

### for Mission-Critical Server and Storage Solutions

#### Abstract

Supermicro's main business has focused on servers, storage, and IT related systems. Over the last 18 years, Supermicro has developed the greatest variety of server configurations in the industry, with several hundred engineers involved in testing and qualification. With so much technical know-how and so many configurations, Supermicro's business interest has been to provide the highest quality, latest generation memory products for its customers. Supermicro selects only the highest quality server-grade memory that can pass an extensive qualification and testing process. These memory products are perfectly optimized for high-performance mission-critical server solutions and reduce the total cost of ownership for Supermicro's customers.

#### Introduction

System memory plays a critical role for every server. With high DDR3 data rates and CPUs with built-in memory controllers, it is critical to strongly consider utilizing pre-qualified server-grade memory with your next mission-critical IT deployment. The reason for this choice is simple: Supermicro spends significant design and test engineering resources to qualify and test each memory SKU across thousands of servers every year. We do this because manufacturing quality and reliability varies greatly from supplier to supplier, lot to lot, and bin to bin.

To eliminate potential issues with manufacturing quality and reliability, each server-grade memory SKU must pass a rigorous qualification and testing process before being certified as Supermicro memory, including the following:

- Over 100 man hours of R&D qualification and testing per system.
- Over 100 man hours and over 200 machine hours stress and margin testing.

Thus with over 100 new motherboards and systems per year being tested with several memory families, speed grades, and capacities, Supermicro spends roughly a quarter million man hours and nearly half a million machine hours qualifying and testing memory each year.

#### Selection and Design Phase

To qualify as Supermicro memory, server-grade memory modules are carefully screened based on system specifications, customer requirements, and industry standards. Then, during Design Verification Testing (DVT) and Engineering Validation Testing (EVT), the memory is validated against signal integrity and thermal margin requirements. The memory modules that meet these requirements are then subjected to validation against system compatibility, JEDEC industry standards, and vendor specifications. This process is then repeated for every compatible Supermicro SuperServer®, SuperBlade®, and storage system.

Once a given memory module passes all the initial tests performed by Supermicro engineers, it becomes a Supermicro memory candidate. After that, every candidate memory SKU must pass Margin and Stress Tests before it can be qualified as Supermicro memory.

#### Margin and Stress Test Phase

The Margin and Stress Test phase can last several weeks per configuration, and helps significantly reduce the risk of future downtime due to memory failures.

#### Only the Best Server-grade Memory meets Supermicro's High Standards

Strategic partnerships with Tier-1 memory suppliers ensure:

- Superior quality, signal integrity, and margin
- Reliability over the entire product life cycle
- Consistency via BOM and ECO control
- Savings from initial cost plus reduced field failures
- First access to new technology means first to profit.

All Supermicro memory must pass a rigorous three-phase engineering and production testing regimen (see Fig. 1):

1. Design timing analysis, signal integrity, and thermal analysis.
2. Margin and stress tests across thousands of configurations.
3. Continuous validation across hundreds of server, storage, and workstation platforms.

Supermicro Memory is backed by a global warranty, service, and support.

**Currently Supermicro is the only supplier in the IT marketplace that offers LRDIMMs on the Intel Tylersburg/Westmere platforms.**

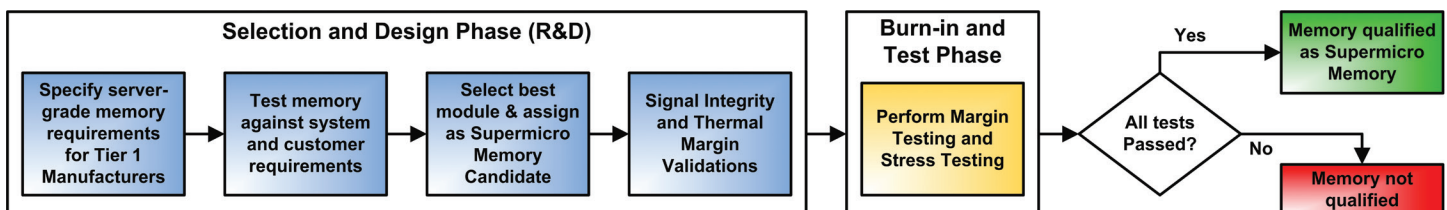


Figure 1—Supermicro Memory Validation Process

As with other semiconductors, memory failure rates over time pass through three distinct phases: 1) early “infant mortality” phase; 2) random failure phase; and 3) wear-out failure phase. Margin testing helps identify potential failures in the early phase by operating the device up to three days at 45°C and varying the memory supply voltage by ±10%.

The stress testing lasts five to seven days, depending on capacity, and includes the following steps:

1. Memory read/write tests using sequential and random patterns.
2. Power on/off and warm reboot tests including memory size check during POST
3. Algorithm-based benchmarking using the High-Performance Linpack (HPL) and Stream tools
4. System-wide stress tests with emphasis on memory
5. Recommended memory test procedures provided by Intel or AMD for a given CPU.

