



Technical White Paper

Contents & navigation

Memory Configurations and Optimization	2
Supported Memory Modules	2
Platform Capabilities	2
Memory Features	3
Optimizing Performance	4
Loading Rules	4
Tower and Small Form Factor	4
Loading Order	4
Mini	4
Optimizing Performance	5
Summary	5



Memory Configurations and Optimization

For the HP Z2 Tower, Small Form Factor, and Mini
G9 Workstation

Memory Configurations and Optimization	2
Supported Memory Modules	2
Platform Capabilities	2
Memory Features	3
Optimizing Performance	4
Loading Rules	4
Tower and Small Form Factor	4
Loading Order	4
Mini	4
Optimizing Performance	5
Summary	5

Memory Configurations and Optimization

Below is an overview of the memory configurations for the HP Z2 Tower/Small Form Factor/Mini G9 Workstation and recommendations to optimize performance

Supported Memory Modules

The types of memory supported on a Z2 TWR/SFF G9 are:

- 8 GB, and 16 GB PC5-4800U Single Ranked 4800 MHz DDR5 Unbuffered non-ECC DIMMs
- 32 GB PC5-4800U Dual Ranked 4800 MHz DDR5 Unbuffered non-ECC DIMMs
- 16 GB PC5-4800E Single Ranked 4800 MHz DDR5 Unbuffered ECC DIMMs
- 32 GB PC5-4800E Dual Ranked 4800 MHz DDR5 Unbuffered ECC DIMMs
- Single and dual rank 16 Gb based DIMMs

The types of memory supported on the Z2 Mini G9 with 12th Generation Intel® Processors are:

- 8 GB, and 16 GB PC5-4800U Single Ranked 4800 MHz DDR5 Unbuffered non-ECC SODIMMs
- 32 GB PC5-4800U Dual Ranked 4800 MHz DDR5 Unbuffered non-ECC SO-DIMMs
- 16 GB PC5-4800E Single Ranked 4800 MHz DDR5 Unbuffered ECC SO-DIMMs
- 32 GB PC5-4800E Dual Ranked 4800 MHz DDR5 Unbuffered ECC SO-DIMMs
- Single and dual rank 16 Gb based DIMMs

The types of memory supported on the Z2 Mini G9 with 13th Generation Intel® Processor are:

- 8 GB, and 16 GB PC5-5600U Single Ranked 5600 MHz DDR5 Unbuffered non-ECC SODIMMs
- 32 GB PC5-5600U Dual Ranked 5600 MHz DDR5 Unbuffered non-ECC SO-DIMMs
- 16 GB PC5-5600E Single Ranked 5600 MHz DDR5 Unbuffered ECC SO-DIMMs
- 32 GB PC5-5600E Dual Ranked 5600 MHz DDR5 Unbuffered ECC SO-DIMMs
- Single and dual rank 16 GB based DIMMs

Platform Capabilities

Z2 TWR and SFF Maximum Capacity: 128 GB

- Z2 TWR/SFF G9 has a total of four DIMM memory sockets
- Two channels per CPU, two sockets per channel
- DIMM 1 and DIMM 2 make up one channel and DIMM 3 and DIMM4 make up the second channel

Z2 Mini Maximum Capacity: 64 GB

- Z2 Mini G9 has a total of two DIMM memory sockets
- Two channels per CPU, one sockets per channel

Processor ECC Support

- Intel® no longer offers Xeon® SKUs on entry desktop architectures (S series).
- All Intel Core i7 and Intel Core i9 processors and most Intel i5 processors support ECC; Core i3 processors do not. Check individual CPU specifications for details.

Speed

- The system speed is dependent on the platform and configuration. Though thememory modules can run up to 4800MHz, not all configurations will be able to support the maximum memory speed of 4800MHz.
- The system speed will be determined by a number of key factors:



Technical White Paper

Contents & navigation

Memory Configurations and Optimization	2
Supported Memory Modules	2
Platform Capabilities	2
Memory Features	3
Optimizing Performance	4
Loading Rules	4
Tower and Small Form Factor	4
Loading Order	4
Mini	4
Optimizing Performance	5
Summary	5

Platform	Module Configuration	Description of Configuration	Max Memory Speed (Actual Memory Speed is dependent on CPU)
Mini with 12th Generation Intel® Processors	All	Any configuration	4800MHz
Mini with 13th Generation Intel® Processors	Single Ranked DIMMs in a channel	Configurations with single ranked DIMMs (8GB and 16GB) installed in system	5600MHz
Mini with 13th Generation Intel® Processors	Dual Ranked DIMMs in a channel	Configurations with dual ranked DIMMs (32GB) installed in the system	5200MHz
Tower/Small Form Factor	Single DIMM per channel	Configurations that contain only one or two DIMM modules with DIMMs only in the black slots	4400MHz
Tower/Small Form Factor	Two Single ranked DIMMs in a channel	Configurations with 3 or 4 single ranked DIMMs (8GB and 16GB) installed in a system	4000MHz
Tower/Small Form Factor	Two Dual ranked DIMMs in a channel	Configurations with 3 or 4 dual ranked DIMMs (32GB) installed in a system	3600MHz
Tower/Small Form Factor	Mixing of Single and Dual ranked DIMMs in a channel is not supported	Mixing 32GB with other capacities in a single channel is not supported.	Not recommended, system will run at 2000MHz and may not be stable. To support this configuration, install identical DIMMs within a channel.

