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Thermal Simulation: LM98725 in 56L TSSOP, on 2 & 4L JEDEC Board

11 Nov 2011

Objective and Package Specifications

Objective:

To evaluate thermal performance of 2 and 4 layers JEDEC boards applied for 56L,TSSOP Package.

Package Specifications	56L, TSSOP	
Package Size (mm)	14.0 x 6.1 x 0.9	
Die Size (mm)		
DAP Size (mm)		
Input Power (Watt)	0.755W on die	
Board Specifications		
Board Type	2L, JEDEC	4L, JEDEC
Board Size (In)	3x 4.5	3x 4.5
Stack-up	2-Layer	4-Layer
Cu Thickness (Power/Ground Layers)	N/A	1 oz
Signal Traces	2 oz	2 oz
via under exposed pad	NO	NO
Environmental Conditions	**Natural Convection**	
Ambient Temperature	22°C	
Air Flow	0 m/s	

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Material Properties & Assumptions

Components	Material	Thermal Conductivity (W/m-K)
Die	Silicon	111
Mold Compound	EME-7351LS	0.837
Epoxy	84-1LMISR4	1.1
PCB Planes Traces	Copper	377
Board Insulator Layer	FR4	0.35
Lead and Pad Attach	Lead Free Solder	50.0
Lead frame	C194	167

Assumptions:

- *Theta JA reference to Die (Worst case scenario).*
- *Theta JA calculation base on total power input towards die.*

Summary of FEM Results

Board Layer	2 layers	4 layers
Total Power Input (W)	0.755	
Ambient Temperature, TA (^{0}C)	22.0	
Max Case Temp, Tj at 22 ^{0}C ambient (^{0}C)	84.64	70.10
Max Die Top, Tj at 22 ^{0}C ambient (^{0}C)	84.90	70.29
Theta JA at 22 ^{0}C ambient (^{0}C/W)	83.31	63.96

Conclusion

- Theta JA Improvement of 23.2% with 4 layers JEDEC Boards
  - Theta JA with 2 lyrs JEDEC Board: 83.31 (^{0}C/W)
  - Theta JA with 4 lyrs JEDEC Board: 63.96 (^{0}C/W)
- Junction temp, Tj Improvement of 17.2% with 4 layers JEDEC Boards
  - Tj with 2 lyrs JEDEC Board: 84.90 ^{0}C
  - Tj with 4 lyrs JEDEC Board: 70.29 ^{0}C

