Memory Configurator

Lenovo ThinkStation P3 Tower, P3 Tiny, P3 Ultra SFF

Table of Contents

Overview

The ThinkStation P3 Intel Raptor Lake (RPL) and Raptor Lake Refresh (RPL-R) platform is the latest desktop workstation replacement for the ThinkStation P360 Intel Alder Lake-S platform.

The purpose of this document is to highlight the major differences between the different memory platform architectures from the previous platforms and help guide users to optimally configure their memory configuration in the ThinkStation P3 platform.

Support for RPL-R CPUs may require a BIOS update, depending on the system's current BIOS revision. Please update the system to at least the following versions or newer for RPL-R support:

- P3 Tower – S0IKT61A
- P3 Ultra SFF – S0JKT19A
- P3 Tiny – M4WKT48A

Section 1 – P3 Tower Memory Architectural Design

The ThinkStation P3 Tower platform utilizes DDR5 memory with bus speeds up to 4400 MT/s, depending on the system processor and number of DIMMs per channel. This platform offers a dual memory channel design based on Intel RPL and RPL-R processors. There is a total of four memory DIMM slots, allowing the P3 to take full advantage of supporting a two DIMM per channel design.

Figure 1 - P3 Tower Motherboard Layout

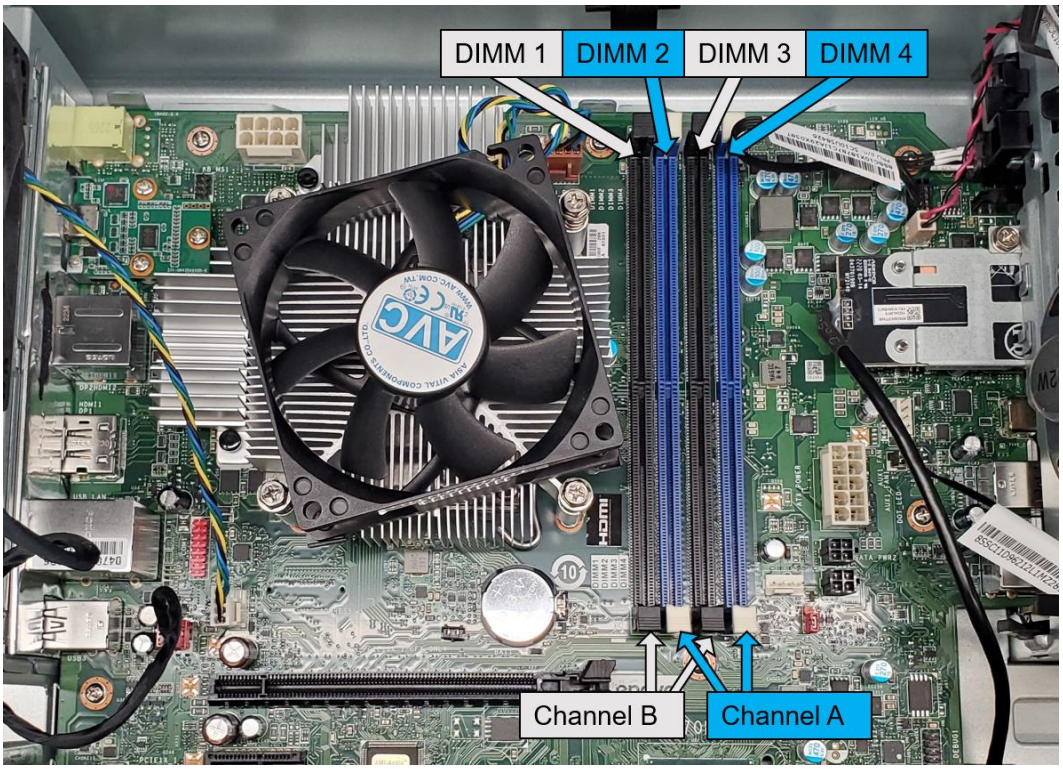
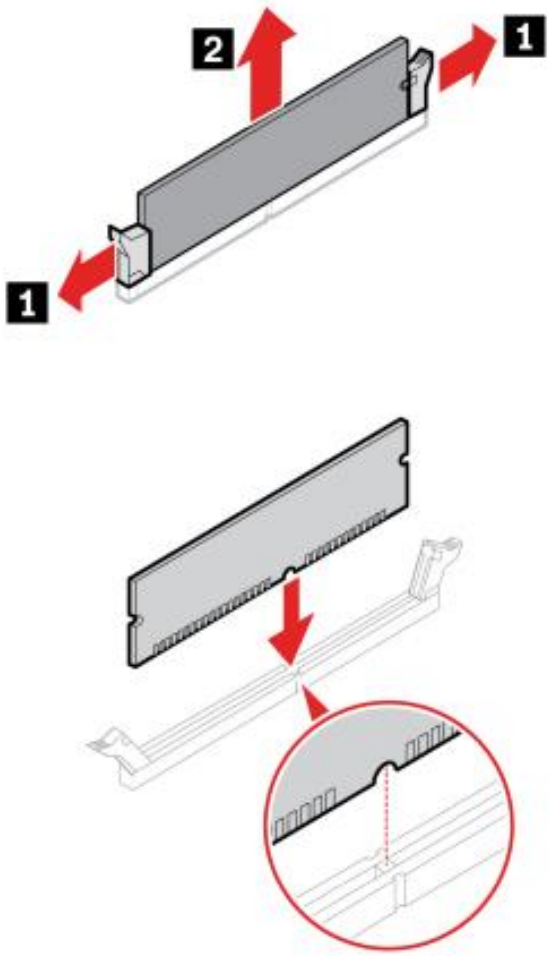


