

## 16.1 Introduction

Intel has introduced a variety of innovative package designs over the years: surface mount, small out-line, very thin package, multilayer molded plastic quad flatpacks (PQFP), and the Tape Carrier Package (TCP) format. Recent configurations for optimum microprocessor performance are the Single Edge Contact (S.E.C.) cartridge and the Mobile Mini-Cartridge.

The S.E.C. cartridge typically combines an area array packaged processor core, L2 cache, other components, and a thermal solution attach point. The entry of the S.E.C. cartridge technology continues the commitment to provide packaging solutions which meet Intel's rigorous criteria for quality and performance.

The mobile mini-cartridge is a packaging technology aimed at the notebook PC market, where minimum form factor is required. It is designed to protect the electronic components of the product and enables a controlled thermal interface between the processor and the thermal solution in the notebook system (see Figure 1). The mini-cartridge provides a socketable microprocessor solution, i.e. it enables the OEM to mount the processor via a motherboard-mounted connector, rather than by soldering it, and mechanically securing it with screws in a manner similar to other notebook components such as hard disk drives.

Several times throughout this chapter you will be referred to Intel's website. The URL for the Intel website is <http://www.intel.com>. Intel's developers website can also be accessed through this site.

## 16.2 Single Edge Contact Cartridge Technology

The S.E.C. cartridge has the following standard features: a plastic enclosure and a substrate with an edge finger connection. The plastic enclosure protects the surface mount components and provides features for mechanical stability when the processor is mounted in a retention mechanism on a motherboard. The edge finger connection maintains socketability for system configuration. There are two edge finger connectors: SC 242 for the Pentium II® and SC 330 for the Pentium II® Xeon™ Processor.

There are several variations to the S.E.C. Cartridge form factor. They are the Single Edge Contact Cartridge (S.E.C.C.) which has a cover and a thermal plate, the Single Edge Contact Cartridge 2 (S.E.C.C.2) which has a cover, but no thermal plate, and the Single Edge Processor Package (S.E.P.P.) which has no cover or thermal plate. In implementations with no thermal plate, the customer can attach a heatsink directly to the MP Package or die.

### 16.2.1 Terminology

The following terms are used in this document and are explained here for clarification.

**S.E.C. cartridge** — The processor packaging technology is called a "Single Edge Contact cartridge."

**S.E.P.P.** — The processor packaging technology known as "Single Edge Processor Package."

**Processor substrate** — The structure on which the components are mounted inside the S.E.C. cartridge (with or without components attached).

**Processor core** — The processor's execution engine.

**Thermal plate** — The surface used to connect a heatsink or other thermal solutions to the S.E.C.C processor.

**Cover** — The processor casing on the opposite side of the processor core.

Figure 16-1. S.E.C. Cartridge 2 — Isometric Views

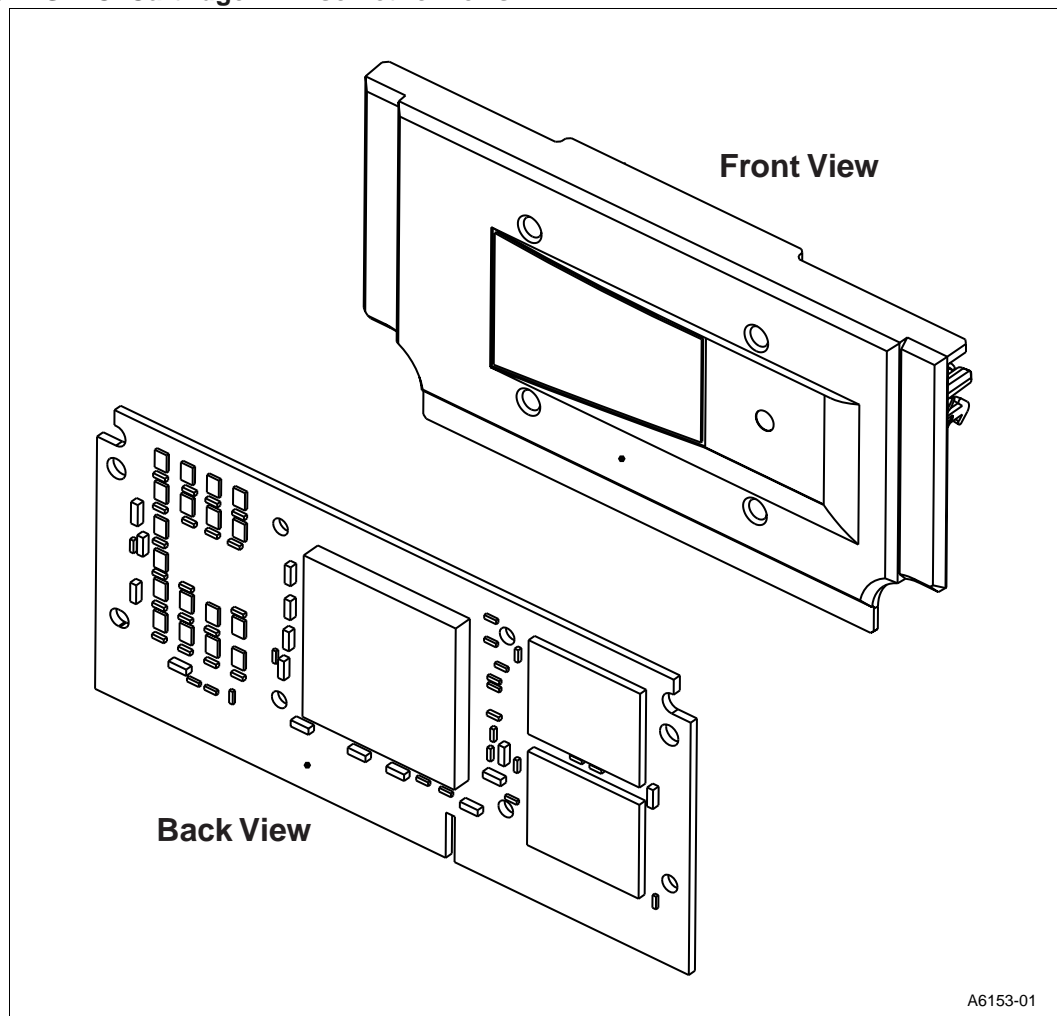
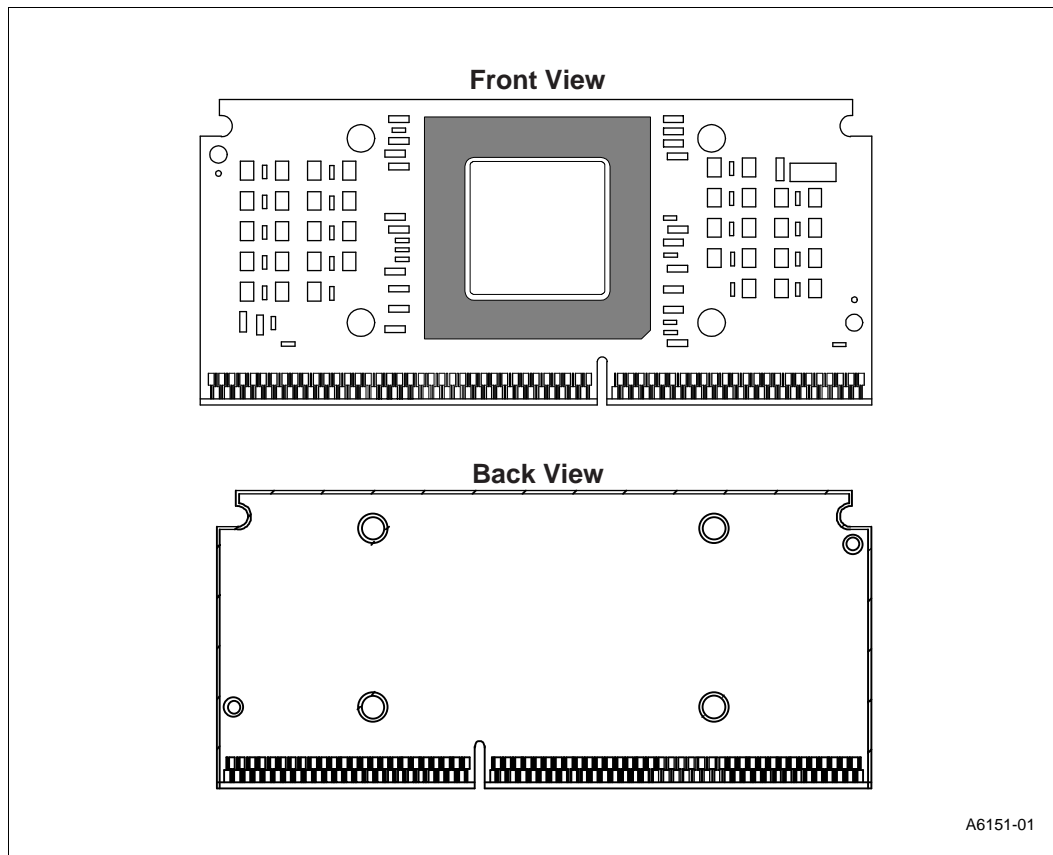


