Increasing Memory Density

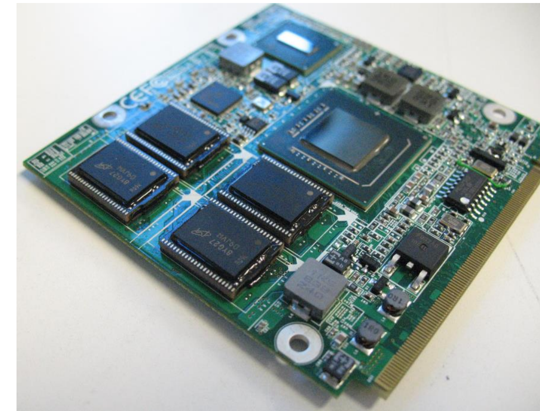
With Legacy Multiple Device Canopy®

Multiple Device Canopy®™ MDC™ Embedded Applications

Flexible

- Multiple Footprints Available
- SDR, DDR, DDR2, DDR3
- High Density Memory Modules
- 8GB and 16GB

4GB VLP ECC RDIMM pictured above, utilizes MDC™ to double density, reduce board space, lower power and reduce costs. Applications include Blade Servers, Enterprise Servers, Embedded Systems and other high density applications.



Intel® System Control Hub with Atom™ Z530 Processor with MDC™

Multiple Device Canopy®™ MDC™

FEATURES/BENEFITS

INCREASE MEMORY DENSITY

- Double density in same space

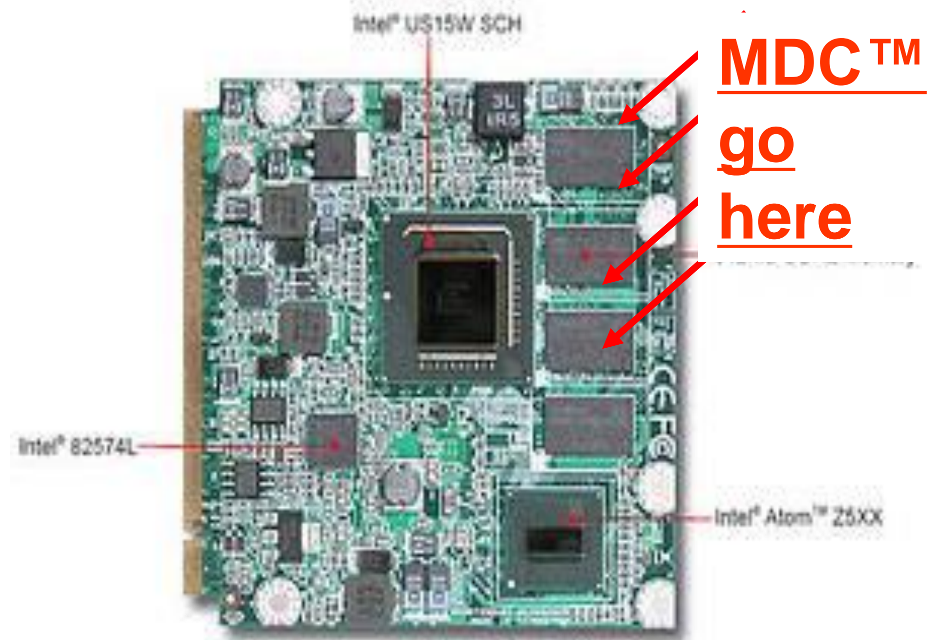
COST EFFECTIVE

- Reduce overall memory cost

RUGGED & RELIABLE

- Extended temp range available

MDC REDUCES MEMORY COST BY 30%
Without any changes to board layout



Simply replace the 2Gbx16 DRAMs
With 2Gbx16 MDC™

Multiple Device Canopy®™ MDC™
Atom Based Solutions

Legacy's Multiple Device Canopy®™
Higher Memory Density & Performance
www.legacyelectronics.com

2Gbx16 DDR2/667 MDC™
1GB with 4 Devices
2GB with 8 Devices
No Board Layout Change
Significant Cost Reduction