Figure 2 - P3 Tower Memory Install and Removal



Section 2 – P3 Tower Memory Configurations

Below are guidelines on how to optimally configure memory for best overall performance and bandwidth for the ThinkStation P3 Tower platform.

- P3 Tower utilizes a two DIMMs per channel (2DPC) configuration. Install DIMM slots in multiples of two to fully take advantage of both memory channels.
- Unregistered Dual In-Line Memory Modules (UDIMMs) only are supported in the P3 Tower platform. Registered DIMMs (RDIMMs) & Load-Reduced DIMMs (LRDIMMs) are not supported.
- DIMM slots should be filled in the order listed in *Figure 3*.
- Maximum frequency is partially dependent on the ranks of DIMMs installed in the system. Due to the 2DPC design, maximum speed is limited to 4400 MT/s (*See Figure 4*).
- Refer to Section 7 for other considerations.

Figure 3 - P3 Tower Slot Fill Order Recommendations

# of DIMMs	DIMM slots used
1 DIMM	DIMM slot 2
2 DIMMs	DIMM slot 2, DIMM slot 4
3 DIMMs	Unsupported[1]
4 DIMMs	DIMM slot 2, DIMM slot 4, DIMM slot 1, DIMM slot 3

Figure 4 – 1R (single rank) and 2R (dual rank) Memory Installation and Maximum Frequency

Slot 1	Slot 2	Slot 3	Slot 4	Actual Speed
	1R			4400 MT/s
	1R		1R	4400 MT/s
1R	1R	1R	1R	4000 MT/s
	2R			4400 MT/s
	2R		2R	4400 MT/s
2R	2R	2R	2R	3600 MT/s

[1] Lenovo does not support or recommend this number of DIMM quantity as it results in an unbalanced memory configuration across the dual channels.

Section 3 – P3 Tiny Memory Architectural Design

The ThinkStation P3 Tiny platform utilizes DDR5 memory with bus speeds up to 5600 MT/s, depending on the system processor, and number of DIMMs per channel. This platform offers two memory channels based on Intel RPL and RPL-R processors. There is a total of two memory DIMM slots, allowing the P3 Tiny to take advantage of supporting a single DIMM per channel design.

