



# Cisco UCS C220/C240/ B200 M5 Memory Guide

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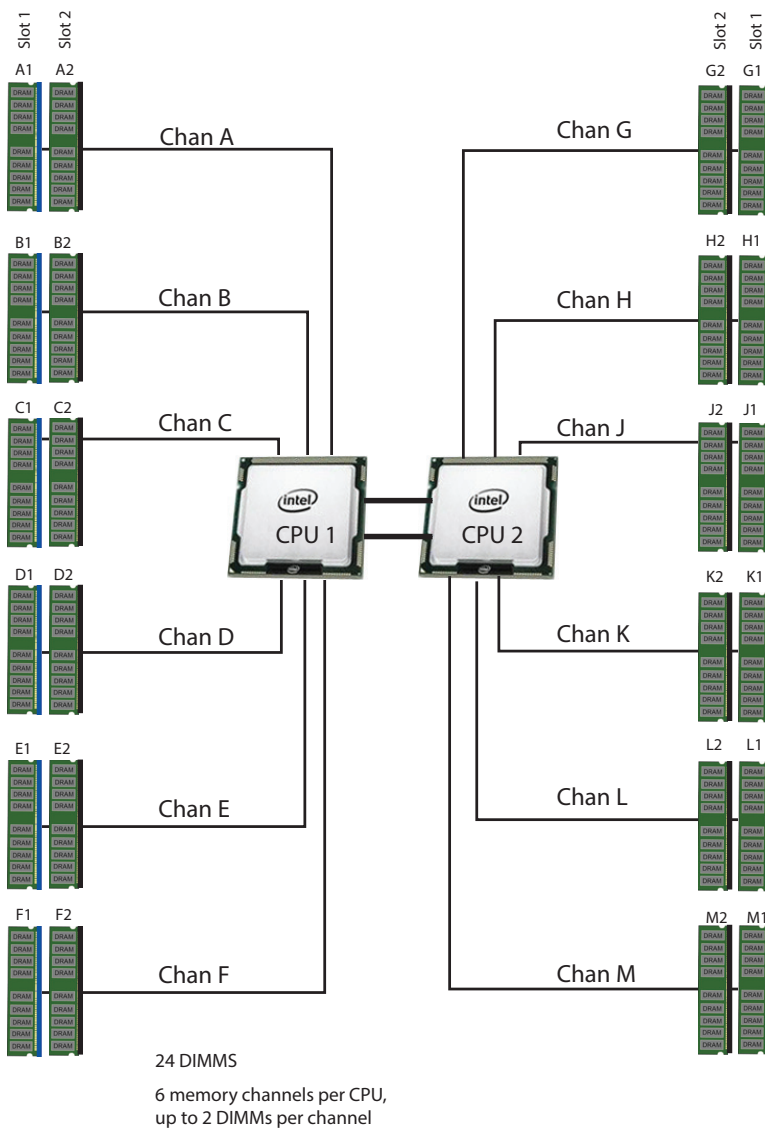
## Memory Organization

The standard memory features are:

- Clock speed: Up to 2933 MHz depending on CPU memory interface speed
- Ranks per DIMM: 1, 2, 4, or 8
- Operational voltage: 1.2 V
- Registered ECC DDR4 DIMMs (RDIMMs), load-reduced DIMMs (LRDIMMs) or Intel® Optane™ Persistent Memory (PMem)

Memory is organized with six memory channels per CPU, with up to two memory devices per channel, as shown in [Figure 1](#).

**Figure 1** C220, C240, B200 M5 Memory Organization



## Memory Devices (DIMMs and PMem)

The available memory devices are listed in [Table 1](#).

**Table 1 Available DDR4 DIMMs**

Product ID (PID)	PID Description	Voltage	Ranks /DIMM
UCS-ML-256G8RT-H <sup>1</sup>	256 GB DDR4-2933MHz LRDIMM/8Rx4 (16Gb) (3DS)	1.2 V	8
UCS-ML-256G8RW <sup>2</sup>	256 GB DDR4-3200MHz LRDIMM 8Rx4 (16Gb) (3DS)	1.2 V	8
UCS-ML-128G4RW <sup>2</sup>	128 GB DDR4-3200MHz LRDIMM 4Rx4 (16Gb) (non-3DS)	1.2 V	4
UCS-MR-X64G2RW <sup>2</sup>	64 GB DDR4-3200MHz RDIMM 2Rx4 (16Gb)	1.2 V	2
UCS-MR-X32G2RW <sup>2</sup>	32 GB DDR4-3200MHz RDIMM 2Rx4 (8Gb)	1.2 V	2
UCS-MR-X16G1RW <sup>2</sup>	16 GB DDR4-3200MHz RDIMM 1Rx4 (8Gb)	1.2 V	1
<b>Intel® Optane™ Persistent Memory Product</b>			
UCS-MP-128GS-A0	Intel® Optane™ Persistent Memory, 128GB, 2666 MHz		
UCS-MP-256GS-A0	Intel® Optane™ Persistent Memory, 256GB, 2666 MHz		
UCS-MP-512GS-A0	Intel® Optane™ Persistent Memory, 512GB, 2666 MHz		
<b>Intel® Optane™ Persistent Memory Product Operational Modes</b>			
UCS-DCPMM-AD	App Direct Mode		
UCS-DCPMM-MM	Memory Mode		
<b>Memory Mirroring Option</b>			
N01-MMIRROR	Memory mirroring option		

**Notes:**

1. Cisco has announced the End-Of-sale of the UCS-ML-256G8RT-H ([EOL15231](#)). [Table 2](#) describes the replacement Memory DIMM product part number of the 256GB
2. DDR4-3200MHz replacement part numbers will operate at the maximum speed of the Intel 2nd generation Xeon Scalable processor memory interface, ranging from 2133 MHz to 2933 MHz.

[Table 2](#) lists the EOL Memory DIMM product part numbers and their replacement PIDs.

**Table 2 Memory DIMM Product Part Numbers and their replacement PIDs**

EOS Product Part Number (PID)	PID Description	Replacement Product PID	Replacement Product Description
UCS-MR-X16G1RT-H	16GB DDR4-2933MHz RDIMM 1Rx4 (8Gb)/1.2v	UCS-MR-X16G1RW	16GB DDR4-3200MHz RDIMM 1Rx4 (8Gb)/1.2v
UCS-MR-X32G2RT-H	32GB DDR4-2933MHz RDIMM 2Rx4 (8Gb)/1.2v	UCS-MR-X32G2RW	32GB DDR4-3200MHz RDIMM 2Rx4 (8Gb)/1.2v

Table 2 Memory DIMM Product Part Numbers and their replacement PIDs

EOS Product Part Number (PID)	PID Description	Replacement Product PID	Replacement Product Description
UCS-MR-X64G2RT-H	64GB DDR4-2933MHz RDIMM 2Rx4 (16Gb)/1.2v	UCS-MR-X64G2RW	64GB DDR4-3200MHz RDIMM 2Rx4 (16Gb)/1.2v
UCS-ML-X64G4RT-H <sup>1</sup>	64GB DDR4-2933MHz LRDIMM 4Rx4 (8Gb)/1.2v	UCS-MR-X64G2RW <sup>1</sup>	64GB DDR4-3200MHz RDIMM 2Rx4 (16Gb)/1.2v
UCS-ML-128G4RT-H	128GB DDR4-2933MHz LRDIMM 4Rx4 (16Gb)/1.2v	UCS-ML-128G4RW	128GB DDR4-3200MHz LRDIMM 4Rx4 (16Gb)/1.2v
UCS-ML-256G8RT-H	256GB DDR4-2933MHz LRDIMM 8Rx4 (16Gb)/1.2v (3DS)	UCS-ML-256G8RW	256GB DDR4-3200MHz LRDIMM 8Rx4 (16Gb)/1.2v (3DS)

## Notes:

1. Cisco doesn't support a Load Reduce DIMM (LRDIMM) 64GB Memory PID as a replacement PID of existing UCS-ML-x64G4RT-H and recommends migrating to the Registered DIMM (RDIMM) instead, delivering the best balance in performance and price.

Table 3 DDR4 Memory DIMMs / 1st and 2nd Generations Intel® Xeon® scalable processor family CPUs support

DIMM/Intel CPUs support	Intel® Xeon® scalable processor family CPUs	2nd Generation Intel® Xeon® scalable processor family CPUs	EOL date
<b>DDR4-2933MHz</b>			
UCS-MR-X16G1RT-H	Supported	Supported	May 11, 2022
UCS-MR-X32G2RT-H	Supported	Supported	May 11, 2022
UCS-MR-X64G2RT-H		Supported	May 11, 2022
UCS-ML-X64G4RT-H	Supported	Supported	May 11, 2022
UCS-ML-128G4RT-H		Supported	May 11, 2022
UCS-ML-256G8RT-H		Supported	Nov 30, 2023
<b>DDR4-3200MHz</b>			
UCS-MR-X16G1RW	Supported	Supported	
UCS-MR-X32G2RW	Supported	Supported	
UCS-MR-X64G2RW		Supported	
UCS-ML-128G4RW		Supported	
UCS-ML-256G8RW		Supported	

# Memory Configurations and Modes

## DIMM Guidelines



**NOTE:** For more details on DIMM population and guidelines, see [DIMM Population Rules, page 13](#).

- System speed is dependent on the CPU DIMM speed support. Refer to [Table 1 on page 4](#) for DIMM speeds.
- The C220/C240/B200 M5 servers support different memory reliability, availability, and serviceability (RAS) features: See “[Cisco UCS C-Series and HX M5 Memory Technical Overview - RAS Features](#)” document.