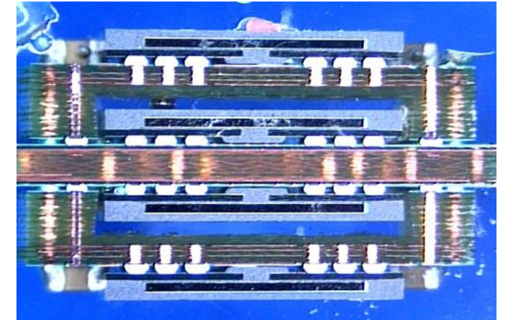
Multiple Device Canopy®™ MDC™ Canopy® BGA, TSOP and CUSTOM

FEATURES

- Added flexibility: route on ALL THREE Planes, X-Y-Z
- Uses proven Legacy Canopy® technology
- TSOP & BGA Supported
- Easily accessible test points
- Assemble using standard SMT/reflow process
- Allows increased density in small footprint
- Enhanced thermal characteristics
- ROHS/WEEE compliant
- NEBS capable
- Supports DRAM, SRAM and FLASH

APPLICATIONS

- Main Board Density Multiplication
- High density memory
- Mixed Signal applications

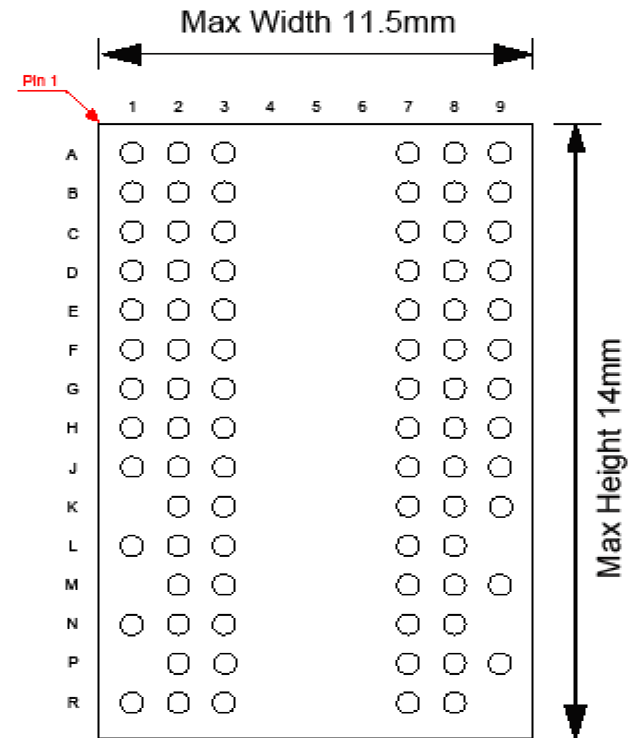


Cross-section of BGA Canopy® Module above Legacy Multiple Device Canopy™ to the left.

Multiple Device Canopy®™ MDC™
84-Ball 2Gbit 128Mx16 DDR2 SDRAM

- **General Description**
- The Legacy Electronics 2Gbit Multiple Device Canopy®™ (MDC™) DDR2 DRAM is functionally and electrically equivalent to a 2Gb monolithic DRAM.
- The 2Gb Canopy® is configured as a 128Mx16 device and supports clock speeds up to 667Mhz. Legacy Electronics' proprietary Canopy® technology is utilized to produce a highly reliable 2Gb DDR2 x16 DRAM device that is pin for pin compatible to a monolithic 128Mx16 (2Gb) DRAM at a significant cost savings with enhanced Signal Integrity probe access.
- **Features**
- Uses JEDEC standard 84 ball footprint
- Impedance-controlled substrate
- High performance and high reliability
- Supports decoupling capacitors - Optional
- Direct-connect power and ground planes
- Proper thermal management
- Accessible probe points - Optional
- RoHS Compliant
- JEDEC-standard 1.8V I/O (SSTL_18-compatible)
- Programmable CAS latency (CL)
- On-die termination (ODT)
- 8 internal banks for concurrent operation
- **Assembly Features**
- Supports Just-In-Time (JIT) manufacturing
- Supported by standard SMT equipment

