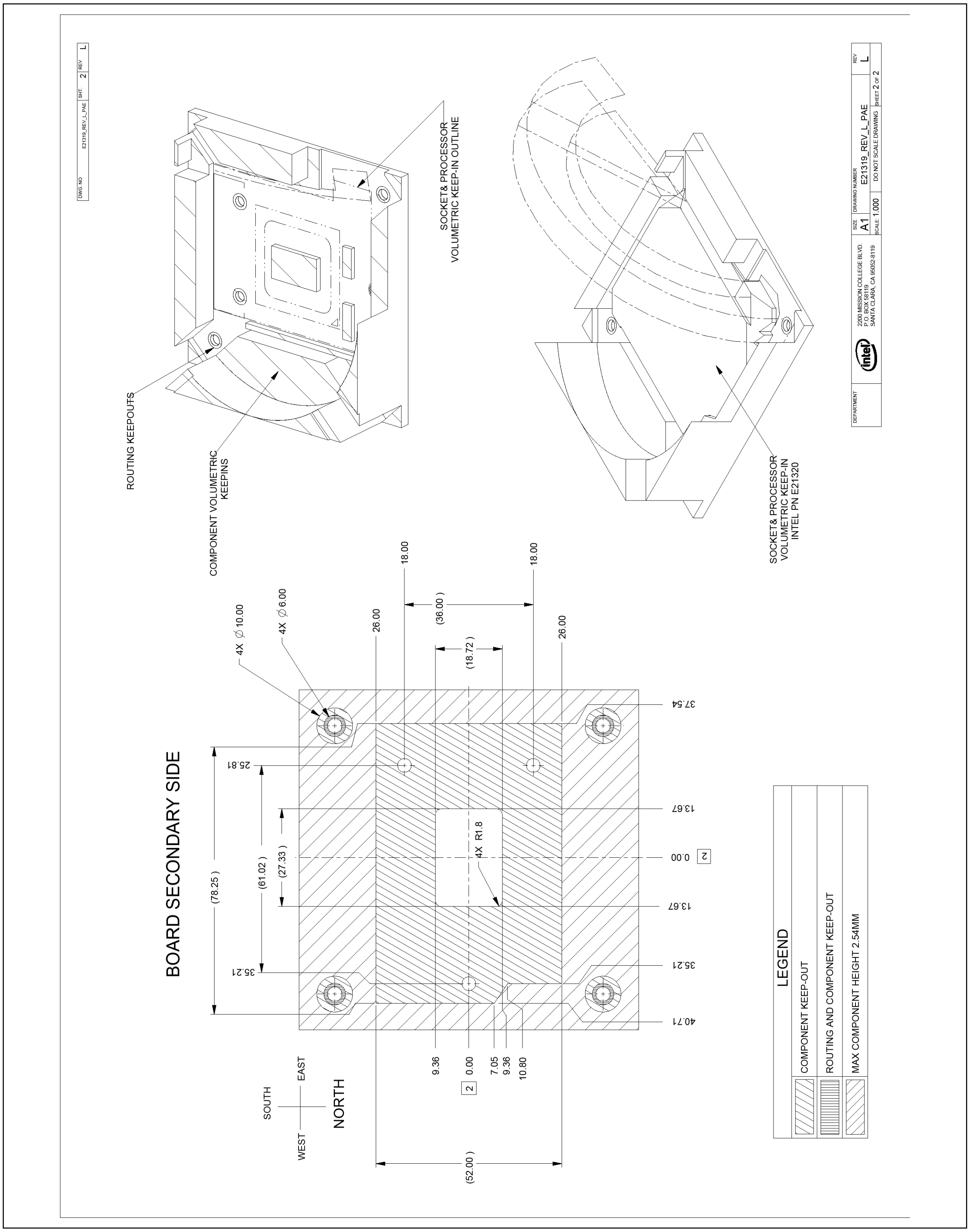


Figure 16. Socket / Processor / ILM Keep-out Zone Primary Side (Top)

