Manufacturing with Intel® Weybridge Platform (aka Bearlake Platform)

Manufacturing Advantage Service (MAS)

Intel® Core™2 Duo Processor interfacing with the motherboard via an LGA775 socket

Intel® 3-Series Chipset Family

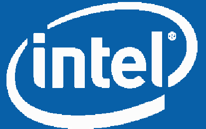
ATX, µATX, BTX, µBTX, and pBTX board form factors

July 2008

Legal Disclaimer

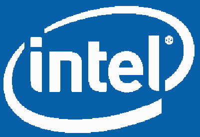
- Information in this document is provided in connection with Intel products. No license, express or implied, by estoppels or otherwise, to any intellectual property rights is granted by this document. Except as provided in Intel's Terms and Conditions of Sale for such products, Intel assumes no liability whatsoever, and Intel disclaims any express or implied warranty, relating to sale and/or use of Intel products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright or other intellectual property right. Intel products are not intended for use in medical, life saving, or life sustaining applications. Intel may make changes to specifications and product descriptions at any time, without notice.
- Intel® processors, chipsets and/or any other Intel component may contain design defects or errors known as errata which may cause the product to deviate from published specifications. Current characterized errata are available on request. All dates, products, and plans are preliminary and subject to change.
- Any recommended operating methods are correct to Intel’s reasonable knowledge at the time of writing. Intel accepts no liability for the implementation of these methods within the customer’s manufacturing environment. Furthermore, any named third party suppliers are provided for information only. Intel accepts no liability for the quality of third party suppliers and cannot guarantee the correct or suitable operation of third party products. The hardware vendor remains solely responsible for the design, manufacture, sale, and functionality of its product, including any liability arising from product infringement or product warranty.
- Intel uses internal code names to identify products (and services) that are in development and not yet released to the public. Once an Intel® product is announced to the public, it will receive and be promoted under a commercial name (e.g., Pentium® II processor). After Intel announces a product or service under its commercial name, all reference to that product or service by the Intel code name should cease entirely, and instead should be made with the commercial name only, e.g. Intel® Celeron® processor or Intel® 915GMS chipset. Customers, licensees, and other third parties are not authorized by Intel to use Intel code names in advertising, promotion or marketing of any product or service.
- Designers must not rely on the absence or characteristics of any features or instructions marked “reserved” or “undefined.” Intel reserves these for future definition and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to them.
- Some platforms may not meet Microsoft’s Windows Vista* ready PC program requirements. Check with your PC Manufacturer for details.
- Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. See http://www.intel.com/products/processor_number for details.
- Contact your local Intel sales office or your distributor to obtain the latest specifications and before placing your product order. All dates, plans and features are preliminary and subject to change without notice.

- Intel, the Intel logo, other Intel brand name(s), and any other Intel logo are registered trademarks of Intel. Intel's trademarks may be used publicly with permission only from Intel. Fair use of Intel's trademarks in advertising and promotion of Intel products requires proper acknowledgement.
- Other names and brands are the property of their respective owners.
- **Copyright © 2008, Intel Corporation**



Component Attributes

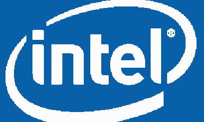
Attribute	CPU (Intel® Core™2 Duo Processor) & Socket (LGA 775)	Intel® Q33, Q35, P35, G33, G35 Express Chipset	Intel® X38 Express Chipset	ICH9	Nineveh LAN
Package Size	$(37.5mm)^2$	$(34mm)^2$	$(40mm)^2$	$(31mm)^2$	$(10mm)^2$
Integrated Heat Spreader	Yes	No	Yes	No	No
Ball Pitch	1.09mmx1.17mm	0.8mm (min)	1.00mm (min)	1.00mm (min)	1.0mm (min)
Ball Pattern	Grid	Non-grid	Non-grid	Non-grid	Grid
Corner Design Rule	No sacrificial	6 sacrificial	6 sacrificial	None	1 ball/corner
Ball Count	775	1226	1300	676	81
Ball Diameter	25mil	20mil	24mil	24mil	24mil
PCB Pad Configuration	Circular	Circular	Circular + Oval	Circular + Oval	Circular
Pad Dimensions	18mil	12/14/16mil	14x22mil (outer 5 rows), 18mil (balance)	14x22mil (outer 3 rows), 18mil (balance)	16mil
Ball Composition	SnAgCu (SAC405)	SnAgCu (SAC405)	SnAgCu (SAC405)	SnAgCu (SAC405)	SnAgCu (SAC405)
TDP Max	65-130W	Q/G: 22W P: 20W	G+: 38W X: 33W	4.0W	1.2W
Max Package Load	70 lb	15 lb	15 lb	3 lb	N/A



MCH Comparison

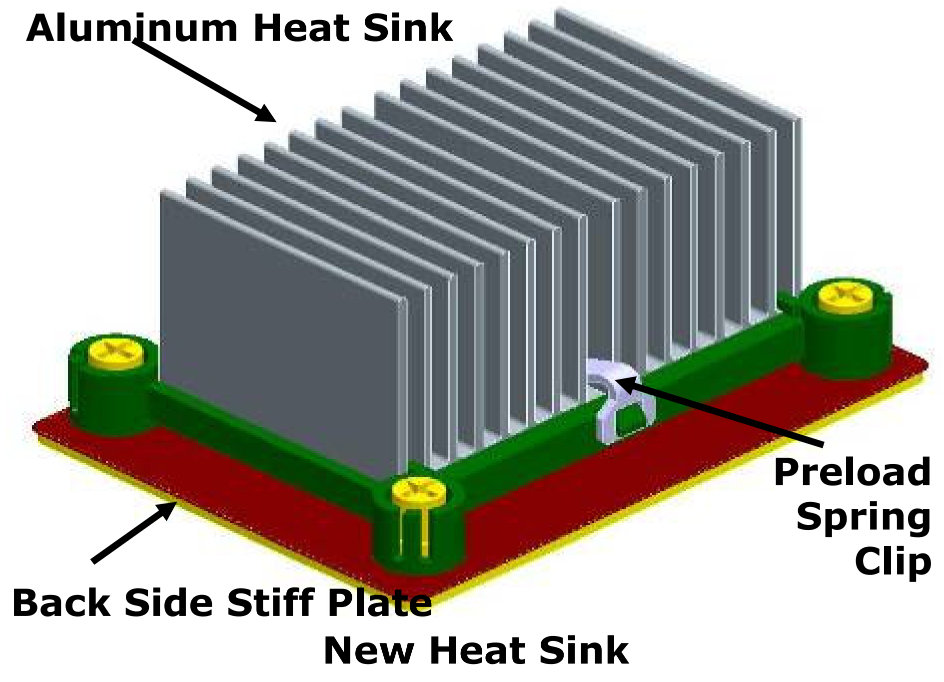
Intel® X38 Express Chipset is larger and stiffer than previous products