Canopy® 84-Ball FBGA Layout

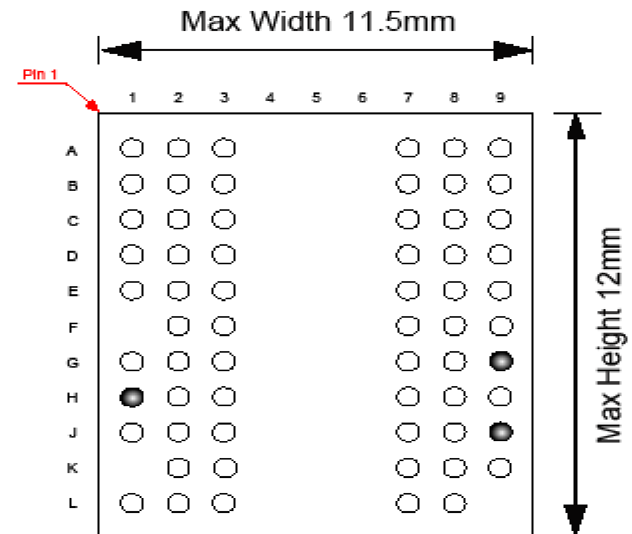


Multiple Device Canopy®™ MDC™
63-Ball 2Gbit x8 / x4 DDR2 SDRAM

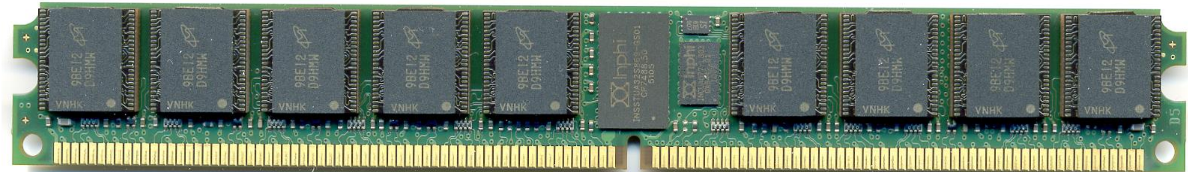
- **General Description**
- The Legacy Electronics 2Gbit Multiple Device Canopy® (MDC®) DRAM is functionally and electrically equivalent to a dual die package DRAM.
- The Legacy 2Gbit MDC® is configured as a 256Mx8 device that is internally configured as two 1Gbit DDR2 DRAM devices. Addressing of the MDC is identical to a monolithic device. The MDC® is 2 rank and includes dual CS#, ODT and CKE signals. The MDC can provide significant cost / space savings.
- **Features**
- Uses JEDEC standard 63 ball footprint (x4 and x8)
- Design for memory down and module applications
- Impedance-controlled substrate
- High performance and high reliability
- Direct-connect power and ground planes
- Proper thermal management
- Accessible probe points - Optional
- RoHS Compliant
- JEDEC-standard 1.8V I/O (SSTL_18-compatible)
- Programmable CAS latency (CL)
- On-die termination (ODT)
- 8 internal banks for concurrent operation
- Custom MDC® solutions also available
- **Assembly Features**
- Supports Just-In-Time (JIT) manufacturing
- Supported by standard SMT equipment