Figure 16-2. S.E.P.P — Isometric Views



**Figure 16-3. S.E.C. Cartridge (330 contacts)— Thermal Plate and Cover Side Views**

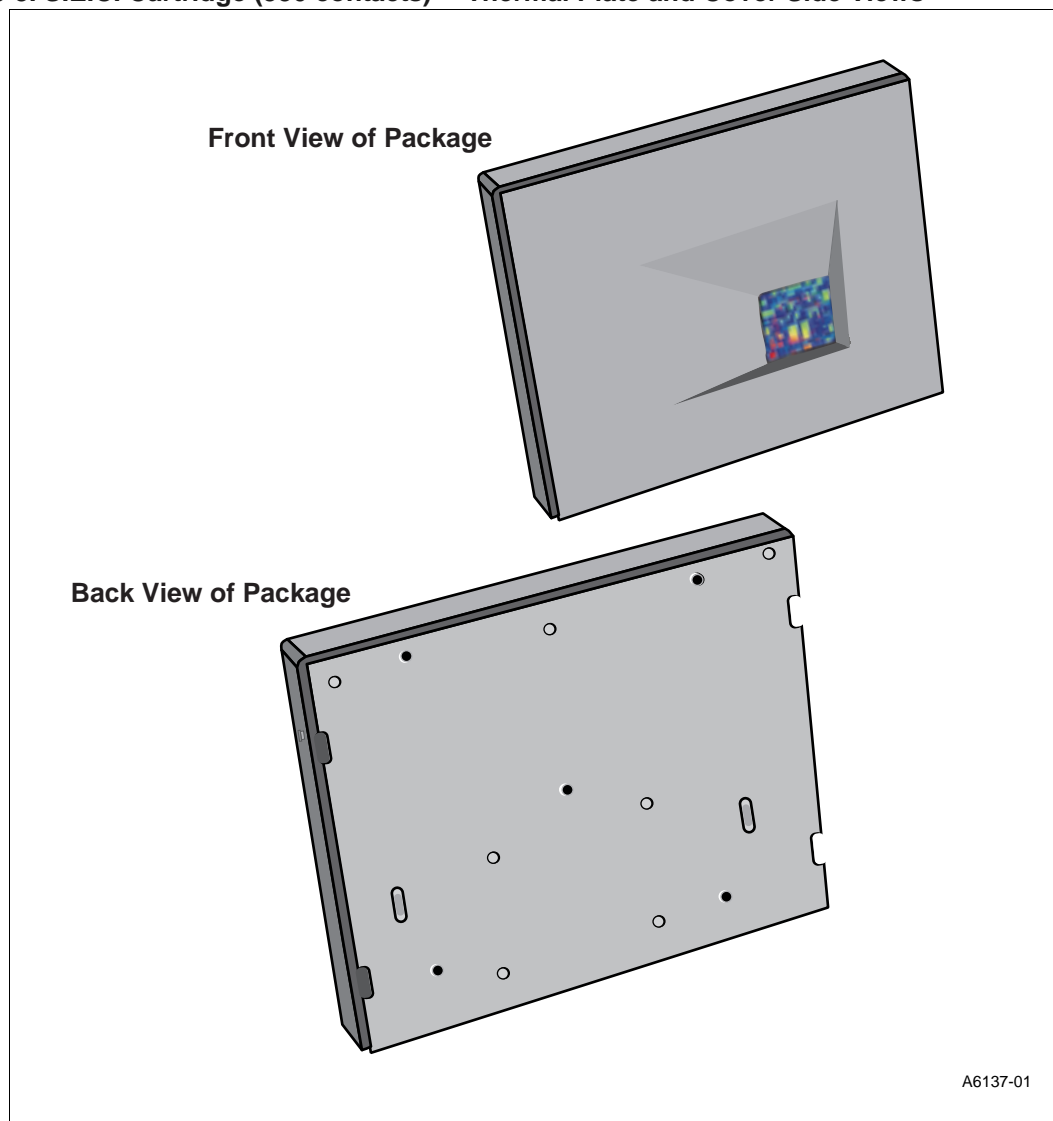
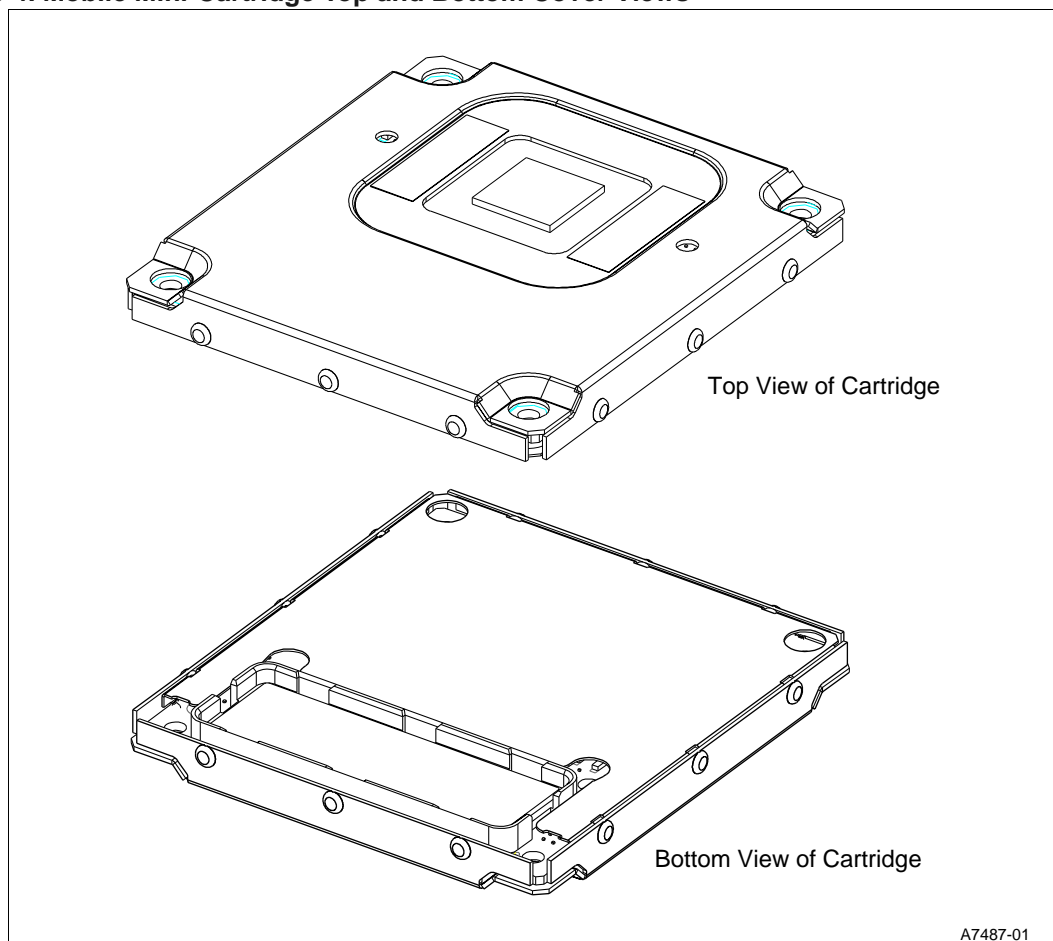


Figure 16-4. Mobile Mini-Cartridge Top and Bottom Cover Views



Additional terms referred to in this and other related documentation are the Mechanical Support Pieces (MSPs), which are used on the system to connect the processor to the system baseboard, and are responsible for retention of the processor during system shock and vibration. The MSPs represent one solution for retention of the processor in the SC 242 connector. This chapter focuses on the use of these pieces:

**SC 242 & SC 330 Contact Connector** — The connectors that the S.E.C. cartridges uses.

**Retention Mechanism** — A mechanical piece which holds the cartridge in the SC 242 or SC 330 connector.

**Retention Mechanism Attach Mount** — An enabled mechanical piece which secures the retention mechanism to the baseboard.

**Dual Retention Mechanism** — A mechanical piece which holds two S.E.C. cartridges in two SC 242 contact connectors for a 2-way SMP processor system.

**Note:** Other mechanical solutions may be available.

## 16.2.2 S.E.C. Cartridge Assembly and Construction

### 16.2.2.1 S.E.C. Cartridge Assembly

Figure 16-5, and Figure 16-6 show exploded views of the S.E.C. cartridge. The S.E.C. cartridge core, substrate, thermal plate (SC330), thermal plate attach clips (SC330), and protective cover are shown. For complete mechanical dimension information for the S.E.C. cartridge, see the datasheet.