**NOTE:** Mixing of Non-Mirrored and Mirrored mode is not allowed.

- Do not mix RDIMMs, LRDIMMs
- Single-rank DIMMs can be mixed with dual-rank DIMMs in the same channel
- For best performance, observe the following:
  - DIMMs with different timing parameters can be installed on different slots within the same channel, but only timings that support the slowest DIMM will be applied to all. As a consequence, faster DIMMs will be operated at timings supported by the slowest DIMM populated.
  - When one DIMM is used, it must be populated in DIMM slot 1 (farthest away from the CPU) of a given channel.
  - When single- or dual-rank DIMMs are populated for two DIMMs per channel (2DPC), always populate the higher number rank DIMM first (starting from the farthest slot). For example, first populate slot 1 with dual rank DIMMs. Then populate DIMM slot 2 with single-rank DIMMs.
- DIMMs for both CPUs must always be configured identically.
- Cisco memory from previous generation servers (DDR3 and DDR4) is not compatible or supported with the UCS C220/C240/B200 M5 servers.



**NOTE:** System performance is optimized when the DIMM type and quantity are equal for both CPUs, and when all channels are filled equally across the CPUs in the server.

## PMem Guidelines

- PMem require second generation Intel Xeon Scalable Family processors. First generation Xeon Scalable processors do not support PMem.
- All installed PMem must be the same size. Mixing PMem of different capacities is not supported.
- PMem and DIMMs must be populated as shown in [Table 4](#) (6 DIMMs per CPU with 2, 4, or 6 PMem per CPU, as shown).

**Table 4 2<sup>nd</sup> Generation Intel® Xeon® Scalable Processor DIMM and PMem<sup>1</sup> Physical Configurations (dual socket)**

DIMM to PMem Count	CPU 1											
	iMC1						iMC0					
	Channel 2		Channel 1		Channel 0		Channel 2		Channel 1		Channel 0	
	F2	F1	E2	E1	D2	D1	C2	C1	B2	B1	A2	A1
6 to 2		DIMM		DIMM	PMem	DIMM		DIMM		DIMM	PMem	DIMM
6 to 4		DIMM	PMem	DIMM	PMem	DIMM		DIMM	PMem	DIMM	PMem	DIMM
6 to 6	PMem	DIMM	PMem	DIMM	PMem	DIMM	PMem	DIMM	PMem	DIMM	PMem	DIMM
DIMM to PMem Count	CPU 2											
	iMC1						iMC0					
	Channel 2		Channel 1		Channel 0		Channel 2		Channel 1		Channel 0	
	M2	M1	L2	L1	K2	K1	J2	J1	H2	H1	G2	G1
6 to 2		DIMM		DIMM	PMem	DIMM		DIMM		DIMM	PMem	DIMM
6 to 4		DIMM	PMem	DIMM	PMem	DIMM		DIMM	PMem	DIMM	PMem	DIMM
6 to 6	PMem	DIMM	PMem	DIMM	PMem	DIMM	PMem	DIMM	PMem	DIMM	PMem	DIMM

**Notes:**

1. All systems must be fully populated with two CPUs when using PMem at this time.

- Two CPUs must be installed when using PMem.
- For Memory Mode and App Direct Mode, install a minimum of 2 PMem and 6 DIMMs per CPU
- When either Memory Mode or Mixed Mode is used, the recommended ratio of DIMM capacity to PMem capacity is between 1:16 and 1:2, and 1:4 achieves the best performance. For example, 6x 16 GB DIMMs + 2x 256 GB PMem is a capacity ratio of 1:5.33 (96GB:512GB). In Mixed Mode, the ratio is between memory and only the volatile portion of the PMem. This ratio requirement does not apply to App Direct mode. See [Table 5](#) for PMem memory modes.

Table 5 Intel® Optane™ Persistent Memory Modes

Intel® Optane™ Persistent Memory Modes	
App Direct Mode:	PMem operates as a solid-state disk storage device. Data is saved and is non-volatile. Both PMem and DIMM capacity counts towards CPU tiering (both PMem and DIMM capacities count towards the CPU capacity limit)
Memory Mode: <sup>1</sup>	PMem operates as a 100% memory module. Data is volatile and DRAM acts as a cache for PMem. Only PMem capacity counts towards CPU tiering (only the PMem capacity counts towards the CPU capacity limit). This is the factory default mode.
Mix Mode:	DRAM as cache. Only PMem capacity counts towards CPU tiering (only the PMem capacity counts towards the CPU capacity limit).

**Notes:**

1. For Memory Mode, the Intel-recommended DIMM to PMem capacity ratio in the same CPU socket is from 1:2 to 1:16.

- For each memory channel with both a PMem and a DIMM installed, the PMem is installed in channel slot 2 (closest to the CPU) and the DIMM is installed in channel slot 1.
- To maximize performance, balance all memory channels
- In configurations with PMem installed, memory mirroring is supported, with two restrictions:
  - Mirroring is only enabled on the DIMMs installed in the server; the PMem themselves do not support mirroring.
  - Only App Direct mode is supported. Memory mirroring cannot be enabled when PMem are in Memory Mode or Mixed Mode.
- Memory sparing is not supported with PMem installed.

For additional information, refer to the following links:

[https://www.cisco.com/c/en/us/td/docs/unified\\_computing/ucs/c/hw/C220M5/install/C220M5/C220M5\\_chapter\\_010.html?bookSearch=true#concept\\_b1k\\_mbt\\_tgb](https://www.cisco.com/c/en/us/td/docs/unified_computing/ucs/c/hw/C220M5/install/C220M5/C220M5_chapter_010.html?bookSearch=true#concept_b1k_mbt_tgb)

[https://www.cisco.com/c/en/us/td/docs/unified\\_computing/ucs/c/hw/C240M5/install/C240M5/C240M5\\_chapter\\_010.html?bookSearch=true#concept\\_b1k\\_mbt\\_tgb](https://www.cisco.com/c/en/us/td/docs/unified_computing/ucs/c/hw/C240M5/install/C240M5/C240M5_chapter_010.html?bookSearch=true#concept_b1k_mbt_tgb)

[https://www.cisco.com/c/en/us/td/docs/unified\\_computing/ucs/hw/blade-servers/B200M5/B200M5\\_chapter\\_011.html?bookSearch=true#concept\\_qtr\\_4xh\\_zgb](https://www.cisco.com/c/en/us/td/docs/unified_computing/ucs/hw/blade-servers/B200M5/B200M5_chapter_011.html?bookSearch=true#concept_qtr_4xh_zgb)



## DIMM Memory Mirroring

Memory mirroring is supported only on the DIMMs; PMem do not support memory mirroring. When memory mirroring is enabled, the memory subsystem simultaneously writes identical data to two adjacent channels. If a memory read from one of the channels returns incorrect data due to an uncorrectable memory error, the system automatically retrieves the data from the other channel. A transient or soft error in one channel does not affect the mirrored data, and operation continues unless there is a simultaneous error in exactly the same location on a DIMM and its mirrored DIMM. Memory mirroring reduces the amount of memory available to the operating system by 50% because only one of the two populated channels provides data.

## CPU DIMM Configuration Without Memory Mirroring

Select from 1, 2, 3, 4, 6, 8, or 12 DIMMs per CPU (DIMMs for both CPUs must be configured identically). The DIMMs will be placed by the factory as shown in the following tables.

	CPU 1 DIMM Placement in Channels (for identically ranked DIMMs)	
1	(A1)	
2	(A1, B1)	
3	(A1, B1, C1)	
4	(A1, B1); (D1, E1)	
6	(A1, B1); (C1, D1); (E1, F1)	
8	(A1, B1); (D1, E1); (A2, B2); (D2, E2)	
12	(A1, B1); (C1, D1); (E1, F1); (A2, B2); (C2, D2); (E2, F2)	

	CPU 2 DIMM Placement in Channels (for identically ranked DIMMs)	
1	(G1)	
2	(G1, H1)	
3	(G1, H1, J1)	
4	(G1, H1); (K1, L1)	
6	(G1, H1); (J1, K1); (L1, M1)	
8	(G1, H1); (K1, L1); (G2, H2); (K2, L2)	
12	(G1, H1); (J1, K1); (L1, M1); (G2, H2); (J2, K2); (L2, M2)	

## CPU DIMM Configuration With Memory Mirroring

Select from 4, 6, 8, or 12 DIMMs per CPU (DIMMs for all four CPUs must be configured identically). In addition, the memory mirroring option (N01-MMIRROR) as shown in [Table 1 on page 4](#) must be selected.