Canopy® 63-Ball FBGA Layout

Target PCB footprint



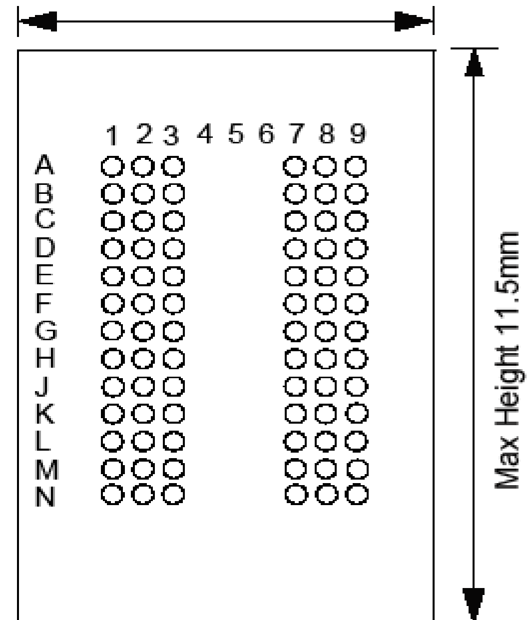
4GB VLP ECC RDIMM



Multiple Device Canopy®™ MDC™
78-Ball 2Gbit 2 Rank DDR3 SDRAM

- **General Description**
- The Legacy Electronics 2Gbit Multiple Device Canopy® (MDC™) DRAM is functionally and electrically equivalent to a dual die package DRAM.
- The Legacy 2Gbit MDC™ is configured as a 512Mx4 or 256Mx8 device that is internally configured as two 2Gbit DDR3 DRAM devices. Addressing of the MDC™ is identical to a monolithic device. The MDC™ is 2 rank and includes dual CS#, ODT and CKE signals. The MDC™ can provide significant cost / space savings.
- **Features**
- Uses JEDEC standard 78 ball footprint (x4 and x8)
- Design for memory down and module applications
- Impedance-controlled substrate
- High performance and high reliability
- Supports decoupling capacitors
- Direct-connect power and ground planes
- Proper thermal management
- Accessible probe points
- RoHS Compliant
- JEDEC-standard 1.5V I/O (SSTL_15)
- Programmable CAS latency (CL)
- On-die termination (ODT)
- 8 internal banks for concurrent operation
- **Assembly Features**
- Supports Just-In-Time (JIT) manufacturing
- Supported by standard SMT equipment

Canopy™ 78-Ball FBGA Layout



COUNT ON QUALITY
EXPECT INNOVATION

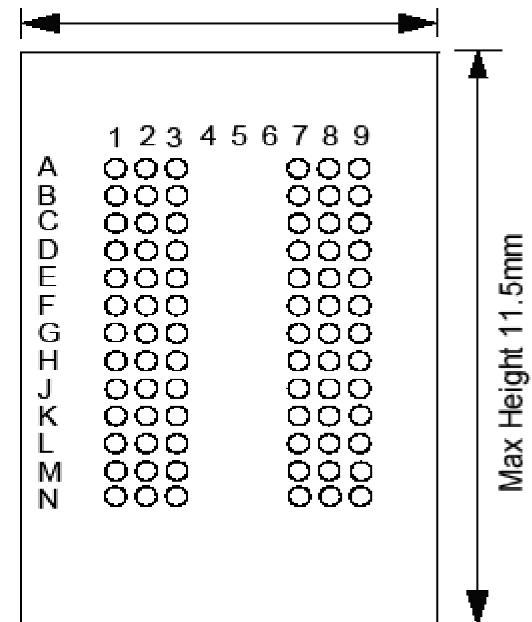
US Patent # 7,102,892 B2

LEGACY
ELECTRONICS, INC.

Multiple Device Canopy®™ MDC™ 78-Ball 4Gbit 2 Rank DDR3 SDRAM

- **General Description**
- The Legacy Electronics 4Gbit Multiple Device Canopy® (MDC™) DRAM is functionally and electrically equivalent to a dual die package DRAM.
- The Legacy 4Gbit MDC™ is configured as a 1024Mx4 or 512Mx8 device that is internally configured as two 2Gbit DDR3 DRAM devices. Addressing of the MDC™ is identical to a monolithic device. The MDC™ is 2 rank and includes dual CS#, ODT and CKE signals. The MDC™ can provide significant cost / space savings.
- **Features**
- Uses JEDEC standard 78 ball footprint (x4 and x8)
- Design for memory down and module applications
- Impedance-controlled substrate
- High performance and high reliability
- Supports decoupling capacitors
- Direct-connect power and ground planes
- Proper thermal management
- Accessible probe points
- RoHS Compliant
- JEDEC-standard 1.5V I/O (SSTL_15)
- Programmable CAS latency (CL)
- On-die termination (ODT)
- 8 internal banks for concurrent operation
- **Assembly Features**
- Supports Just-In-Time (JIT) manufacturing
- Supported by standard SMT equipment