Recommendations for upgrading memory in a system:

To make sure that the system can run at the max speed, it is recommended to:

- Buy the same capacity that is already installed in the platform.
- Buy modules in pairs
- Move similar modules into the same channel (memory slots 1 and 2) and install new modules together in the second channel (slots 3 and 4)
-

Memory Features

On-Die ECC is supported on all Unbuffered UDIMMs/SO-DIMMs

- On-Die ECC does add some protection, but it doesn't replace System ECC.
- On-Die ECC is where the data stored on the memory module is monitored for errors
- Single-bit errors are detected and automatically corrected
- Multi-bit errors are not detected.

System ECC is supported on Unbuffered ECC UDIMMs/SO-DIMMs

- System ECC provides full system data integrity protections
- System ECC is where the data integrity is monitored at the system level instead of only the memory module
- Only supported with ECC UDIMMs and SO-DIMMs and with CPUs that support ECC.
- Monitors CPU transactions across the memory bus and the module for any errors.
- Single-bit errors are detected and automatically corrected
- Multi-bit errors are detected and cause the system to immediately reboot and halt with an F1 prompt error message

Although HP does support non-ECC memory on this platform as a lower cost option, it should be noted that non-ECC memory does not fully detect or correct single-bit or multi-bit errors which can cause instability or corruption of data in the platform.

Memory Configurations and Optimization	2
Supported Memory Modules	2
Platform Capabilities	2
Memory Features	3
Optimizing Performance	4
Loading Rules	4
Tower and Small Form Factor	4
Loading Order	4
Mini	4
Optimizing Performance	5
Summary	5

Optimizing Performance

Generally, maximum memory performance is achieved by evenly distributing total desired memory capacity across all operational channels. Proper individual DIMM capacity selection is essential to maximizing performance.

DDR5 vs DDR4 key performance differences:

- DDR5 has higher frequency than DDR4
- DDR5 has increased technology efficiencies
- DDR4 has shorter latency
- DDR4 has lower gear mode
- Benchmark results might vary depending on DDR technology and type of Benchmark algorithm.

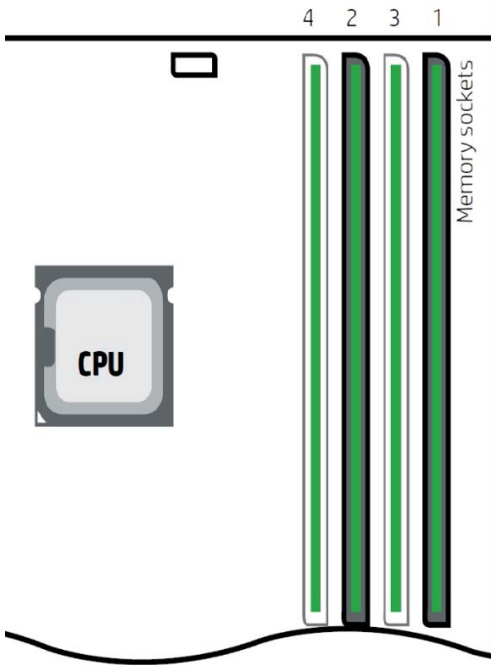
Loading Rules

Tower and Small Form Factor

- Each channel includes two DIMM sockets. Load DIMM slots 1 and 3 first, then 2 and 4. Slot 2 should not be loaded unless slot 1 is also loaded. Slot 4 should not be loaded unless slot 3 is also loaded.
- If mixing dual ranked and single ranked DIMMs, load the dual ranked DIMMs in slots 1 and 2 and load single ranked DIMMs in slots 3 and 4.
- See Figure 3 for loading order.

Loading Rules

Figure 1. Memory modules loading order



Mini

Each channel includes one DIMM sockets. Load slot 1 and then slot 2

Memory Configurations and Optimization	2
Supported Memory Modules	2
Platform Capabilities	2
Memory Features	3
Optimizing Performance	4
Loading Rules	4
Tower and Small Form Factor	4
Loading Order	4
Mini	4
Optimizing Performance	5
Summary	5

Optimizing Performance

The memory configurations of the HP Z2 Tower/ Small Form Factor/Mini G9 Workstation have been specifically crafted to meet strict long-term reliability standards with an optimized performance that provides users with seamless functionality. Design, cooling, and power solutions were validated to ensure DIMMs met max performance. HP values product quality and end user productivity, which is why the products discussed in this document are backed by HP's warranty.

For more information, visit

<https://www.hp.com/us-en/workstations/desktop-workstation-pc.html>.