The DIMMs will be placed by the factory as shown in the following tables.

# DIMMS	CPU 1 DIMM Placement in Channels (for identical ranked DIMMs)	CPU 2 DIMM Placement in Channels (for identical ranked DIMMs)
	CPU 1	CPU 2
8	(A1,B1); (D1,E1)	(G1, H1); (K1, L1)
12	(A1, B1, C1); (D1, E1, F1)	(G1, H1, J1); (K1, L1, M1)
16	(A1, A2, B1, B2); (D1, D2, E1, E2)	(G1, G2, H1, H2); (K1, K2, L1, L2)
24	(A1, A2, B1, B2, C1, C2); (D1, D2, E1, E2, F1, F2)	(G1, G2, H1, H2, J1, J2); (K1, K2, L1, L2, M1, M2)



**NOTE:** System performance is optimized when the DIMM type and quantity are equal for both CPUs, and when all channels are filled equally across the CPUs in the server.

## System Speeds

Memory will operate at the maximum speed of the Intel Xeon Scalable processor memory controller, ranging from 2133 MHz to 2933 MHz for M5 servers. Check CPU specifications for supported speeds.

# Physical Layout

Each CPU has six DIMM channels:

- CPU1 has channels A, B, C, D, E, and F
- CPU2 has channels G, H, J, K, L, and M

Each DIMM channel has two slots: slot 1 and slot 2. The blue-colored DIMM slots are for slot 1 and the black slots for slot 2.

As an example, DIMM slots A1, B1, C1, D1, E1, and F1 belong to slot 1, while A2, B2, C2, D2, E2, and F2 belong to slot 2.

Figure 2 and Figure 3 show how slots and channels are physically laid out on the motherboards for the servers. Channels A, B, C, D, E, and F are associated with CPU 1, while channels G, H, J, K, L, and M are associated with CPU 2. The slot 1 (blue) DIMM slots are always located farther away from a CPU than the corresponding slot 2 (black) slots. Slot 1 slots (blue) are populated before slot 2 slots (black).

Figure 2 Physical Layout of C220/C240 M5 CPU DIMM Channels and Slots

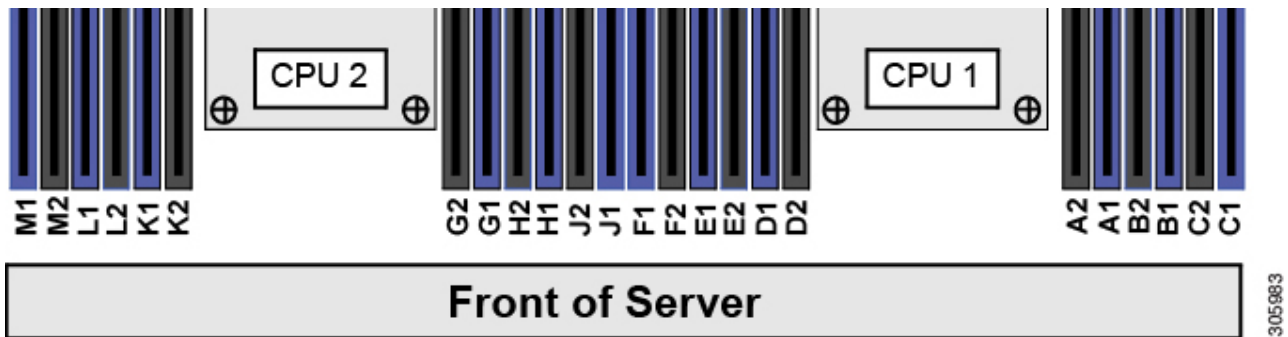
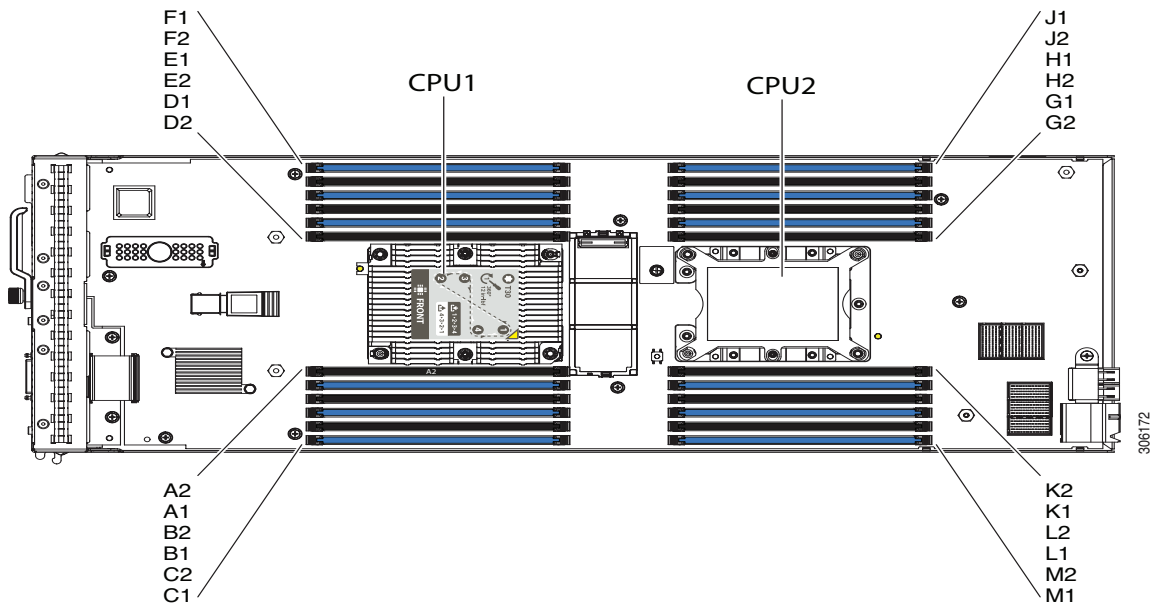


Figure 3 Physical Layout of B200 M5 CPU DIMM Channels and Slots



## DIMM Population Rules

When considering the memory configuration of your server, consider the following items:

- Each channel has two DIMM slots (for example, channel A = slots A1 and A2).
  - A channel can operate with one or two DIMMs installed.
  - If a channel has only one DIMM, populate slot 1 first (the blue slot).
- When both CPUs are installed, populate the DIMM slots of each CPU identically.
  - For 1, 2, 3, 4, and 6 DIMMs per socket configurations, fill the blue slots (slot 1) in the memory channels as per recommended DIMM populations in [DIMM Population Order, page 15](#).
  - For 8 and 12 DIMMs per socket configurations, fill the blue slots (slot 1) and black slots (slot 2) as per recommended DIMM populations in [DIMM Population Order, page 15](#).
  - Refer to [DIMM Population Order, page 15](#) for more details.
- For best memory performance, use identical DIMM types within a server (same speed, size and ranks).
- For optimum performance, populate at least one DIMM per memory channel per CPU.
- When populating DIMM slots for optimal performance, multiples of 12 DIMMs are best because there are 6 memory channels per CPU socket and 2 CPUs must be populated.
- For populations of 1 DIMM per channel (1DPC) and 2DPC, with Intel Xeon scalable processors, all supported DIMMs on Cisco UCS M5 servers run at their labeled speed provided the processor supports that speed.
- At the same memory speed, 2 DPC may perform slightly better than 1 DPC for RDIMMs (workload dependent).
- For optimum performance, use dual rank RDIMMs preferably, then single rank RDIMMs, and last LRDIMMs. Larger size LRDIMMs provide large capacity memory configurations but the performance of these DIMMs is lower than standard RDIMMs.
- For small to medium memory capacities, whenever possible, install dual rank RDIMMs for optimal performance. Dual rank RDIMMs perform better than single rank RDIMMs. Single rank DIMMs limit the performance of memory-intensive workloads in 1 DIMM per channel configurations.
- When mixing DIMMs, the following rules must be followed:
  - RDIMMs cannot be mixed with LRDIMMs.
  - RDIMMs of different sizes can be mixed within a channel. When mixing RDIMMs of different densities (sizes), populate DIMMs with the highest density first. For example, if you have to mix 32 GB RDIMMs with 16 GB RDIMMs, then populate the 32 GB DIMMs in blue slots (or slot 1) and then 16 GB DIMMs in black slots (or slot 2).
  - RDIMMs of different ranks can be mixed within a channel. When mixing RDIMMs with different ranks, populate RDIMMs with the higher rank first. For example, when
  - mixing dual-rank RDIMMs with single-rank RDIMMs populate the dual-rank RDIMMs in blue slots first and then single-rank RDIMMs in black slots.