	Intel® 965 Express Chipset Family	Intel® 3-Series Chipset Family	Intel® X38 Express Chipset
Package Size	34mm x 34mm	34mm x 34mm	40mm x 40mm
Ball Count	1226	1226	1300
IHS	No	No	Yes
Pitch	0.8mm (min) non-grid	0.8mm (min) non-grid	1.0mm (min) non-grid
Pad Info	Circular 12/14/16mil	Circular 18mil	Circular & oval: 18mil & 14 x 22mil
Package Pad Layout Drawing			

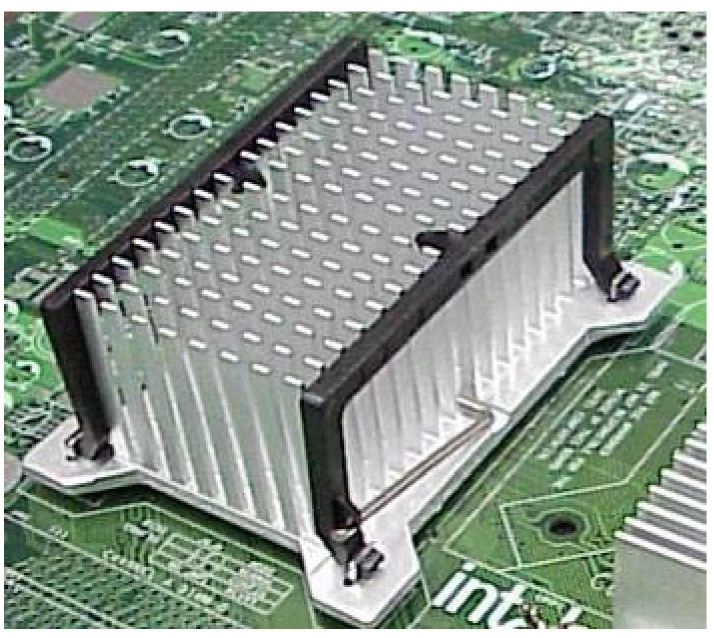


Heat Sink Reference Design

- Intel has designed a heat sink to help reduce risk on solder joint reliability of Intel X38 chipset for ATX platforms.

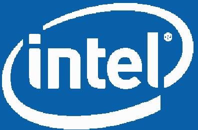


New Heat Sink



Preload Wave Solder Heat Sink

Consult the Thermal Mechanic Design Guide for current design.



Back Side Stiffener

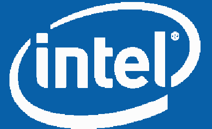
Back side stiffener reduces bending of PCB under the MCH and risk of solder joint cracks

Insulator prevents metal to PCB contact.

Custom PEM flush mount Press in stud.

Cutout for Backside Component Placement

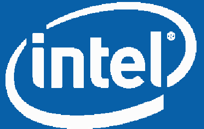
Steel Backing plate



Heat Sink Design Summary

- Intel® X38 Express Chipset is a larger and stiffer BGA package with IHS.
- The validation data was showing a higher incidence of solder joint cracks than with Intel 965 Express Chipset Family and it's reference thermal solution.
- Intel has updated the reference heat sink for the Intel X38 Express Chipset to reduce the risk of solder joint cracks from environmental testing.
- Consult your FAE to order the current revision of the *Intel® X38 Express Chipset (G)MCH Thermal and Mechanical Design Guide*

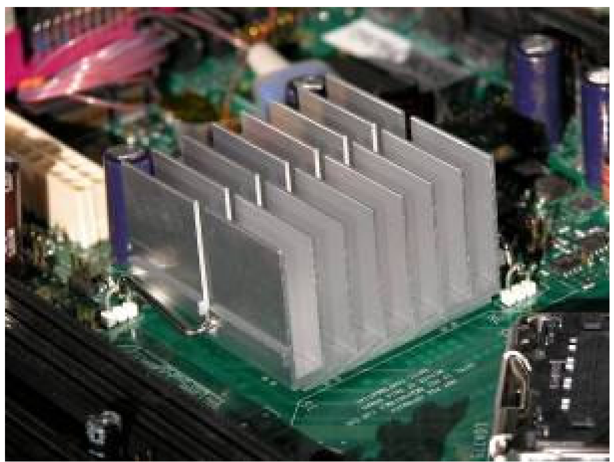
Intel recommends evaluating your design to determine the appropriate thermal solution.