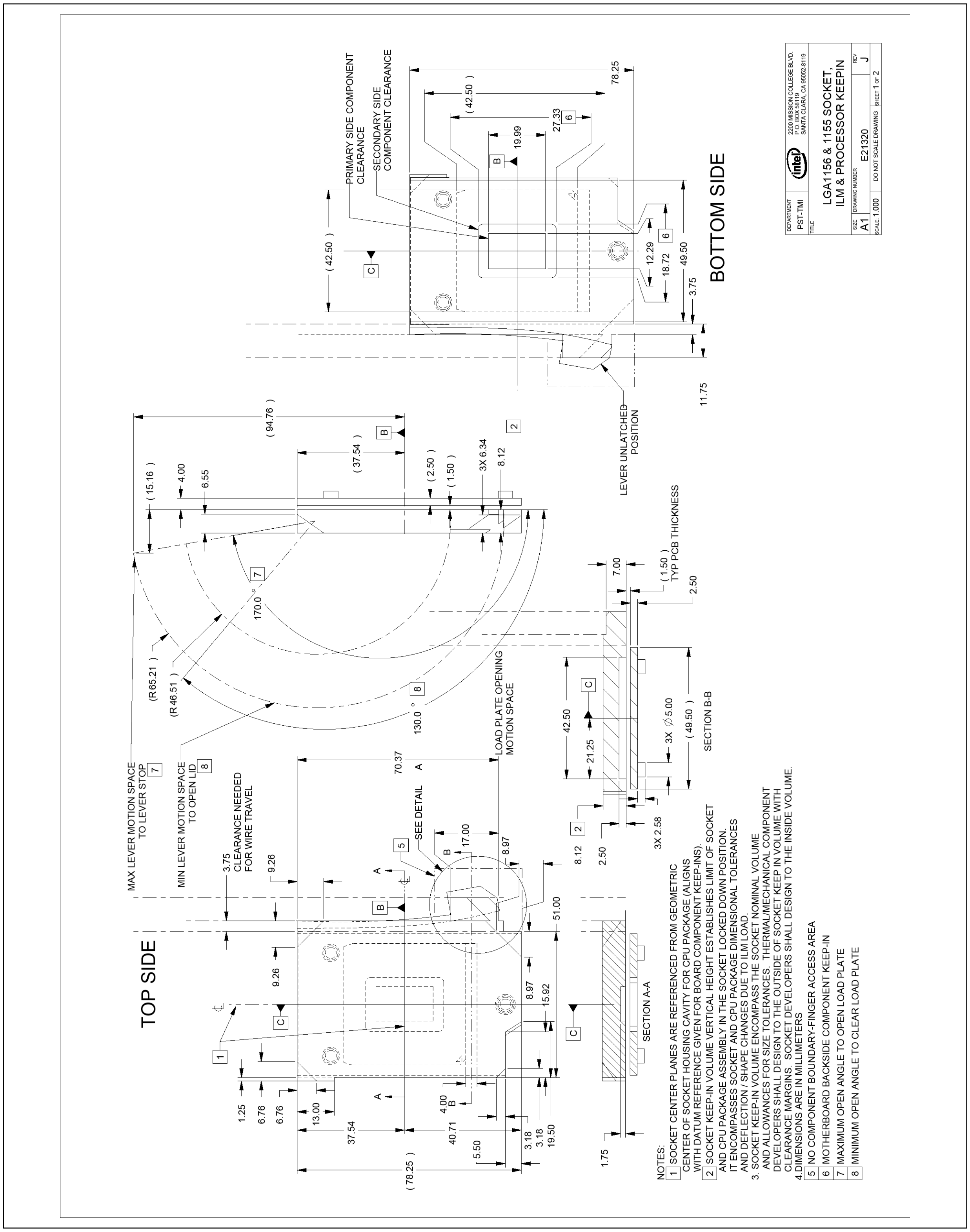