After passing all tests outlined in Figure 1, memory becomes Supermicro qualified memory. Furthermore, because Supermicro tests thousands of different memory modules across hundreds of motherboards, the memory testing is performed across thousands of server and storage systems. These tests cover the most extensive set of conditions in the market, providing customers with confidence when selecting Supermicro memory for their next data center solution.

### Latest Generation LRDIMM Memory

In addition to providing High Quality and Reliable memory, Supermicro is also the leader in offering the next generation of industry standard memory module, LRDIMM. The LRDIMM (Load-Reduced Dual In-line Memory Module) is the next generation of industry standard DDR3 DIMM for Servers and Workstations. LRDIMM was developed in JEDEC (Joint Electron Devices Engineering Council) Standards committees to address the increased speed and capacity requirements in the market.

The current industry standard DDR3 DIMMs, Un-buffered (UDIMM) and Registered (RDIMM), support memory support speed of 800, 1066, 1333 MT/s, voltages of 1.5V and 1.35V, and densities of 1GB to 32GB using 1Gb to 4Gb DRAMs. The UDIMM, with no signal buffering, is limited to a maximum density of 8GB. The RDIMM enables the maximum DIMM density to increase to 32GB, a 4x increase over the UDIMM, but the data loading of the 4Rx4 32GB RDIMM reduces the speed to DDR3-800 when fully loaded at two DIMMs per memory channel.

To break through these density and speed limitations, the LRDIMM uses the MB (Memory Buffer) logic device and has Load-Reduction (LR) for all the signals between the DIMM and the memory channel. The MB reduces each Clock, Command and Address and Data input to a single load, which increases the memory speed from DDR3-800 to DDR3-1066 for both the 16GB LRDIMM at 3DPC, and the 32GB LRDIMM at 2DPC. Thus LRDIMMs provide higher capacity and higher speeds.

### Benefits of Using Supermicro Memory

Using integrated Supermicro memory reduces your total cost of ownership and provides peace of mind by

- Saving you time with one-stop shopping and tech support with direct lines to vendor knowledge bases
- Improving signal integrity margin, noise immunity, system compatibility, and overall quality
- Eliminating the time required for you to research, qualify, test, and support 3rd-party memory
- Reducing your RMAs by using known-good memory.

Currently Supermicro is the only supplier in the IT marketplace that offers LRDIMMs on the Intel Tylersburg/Westmere platforms. Customers should definitely take advantage of this early window of opportunity to utilize this next-generation memory technology on their current Supermicro systems.

DIMM Input Signal(s)	UDIMM	RDIMM	LRDIMM
Clock	Un-Buffered	Buffered	Buffered
Command and Address	Un-Buffered	Buffered	Buffered
Data	Un-Buffered	Un-Buffered	Buffered

Figure 2- Comparison of DIMM Technology Buffering

DIMM	Max Density (4Gb DRAMs)	Max Speed (1DPC)	Max Speed (2DPC)	Max Speed (3DPC)
UDIMM	8GB 2Rx8	1333	1333	n/a
	16GB or 32GB	n/a	n/a	n/a
RDIMM	16GB 2Rx4	1333	1333	800
	32GB 4Rx4	1066	800	n/a
LRDIMM	16GB 4Rx4	1066	1066	1066
	32GB 8Rx4 <sup>(1)</sup>	1066	1066	1066

Note 1. Contains 2Gb DRAMs

Figure 3- Comparison of DIMM Technology Density and Maximum Speed (DPC = DIMMs per Channel)

### Conclusion

System memory plays a critical role in servers, and the slightest glitch can lead to system failure. Also, memory issues are among the most difficult to diagnose, especially intermittent ones. With such a critical system role for servers that must scale with changing demands, why take a chance using generic memory?

Using Supermicro memory in your SuperServer®, SuperBlade®, and server systems reduces the risk of system failures, downtime, and cost of ownership, resulting in overall peace of mind. Supermicro memory mitigates the risks of possible failures, including the following:

- Margin issues that may lead to failures under stress or failures due to aging
- Noise and signal integrity related issues
- Issues associated with low-quality generic memory

The risks are mitigated using high-reliability quality server-grade memory from Tier 1 suppliers, and a qualification process that tests memory in every supported SuperServer®, SuperBlade®, and storage system configuration.

At Supermicro, memory quality and testing is part of our mission, and several hundred of our engineers are involved in memory testing and qualification.

When consider your next mission-critical IT deployment, ask yourself what is peace of mind worth? After briefly contemplating this, you’ll conclude using a Supermicro memory solution far outweighs the potential cost of downtime and repair due to system failure that can result from using generic memory.

Next-generation LRDIMM memory technology offers speed and capacity advantages for server systems, and TCO improvements for end customers. Supermicro is among the leading server suppliers today offering LRDIMMs to the marketplace, having already established the technical knowhow and business processes to support this key technology. Customers looking for the latest server technology advances in their HPC, Data Center and Cloud deployments should look to Supermicro first as their strategic supplier.