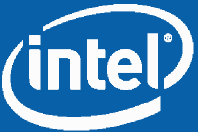
Bearlake MCH Thermal Solutions

- **Business**
  - POR (plan of record) for Intel® G33/35, Q33/35, and P35 Express Chipset in 34 mm package is:
    - PWSHS (pre-wave solder heat sink) for ATX
    - Spring Clip design for BTX
  - Keep In Zone for Intel® G33/35, Q33/35 and P35 Express Chipset in 34 mm package is the same as Intel 965 Express Chipset Family
- **Consumer**
  - POR for Intel® Bearlake X38 Express Chipset in 40 mm package is a Preload Wave Solder Heatsink (PWSHS) for ATX and BTX
  - Keep In Zone for BTX is sized to support the PWSHS & the spring clip design as used in Intel 965 Express Chipset Family

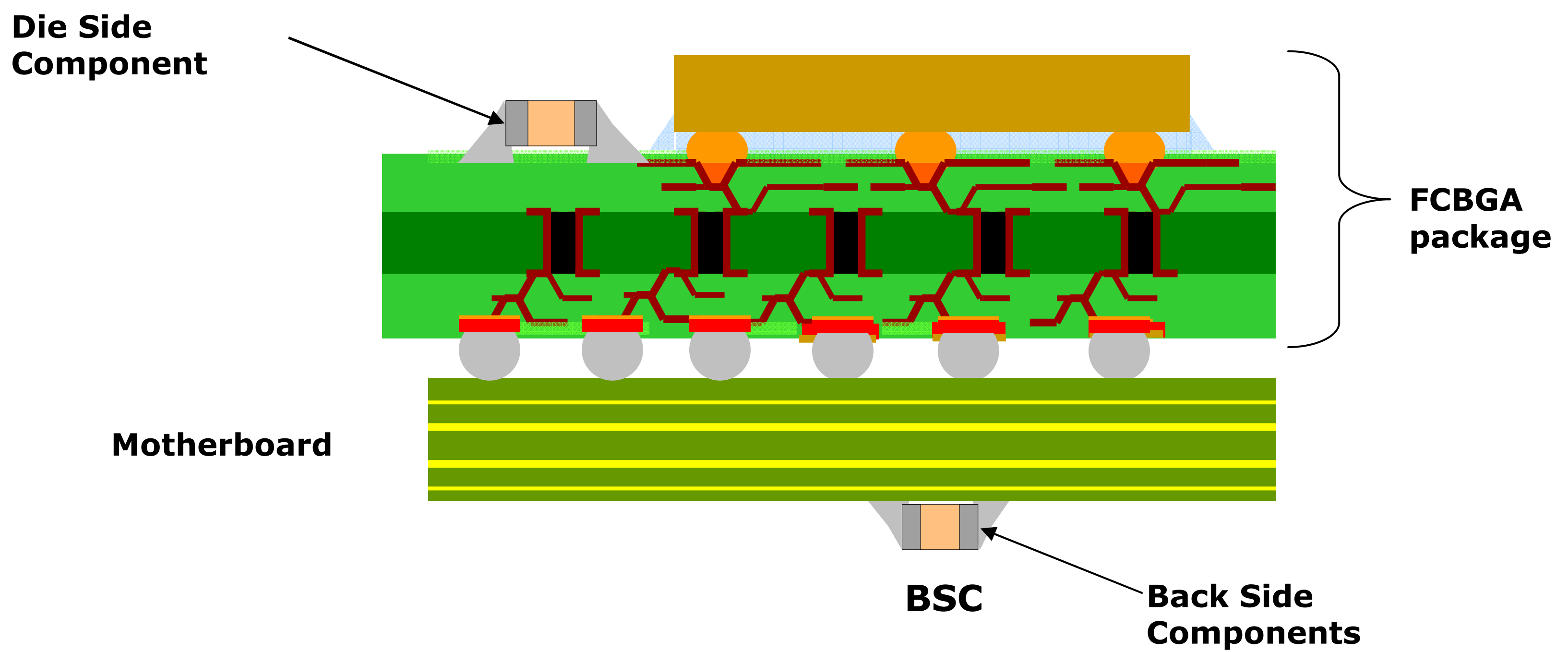
Example Spring Clip Heat Sink for BTX



Consult the Thermal Mechanical Design Guidelines for additional details

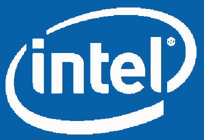


Backside Components



- Backside components are required for the X38 MCH (40mmX40mm)
- Capacitor sizes may range from 0402 to 0805**
- The MCH (40mmx40mm) will require up to ~ 20 backside capacitors
- The 34mmx34mm MCH does NOT require any backside capacitors for 2007

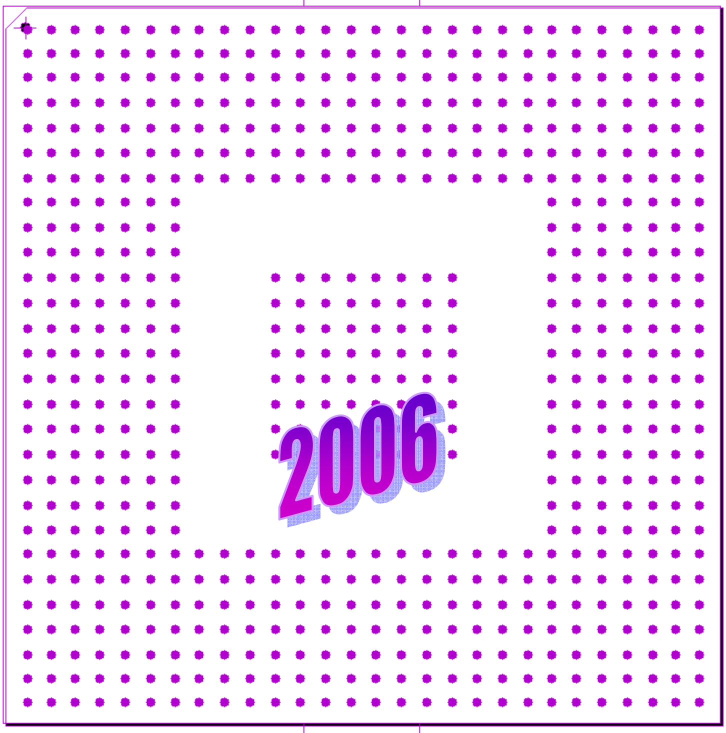
**recommendation only – subject to change