**Figure 16-5. Exploded View of S.E.C. Cartridge 2**

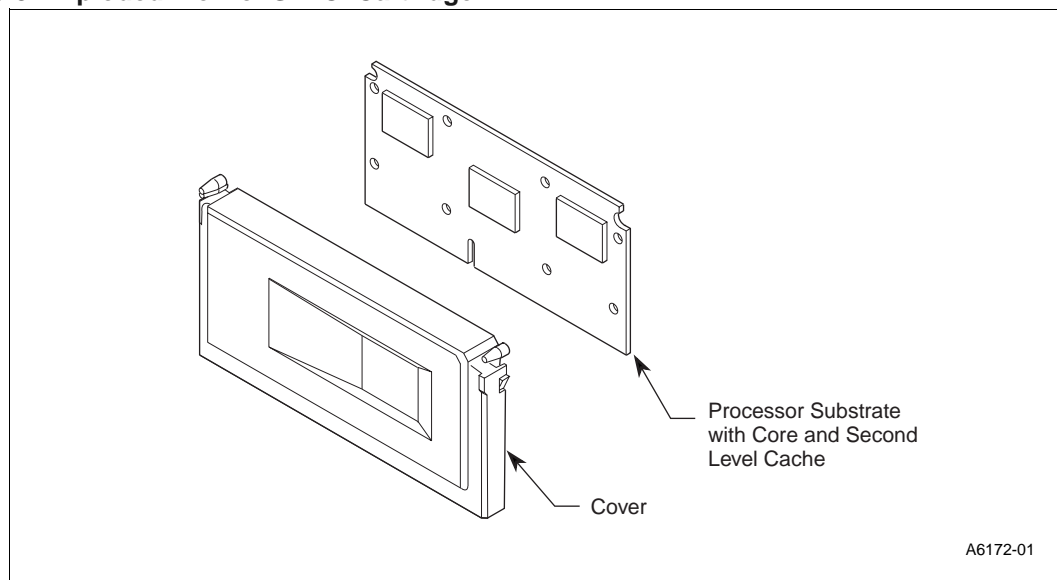
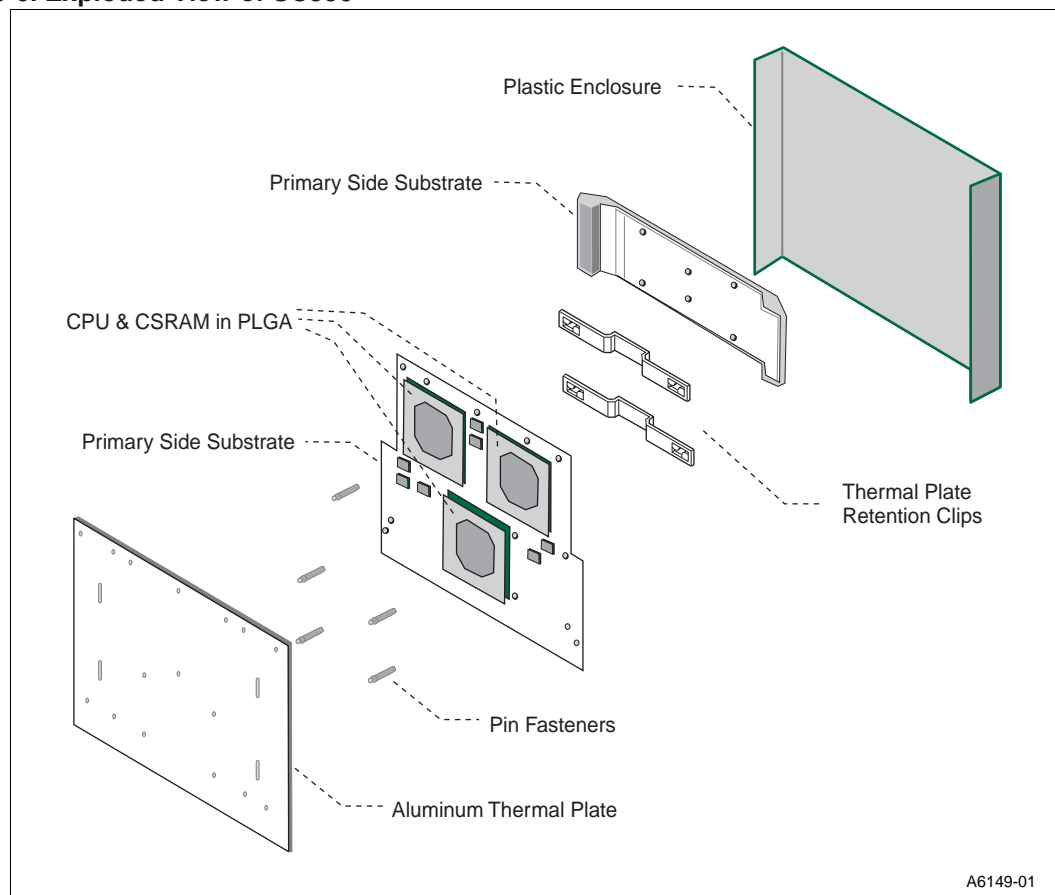


Figure 16-6. Exploded View of SC330



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Figure 16-7 and Figure 16-8 shows an exploded view of the mobile mini-cartridge assembly. The PCB substrate is populated on both sides with surface-mount passive and active components consisting of the processor core and tag RAM memory on the primary side, and two L2 cache memory devices and the connector on the secondary side. After the substrate is populated, it is placed into the top cover and then the bottom cover is snapped into place and retained by nine snap lances around its perimeter.

The connector plug is designed to mate with either of the two available receptacle versions. The receptacle versions enable connector stack heights of approximately 3.4 mm and 4.2 mm. Final connector stack height is dependent on the characteristics of the surface-mount process used to place the receptacle onto the motherboard.