Figure 5 - P3 Tiny Motherboard Layout

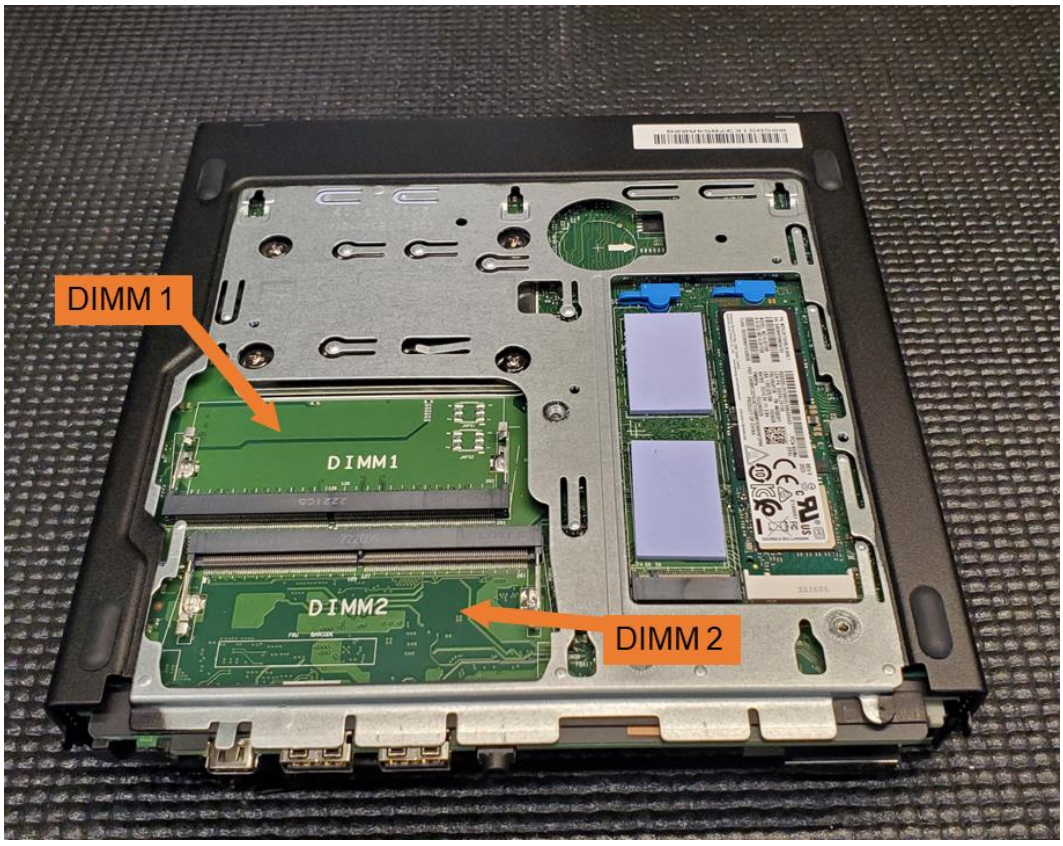
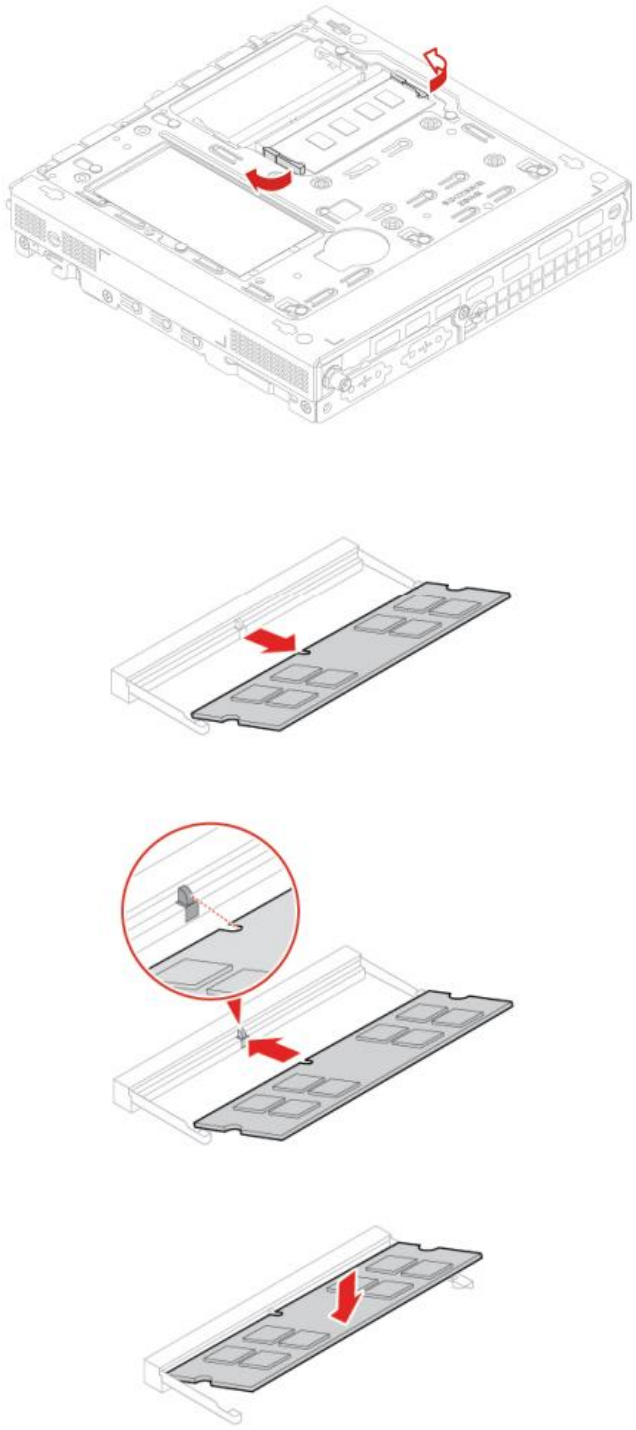