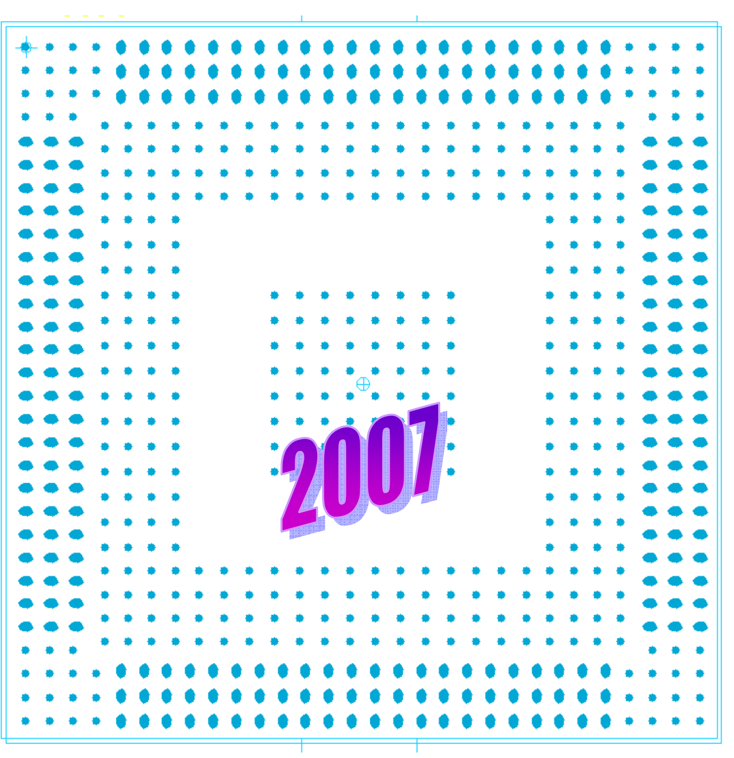


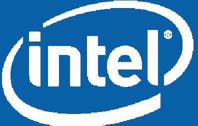
ICH Comparison

*Oval pads not drawn to scale

	ICH8 (2006)	ICH9 (2007)
Package Size	31mm x 31mm	31mm x 31mm
Ball Count/Pitch	652	676
Pad Info	All circular, 18mil	Circular & oval, 18mil & 14x22mil

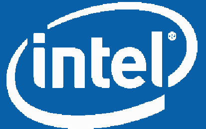






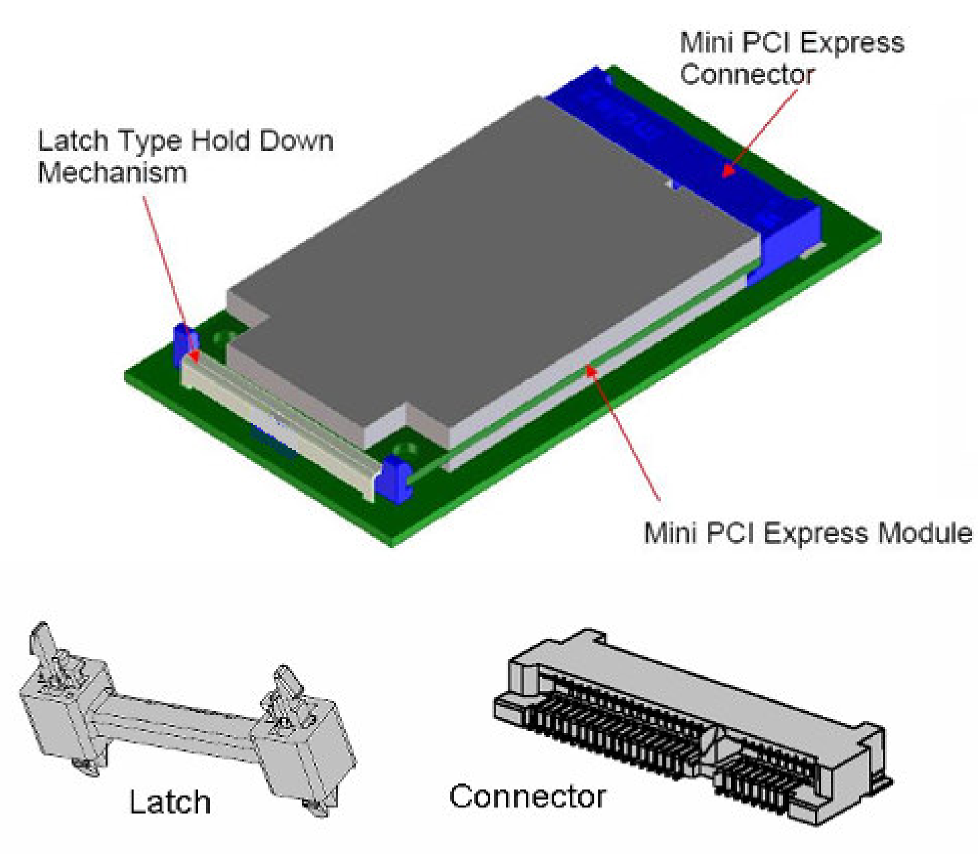
PCI Express Mini Card

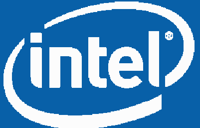
- Intended for (but not limited to) wired and wireless communications such as LAN, WAN and WLAN
- Benefits include:
  - Flexibility: easy upgrades and made-to-order configurations
  - Serviceability: cards can be easily removed, repaired, and replaced
  - Reduced size: smaller than other add-in cards to free up more board real estate