**Figure 16-7. Mobile Mini-Cartridge Exploded Views, 1 of 2**

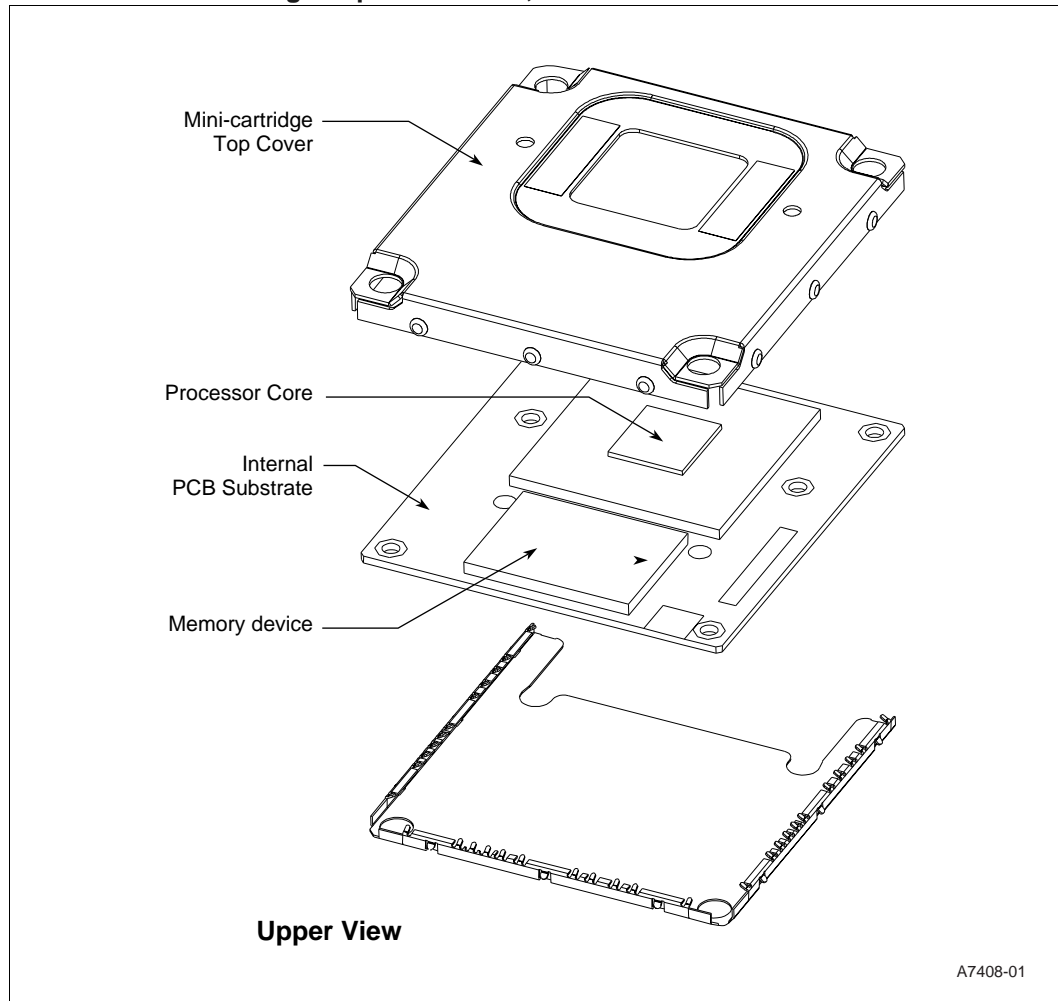
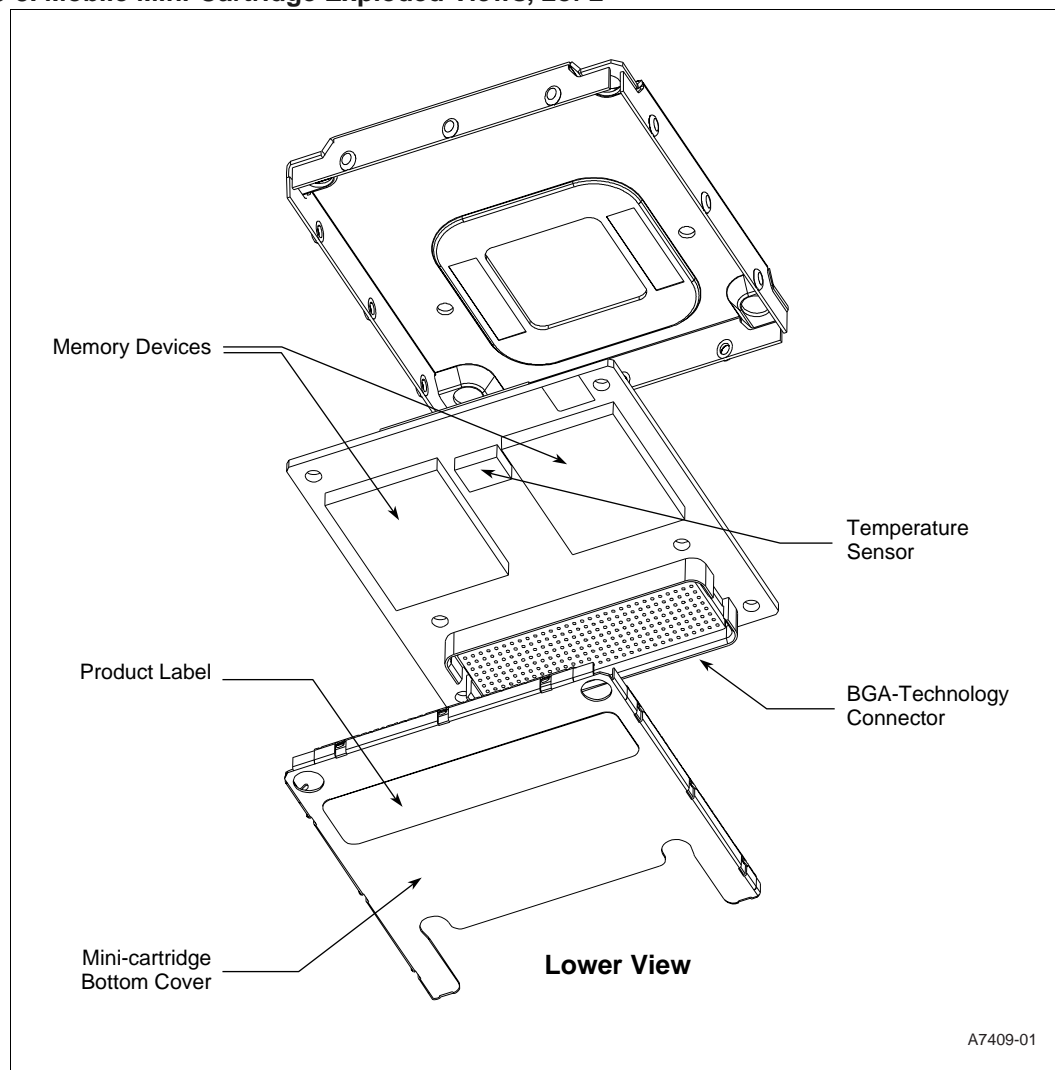




Figure 16-8. Mobile Mini-Cartridge Exploded Views, 2of 2



### 16.2.2.2 S.E.C. Cartridge Substrate

The S.E.C. cartridge typically contains an area array packaged processor core and L2 cache components (TagRAM and BSRAMs for the processor) mounted onto a substrate. The substrate has contact fingers on one edge that provide the electro-mechanical connection to the connector (and thus to the system baseboard). The substrate is fabricated of standard FR-4 based organic laminate material and has a minimum flammability rating of 94V-0. Copper trace and power plane parametrics, along with other key performance and manufacturing designs, have been selected to provide optimum electrical performance. The edge finger contacts are plated with gold over a nickel barrier layer for a reliable substrate edge finger to the connector electrical contact. The edge fingers are equally distributed between the primary and secondary sides of the substrate. The contact areas of these edge fingers are maximized by using a two-sided staggered design for the placement of the fingers. A key slot is provided in the edge finger array, off center of the card length, to prevent improper placement of the S.E.C. cartridge substrate into the contact connector.

### 16.2.2.3 Thermal Plate

In designs incorporating thermal plates, the thermal plate is made of aluminum, with a black anodized coating. To improve thermal conduction, the thermal plate is attached directly to the heat slug on the processor core using a thermal interface material. Stainless steel spring clips attach to pins, which extend from the thermal plate through the substrate, securing the thermal plate to the logic core package body. Intel has performed extensive testing to ensure that the thermal interface material is non-volatile, and that it will continue to provide an effective thermal path over the lifetime of the S.E.C. cartridge processor.

### 16.2.2.4 Mobile Mini-Cartridge Stackup Dimensions

Figure 16-9. Mobile Mini-Cartridge Stackup Dimensions

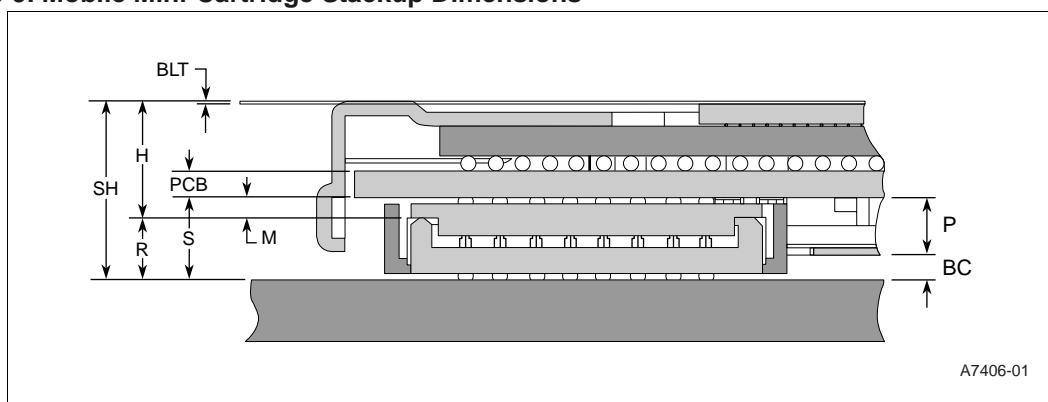


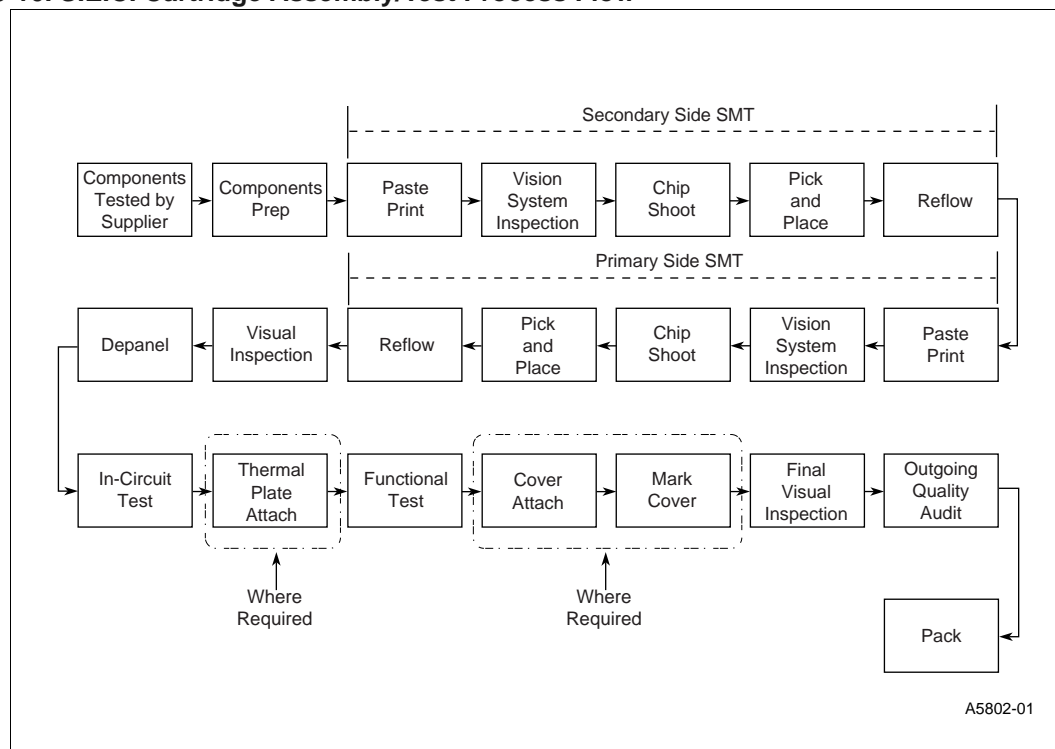
Table 16-1. Mini-Cartridge Stackup Dimension Values (in millimeters)