Figure 6 - P3 Tiny Memory Install and Removal



Section 4 – P3 Tiny Memory Configurations

The following recommended guidelines will help obtain the best overall memory bandwidth from the P3 Tiny system:

- P3 Tiny utilizes one DIMM per channel (DPC) to allow for full maximum memory bandwidth performance. Max memory speed will be dependent on CPU SKU and the maximum rated speed of the DIMMs installed.
- DIMM slots should be filled in the order listed in *Figure 7*.
- **Non-ECC** Small Outline Dual In-Line Memory Modules (SODIMMs) only are supported in the P3 Tiny platform.
- Memory speed dependent on CPU and DIMM capabilities.
- Refer to Section 7 for other considerations.

Figure 7 - P3 Tiny Slot Fill Order Recommendations

# of DIMMs	DIMM slots used
1 DIMM	DIMM slot 1
2 DIMMs	DIMM slot 1, DIMM slot 2

Section 5 – P3 Ultra SFF Memory Architectural Design

The ThinkStation P3 Ultra SFF is Lenovo's latest small form factor workstation platform, utilizing DDR5 memory with bus speeds up to 4000 MT/s, depending on the system processor and number of DIMMs per channel. This platform offers a dual memory channel design based on Intel RPL and RPL-R processors. There is a total of four memory DIMM slots, allowing the P3 Ultra SFF to take advantage of supporting a dual DIMM per channel design.