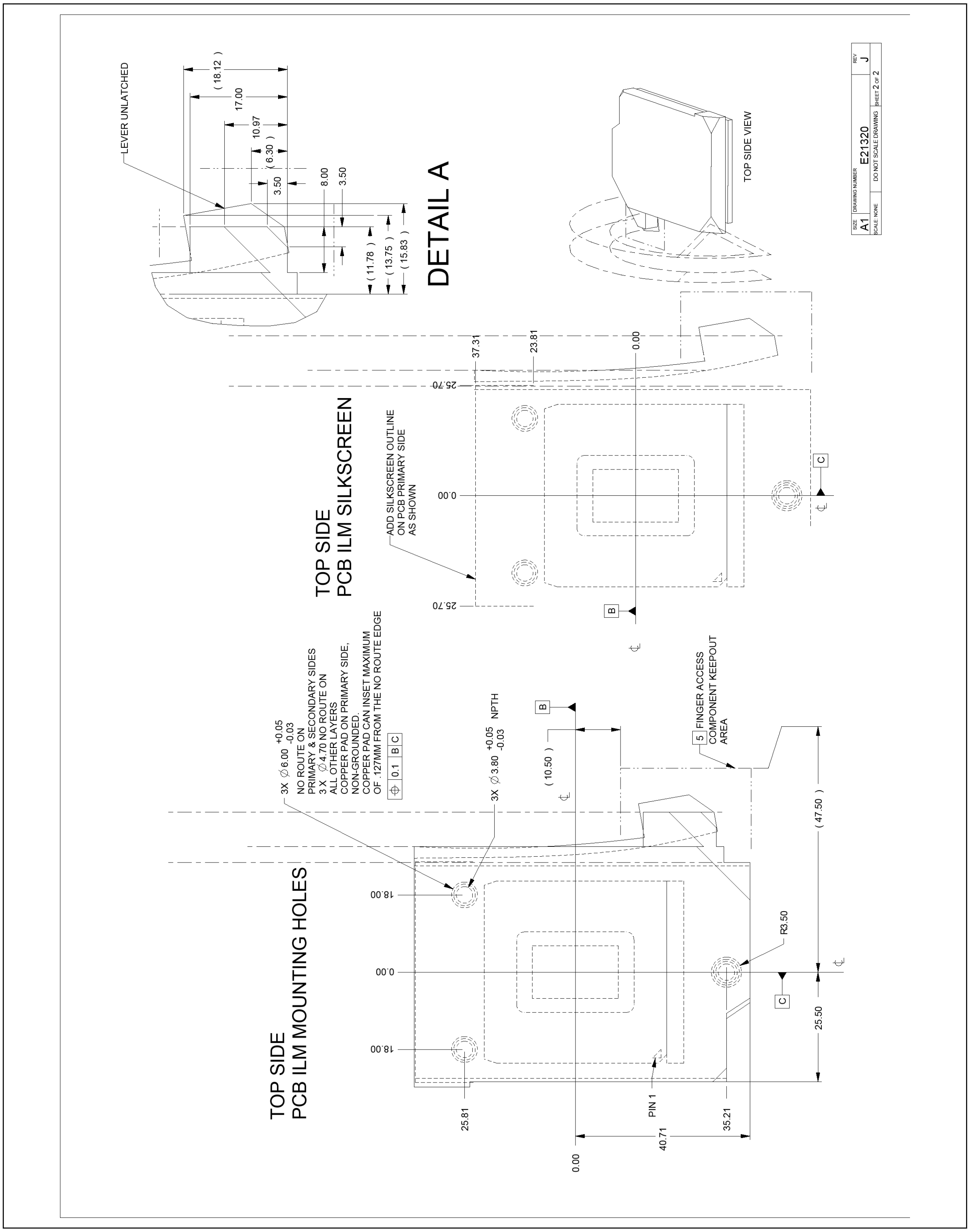