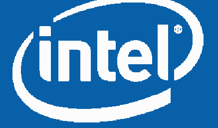
PCI Express Minicard

- SMT connector has 52 pins and is available in different heights
- Latches come in SMT and plastic (hand-placed) formats
- Mini Card dimensions are: 30.00 x 50.95mm





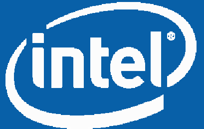
Board Manufacturing Key Parameter Recommendations



Pb-free Board Assembly Critical To Function (CTF) Parameters

Stage	Attention Area	Recommendation
Screen Print	Oval circular PCB pads for G+/X MCH and ICH9	1:1 stencil ratio for all pads
Placement	MCH non-grid array.	Camera and software upgrades may be required for ball recognition
Reflow	No incremental technology challenges from Pb-free 2006 platform. Ensure temp on G+/X MCH	Utilize Intel's profile board methodology: Intel® SMT Profile Board Information
Inspection	No incremental technology challenges from Pb-free 2006 platform	Use silkscreen as a placement verification—Use X-Ray to verify placement program setup.
MDA Test	*Strain; Socket Testing; Ability to make contact with test points;*	*Follow BFI guidelines. Use ISTT-YP for LGA775 socket. Refer to the Pb-free MAS. Utilize offline programming*
Assembly / Wave Solder	No incremental technology challenges from Pb-free 2006 platform. WS accommodates back side cap	Use Intel's recommended profile board methodology
ATE Test	*Strain; Socket Testing; Ability to make contact with test points; SPI Content Programming/Verification*	*Follow BFI guidelines. Use ISTT-YP for LGA775 socket, Refer to the Pb-free MAS. Allow time for programming or do offline*
Rework	No incremental technology challenges from Pb-free 2006 platform	Intel's recommended rework process – profile board & paste.
Func. Test	Manageability Engine W/ AMT and Automatic Fan Speed Control	Verification of remote management capabilities and sleep state (S3-S5) functionality. For fan control, reference HDCP MAS
Final Inspect	Method to validate outgoing quality solder bridging	100% X-Ray
Pack / Ship	No incremental technology challenges from Pb-free 2006 platform	N/A

*Other names and brands may be claimed as the property of others.

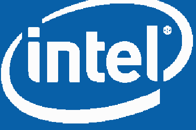


Board Assembly Process

Reference Process CTF Parameter (Pb-free)

	CTFP	Recommended Spec	Manufacturing Consideration
		0.005” (0.127mm)	
		0.4mm QFP/TSOP 7.5X60mils All other devices 1:1	
		5.0 to 6.8 mils	
		<= 25% off the pad	
		Metal squeegee	

*Other names and brands may be claimed as the property of others.

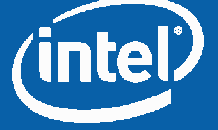


Board Assembly Process

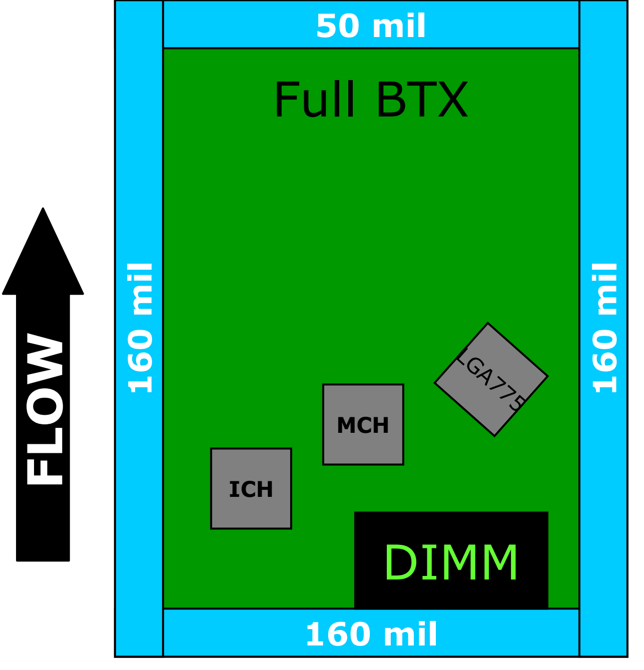
Reference Process CTF Parameter (Pb-free)

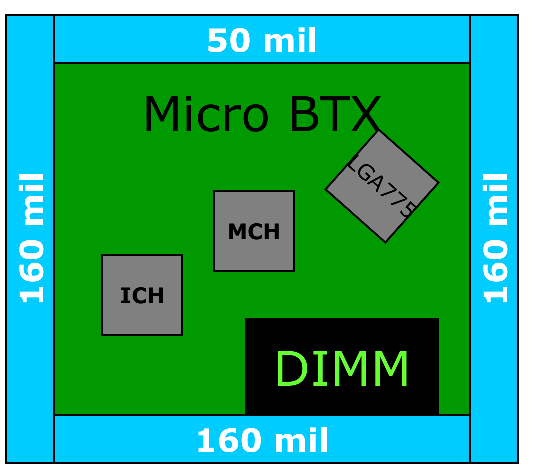
	CTFP	Recommended Spec	Manufacturing Consideration
			D < 0.5 *D

*Other names and brands may be claimed as the property of others.