Figure 8 - P3 Ultra SFF Motherboard Layout (CPU side)

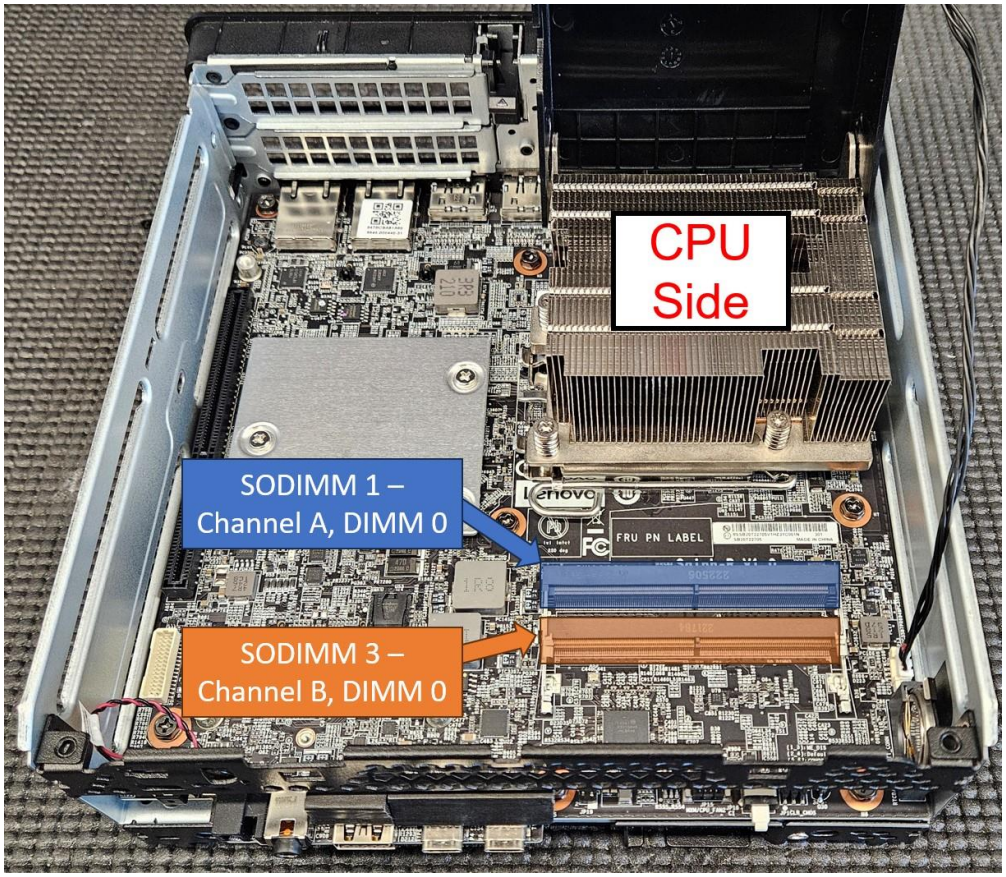


Figure 9 - P3 Ultra SFF Motherboard Layout (SSD side)