Dimension	Minimum	Nominal	Maximum
BLT	0.01	0.12	0.23
H	4.40	4.55	4.70
M	0.91	1.03	1.15
P	2.81 REF		
PCB	0.90	1.00	1.10
R*	3.09	3.21	3.33
S*	4.34	4.44	4.54
BC*	1.60	1.89	2.18
SH*	7.74	7.96	8.17
<b>NOTE:</b> * For 4.0mm connector			

### 16.2.3 S.E.C. Cartridge Assembly and Test

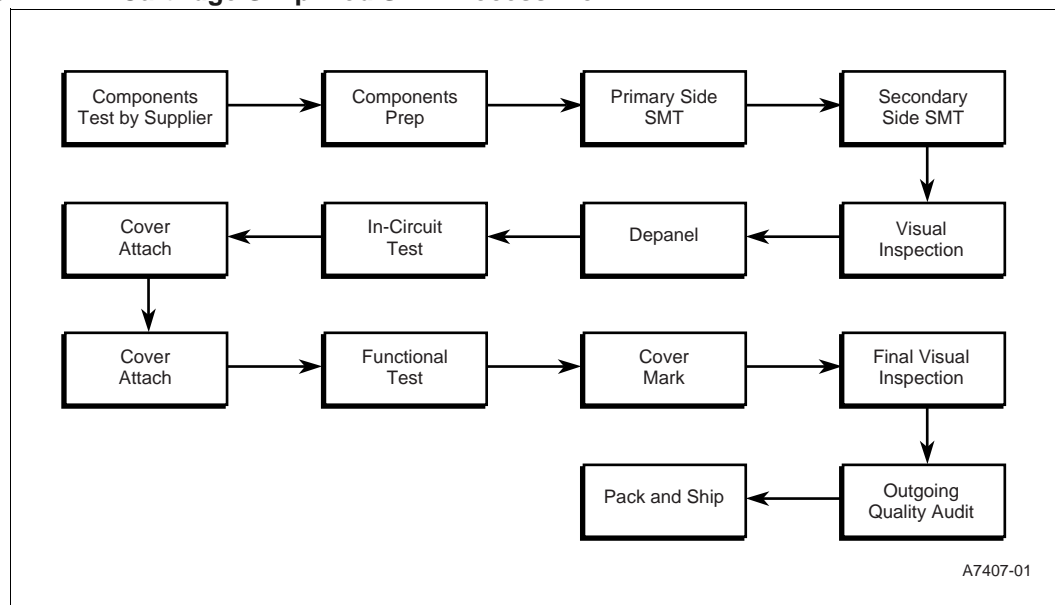
The processor core, TagRAM, BSRAMs and other components are assembled onto the substrate using traditional SMT processes and methodologies. The S.E.C. cartridge assembly and test flow is shown in Figure 16-10.

**Figure 16-10. S.E.C. Cartridge Assembly/Test Process Flow**



Standard SMT processes are used to place components on the mini-cartridge substrate. The cover is a two piece snap together assembly. A simplified process flow is shown in Figure 16-11.

**Figure 16-11. Mini-Cartridge Simplified SMT Process Flow**



## 16.3 Package Handling And Shipping Media

The S.E.C. cartridge was designed to be a robust packaging solution for processors. Sealed, desiccant, ESD protective bags are not required, and thus not used during shipping of the processors from Intel. The S.E.C. cartridge processor, however, should be unpacked at ESD workstations. The package is NOT meant to survive mishandling such as dropping the processors, breaking the latch arms, inserting long metal objects into the thermal plate holes and slots, allowing foreign material to contact substrate edge fingers, and attempting to disassemble the cartridge. Surface mount technology (SMT) moisture levels are not applicable for the cartridge processor.

This section will provide additional handling guidelines and information on the shipping media used for the processors. The “datasheet cross reference” contains specific operational and storage specifications for the processor.

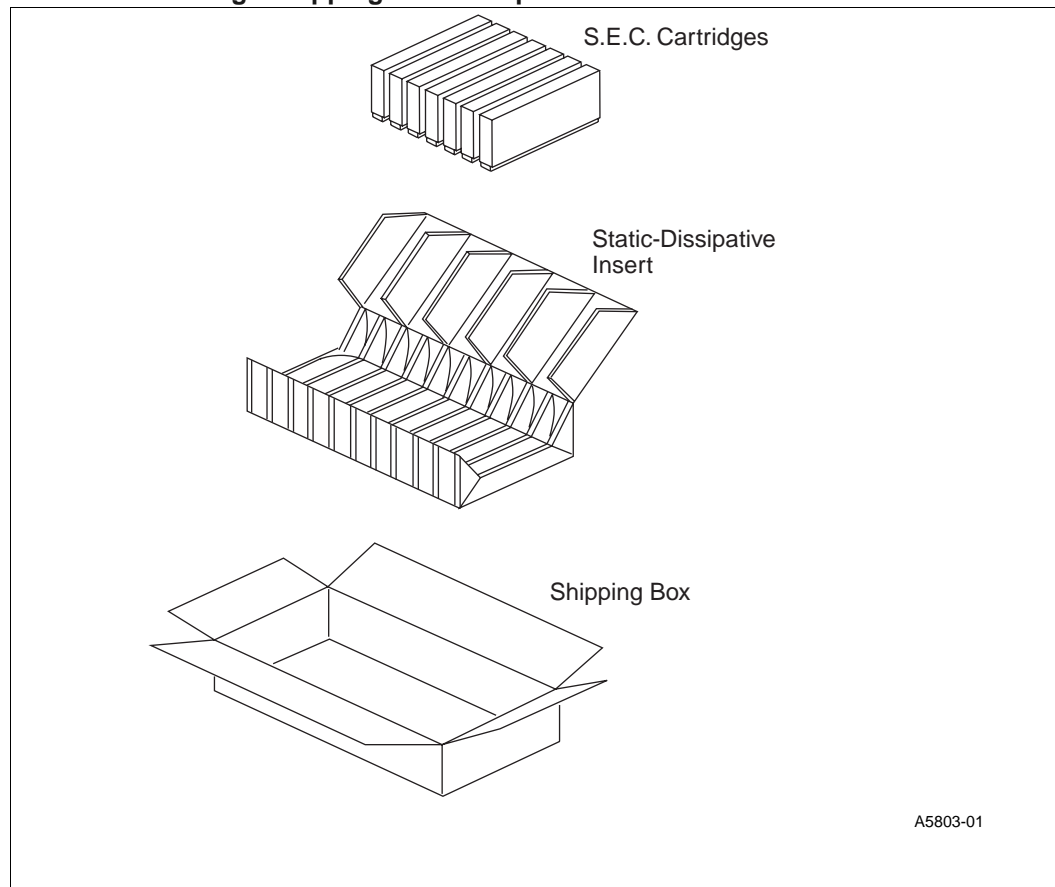
### 16.3.1 Shipping Media Description And Specifications

The S.E.C. Cartridge Processor is packaged in a shipping box using materials which are different from PGA processors. See Figure 16-12 and Figure 16-13 illustrations of the processor shipping media. As shown, a plastic insert is first placed into the shipping box. The S.E.C. cartridge processors are loaded into the thermo-formed ESD plastic (industry name is XERSTAT 1000) with the substrate edge fingers down. The ESD plastic insert is an electrically dissipative, Recycled High Density Polyethylene (RHDPE) molded plastic which meets JEDEC registered outline drawings. As shown in Figure 16-12, the insert closes over the S.E.C cartridge processor in a clam-shell fashion. There are multiple cartridges per insert, oriented edge finger side down, allowing the laser mark on the top edge of the S.E.C. cartridge (S.E.C.C.2 and S.E.C.C SC 330 configurations) to be visible when the top of the shipping box and insert are opened. The outer box is constructed from corrugated cardboard and has a conductive carbon coating inside to dissipate any electrostatic charge.