Canopy™ 78-Ball FBGA Layout



Multiple Device Canopy®™ MDC™ FloTHERM® Model

Component Temperature Summary

DRAM	Tcase_predicted (° C)	*Tcase_max (° C)	Margin (° C)
top	**51.4**	85	33.6
bottom	**46.5**	85	38.5

•max junction temperature from Micron datasheet

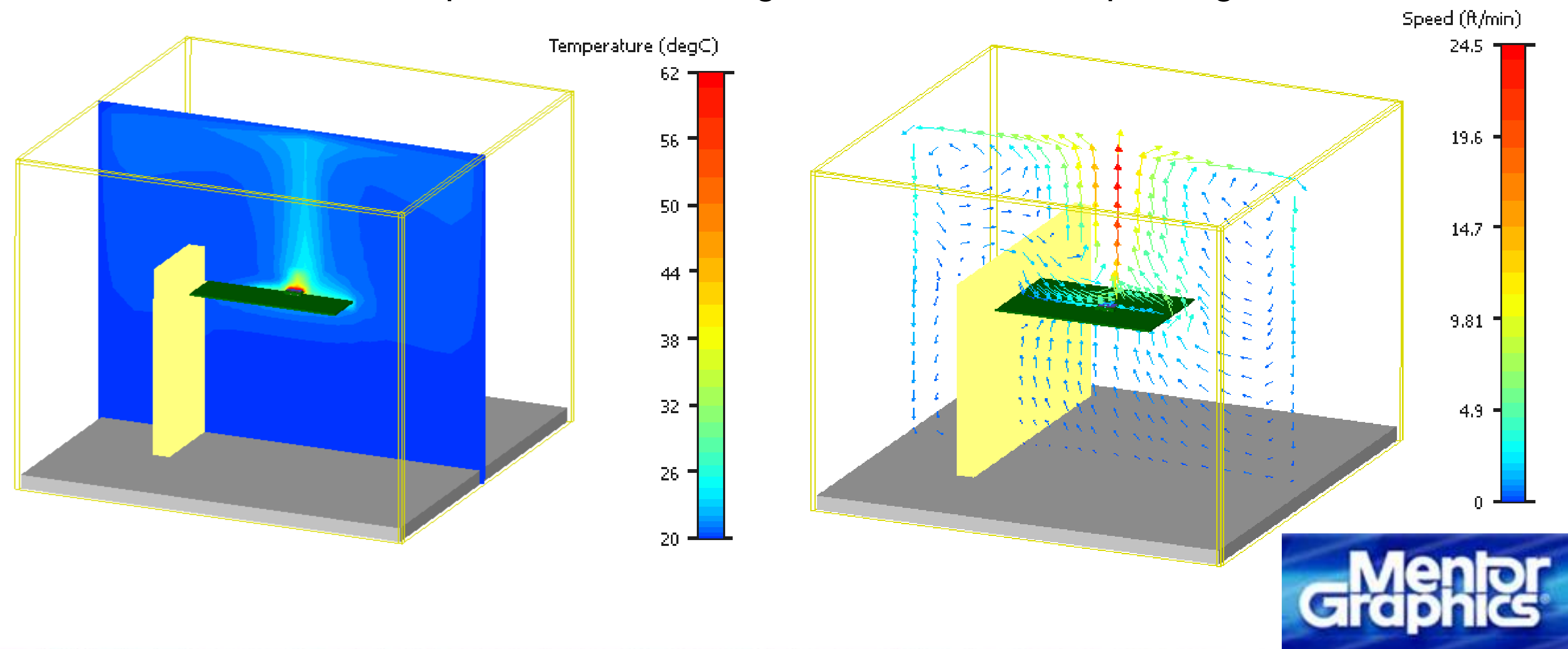
DRAM	Tj_predicted (° C)	Tamb (° C)	Heat Diss (W)	Θja* (° C/W)
top	51.4	20.0	0.36	87.3
bottom	46.5	20.0	0.36	73.7