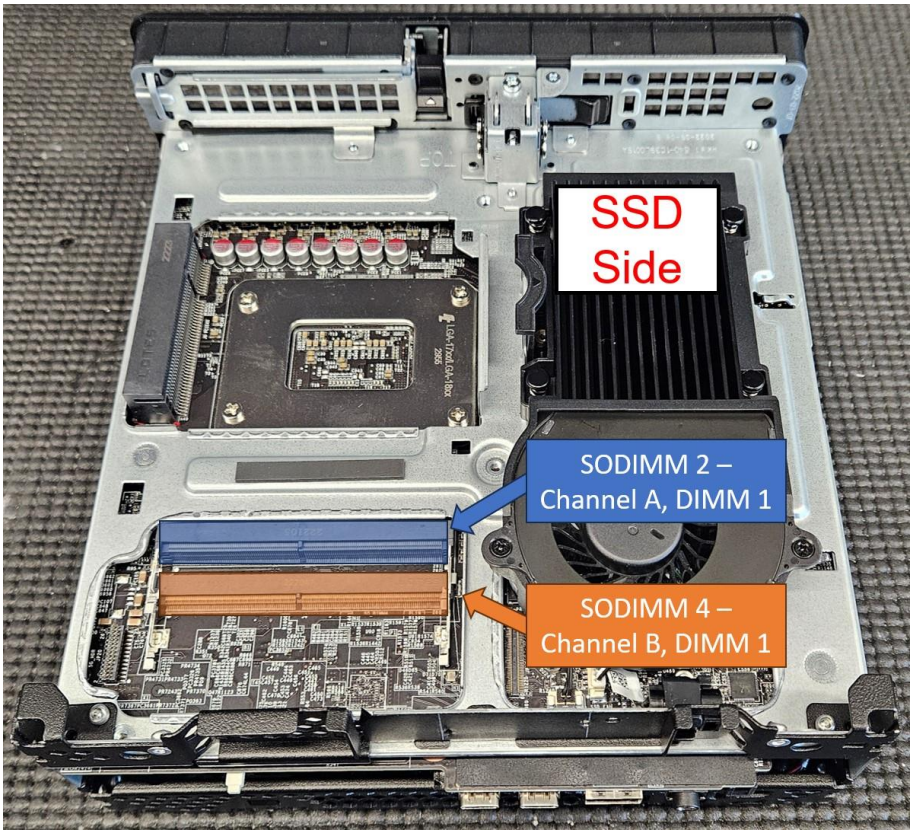
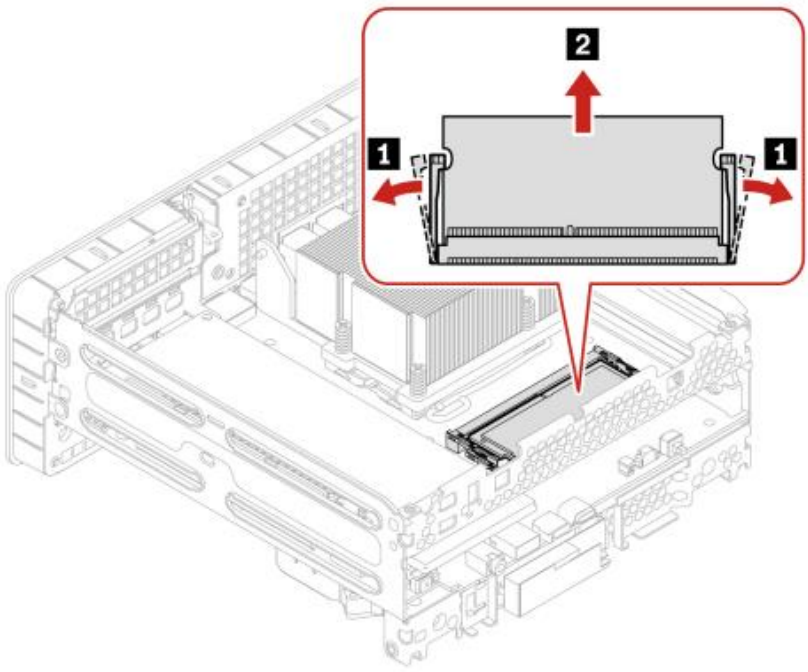
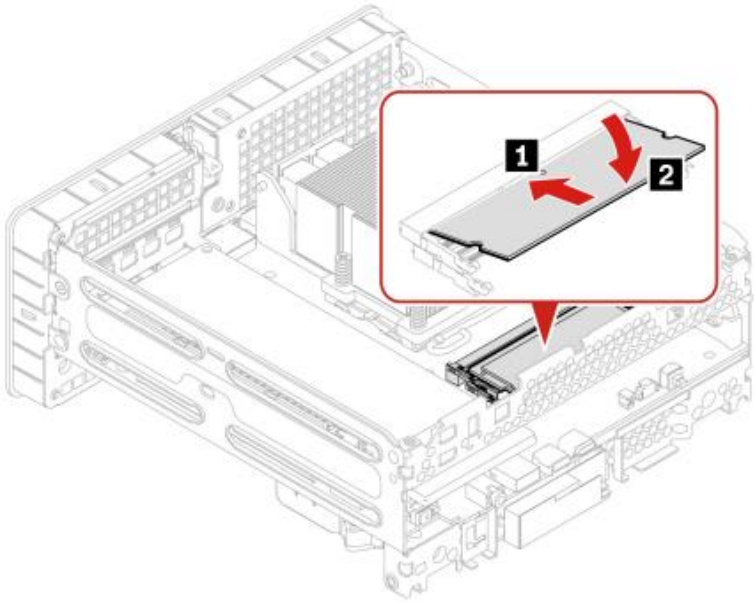


Figure 10 - P3 Ultra SFF Memory Install & Removal Instructions





Section 6 – P3 Ultra SFF Memory Configurations

Below are guidelines on how to optimally configure memory for best overall performance and bandwidth for the ThinkStation P3 Ultra SFF platform.