- 64 GB DDR4-2933MHz LRDIMMs can only be mixed with 128 GB DDR4-2933MHz LRDIMMs.
  - Mixing 16 GB, 32 GB, and 64 GB DDR4-3200MHz RDIMMs together is supported.
  - 128 GB and 256 GB LRDIMMs cannot be mixed with other RDIMMs.
  - 128 GB DDR4-3200MHz non-3DS LRDIMM cannot be mixed with the 256 GB DDR4-3200MHz (3DS).
  - Mixing DDR4-2933MHz and DDR4-3200MHz speeds on existing systems is allowed in accordance with the mixing rules described above and Tables 2/3. DDR4-3200MHz PIDs will operate at the maximum speed of the Intel Xeon Scalable processor memory interface, ranging from 2133 MHz to 2933 MHz.
  - Firmware: Brand-new ordered M5 systems will be loaded with the latest Firmware, and DDR4-320MHz DIMMs will be fully operational. For existing M5 customers, ordering new M5 servers with the DDR4-3200 PIDs, an upgrade of the UCSM catalog will be required.
- Any DIMM installed in a DIMM socket for which the CPU is absent is not recognized.
  - Observe the DIMM mixing rules shown in [Table 6](#)

**Table 6 DIMM Rules for C220, C240, B200 M5 Servers**

DIMM Parameter	DIMMs in the Same Channel	DIMM in the Same Slot <sup>1</sup>
<u>DIMM Capacity</u> RDIMM = 16, 32, 64 LRDIMM = 64 GB (2933 MHz only), 128 GB	DIMMs in the same channel (for example, A1 and A2) can have different capacities.	For best performance, DIMMs in the same slot (for example, A1, B1, C1, D1, E1, F1) should have the same capacity.
<u>DIMM Speed</u> 2933 MHz or 3200 MHz	DIMMs will run at the lowest speed of the CPU installed	DIMMs will run at the lowest speed of the CPU installed
<u>DIMM Type</u> RDIMMs or LRDIMMs	Do not mix: <ul style="list-style-type: none"> <li>■ DIMMs with different clock rates in a channel</li> <li>■ RDIMMs and LRDIMMs with any other DIMMs</li> </ul>	Do not mix DIMM types in a slot

**Notes:**

1. Although different DIMM capacities can exist in the same slot, this will result in less than optimal performance. For optimal performance, all DIMMs in the same slot should be identical.

## DIMM Population Order

Populate the DIMMs for a CPU according to [Table 7](#). There are many possible DIMM populations; however, the populations shown in the table provide consistent, stable results.

**Table 7 C220, C240, B200 M5 DIMM Population Order**

	Populate CPU1 Slot		Populate CPU2 Slot	
	Blue Slots	Black slots	Blue slots	Black slots
1	(A1)	-	(G1)	-
2	(A1, B1)	-	(G1, H1)	-
3	(A1, B1, C1)	-	(G1, H1, J1)	-
4	(A1,B1); (D1,E1)	-	(G1,H1); (K1,L1)	-
6	(A1,B1); (C1,D1); (E1, F1)	-	(G1,H1); (J1,K1); (L1, M1)	-
8	(A1,B1); (D1,E1)	(A2,B2); (D2,E2)	(G1,H1); (K1,L1)	(G2,H2); (K2,L2)
12	(A1,B1); (C1,D1); (E1, F1)	(A2,B2); (C2,D2); (E2, F2)	(G1, H1); (J1, K1); (L1, M1)	(G2,H2); (J2,K2); (L2,M2)



**NOTE:** 5, 7, 9, 10, 11 DIMMs per CPU is not recommended.

- The maximum combined memory allowed in the 12 DIMM slots controlled by any one CPU is 768 GB. To populate the 12 DIMM slots with more than 768 GB of combined memory, you must use a high-memory CPU that has a PID that ends with an “M”, for example, UCS-CPU-6134M.
- All DIMMs must be DDR4 DIMMs that support ECC. Non-buffered UDIMMs and non-ECC DIMMs are not supported.
- Memory mirroring reduces the amount of memory available by 50 percent because only one of the two populated channels provides data. When memory mirroring is enabled, you must install DIMMs in even numbers of channels.
- NVIDIA M-Series GPUs can support only less than 1 TB memory in the server.
- NVIDIA P-Series GPUs can support 1 TB or more memory in the server.
- AMD FirePro S7150 X2 GPUs can support only less than 1 TB memory in the server.

## Recommended DIMM Configurations

This section explains the recommended DIMM population order rules for best performance.

- All DIMMs must be DDR4 DIMMs.
- Do not mix:
  - DIMMs with different clock rates in a channel
  - RDIMMs and LRDIMMs with any other DIMMs
- There are blue and black DIMM slots. Populate blue slots first.
- When DIMMs ranks are mixed in the same channel, always populate the highest rank DIMM in the blue DIMM slot and lower rank DIMM(s) in the black DIMM slots.
- [Table 8](#) shows the recommended configurations for 2nd Generation Intel Xeon Scalable Processors and [Table 9](#) shows the recommended configurations for Intel Xeon Scalable Processors. The rows highlighted in yellow indicate configurations with optimum performance.

**Table 8 Recommended Memory Configurations for 2nd Generation Intel Xeon Scalable Processors**

Total System Memory Size	CPU-1		CPU-2		DIMM Type	Total DIMMs in the system
	Blue Slots	Black Slots	Blue Slots	Black Slots		
	Bank 1	Bank 2	Bank 1	Bank 2		
	(A1, B1, C1, D1, E1, F1)	(A2, B2, C2, D2, E2, F2)	(G1, H1, J1, K1, L1, M1)	(G2, H2, J2, K2, L2, M2)		
192 GB	6x16 GB	-	6x16 GB	-	R	12
384 GB	6x16 GB	6x16 GB	6x16 GB	6x16 GB	R	24
384 GB	6x32 GB	-	6x32 GB	-	R	12
576 GB	6x32 GB	6x16 GB	6x32 GB	6x16 GB	R	24
768 GB	6x32 GB	6x32 GB	6x32 GB	6x32 GB	R	24
768 GB	6x64 GB	-	6x64 GB	-	R	12
768 GB	6x64 GB <sup>1</sup>	-	6x64 GB <sup>1</sup>	-	LR	12
1152 GB	6x64 GB	6x32 GB	6x64 GB	6x32 GB	R	24
1536 GB	6x64 GB	6x64 GB	6x64 GB	6x64 GB	R	24
1536 GB	6x64 GB <sup>1</sup>	6x64 GB <sup>1</sup>	6x64 GB <sup>1</sup>	6x64 GB <sup>1</sup>	LR	24
1536 GB	6x128 GB	-	6x128 GB	-	LR	12
2304 GB	6x128 GB	6x64 GB <sup>1</sup>	6x128 GB	6x64 GB <sup>1</sup>	LR	24
3072 GB	6x128 GB	6x128 GB	6x128 GB	6x128 GB	LR	24
3072 GB	6x256 GB	-	6x256 GB	-	LR	12
6144 GB	6x256 GB	6x256 GB	6x256 GB	6x256 GB	LR	24



## Notes:

1. Only DDR4-2933MHz supports 64 GB LRDIMM

Table 9 Recommended Memory Configurations for Intel Xeon Scalable Processors

Total System Memory Size	CPU-1		CPU-2		DIMM Type	Total DIMMs in the system
	Blue Slots	Black Slots	Blue Slots	Black Slots		
	Bank 1	Bank 2	Bank 1	Bank 2		
	(A1, B1, C1, D1, E1, F1)	(A2, B2, C2, D2, E2, F2)	(G1, H1, J1, K1, L1, M1)	(G2, H2, J2, K2, L2, M2)		
192 GB	6x16 GB	-	6x16 GB	-	R	12
384 GB	6x16 GB	6x16 GB	6x16 GB	6x16 GB	R	24
384 GB	6x32 GB	-	6x32 GB	-	R	12
576 GB	6x32 GB	6x16 GB	6x32 GB	6x16 GB	R	24
768 GB	6x32 GB	6x32 GB	6x32 GB	6x32 GB	R	24
768 GB	6x64 GB <sup>1</sup>	-	6x64 GB <sup>1</sup>	-	LR	12
1536 GB	6x64 GB <sup>1</sup>	6x64 GB <sup>1</sup>	6x64 GB <sup>1</sup>	6x64 GB <sup>1</sup>	LR	24

## Notes:

1. Only DDR4-2933MHz supports 64 GB LRDIMM

## Supported DIMM Configurations

**Table 10** shows some (not all) of the alternative DIMM configurations for configurations with 1, 2, 3, 4 and 8 DIMMs per socket. These lower DIMM counts per socket may not have the same amount of memory bandwidth and overall memory performance as in the recommended configurations shown in **Table 8** and **Table 9**.