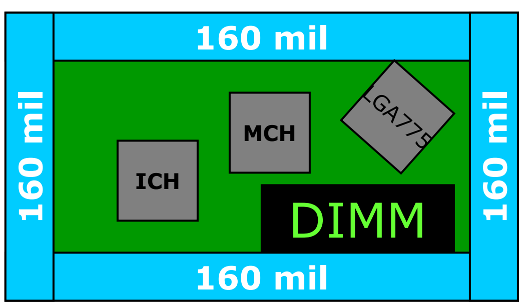


BTX Boards Orientation in Reflow



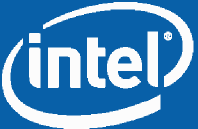


Pico BTX

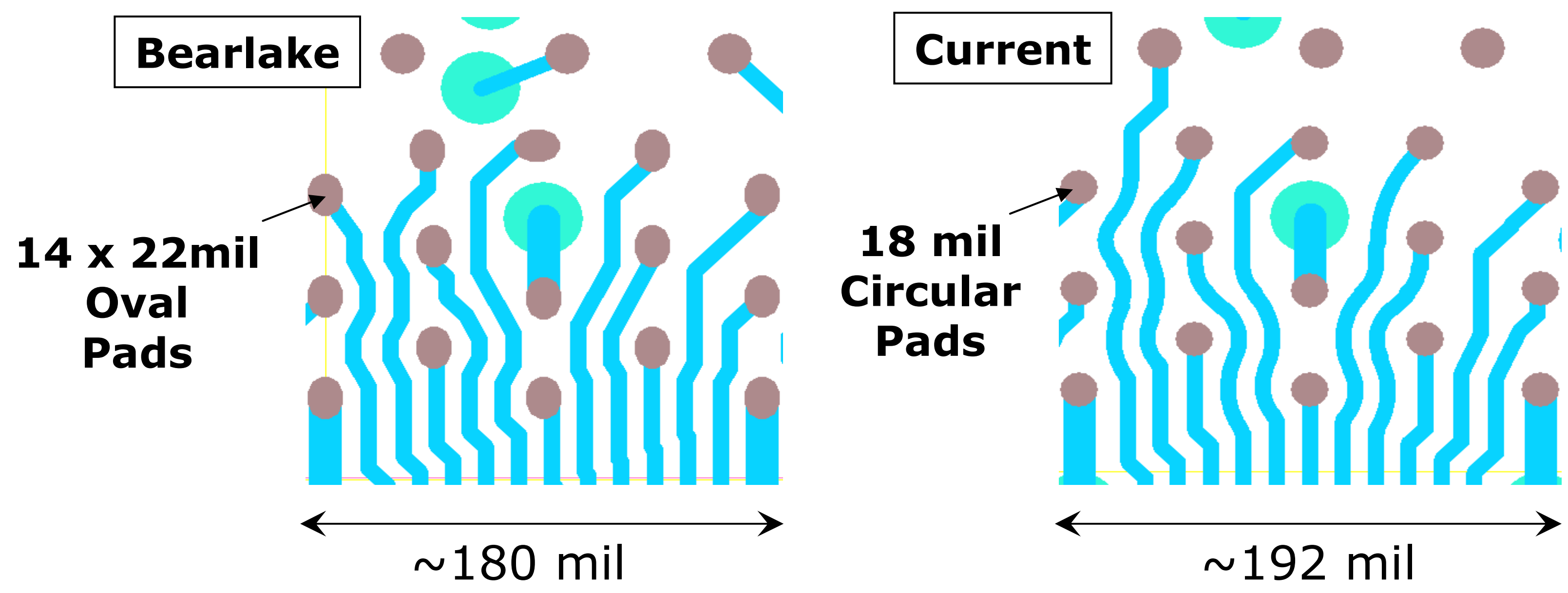


FLOW

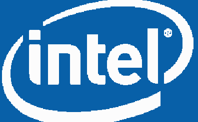
Switching the orientation for Pico BTX **significantly** reduces PCB warping during assembly