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Appendix

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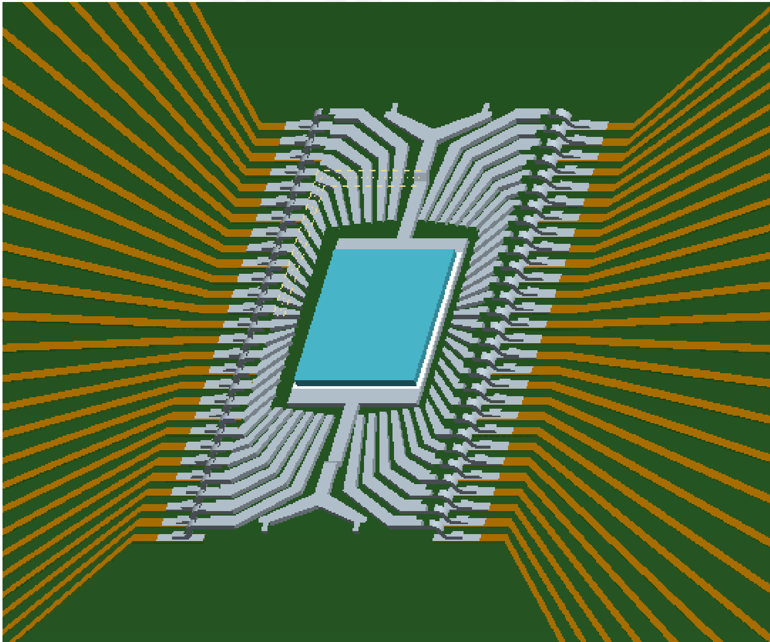
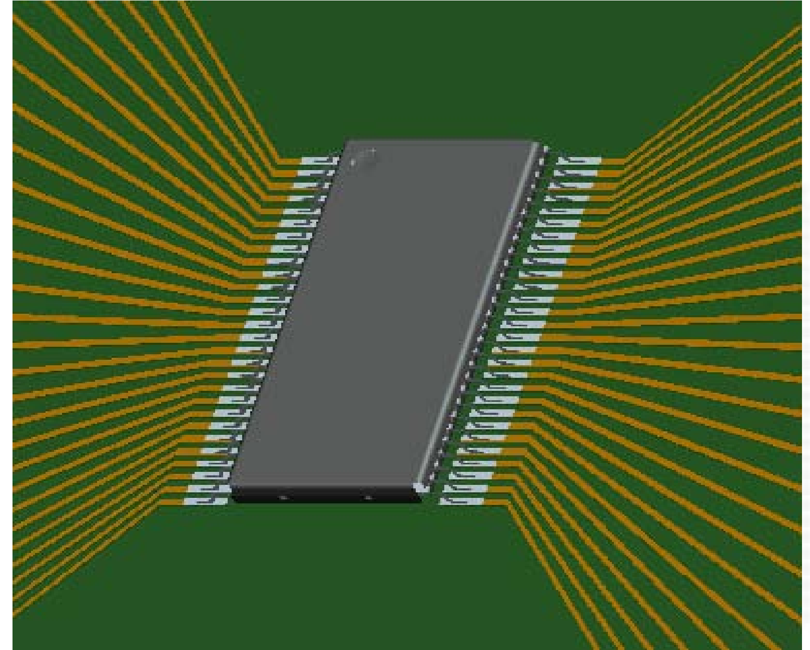
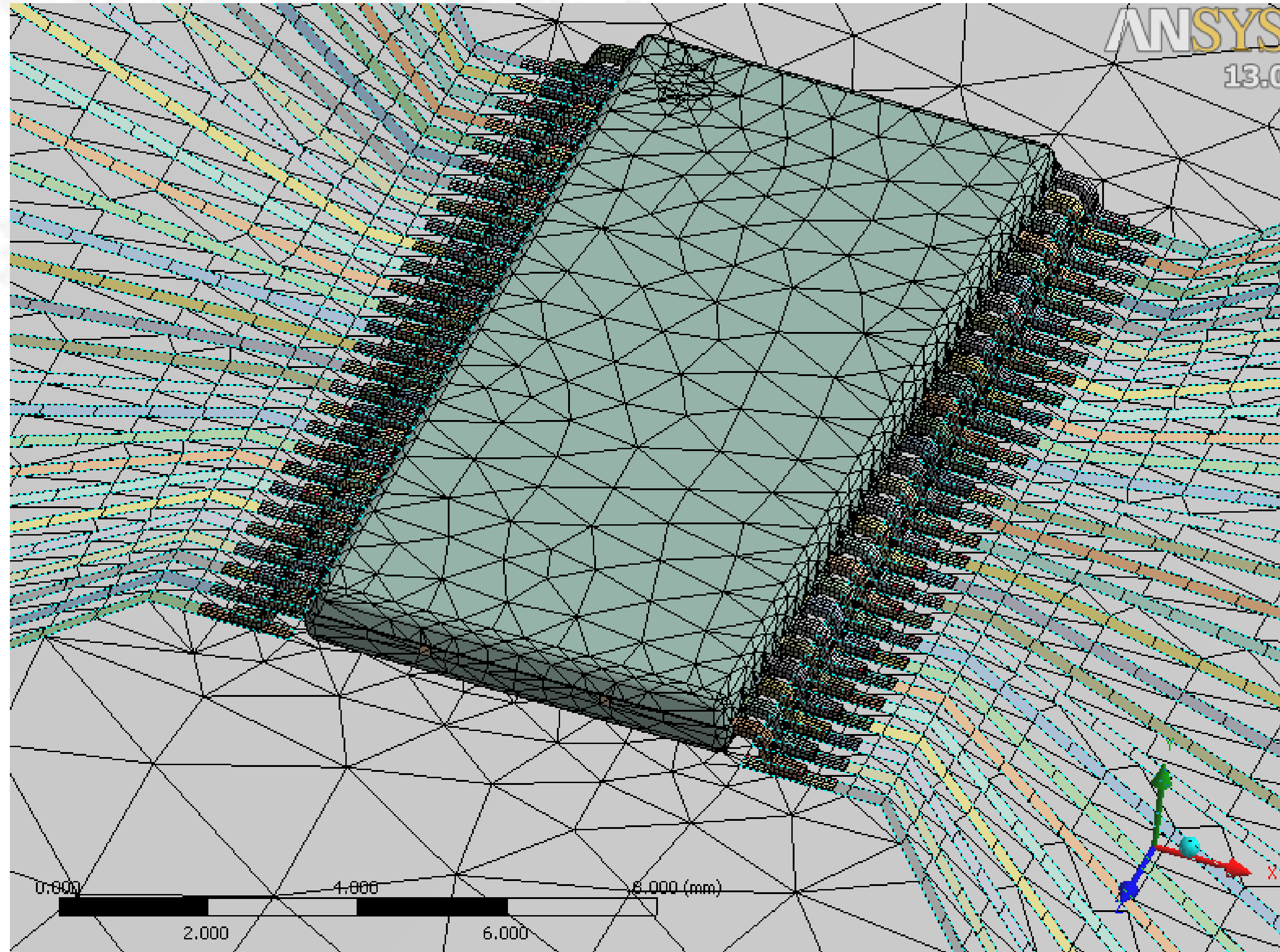
Package Compilation