The Static-Dissipative insert (see Figure 16-12) is recyclable. The inserts may be shipped to:

Richmond Technology  
1897 E. Colton Avenue  
Redland, CA. 92373  
(909)794-2111

**Figure 16-12. S.E.C. Cartridge Shipping Box — Exploded View**



**Figure 16-13. S.E.C Cartridge Shipping Box — Assembled View**

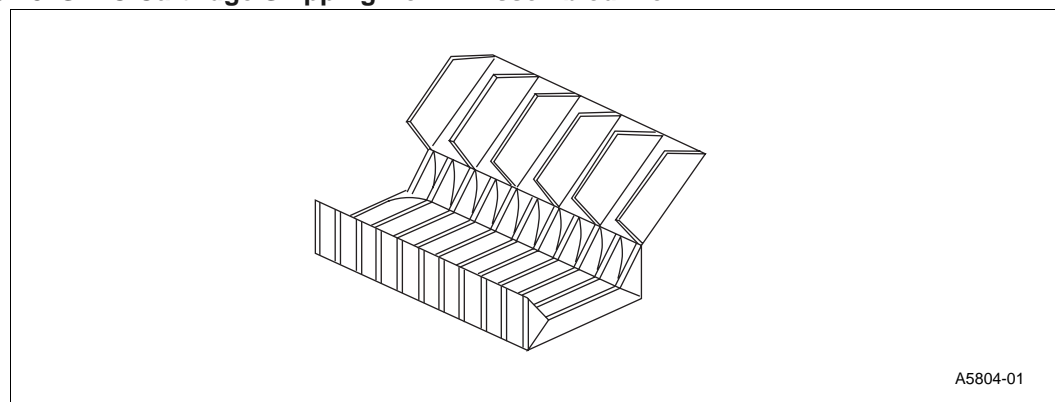
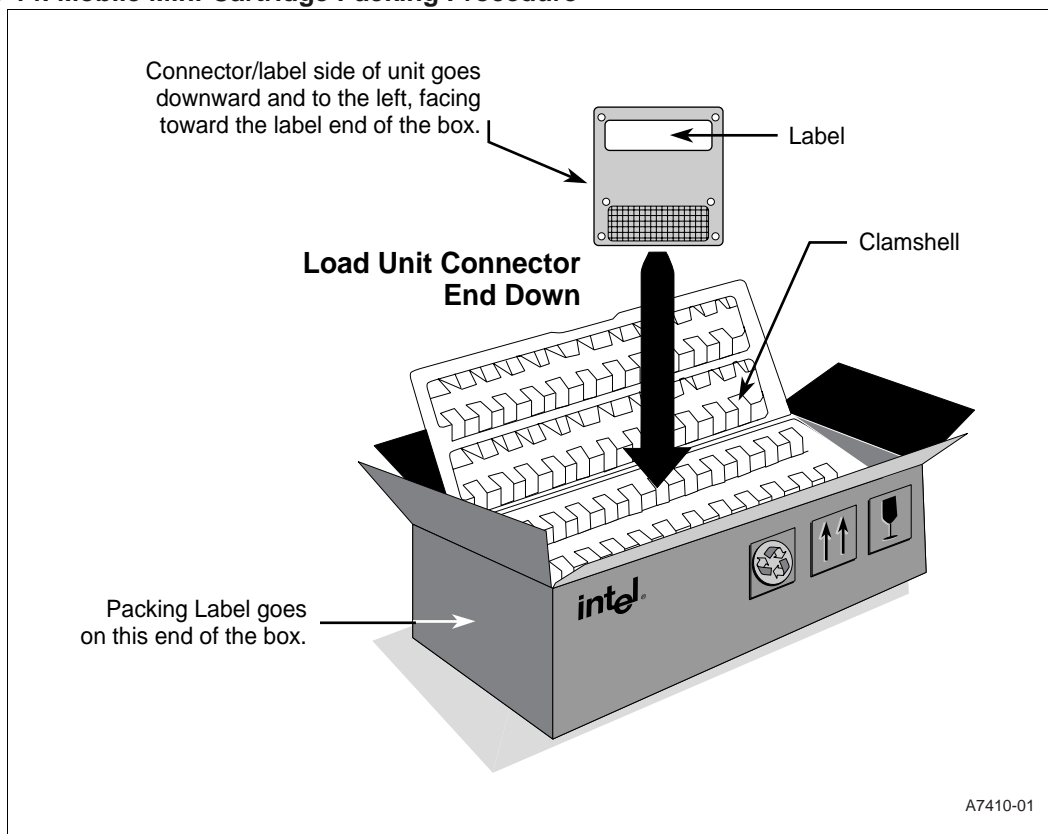
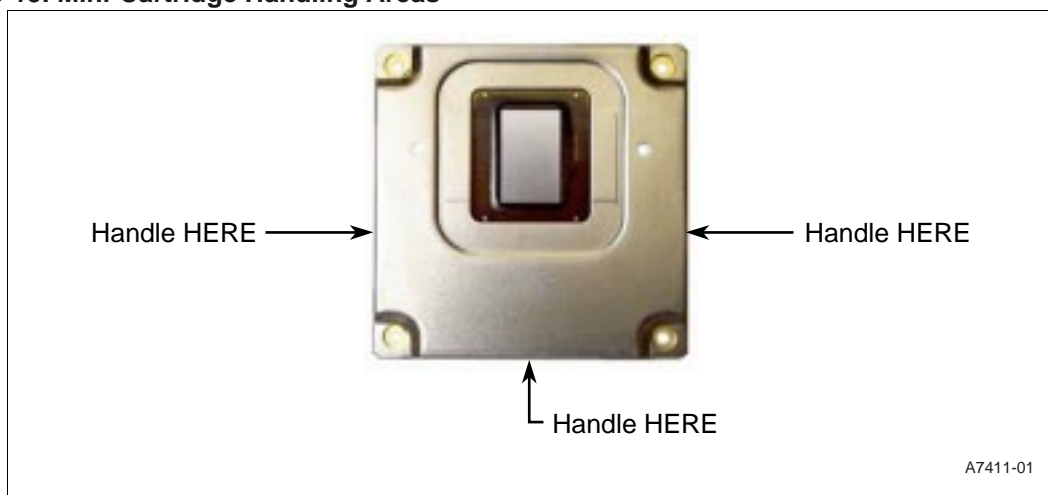


Figure 16-14. Mobile Mini-Cartridge Packing Procedure



**Warning:** Only handle the mini cartridge by holding at the edge of the unit and with clean personal protective equipment (PPE) eg: vinyl ESD dissipative gloves. Do not touch the connector, die and flat metal surface area.

Figure 16-15. Mini-Cartridge Handling Areas



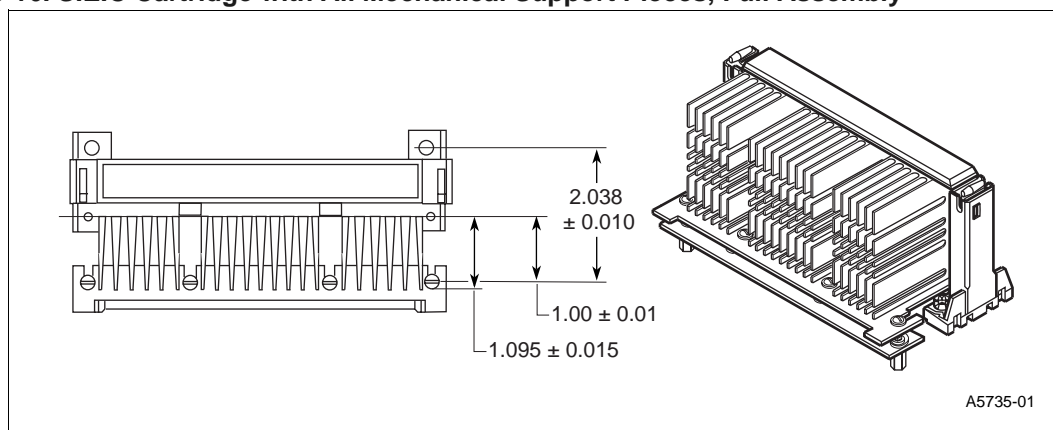
## 16.4 S.E.C. Cartridge Mechanical Support Pieces (MSP)

