



Cisco UCS C220/C240/ B200 M5 Memory Guide

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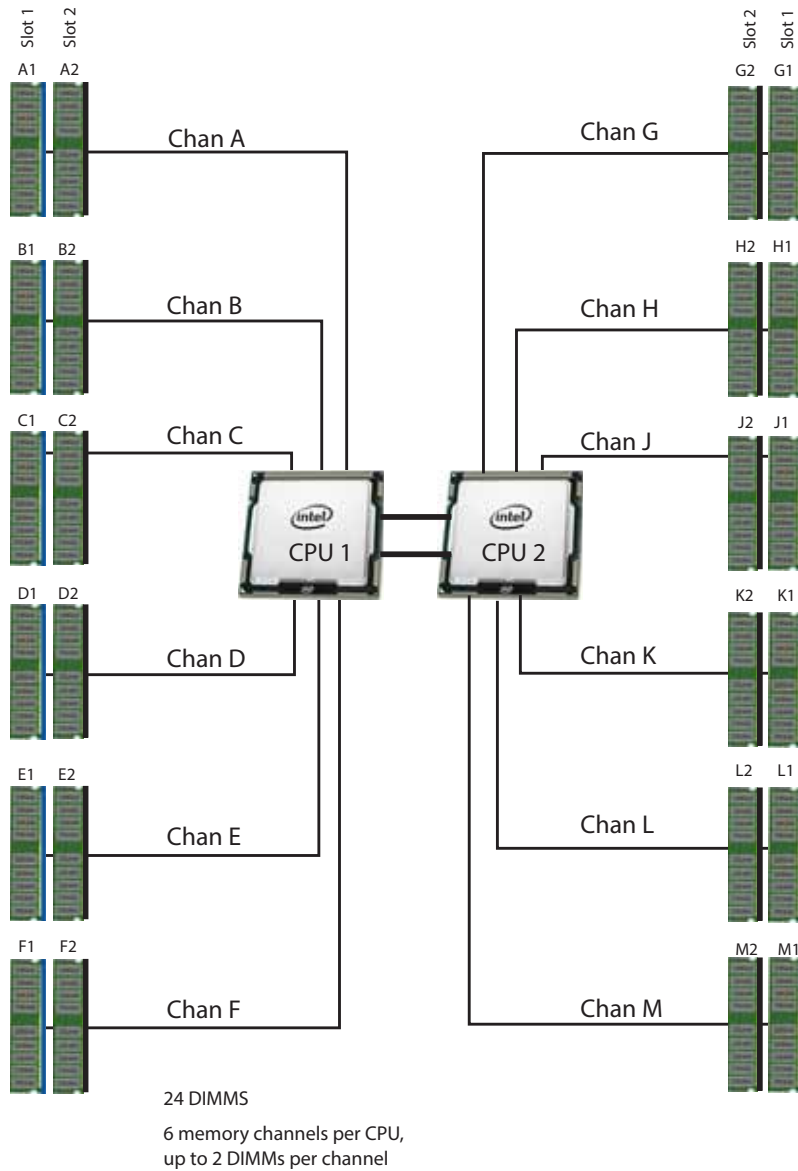
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Memory Organization, Available PIDs and Memory Mirroring

The standard memory features are:

- Clock speed: 2666 MHz or 2933 MHz depending on CPU type
 - Ranks per DIMM: 1, 2, 4, or 8
 - Operational voltage: 1.2 V
 - Registered ECC DDR4 DIMMs (RDIMMs) or load-reduced DIMMs (LRDIMMs)
- Memory is organized with six memory channels per CPU, with up to two DIMMs per channel, as shown in [Figure 1](#).

Figure 1 C220, C240, B200 M5 Memory Organization



Select DIMMs and Memory Mirroring

Select the memory configuration and whether or not you want the memory mirroring option. The available memory DIMMs and mirroring option are listed in [Table 1](#).



NOTE: When memory mirroring is enabled, the memory subsystem simultaneously writes identical data to two DIMMs. If a memory read from primary DIMM returns incorrect data due to an uncorrectable memory error, the system automatically retrieves the data from the secondary DIMM in the mirrored pair. Thus, an error in one DIMM does not affect the mirrored data, and operation continues unless the error propagates to both the DIMMs in the mirrored pair. Memory mirroring reduces the amount of memory available to the operating system by 50% because only one of the two DIMMs in the mirrored pair provides data.