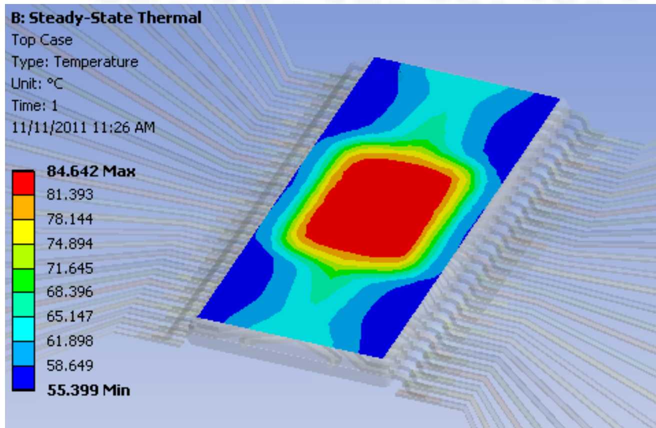


Texas Instruments

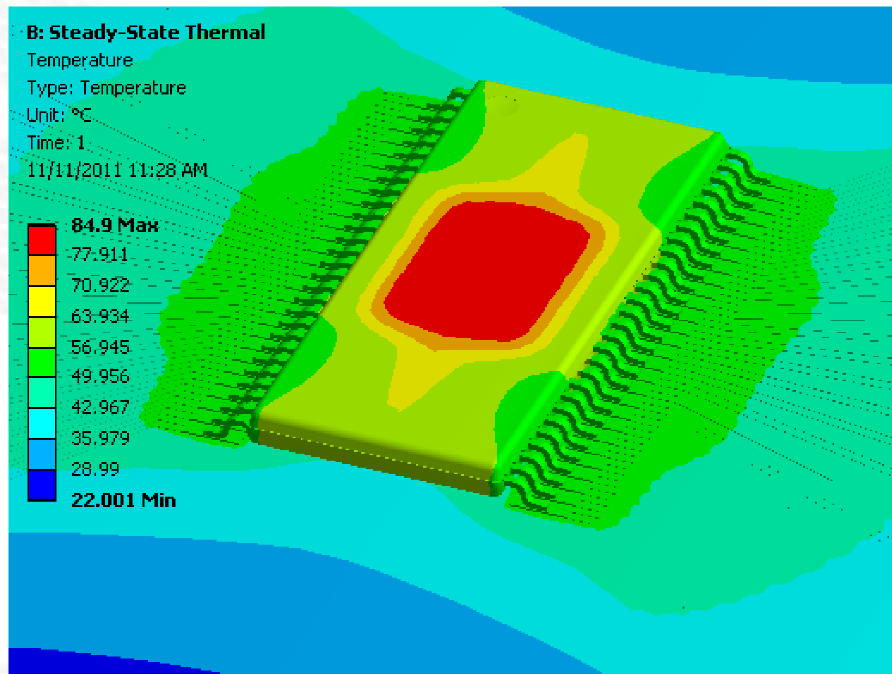
Finite Element Model

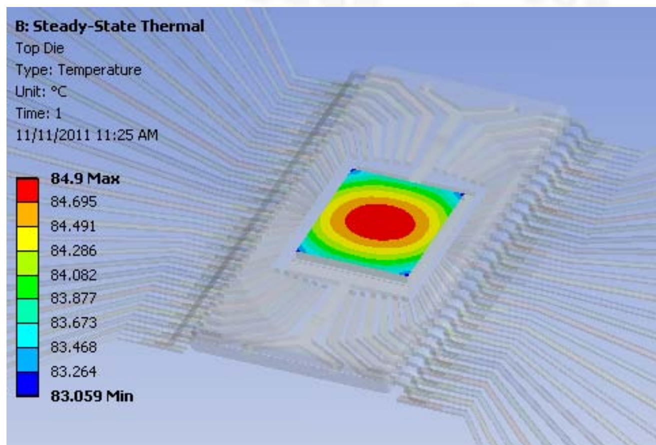


2 layers JEDEC Board



Max. Case Temp. = 84.64 ^{O}C





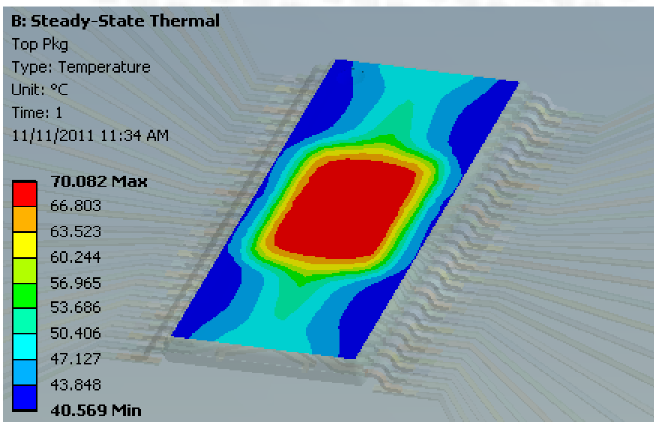
Max. Device Temp. = 84.90 ^{O}C

$T_{Junction} = 84.90\ ^{0}C$

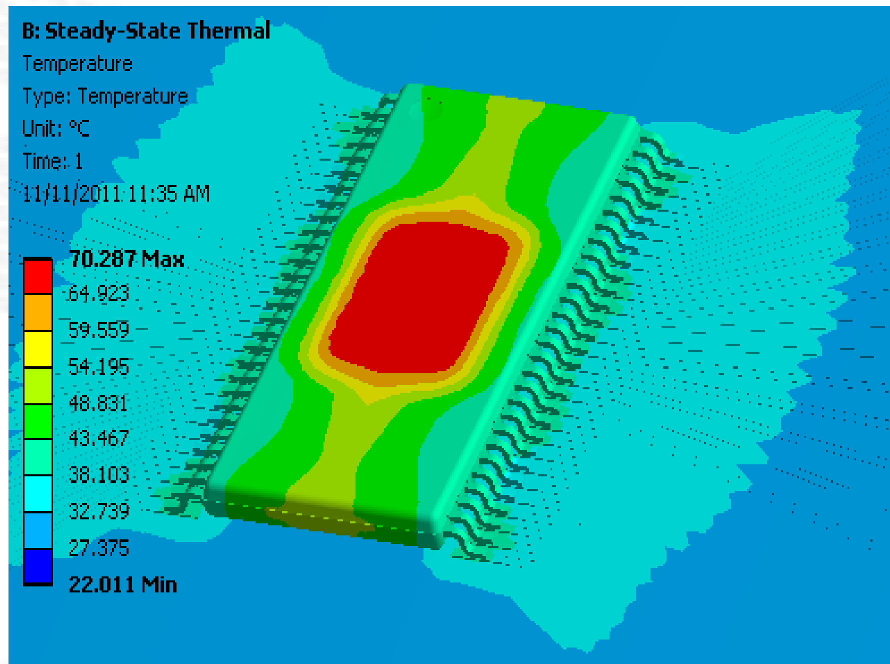