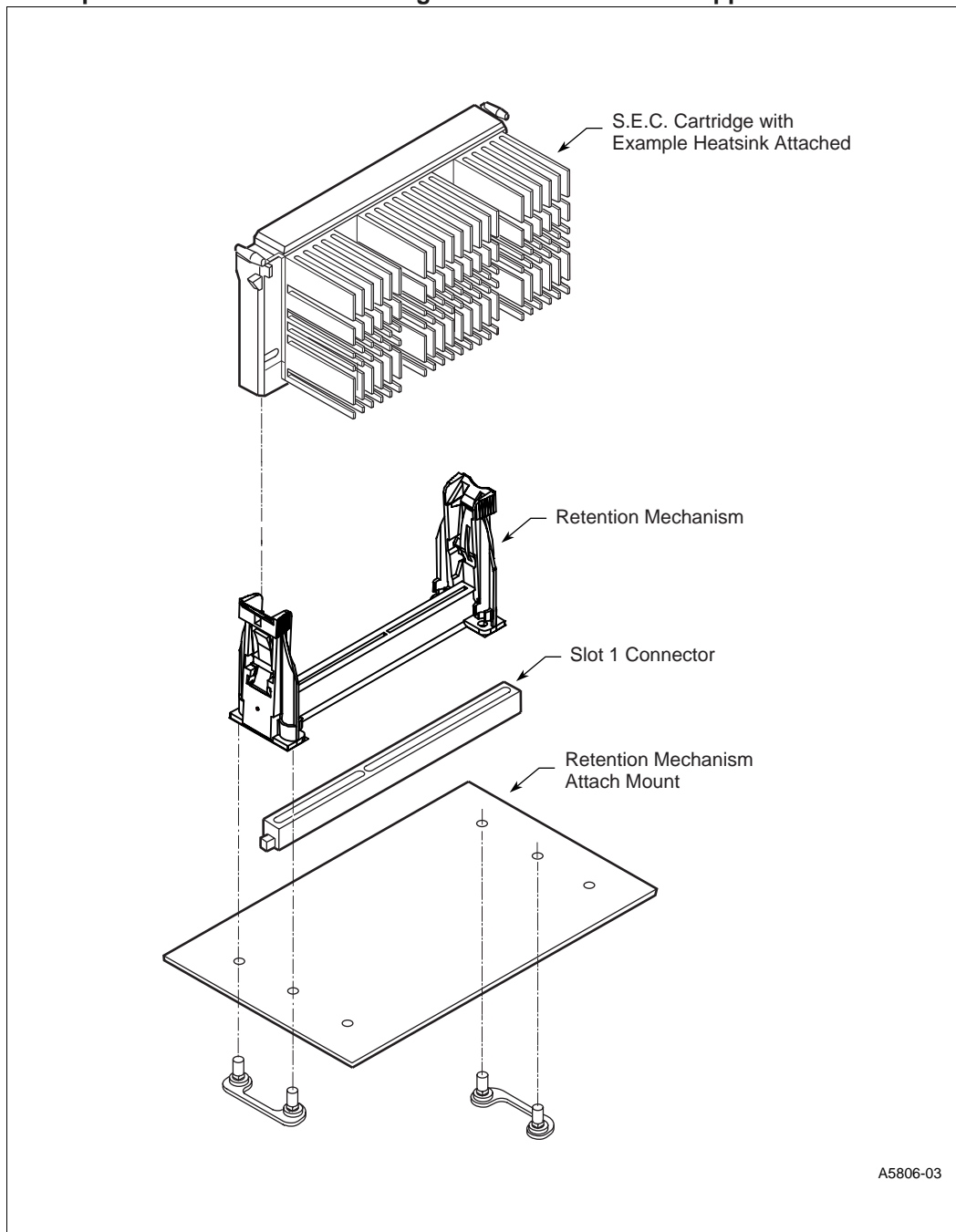
It is imperative to ensure good electrical contact between the S.E.C. cartridge substrate and the connector. To keep the connector simple, the connector does NOT have features to retain the S.E.C. cartridge during significant, but realistic, environmental conditions. These conditions are encountered during normal transport of baseboards (with processor installed) and systems in an OEM production line and eventual shipment to an end user.

Intel has enabled a Mechanical Solution (MS) to support the S.E.C. cartridge and to ensure retention of the processor into the SC 242 and SC 330 contact connectors. This solution is referred to as the Mechanical Support Pieces (MSPs). These pieces represent only one solution to ensure that the processor stays in the connector. Other methods and mechanical solutions will NOT be covered by this document. This document only provides details on the use and operation of the MSPs. While each OEM must perform actual validation for mechanical performance ensuring that the processor stays in the connector, Intel has shown that, through shock and vibration test validation, these pieces provide adequate mechanical support of the processor when used correctly.

The mechanical support pieces consist of the connector, retention mechanism, retention mechanism attach mount (RMAM) and heatsink support (HSS). The connector provides the electrical path between the processor and the other logic components on the baseboard. The retention mechanism holds the processor into the connector during mechanical shock and vibration. The RMAM attaches the retention mechanism to the baseboard. Figure 16-17 provides illustrations of all MSPs and how they interact with the processor.

**Figure 16-16. S.E.C Cartridge with All Mechanical Support Pieces, Full Assembly**



**Figure 16-17. Exploded View of S.E.C. Cartridge with All Mechanical Support Pieces**

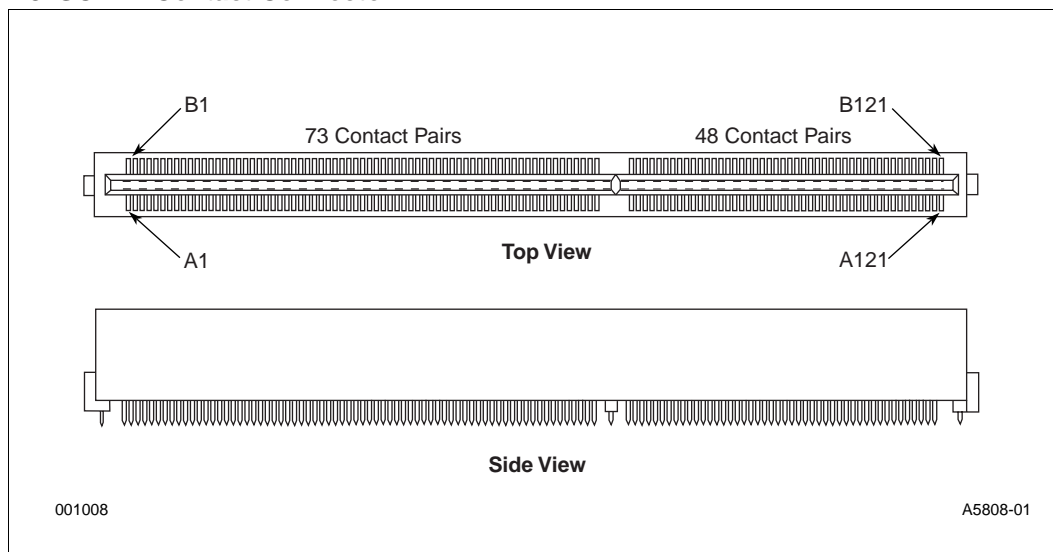
Intel does not supply the MSPs or equipment detailed in this chapter. Information for suppliers is provided in this document as applicable. An updated supplier's guide can be located at the Intel website by searching for the terms "suppliers of support components."



### 16.4.1 SC 242 Contact Connector

The SC 242 contact connector is a 242 contact, 1.0 mm pitch edge connector intended for high volume desktop systems based upon the processor using S.E.C. cartridge technology. The SC 242 contact connector mounts on the baseboard and allows insertion and removal of the processor from the baseboard (see Figure 16-18).

**Figure 16-18. SC 242 Contact Connector**

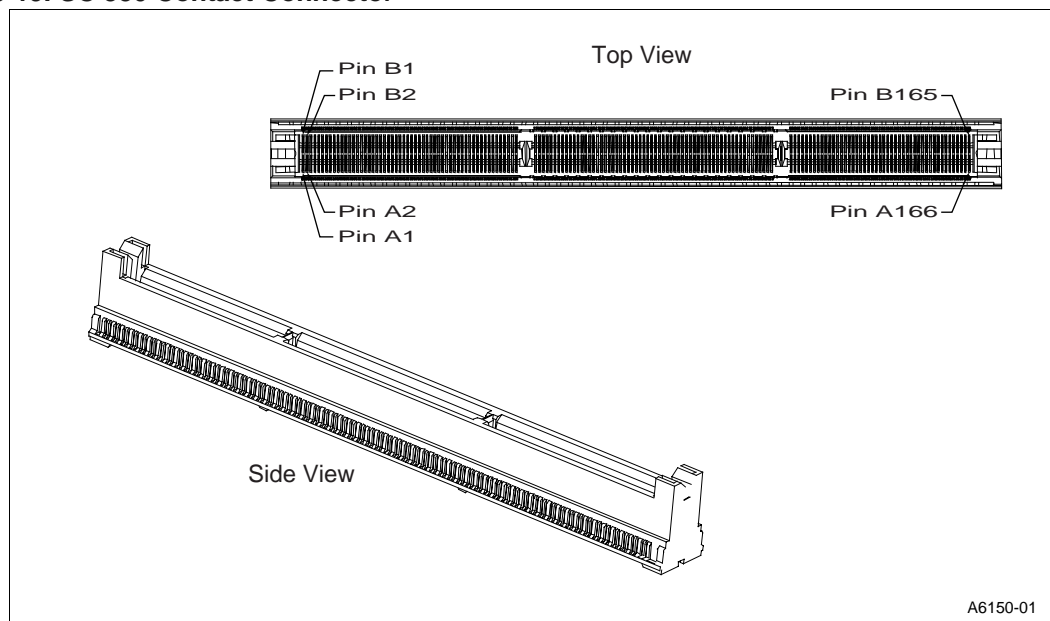


### 16.4.2 SC 330 Contact Connector

The SC 330 contact connector is a 330 contact, 1.0 mm pitch edge connector intended for high volume server and workstation systems based upon the processor using S.E.C. cartridge technology. The SC 330 contact connector mounts on the baseboard and allows insertion and removal of the processor from the baseboard (see Figure 16-19).