**Table 10** shows some alternative supported configurations for 2nd Generation Intel Xeon Scalable Processors.

**Table 10 Supported Memory Configurations for 2nd Generation Intel Xeon Scalable Processors**

Total System Memory Size	CPU-1		CPU-2		DIMM Type	Total DIMMs in the system
	Blue Slots	Black Slots	Blue Slots	Black Slots		
	Bank 1	Bank 2	Bank 1	Bank 2		
	(A1, B1, C1, D1, E1, F1)	(A2, B2, C2, D2, E2, F2)	(G1, H1, J1, K1, L1, M1)	(G2, H2, J2, K2, L2, M2)		
32 GB	1x16 GB	-	1x16 GB	-	R	2
64 GB	2x16 GB	-	2x16 GB	-	R	4
64 GB	1x32 GB	-	1x32 GB	-	R	2
96 GB	3x16 GB	-	3x16 GB	-	R	6
128 GB	4x16 GB	-	4x16 GB	-	R	8
128 GB	2x32 GB	-	2x32 GB	-	R	4
128 GB	1x64 GB <sup>1</sup>	-	1x64 GB <sup>1</sup>	-	LR	2
128 GB	1x64 GB	-	1x64 GB	-	R	2
192 GB	3x32 GB	-	3x32 GB	-	R	6
256 GB	4x16 GB	4x16 GB	4x16 GB	4x16 GB	R	16
256 GB	4x32 GB	-	4x32 GB	-	R	8
256 GB	2x64 GB	-	2x64 GB	-	LR	4
256 GB	2x64 GB	-	2x64 GB	-	R	4
256 GB	1x128 GB	-	1x128 GB	-	LR	2
384 GB	3x64 GB <sup>1</sup>	-	3x64 GB <sup>1</sup>	-	LR	6
384 GB	3x64 GB	-	3x64 GB	-	R	6
512 GB	4x32 GB	4x32 GB	4x32 GB	4x32 GB	R	16
512 GB	4x64 GB <sup>1</sup>	-	4x64 GB <sup>1</sup>	-	LR	8

Table 10 Supported Memory Configurations for 2nd Generation Intel Xeon Scalable Processors

Total System Memory Size	CPU-1		CPU-2		DIMM Type	Total DIMMs in the system
	Blue Slots	Black Slots	Blue Slots	Black Slots		
	Bank 1	Bank 2	Bank 1	Bank 2		
	(A1, B1, C1, D1, E1, F1)	(A2, B2, C2, D2, E2, F2)	(G1, H1, J1, K1, L1, M1)	(G2, H2, J2, K2, L2, M2)		
512 GB	4x64 GB	-	4x64 GB	-	R	8
512 GB	2x128 GB	-	2x128 GB	-	LR	4
768 GB	3x128 GB	-	3x128 GB	-	LR	6
1024 GB	4x64 GB <sup>1</sup>	4x64 GB <sup>1</sup>	4x64 GB <sup>1</sup>	4x64 GB <sup>1</sup>	LR	16
1024 GB	4x64 GB	4x64 GB	4x64 GB	4x64 GB	R	16
1024 GB	4x128 GB	-	4x128 GB	-	LR	8
2048 GB	4x128 GB	4x128 GB	4x128 GB	4x128 GB	LR	16

## Notes:

1. Only DDR4-2933MHz supports 64 GB LRDIMM

## Memory Capacities for CPU Classes

This following material describes the configurable memory capacities using DIMMs and PMem for various classes of 2nd Generation Intel® Xeon® Scalable Processors and Intel® Xeon® Scalable Processors used in C220/C240/B200 M5 servers.

### All DIMM Configurations

This section describes the memory capacities for configurations that use all DIMMs.

### All DIMM Configurations for 2<sup>nd</sup> Generation Intel® Xeon® Scalable Processors

*Table 11* through *Table 13* show the possible configurations for 2nd Generation Intel® Xeon® Scalable Processors populated with all DIMMs.

Table 11 2nd Gen “M” CPUs With All DIMM Memory (4, 6, 8, or 12 DIMMs per CPU)<sup>1</sup>

Number of DIMMs per CPU	Capacity Per DIMM (GB)				
	16	32	64	128	256
	Total Capacity per CPU (GB)				
4	64	128	256	512	1024
6	96	192	384	768	1536
8	128	256	512	1024	2048
12	192	384	768	1536	N/A

**Notes:**

1. Total DIM M capacity for 2nd Gen ”M” CPUs cannot exceed 2048 GB



**NOTE:** The cells marked with N/A indicate a memory capacity that would be more than the allowable 2048 GB and therefore cannot be configured.

Table 12 2nd Gen “L” CPUs With All DIMM Memory (4, 6, 8, or 12 DIMMs per CPU)<sup>1</sup>

Number of DIMMs per CPU	Capacity Per DIMM (GB)				
	16	32	64	128	256
	Total Capacity per CPU (GB)				
4	64	128	256	512	1024
6	96	192	384	768	1536
8	128	256	512	1024	2048
12	192	384	768	1536	3072

**Notes:**

1. Total DIM M capacity for 2nd Gen “L” CPUs cannot exceed 3072 GB

Table 13 2nd Gen non-“M” and non-“L” CPU All DIMM Memory (4, 6, 8, or 12 DIMMs per CPU)<sup>1</sup>

Number of DIMMs per CPU	Capacity Per DIMM (GB)				
	16	32	64	128	256
	Total Capacity per CPU (GB)				
4	64	128	256	512	1024
6	96	192	384	768	N/A
8	128	256	512	1024	N/A
12	192	384	768	N/A	N/A

**Notes:**

1. Total DIM M capacity for 2nd Gen non-“M” and non-“L” CPUs cannot exceed 1024 GB



**NOTE:** The cells marked with N/A indicate a memory capacity that would be more than the allowable 1024 GB and therefore cannot be configured.

## All DIMM Configurations for Intel® Xeon® Scalable Processors

*Table 14* and *Table 15* show the possible configurations for Intel® Xeon® Scalable Processors populated with all DIMMs.



**NOTE:** Intel® Xeon® Scalable Processors do not support PMem and do not support 256 GB DIMMs.

**Table 14** Regular “M” CPU All DIMM Memory (4, 6, 8, or 12 DIMMs per CPU)

Number of DIMMs per CPU	Capacity Per DIMM (GB)			
	16	32	64	128
	Total Capacity per CPU (GB)			
4	64	128	256	512
6	96	192	384	768
8	128	256	512	1024
12	192	384	768	1536

**Table 15** Regular non-“M” CPU All DIMM Memory (4, 6, 8, or 12 DIMMs per CPU)<sup>1</sup>

Number of DIMMs per CPU	Capacity Per DIMM (GB)			
	16	32	64	128
	Total Capacity per CPU (GB)			
4	64	128	256	512
6	96	192	384	768
8	128	256	512	N/A
12	192	384	768	N/A

**Notes:**

1. Total DIM M capacity for regular non-“M” CPUs cannot exceed 768 GB



**NOTE:** The cells marked with N/A indicate a memory capacity that would be more than the allowable 768 GB and therefore cannot be configured.

## Mixed DIMM/PMem Configurations

This section describes the memory capacities for configurations that use a combination of DIMMS and PMem.

### DIMM/PMem Configurations for 2<sup>nd</sup> Generation Intel® Xeon® Scalable Processors

*Table 16*, *Table 17* and *Table 18* show the possible configurations for 2nd Generation Intel® Xeon® Scalable Processors populated with combinations of DIMMs and PMem. When PMem are selected, there must be 6 DIMMs per CPU and can be 2, 4, or 6 PMem per CPU, depending on CPU class (“M”, “L”, or regular class) and PMem capacity. Selection of PMem also requires that all CPUs be fully populated. The tables below show configurations for 1 CPU. For Memory Mode and Mixed Memory Mode, the Intel-recommended DIMM to PMem capacity ratio for the same CPU is from 1:2 to 1:16. The green-shaded cells of the table indicate ratios within that range, while the red-shaded portions indicate ratios outside that range. For App Direct Mode, the ratio requirement does not apply.

#### For 2<sup>nd</sup> Generation Intel® Xeon® Scalable Processors:

- DIMMs and PMem are supported
- CPU PIDs ending in “M” support up to a limit of 2048 GB per CPU
- CPU PIDs ending in “L” support up to a limit of 4608 GB per CPU
- All other CPU PIDs support up to a limit of 1024 GB per CPU
- For the App Direct Mode, both PMem and DIMM capacities count towards the CPU capacity limit
- For the Memory Mode and Mixed Mode only the PMem capacity counts towards the CPU capacity limit. DIMMs are used for cache only and do not counts toward the CPU capacity limit.

App Direct Mode

The following tables apply to the App Direct Mode. For App Direct Mode, the DIMM to PMem ratio requirement does not apply.