$\theta_{JA} = (84.90-22)/0.755W$

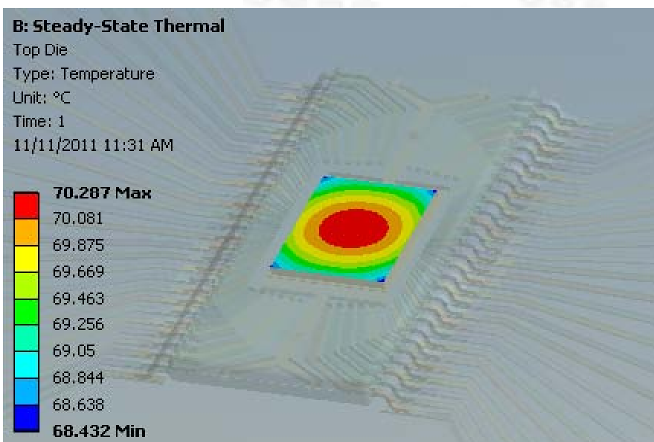
$= \underline{83.31\ ^{0}C/W}$

4 layers JEDEC Board



Max. Case Temp. = 70.10 ^{O}C





Max. Device Temp. = 70.29 ^{O}C

$T_{Junction} = 70.29\ ^{0}C$

$\theta_{JA} = (70.29-22)/0.755W$

$= \underline{\mathbf{63.96\ ^{0}C/W}}$

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Thank You