- P3 Ultra SFF utilizes a two DIMMs per channel (2DPC) configuration. Install DIMM slots in multiples of two to fully take advantage of both memory channels.
- DIMM slots should be filled in the order listed in *Figure 11.*
- Maximum frequency is partially dependent on the ranks of DIMMs installed in the system (*See Figure 12*).
- Small Outline Dual In-Line Memory Modules (SODIMMs) only are supported in the P3 Ultra SFF platform.
- Refer to Section 7 for other considerations.

Figure 11 - P3 Ultra SFF Slot Fill Order Recommendations

# of DIMMs	DIMM slots used
1 DIMM	DIMM slot 2
2 DIMMs	DIMM slot 2, DIMM slot 4
3 DIMMs	Unsupported[2]
4 DIMMs	DIMM slot 2, DIMM slot 4, DIMM slot 1, DIMM slot 3

Figure 12 – 1R (single rank) and 2R (dual rank) Memory Installation and Maximum Frequency

Slot 1	Slot 3	Slot 2	Slot 4	Actual Speed
		1R		4000 MT/s
		1R	1R	4000 MT/s
1R	1R	1R	1R	4000 MT/s
		2R		4000 MT/s
		2R	2R	4000 MT/s
2R	2R	2R	2R	3600 MT/s

[2] Lenovo does not support or recommend this number of DIMM quantity as it results in an unbalanced memory configuration across the dual channels.

Section 7 – Considerations

The following is a list of situations a user should consider in order to optimally configure memory for the best overall system performance. The configuration guidelines below apply generally to the P3 Tower, P3 Ultra SFF, and P3 Tiny.

- Mixing ECC and non-ECC memory is not supported.
- Lenovo does not support installing three (3) DIMMs resulting in an unbalanced memory channel configuration.
- Lenovo recommends using the same capacity, rank, and brand within the same channel.
- Lenovo does not support mixing different memory DIMM capacities or mixing single rank (1R) and dual rank (2R) memory DIMMs.

Platform-specific limitations:

P3 Tower

- Intel Core i5-14400, i3-14100, i5-13400, and i3-13100 do not support ECC memory.
- If an Nvidia ConnectX-6 25G Adapter or Intel X710-T2L Dual Port Copper 10Gb Adapter is installed, maximum supported number of DIMMs is two.

P3 Ultra SFF

- Intel Core i5-14400T, i3-14100, i5-13400T, and i3-13100 do not support ECC memory.
- 4x 48GB SODIMMs (ECC and non-ECC) is not supported with either of the following:
  - Windows 11 Home
  - 256GB capacity onboard boot drive
- 32GB and 48GB SODIMM capacity is not supported for configs with the following:
  - Dual A1000 or dual A400 GPUs
  - 125W CPU with A1000 or A400 GPU

P3 Tiny

- Supports only non-ECC memory.
- Per Intel specifications, some CPU SKUs are limited to 4800 MT/s speeds.
- 48GB SODIMMs are limited to 5200 MT/s.
- If Intel Core 14th Gen (RPL-R) CPU is installed in the system, only 5600 MT/s memory is supported.

Revision History

Version	Date	Author	Changes/Updates
v1.0	5/25/23	Chris C	Initial Release
v1.1	4/22/24	Chris C	Updated for 14th Gen CPUs
v1.2	10/3/24	Chris C	Updated 48GB SODIMMs
v1.3	2/28/25	Chris C	Updated rules