Table 16 2nd Gen “M” CPU DIMM/PMem Memory (6 DIMMs per CPU, and 2, 4, or 6 PMem per CPU)

Number of DIMMs <sup>1</sup> /PMem per CPU					
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 2 PMem	128 x2	128 x2	128 x2	128 x2	128 x2
Total PMem Capacity (GB)	256	256	256	256	256
Total Capacity per CPU	352	448	640	1024	1792
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 2 PMem	256 x2	256 x2	256 x2	256 x2	256 x2
Total PMem Capacity (GB)	512	512	512	512	512
Total Capacity per CPU	608	704	896	1280	2048
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 2 PMem	512 x2	512 x2	512 x2	512 x2	512 x2
Total PMem Capacity (GB)	1024	1024	1024	1024	N/A
Total Capacity per CPU	1120	1216	1408	1792	N/A
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 4 PMem	128 x4	128 x4	128 x4	128 x4	128 x4
Total PMem Capacity (GB)	512	512	512	512	512
Total Capacity per CPU	608	704	896	1280	2048
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 4 PMem	256 x4	256 x4	256 x4	256 x4	256 x4
Total PMem Capacity (GB)	1024	1024	1024	1024	N/A
Total Capacity per CPU	1120	1216	1408	1792	N/A



Table 16 2nd Gen “M” CPU DIMM/PMem Memory (6 DIMMs per CPU, and 2, 4, or 6 PMem per CPU)

Number of DIMMs <sup>1</sup> /PMem per CPU					
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	N/A	N/A	N/A	N/A	N/A
Capacity Per PMem(GB) x 4 PMem	512 x4	512 x4	512 x4	512 x4	512 x4
Total PMem Capacity (GB)	N/A	N/A	N/A	N/A	N/A
Total Capacity per CPU	N/A	N/A	N/A	N/A	N/A
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	N/A
Capacity Per PMem(GB) x 6 PMem	128 x6	128 x6	128 x6	128 x6	128 x6
Total PMem Capacity (GB)	768	768	768	768	N/A
Total Capacity per CPU	864	960	1152	1536	N/A
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	N/A
Capacity Per PMem(GB) x 6 PMem	256 x6	256 x6	256 x6	256 x6	N/A
Total PMem Capacity (GB)	1536	1536	1536	1536	N/A
Total Capacity per CPU	1632	1728	1920	N/A	N/A
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	N/A	N/A	N/A	N/A	N/A
Capacity Per PMem(GB) x 2 PMem	512 x2	512 x2	512 x2	512 x2	512 x2
Total PMem Capacity (GB)	N/A	N/A	N/A	N/A	N/A
Total Capacity per CPU	N/A	N/A	N/A	N/A	N/A

## Notes:

1. If PMem are selected, 6 DIMMs per CPU must also be selected



**NOTE:** The cells marked with N/A indicate a memory capacity that would be more than the allowable 2048 GB and therefore cannot be configured.

Table 17 2nd Gen “L” CPU DIMM/PMem Memory (6 DIMMs per CPU, and 2, 4, or 6 PMem per CPU)

Number of DIMMs <sup>1</sup> /PMem per CPU					
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 2 PMem	128 x2	128 x2	128 x2	128 x2	128 x2
Total PMem Capacity (GB)	256	256	256	256	256
Total Capacity per CPU	352	448	640	1024	1792
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 2 PMem	256 x2	256 x2	256 x2	256 x2	256 x2
Total PMem Capacity (GB)	512	512	512	512	512
Total Capacity per CPU	608	704	896	1280	2048
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 2 PMem	512 x2	512 x2	512 x2	512 x2	512 x2
Total PMem Capacity (GB)	1024	1024	1024	1024	1024
Total Capacity per CPU	1120	1216	1408	1792	2560
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 4 PMem	128 x4	128 x4	128 x4	128 x4	128 x4
Total PMem Capacity (GB)	512	512	512	512	512
Total Capacity per CPU	608	704	896	1280	2048
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 4 PMem	256 x4	256 x4	256 x4	256 x4	256 x4
Total PMem Capacity (GB)	1024	1024	1024	1024	1024
Total Capacity per CPU	1120	1216	1408	1792	2560

Table 17 2nd Gen “L” CPU DIMM/PMem Memory (6 DIMMs per CPU, and 2, 4, or 6 PMem per CPU)

Number of DIMMs <sup>1</sup> /PMem per CPU					
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 4 PMem	512 x4	512 x4	512 x4	512 x4	512 x4
Total PMem Capacity (GB)	2048	2048	2048	2048	2048
Total Capacity per CPU	2144	2240	2432	2816	3584
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 6 PMem	128 x6	128 x6	128 x6	128 x6	128 x6
Total PMem Capacity (GB)	768	768	768	768	768
Total Capacity per CPU	864	960	1152	1536	2304
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 6 PMem	256 x6	256 x6	256 x6	256 x6	256 x6
Total PMem Capacity (GB)	1536	1536	1536	1536	1536
Total Capacity per CPU	1632	1728	1920	2304	3072
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 6 PMem	512 x6	512 x6	512 x6	512 x6	512 x6
Total PMem Capacity (GB)	3072	3072	3072	3072	3072
Total Capacity per CPU	3168	3264	3456	3840	4608

## Notes:

1. If PMem are selected, 6 DIMMs per CPU must also be selected

Table 18 2nd Gen non-“L” and non-“M” CPU DIMM/PMem Memory (6 DIMMs per CPU, and 2, 4, or 6 PMem per CPU)

Number of DIMMs <sup>1</sup> /PMem per CPU					
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 2 PMem	128 x2	128 x2	128 x2	128 x2	128 x2
Total PMem Capacity (GB)	256	256	256	256	N/A
Total Capacity per CPU	352	448	640	1024	N/A
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 2 PMem	256 x2	256 x2	256 x2	256 x2	256 x2
Total PMem Capacity (GB)	512	512	512	N/A	N/A
Total Capacity per CPU	608	704	896	N/A	N/A
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 2 PMem	512 x2	512 x2	512 x2	512 x2	512 x2
Total PMem Capacity (GB)	N/A	N/A	N/A	N/A	N/A
Total Capacity per CPU	N/A	N/A	N/A	N/A	N/A
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 4 PMem	128 x4	128 x4	128 x4	128 x4	128 x4
Total PMem Capacity (GB)	512	512	512	N/A	N/A
Total Capacity per CPU	608	704	896	N/A	N/A
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 4 PMem	256 x4	256 x4	256 x4	256 x4	256 x4
Total PMem Capacity (GB)	N/A	N/A	N/A	N/A	N/A
Total Capacity per CPU	N/A	N/A	N/A	N/A	N/A

Table 18 2nd Gen non-“L” and non-“M” CPU DIMM/PMem Memory (6 DIMMs per CPU, and 2, 4, or 6 PMem per CPU) (continued)

Number of DIMMs <sup>1</sup> /PMem per CPU					
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	N/A	N/A	N/A	N/A	N/A
Capacity Per PMem(GB) x 4 PMem	512 x4	512 x4	512 x4	512 x4	512 x4
Total PMem Capacity (GB)	N/A	N/A	N/A	N/A	N/A
Total Capacity per CPU	N/A	N/A	N/A	N/A	N/A
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	N/A	N/A	N/A
Capacity Per PMem(GB) x 6 PMem	128 x6	128 x6	128 x6	128 x6	128 x6
Total PMem Capacity (GB)	768	768	N/A	N/A	N/A
Total Capacity per CPU	864	960	N/A	N/A	N/A
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	N/A	N/A	N/A	N/A	N/A
Capacity Per PMem(GB) x 6 PMem	256 x6	256 x6	256 x6	256 x6	256 x6
Total PMem Capacity (GB)	N/A	N/A	N/A	N/A	N/A
Total Capacity per CPU	N/A	N/A	N/A	N/A	N/A
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	N/A	N/A	N/A	N/A	N/A
Capacity Per PMem(GB) x 6 PMem	512 x6	512 x6	512 x6	512 x6	512 x6
Total PMem Capacity (GB)	N/A	N/A	N/A	N/A	N/A
Total Capacity per CPU	N/A	N/A	N/A	N/A	N/A

## Notes:

1. If PMem are selected, 6 DIMMs per CPU must also be selected



## NOTE:

- The cells marked with N/A indicate a memory capacity configuration that would be more than the allowable 1024 GB and therefore cannot be configured.
- Configurations of any 6 DIMMs and 2 512 GB PMem, or any 6 DIMMs and any 6 PMem are not valid, because they always exceed the 1024 GB capacity limit.

**Memory Mode and Mixed Mode**

The following tables apply to the Memory Mode and Mixed Mode. The recommended DIMM:PMem ratio for Memory Mode is from 1:2 to 1:16. Ratios in that range are indicated in green shading below; ratios outside that range are indicated in red shading. In Mixed Mode, the ratio is between memory and only the volatile portion of the PMem and is not specifically called out in the tables below because the ratio depends on how much of the PMem memory has been allocated to volatile memory.