* Junction-to-Ambient thermal resistance

Multiple Device Canopy®™ MDC™ FloTHERM® Model

Air Temperature and Speed

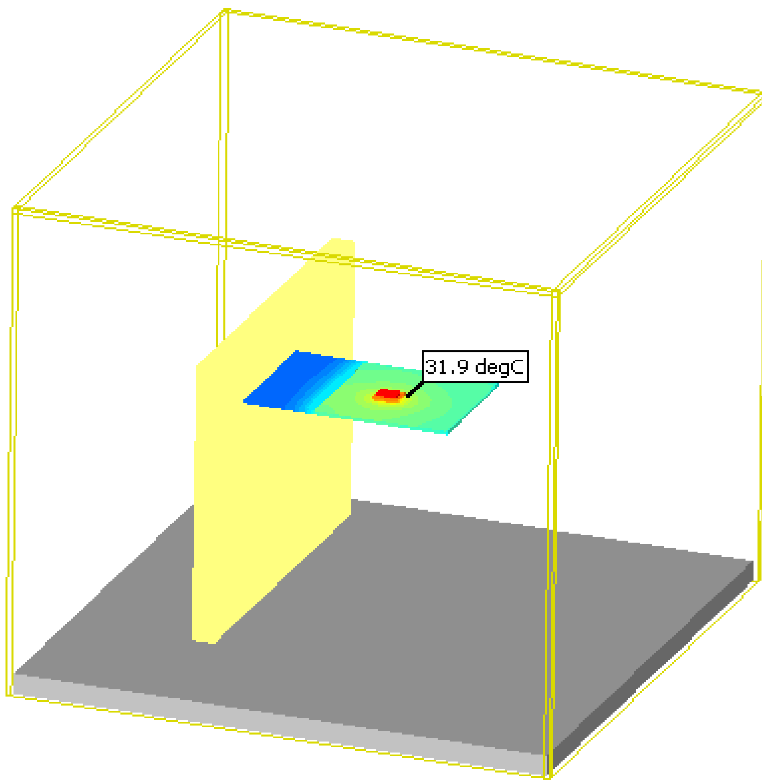
- Cutplane taken through centerline of the package