Figure 17. Socket / Processor / ILM Keep-out Zone Secondary Side (Bottom)



Appendix C Heatsink Back Plate Drawings

This heatsink back plate design is intended to adapt as a reference for OEMs that use threaded fasteners on customized thermal solution, to comply with the mechanical and structural requirements for the LGA115x socket. The heatsink back plate does not have to provide additional load for socket solder joint protect. Structural design strategy for the heatsink is to provide sufficient load for the Thermal Interface Material (TIM) and to minimize stiffness impact on the motherboard.

Note: Design modifications for specific application and manufacturing are the responsibility of OEM and the listed vendors for customized system implementation and validation. These vendors and devices are listed by Intel as a convenience to Intel's general customer base, but Intel does not make any representations or warranties whatsoever regarding quality, reliability, functionality, or compatibility of these devices. Customers are responsible for thermal, mechanical, and environmental validation of these solutions. This list and/or these devices may be subject to change without notice.

Please refer to the motherboard keep-out zone listed in the *LGA1150 Socket Application Guide* to ensure compliant with the heatsink back plate implementation. Figure 18 on page 35 is the heatsink back plate keep-in zone for the design implementation.

Table 10 on page 34 lists the mechanical drawings included in this appendix. Table 11 on page 34 lists the mechanical drawings

Table 10. Mechanical Drawing List

Drawing Description	Figure Number/Location
Heatsink Back Plate Keep-in Zone	Figure 18 on page 35
Heatsink Back Plate	Figure 19 on page 36

Table 11. Supplier Contact Information

Supplier	Contact	Phone	Email
CCI (Chaun Choung Technology Corp.)	Monica Chih	+886-2-29952666 x1131	monica_chih@ccic.com.tw

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

Figure 18. Heatsink Back Plate Keep-in Zone

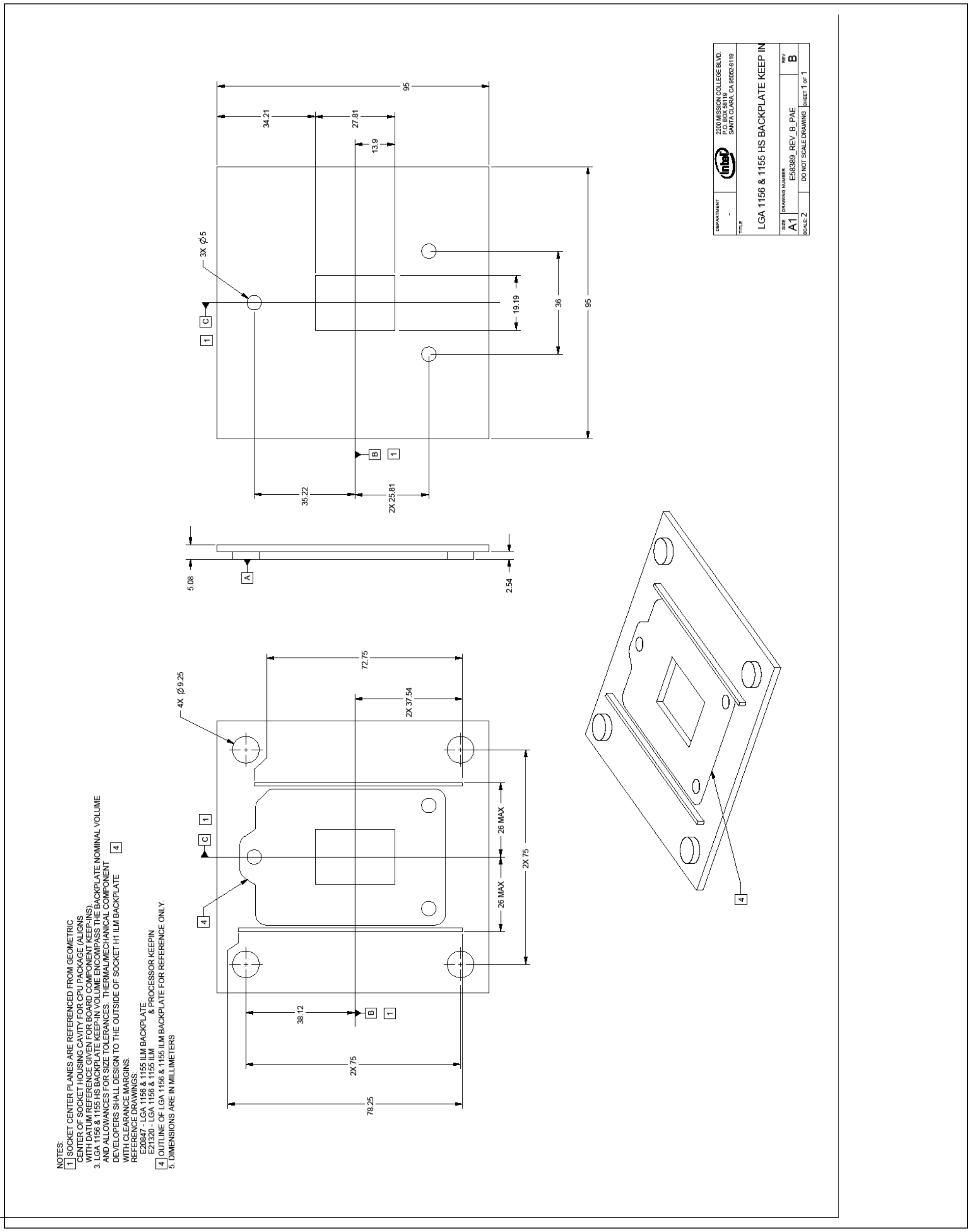


Figure 19. Heatsink Back Plate