**NOTE:** For Memory and Mixed Modes, DIMMs are used as cache and do not factor into CPU capacity.

**Table 19 2nd Gen “M” CPU DIMM/PMem Memory (6 DIMMs per CPU, and 2, 4, or 6 PMem per CPU)**

Number of DIMMs <sup>1</sup> /PMem per CPU					
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 2 PMem	128 x2	128 x2	128 x2	128 x2	128 x2
Total PMem Capacity (GB)	256	256	256	256	256
DIMM:PMem capacity ratio per CPU	1:2.67	1:1.33	1:0.67	1:0.33	2:0.167
Total Capacity per CPU	256	256	256	256	256
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB) (cache only)	96	192	384	768	1536
Capacity Per PMem(GB) x 2 PMem	256 x2	256 x2	256 x2	256 x2	256 x2
Total PMem Capacity (GB)	512	512	512	512	512
DIMM:PMem capacity ratio per CPU	1:5.33	1:2.67	1:1.33	1:0.67	1:0.33
Total Capacity per CPU	512	512	512	512	512

Table 19 2nd Gen “M” CPU DIMM/PMem Memory (6 DIMMs per CPU, and 2, 4, or 6 PMem per CPU)

Number of DIMMs <sup>1</sup> /PMem per CPU					
<b>Capacity Per DIMM(GB) x 6 DIMMs</b>	<b>16 x6</b>	<b>32 x6</b>	<b>64 x6</b>	<b>128 x6</b>	<b>256 x6</b>
Total DIMM Capacity (GB) (cache only)	96	192	384	768	1536
<b>Capacity Per PMem(GB) x 2 PMem</b>	<b>512 x2</b>	<b>512 x2</b>	<b>512 x2</b>	<b>512 x2</b>	<b>512 x2</b>
Total PMem Capacity (GB)	1024	1024	1024	1024	1024
DIMM:PMem capacity ratio per CPU	<b>1:10.67</b>	<b>1:5.33</b>	<b>1:2.67</b>	<b>1:1.33</b>	<b>1:0.67</b>
<b>Total Capacity per CPU</b>	<b>1024</b>	<b>1024</b>	<b>1024</b>	<b>1024</b>	<b>1024</b>
<b>Capacity Per DIMM(GB) x 6 DIMMs</b>	<b>16 x6</b>	<b>32 x6</b>	<b>64 x6</b>	<b>128 x6</b>	<b>256 x6</b>
Total DIMM Capacity (GB) (cache only)	96	192	384	768	1536
<b>Capacity Per PMem(GB) x 4 PMem</b>	<b>128 x4</b>	<b>128 x4</b>	<b>128 x4</b>	<b>128 x4</b>	<b>128 x4</b>
Total PMem Capacity (GB)	512	512	512	512	512
DIMM:PMem capacity ratio per CPU	<b>1:5.33</b>	<b>1:2.67</b>	<b>1:1.33</b>	<b>1:0.67</b>	<b>1:0.33</b>
<b>Total Capacity per CPU</b>	<b>512</b>	<b>512</b>	<b>512</b>	<b>512</b>	<b>512</b>
<b>Capacity Per DIMM(GB) x 6 DIMMs</b>	<b>16 x6</b>	<b>32 x6</b>	<b>64 x6</b>	<b>128 x6</b>	<b>256 x6</b>
Total DIMM Capacity (GB) (cache only)	96	192	384	768	1536
<b>Capacity Per PMem(GB) x 4 PMem</b>	<b>256 x4</b>	<b>256 x4</b>	<b>256 x4</b>	<b>256 x4</b>	<b>256 x4</b>
Total PMem Capacity (GB)	1024	1024	1024	1024	1024
DIMM:PMem capacity ratio per CPU	<b>1:10.66</b>	<b>1:5.33</b>	<b>1:2.67</b>	<b>1:1.33</b>	<b>1:0.67</b>
<b>Total Capacity per CPU</b>	<b>1024</b>	<b>1024</b>	<b>1024</b>	<b>1024</b>	<b>1024</b>

Table 19 2nd Gen “M” CPU DIMM/PMem Memory (6 DIMMs per CPU, and 2, 4, or 6 PMem per CPU)

Number of DIMMs <sup>1</sup> /PMem per CPU					
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 4 PMem	512 x4	512 x4	512 x4	512 x4	512 x4
Total PMem Capacity (GB)	2048	2048	2048	2048	2048
DIMM:PMem capacity ratio per CPU	1:21.33	1:10.66	1:5.33	1:2.67	1:1.33
Total Capacity per CPU	2048	2048	2048	2048	2048
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 6 PMem	128 x6	128 x6	128 x6	128 x6	128 x6
Total PMem Capacity (GB)	768	768	768	768	768
DIMM:PMem capacity ratio per CPU	1:8	1:4	1:2	1:1	1:0.5
Total Capacity per CPU	768	768	768	768	768
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 6 PMem	256 x6	256 x6	256 x6	256 x6	256 x6
Total PMem Capacity (GB)	1536	1536	1536	1536	1536
DIMM:PMem capacity ratio per CPU	1:16	1:8	1:4	1:2	1:1
Total Capacity per CPU	1536	1536	1536	1536	1536



Table 19 2nd Gen “M” CPU DIMM/PMem Memory (6 DIMMs per CPU, and 2, 4, or 6 PMem per CPU)

Number of DIMMs <sup>1</sup> /PMem per CPU					
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	N/A	N/A	N/A	N/A	N/A
Capacity Per PMem(GB) x 6 PMem	512 x6	512 x6	512 x6	512 x6	512 x6
Total PMem Capacity (GB)	N/A	N/A	N/A	N/A	N/A
DIMM:PMem capacity ratio per CPU	1:32	1:16	1:8	1:4	1:2
Total Capacity per CPU	N/A	N/A	N/A	N/A	N/A

## Notes:

1. If PMem are selected, 6 DIMMs per CPU must also be selected



**NOTE:** The cells marked with N/A indicate a memory capacity that would be more than the allowable 2048 GB for “M” CPUs and therefore cannot be configured.

Table 20 2nd Gen “L” CPU DIMM/PMem Memory (6 DIMMs per CPU, and 2, 4, or 6 PMem per CPU)

Number of DIMMs <sup>1</sup> /PMem per CPU					
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 2 PMem	128 x2	128 x2	128 x2	128 x2	128 x2
Total PMem Capacity (GB)	256	256	256	256	256
DIMM:PMem capacity ratio per CPU	1:2.67	1:1.33	1:0.67	1:0.33	1:0.67
Total Capacity per CPU	256	256	256	256	256
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 2 PMem	256 x2	256 x2	256 x2	256 x2	256 x2
Total PMem Capacity (GB)	512	512	512	512	512
DIMM:PMem capacity ratio per CPU	1:5.33	1:2.67	1:1.33	1:0.67	1:0.33
Total Capacity per CPU	512	512	512	512	512

Table 20 2nd Gen “L” CPU DIMM/PMem Memory (6 DIMMs per CPU, and 2, 4, or 6 PMem per CPU)

Number of DIMMs <sup>1</sup> /PMem per CPU					
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 2 PMem	512 x2	512 x2	512 x2	512 x2	512 x2
Total PMem Capacity (GB)	1024	1024	1024	1024	1024
DIMM:PMem capacity ratio per CPU	1:10.66	1:5.33	1:2.67	1:1.33	1:0.67
Total Capacity per CPU	1024	1024	1024	1024	1024
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 4 PMem	128 x4	128 x4	128 x4	128 x4	128 x4
Total PMem Capacity (GB)	512	512	512	512	512
DIMM:PMem capacity ratio per CPU	1:5.33	1:2.67	1:1.33	1:0.67	1:0.33
Total Capacity per CPU	512	512	512	512	512
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 4 PMem	256 x4	256 x4	256 x4	256 x4	256 x4
Total PMem Capacity (GB)	1024	1024	1024	1024	1024
DIMM:PMem capacity ratio per CPU	1:10.66	1:5.33	1:2.67	1:1.33	1:0.67
Total Capacity per CPU	1024	1024	1024	1024	1024
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 4 PMem	512 x4	512 x4	512 x4	512 x4	512 x4
Total PMem Capacity (GB)	2048	2048	2048	2048	2048
DIMM:PMem capacity ratio per CPU	1:21.33	1:10.66	1:5.33	1:2.67	1:1.33
Total Capacity per CPU	2048	2048	2048	2048	2048

Table 20 2nd Gen “L” CPU DIMM/PMem Memory (6 DIMMs per CPU, and 2, 4, or 6 PMem per CPU)

Number of DIMMs <sup>1</sup> /PMem per CPU					
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 6 PMem	128 x6	128 x6	128 x6	128 x6	128 x6
Total PMem Capacity (GB)	768	768	768	768	768
DIMM:PMem capacity ratio per CPU	1:8	1:4	1:2	1:1	2:1
Total Capacity per CPU	768	768	768	768	768
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 6 PMem	256 x6	256 x6	256 x6	256 x6	256 x6
Total PMem Capacity (GB)	1536	1536	1536	1536	1536
DIMM:PMem capacity ratio per CPU	1:16	1:8	1:4	1:2	1:1
Total Capacity per CPU	1536	1536	1536	1536	1536
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 6 PMem	512 x6	512 x6	512 x6	512 x6	512 x6
Total PMem Capacity (GB)	3072	3072	3072	3072	3072
DIMM:PMem capacity ratio per CPU	1:32	1:16	1:8	1:4	1:2
Total Capacity per CPU	3072	3072	3072	3072	3072