#### 16.4.2.1 Other Connector Form Factors: Restrictions and Requirements

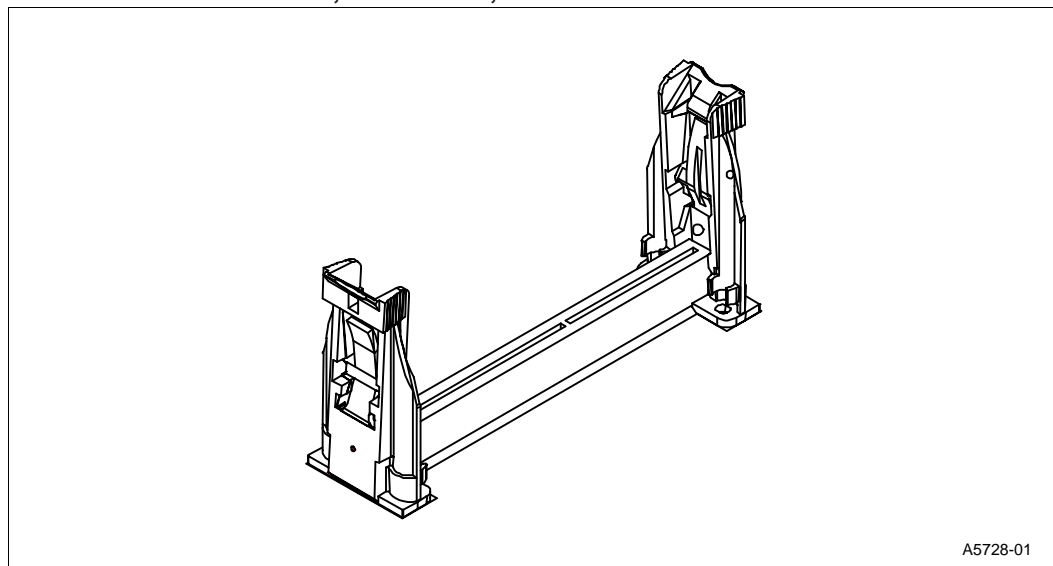
The SC 242 and 330 contact connectors are only two of the possible connector solutions for the S.E.C. cartridge processor. Any other solution for providing the electro-mechanical connection between the processor and the baseboard must meet the processor specifications as defined in the datasheet.

**Figure 16-19. SC 330 Contact Connector**

## 16.4.3 Retention Mechanism

### 16.4.3.1 Retention Mechanism Mechanical Description

The retention mechanism holds the S.E.C. cartridge in the connector during mechanical shock and vibration. The retention mechanism is not symmetrical. If it is placed around the connector incorrectly, the processor will not engage into the retention mechanism. The retention mechanism, however, is designed to engage with a matching polarization key on the connector for correct assembly onto the baseboard. The retention mechanism is also designed to aid in processor alignment to the connector during insertion of the processor. The retention mechanism contains draft angles, lead-ins and chamfers to allow smooth travel of the processor down the posts and into the connector (see Figure 16-20).

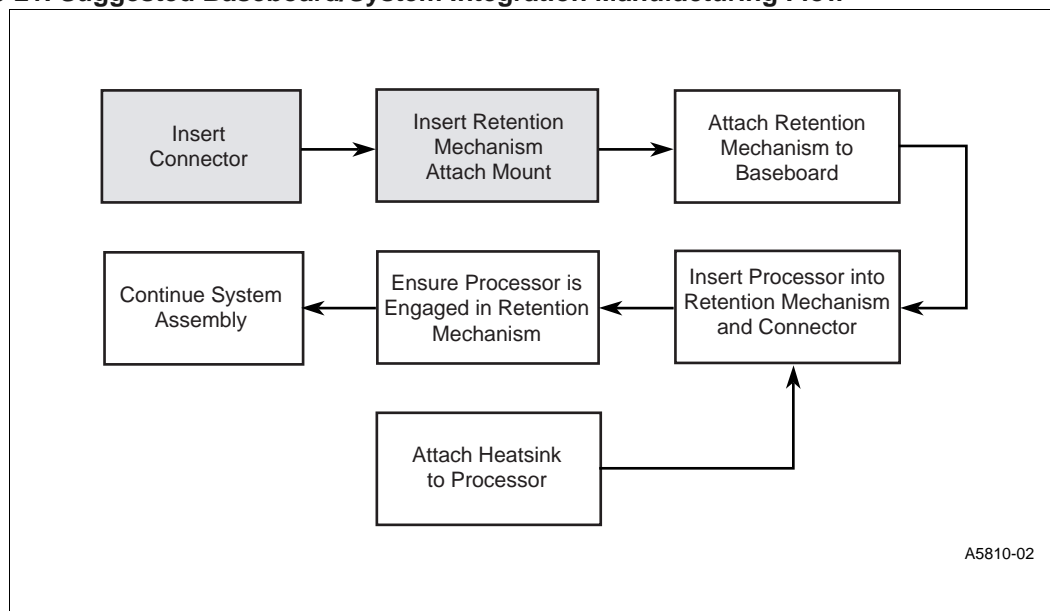
**Figure 16-20. Retention Mechanism, Assembled, Isometric View**

The mechanical force of the connector contacts provide some friction grabbing of the processor. The retention mechanism is designed to allow a small amount of back-out of the connector before stopping the travel of the processor. The vertical travel associated with this back-out is comprehended in specifications for the processor (particularly the substrate), connector and the retention mechanism.

## 16.5 Suggested Integration Flow

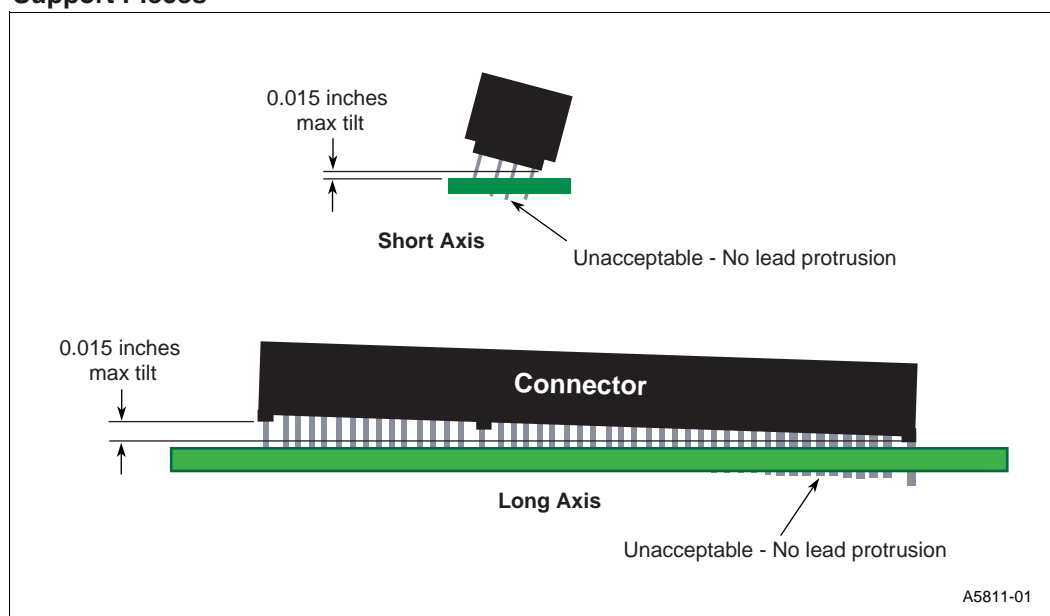
### 16.5.1 Introduction and Suggested Integration Flow

Figure 16-21 provides the overall manufacturing flow for the integration of the S.E.C. cartridge processor and mechanical support pieces into the baseboard and system manufacturing flow.

**Figure 16-21. Suggested Baseboard/System Integration Manufacturing Flow**

### 16.5.1.1 Connector Insertion Requirements

Figure 16-22 provides criteria that should be met to ensure that the S.E.C. cartridge interacts correctly with the remaining enabled mechanical pieces. The tilt criteria along both axes is to ensure that the S.E.C. cartridge can interface correctly with the connector and other enabled mechanical pieces (retention mechanism, etc.).

**Figure 16-22. Criteria to Ensure Correct Interaction of S.E.C. Cartridge and Mechanical Support Pieces**

## **16.6 System Integration Manufacturing Guidelines**

### **16.6.1 Introduction and Suggested Integration Flow**

System integration manufacturing guidelines and suggested integration flow can be found in the following Application Notes and or Data Sheets based on product specific Information

- S.E.C.C. (242 Contacts): Order Number 243502-001
- S.E.C.C. (330 Contacts): Order Number 243770-001
- S.E.P.P.: Order Number 243658
- Mobile Mini-Cartridge: Order Number 245108-002

All of these material are available electronically at Intel's Developer's Insight Web Site online at:

<http://developer.intel.com/design/litcentr/index.htm>

## **16.7 Revision History**

- Revised & Updated Slot 1 and Slot 2 content
- Added Mobile Mini-Cartridge Section