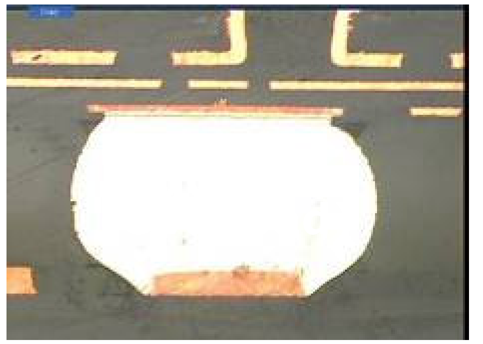
Benefits of Oval Pads

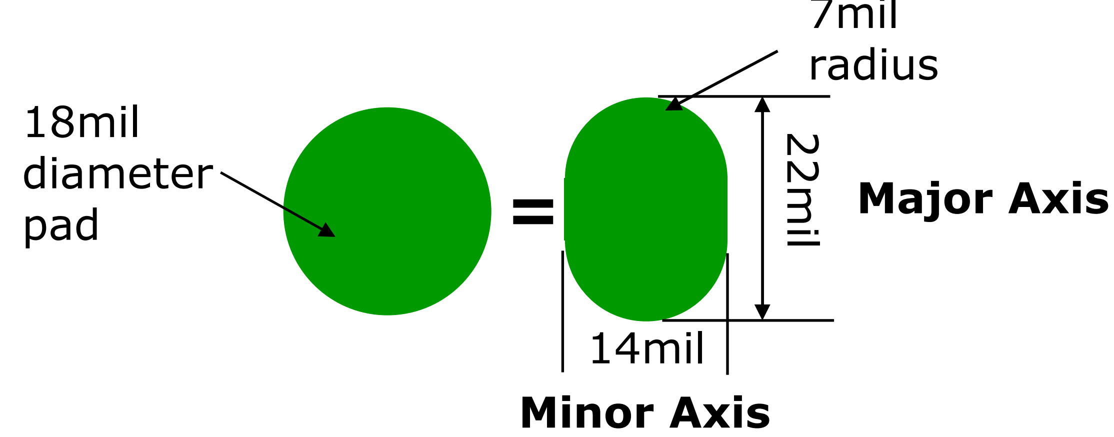


Oval pads improve routing density
by increasing the I/O capability

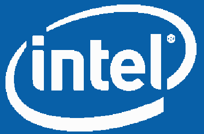


Cross-Section Analysis of Oval Pad Design



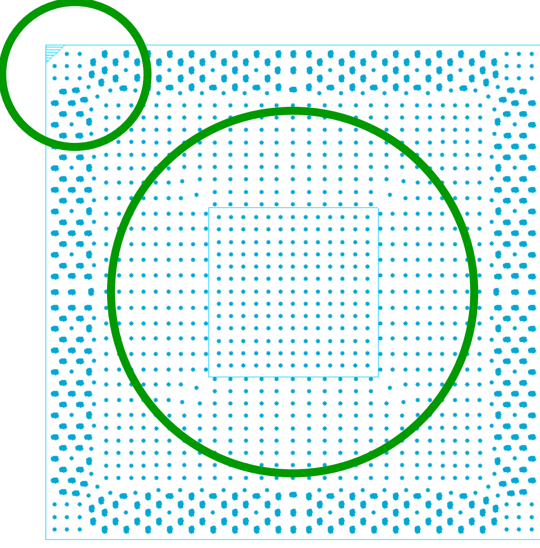


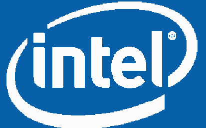
- No major differences observed in solder joint shape
- 14 x 22mil oval pad is equal in area to the 18mil circular pad
- Package side pad geometry remains circular



Oval Pad Reliability

- Corner and Die Shadow pads remain 18 mil diameter (circular)
- Intel® 965 Express Chipset thermal mechanical test samples w/oval pads were tested using:
  - Temperature Cycling
  - Shock
  - Vibration
- No Oval Pad reliability failures were found
- No impact to PCB testing costs – large pad dimensions (14mil x 22mil) do not require increased probing accuracy

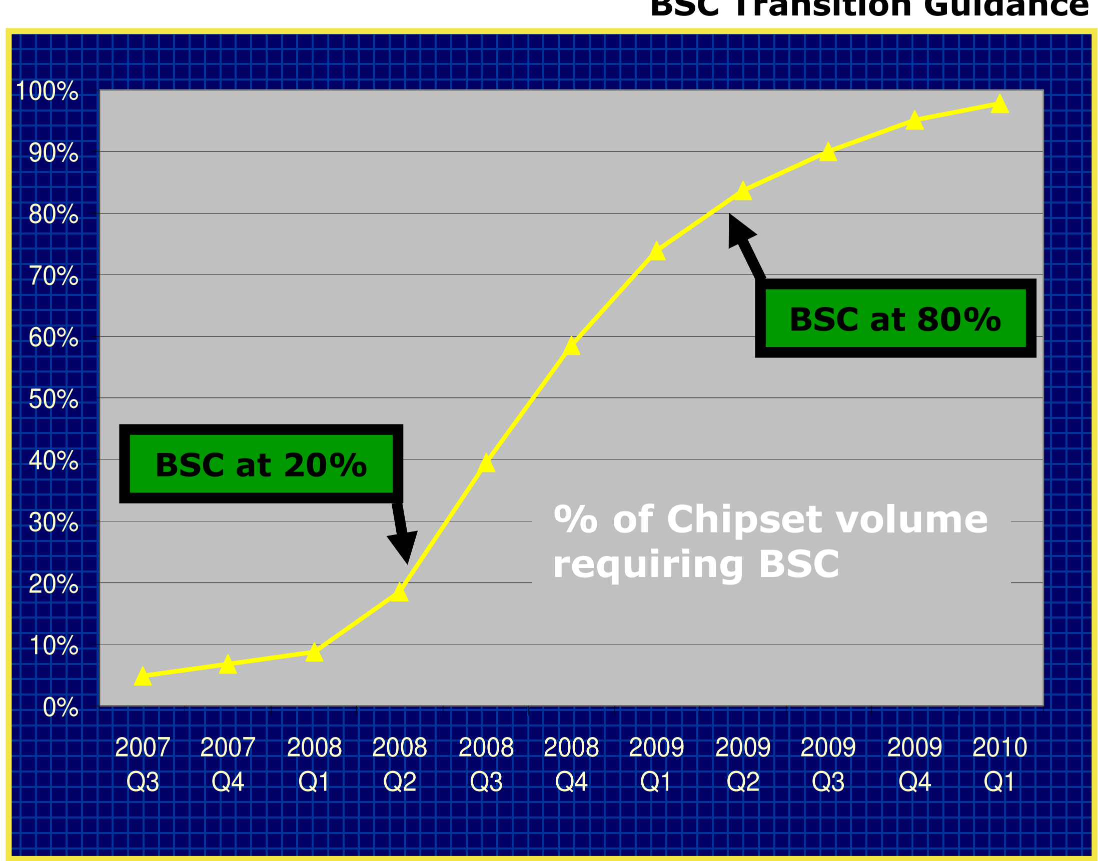


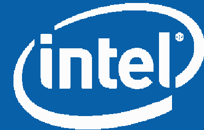


Backside Cap (BSC) Technology Transition Guidance

- Future Intel desktop chipsets will require Back Side Capacitor (BSC) assembly
  - BSCs required to meet higher di/dt requirements of smaller silicon lithography technologies and component power deliver requirements
- BSC transition guidance
  - BSC required on X38 chipsets (40mm package)
  - All 2008 chipsets will require BSC for compliance to specification.
  - 80% volume transition expected in 2nd half of 2009

BSC Transition Guidance





Integrated Heat Spreader (IHS)
Consumer Platform

Why is an IHS required?

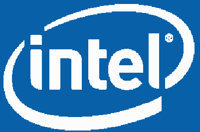
• JEDEC co-planarity requirements drive the necessity of the IHS for the 40mm x 40mm package.

•Ensures good package coplanarity for higher assembly yields

What are the manufacturing risks of an IHS?

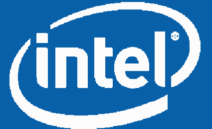
• Thermal profiling could present a challenge based on the heat dissipation characteristics of the IHS.