## Notes:

1. If PMem are selected, 6 DIMMs per CPU must also be selected

Table 21 2nd Gen non-“L” and non-“M” CPU DIMM/PMem Memory (6 DIMMs per CPU, and 2, 4, or 6 PMem per CPU)

Number of DIMMs <sup>1</sup> /PMem per CPU					
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 2 PMem	128 x2	128 x2	128 x2	128 x2	128 x2
Total PMem Capacity (GB)	256	256	256	256	256
DIMM:PMem capacity ratio per CPU	1:2.67	1:1.33	1:0.67	1:0.33	1:0.67
Total Capacity per CPU	256	256	256	256	256

Table 21 2nd Gen non-“L” and non-“M” CPU DIMM/PMem Memory (6 DIMMs per CPU, and 2, 4, or 6 PMem per CPU) (continued)

Number of DIMMs <sup>1</sup> /PMem per CPU					
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 2 PMem	256 x2	256 x2	256 x2	256 x2	256 x2
Total PMem Capacity (GB)	512	512	512	512	512
DIMM:PMem capacity ratio per CPU	1:5.33	1:2.67	1:1.33	1:0.67	1:0.33
Total Capacity per CPU	512	512	512	512	512
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 2 PMem	512 x2	512 x2	512 x2	512 x2	512 x2
Total PMem Capacity (GB)	1024	1024	1024	1024	1024
DIMM:PMem capacity ratio per CPU	1:10.66	1:5.33	1:2.67	1:1.33	1:0.67
Total Capacity per CPU	1024	1024	1024	1024	1024
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 4 PMem	128 x4	128 x4	128 x4	128 x4	128 x4
Total PMem Capacity (GB)	512	512	512	512	512
DIMM:PMem capacity ratio per CPU	1:5.33	1:2.67	1:1.33	1:0.67	1:0.33
Total Capacity per CPU	512	512	512	512	512
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 4 PMem	256 x4	256 x4	256 x4	256 x4	256 x4
Total PMem Capacity (GB)	1024	1024	1024	1024	1024
DIMM:PMem capacity ratio per CPU	1:10.66	1:5.33	1:2.67	1:1.33	1:0.67
Total Capacity per CPU	1024	1024	1024	1024	1024
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	N/A	N/A	N/A	N/A	N/A
Capacity Per PMem(GB) x 2 PMem	512 x2	512 x2	512 x2	512 x2	512 x2
Total PMem Capacity (GB)	N/A	N/A	N/A	N/A	N/A
DIMM:PMem capacity ratio per CPU	N/A	N/A	N/A	N/A	N/A
Total Capacity per CPU	N/A	N/A	N/A	N/A	N/A

Table 21 2nd Gen non-“L” and non-“M” CPU DIMM/PMem Memory (6 DIMMs per CPU, and 2, 4, or 6 PMem per CPU) (continued)

Number of DIMMs <sup>1</sup> /PMem per CPU					
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	96	192	384	768	1536
Capacity Per PMem(GB) x 6 PMem	128 x6	128 x6	128 x6	128 x6	128 x6
Total PMem Capacity (GB)	768	768	768	768	768
DIMM:PMem capacity ratio per CPU	1:8	1:4	1:2	1:1	2:1
Total Capacity per CPU	768	768	768	768	768
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	N/A	N/A	N/A	N/A	N/A
Capacity Per PMem(GB) x 6 PMem	256 x6	256 x6	256 x6	256 x6	256 x6
Total PMem Capacity (GB)	N/A	N/A	N/A	N/A	N/A
DIMM:PMem capacity ratio per CPU	N/A	N/A	N/A	N/A	N/A
Total Capacity per CPU	N/A	N/A	N/A	N/A	N/A
Capacity Per DIMM(GB) x 6 DIMMs	16 x6	32 x6	64 x6	128 x6	256 x6
Total DIMM Capacity (GB)	N/A	N/A	N/A	N/A	N/A
Capacity Per PMem(GB) x 6 PMem	512 x6	512 x6	512 x6	512 x6	512 x6
Total PMem Capacity (GB)	N/A	N/A	N/A	N/A	N/A
DIMM:PMem capacity ratio per CPU	N/A	N/A	N/A	N/A	N/A
Total Capacity per CPU	N/A	N/A	N/A	N/A	N/A

## Notes:

1. If PMem are selected, 6 DIMMs per CPU must also be selected.



**NOTE:** The cells marked with N/A indicate a memory capacity that would be more than the allowable 1024 GB for non “M” and non “L” CPUs and therefore cannot be configured.

## Installing a DIMM or DIMM Blank

To install a DIMM or a DIMM blank into a slot on the blade server, follow these steps.

### Procedure

Step 1 Open both DIMM connector latches.

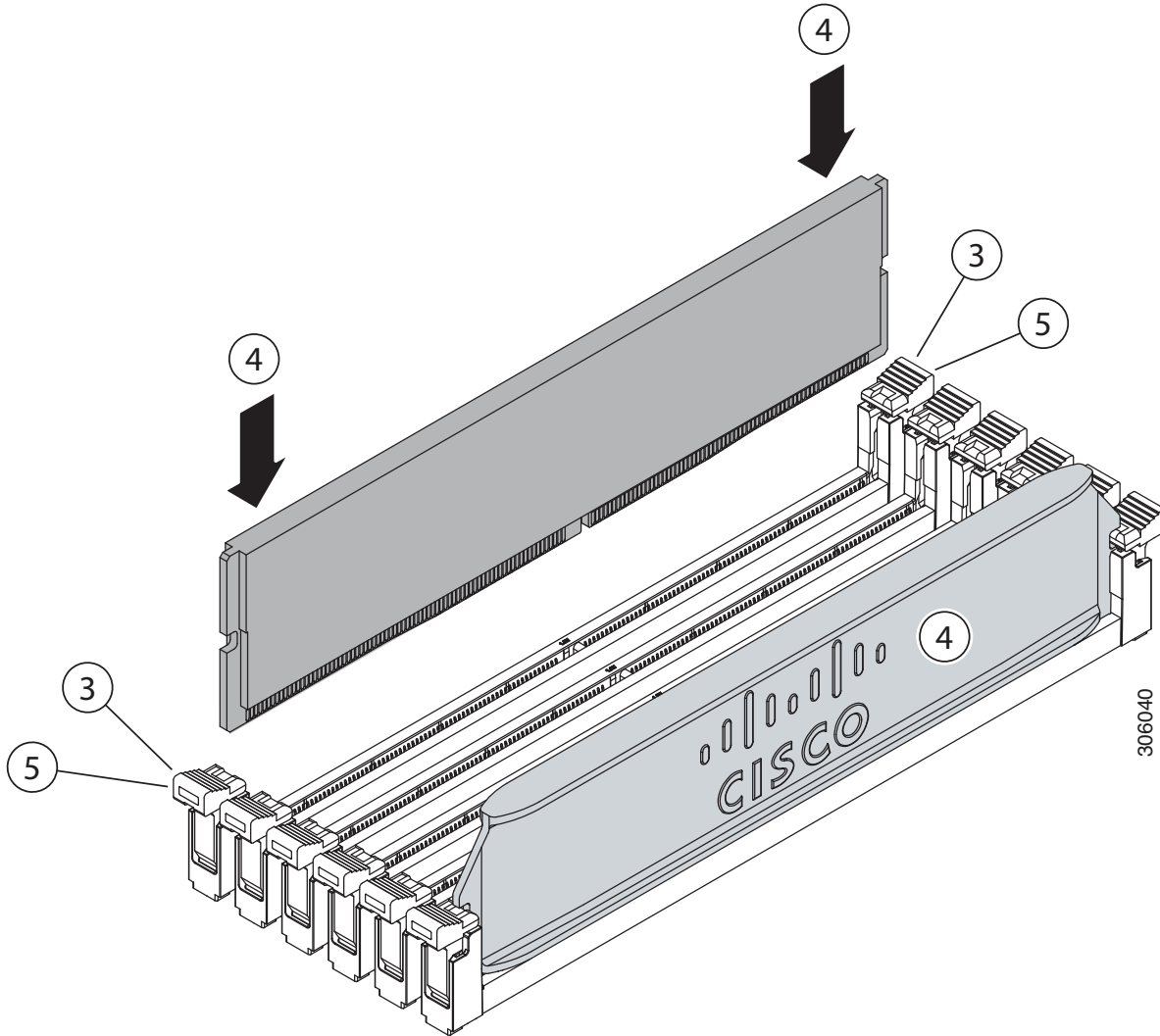
Step 2 Press evenly on both ends of the DIMM until it clicks into place in its slot

Note: Ensure that the notch in the DIMM aligns with the slot. If the notch is misalignment is possible damage the DIMM, the slot, or both.

Step 3 Press the DIMM connector latches inward slightly to seat them fully.

Step 4 Populate all slots with a DIMM or DIMM blank. A slot cannot be empty.

Figure 4 Installing Memory







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