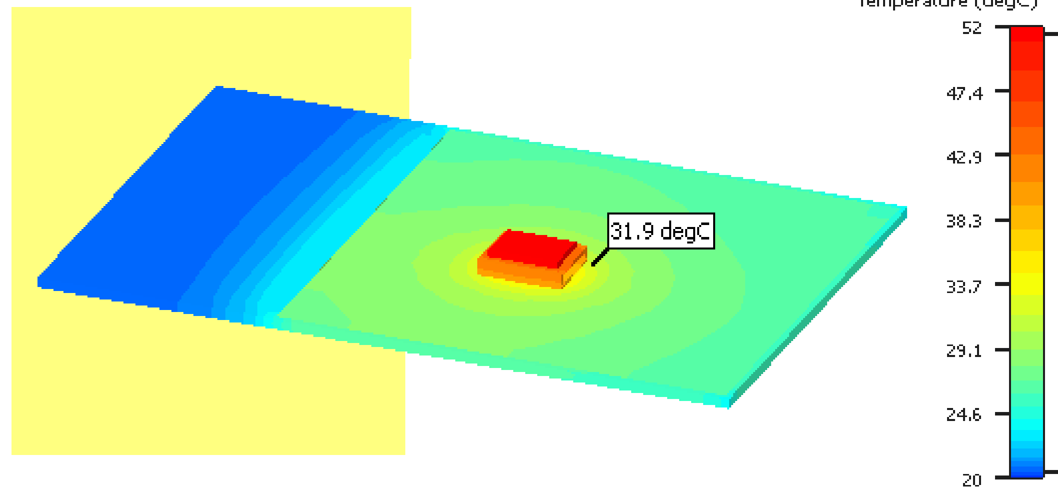


Mentor Graphics

Multiple Device Canopy®™ MDC™ FloTHERM® Model

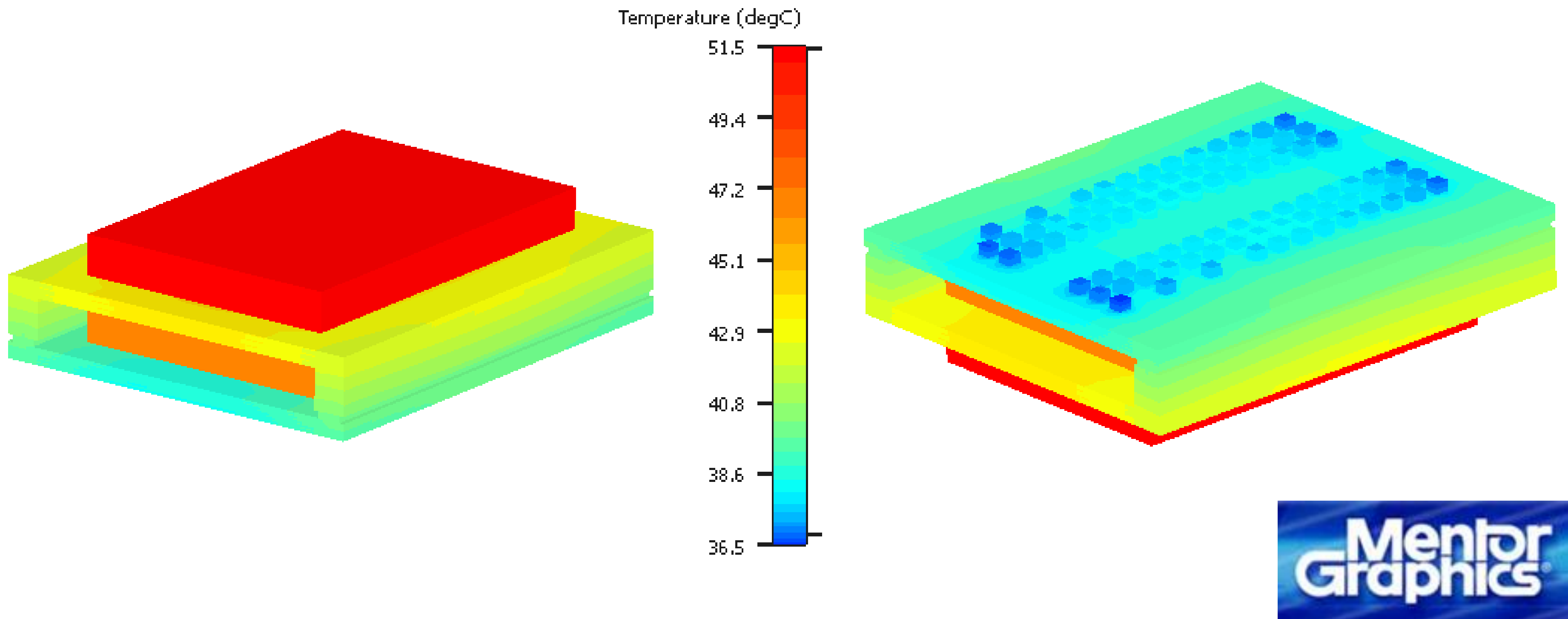
Host Board Surface Temperature





Multiple Device Canopy®™ MDC™ FloTHERM® Model

Component Surface Temperature



US Patent # 7,102,892 B2

Summary

- A Computational Fluid Dynamics, FloTHERM® model of Legacy Electronics' **MDC22GCMG-67E0 multiple device canopy** has been created. The device has been equipped with 2 Micron DDR2-MT47H256M4 memory chips, and simulated in a JEDEC JESD51-2A Still-Air test environment.
- The predicted case temperature of the memory chips are:
  - Top DRAM – 51.4 ° C; 33.6 ° C below the maximum operating temperature
  - Bottom DRAM – 46.5 ° C; 38.5 ° C below the maximum operating temperature
- The junction-to-ambient thermal resistance of the hottest DRAM is predicted to be ~ 87.3 ° C/W