• Verify Transient Bend is within Intel Guidelines to avoid factory induced damage.



Assembly Impact Summary

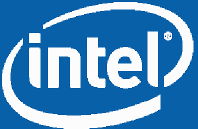
- No changes to the LGA socket, LAN, or 34mm MCH
- New assembly challenges are:
  - Oval pads (ICH9 and 40mm MCH)
  - Backside Capacitors (40mm MCH ‘07, all MCH ‘08)
  - MCH package for Consumer platform
    - Larger, 40mm x 40mm
    - Integrated Heat Spreader



Testing

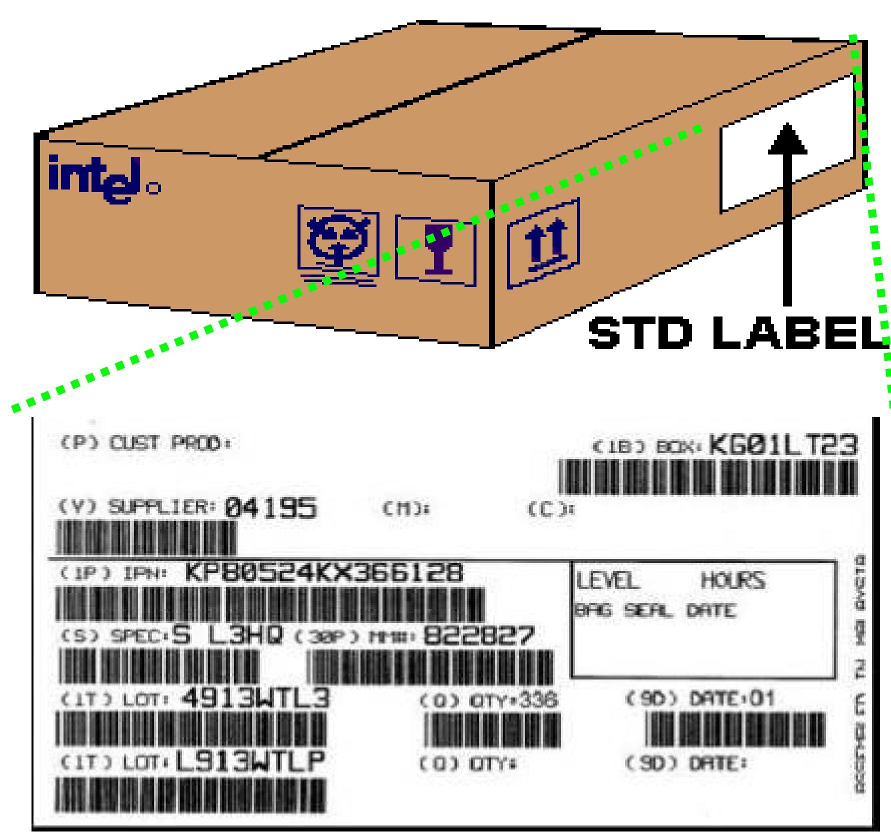
- Intel® Socket Test Technology – LGA775YP (product code:JM8YKZLVA) is currently available for the Intel® 965 Express Chipset Family platform through normal ordering channel
  - http://www.intel.com/design/PentiumD/applnots/307507.htm
- Lakeport (Intel® 945/955x Express Chipset family) platform uses the same testing device (product code: JM8YKZLVA);
- Grantsdale (Intel® 915/925 Express Chipset family) platform uses a different testing device (product code: JM8HKZLVA);
  - http://www.intel.com/design/pentium4/applnots/303334.htm
- To ensure maximum testing coverage, these 2 products(JM8YKZLVA and JM8HKZLVA) should not be interchanged.

Intel, Pentium, and Intel logo are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.



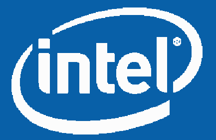
Package Shipping Media

Shipping Box and Labeling



Picture here for illustration only; exact number varies.

- Shipping Box Dimension similar to current processor package.
- Empty thermoformed tray on top
- Recommended storage condition: 50 ° C (max) with 70% R/H (max)
- Label similar with current processors shipping box.



References

- Intel® Pentium® 4 Processor 580, 570, 560, 550, 540, 530, and 520△ on 90nm Process Package Electrical, Mechanical, and Thermal Specification
- Intel® Pentium® 4 Processor on 90nm Process Package Thermal Design Guideline
- Intel® Pentium® D Processor Electrical, Mechanical, and Thermal Specification
- Intel® Pentium® D 840, 830 and 820△ and Intel® Pentium® Processor Extreme Edition 840△ Thermal and Mechanical Design Guidelines
- LGA775 Socket Mechanical Design Guide
- BTX specification: http://www.formfactors.org
- Intel® 965 Express Chipset Family Platform Customer Feedback Package
- MAS - Manufacturing with Intel® Components: Using 775-Land LGA Package/LGA775 Socket
  - Overview Module
  - Handling and Inspection Module
  - System Integration Module
  - Test Module
- MAS - Manufacturing with Intel® Components: Intel® SMT Profile Board Information
- MAS - Manufacturing with Intel® Components Using Lead Free Technology Board Assembly Overview
- MAS - Intel® Lead-free Board Assembly MAS Rev 2.0
- Tested Chassis and Power Supply Lists: http://www.intel.com/cd/channel/reseller/asmo-na/eng/215842.htm
- Tested Power Supply: http://www.intel.com/cd/channel/reseller/asmo-na/eng/35829.htm
- Intel® Socket Test Technology Application Note: http://www.intel.com/design/PentiumD/applnots/307507.htm

Note:

1) Contact your Intel field sales representatives for latest revision and order number for these documents.
2) Some documents may not be released at the time of publication of this document.

△ Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. See http:\\www.intel.com/products/processor_number for details.

Intel, Pentium, and Intel logo are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.