Table 1 Available DDR4 DIMMs

Product ID (PID)	PID Description	Voltage	Ranks /DIMM
UCS-MR-128G8RS-H	128 GB DDR4-2666-MHz TSV-RDIMM/8R/x4	1.2 V	8
UCS-MR-X64G4RS-H	64 GB DDR4-2666-MHz TSV-RDIMM/4R/x4	1.2 V	4
UCS-ML-X64G4RS-H	64 GB DDR4-2666-MHz LRDIMM/4R/x4	1.2 V	4
UCS-MR-X32G2RS-H	32 GB DDR4-2666-MHz RDIMM/2R/x4	1.2 V	2
UCS-ML-X32G2RS-H	32 GB DDR4-2666-MHz LDIMM/2R/x4	1.2 V	2
UCS-MR-X16G2RS-H	16 GB DDR4-2666-MHz RDIMM/2R/x4	1.2 V	2
UCS-MR-X16G1RS-H	16 GB DDR4-2666-MHz RDIMM/1R/x4	1.2 V	1
UCS-MR-X8G1RS-H	8 GB DDR4-2666-MHz RDIMM/1R/x4	1.2 V	1
UCS-ML-128G4RT-H	128 GB DDR4-2933-MHz LRDIMM/4Rx4 (16Gb) 1.2v	1.2 V	4
UCS-ML-X64G4RT-H	64 GB DDR4-2933-MHz LRDIMM/4Rx4 (8Gb) 1.2v	1.2 V	4
UCS-MR-X64G2RT-H	64 GB DDR4-2933-MHz RDIMM/2Rx4 (16Gb) 1.2v	1.2 V	2
UCS-MR-X32G2RT-H	32GB DDR4-2933-MHz RDIMM/2Rx4 (8Gb) 1.2v	1.2 V	2
UCS-MR-X16G1RT-H	16 GB DDR4-2933-MHz RDIMM/1Rx4 (8Gb) 1.2v	1.2 V	1
Intel® Optane™ DC Persistent Memory Product			
UCS-MP-128GS-A0	Intel® Optane™ DC Persistent Memory, 128GB, 2666MHz		
UCS-MP-256GS-A0	Intel® Optane™ DC Persistent Memory, 256GB, 2666MHz		
UCS-MP-512GS-A0	Intel® Optane™ DC Persistent Memory, 512GB, 2666MHz		
Memory Mirroring Option			
N01-MMIRROR	Memory mirroring option		

Approved Configurations

(1) 1-CPU configuration without memory mirroring:

- Select from 1 to 12 DIMMs. Refer to [page 9](#) for more detailed information.

(2) 1-CPU configuration with memory mirroring:

- Select 4, 6, 8, or 12 identical DIMMs. The DIMMs will be placed by the factory as shown in the following table.

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

- Select the memory mirroring option (N01-MMIRROR) as shown in [Table 1 on page 4](#).

(3) 2-CPU configuration without memory mirroring: Select from 1 to 12 DIMMs per CPU. Refer to [page 9](#) for more detailed information.

(4) 2-CPU configuration with memory mirroring:

- Select 8, 12, 16, or 24 identical DIMMs. The DIMMs will be placed by the factory as shown in the following table.

	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)

- Select the memory mirroring option (N01-MMIRROR) as shown in [Table 1 on page 4](#).



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.

Caveats

- System speed is dependent on how many DIMMs are populated per channel and the CPU DIMM speed support. See [Table 2](#) for details.

Table 2 2666-MHz DIMM Memory Speeds with Different Intel® Xeon® Scalable Processors

DIMM and CPU Frequencies (MHz)	DPC	TSV-RDIMM (8Rx4) - 128 GB (MHz)	TSV-RDIMM (4Rx4) - 64 GB (MHz)	LRDIMM (4Rx4) - 64 GB (MHz)	RDIMM (2Rx4) - 32 GB (MHz)	LRDIMM (2Rx4) - 32 GB (MHz)	RDIMM (1Rx4) - 16 GB (MHz)	RDIMM (1Rx4) - 8 GB (MHz)
		1.2 V	1.2 V	1.2 V	1.2 V	1.2 V	1.2 V	1.2 V
DIMM = 2666 CPU = 2666	1DPC	2666	2666	2666	2666	2666	2666	2666
	2DPC	2666	2666	2666	2666	2666	2666	2666
DIMM = 2666 CPU = 2400	1DPC	2400	2400	2400	2400	2400	2400	2400
	2DPC	2400	2400	2400	2400	2400	2400	2400
DIMM = 2666 CPU = 2133	1DPC	2133	2133	2133	2133	2133	2133	2133
	2DPC	2133	2133	2133	2133	2133	2133	2133

 Table 3 2993-MHz DIMM Memory Speeds with Different 2nd Generation Intel® Xeon® Scalable Processors

DIMM and CPU Frequencies (MHz)	DPC	LRDIMM (4Rx4)- 128 GB (MHz)	LRDIMM (4Rx4) - 64 GB (MHz)	RDIMM (2Rx4) - 64 GB (MHz)	RDIMM (2Rx4) - 32 GB (MHz)	RDIMM (1Rx4) - 16 GB (MHz)
		1.2 V	1.2 V	1.2 V	1.2 V	1.2 V
DIMM = 2993 CPU = 2993	1DPC	2993	2993	2993	2993	2993
	2DPC	2993	2993	2993	2993	2993
DIMM = 2993 CPU = 2666	1DPC	2666	2666	2666	2666	2666
	2DPC	2666	2666	2666	2666	2666
DIMM = 2993 CPU = 2400	1DPC	2400	2400	2400	2400	2400
	2DPC	2400	2400	2400	2400	2400
DIMM = 2993 CPU = 2133	1DPC	2133	2133	2133	2133	2133
	2DPC	2133	2133	2133	2133	2133

Intel® Optane™ DC Persistent Memory

App Direct Mode:	Both DCPMM and DRAM capacity counts towards to CPU Tiering
Memory Mode: ¹	DRAM as cache. Only DCPMM capacity counts towards to CPU Tiering
Mix Mode:	DRAM as cache. Only DCPMM capacity counts towards to CPU Tiering

Notes:

1. For Memory Mode, the recommended DRAM: DCPMM density ratio is between 1:4 to 1:16

Table 4 2nd Generation Intel® Xeon® DRAM and DCPMM Physical Configuration (dual socket)

DCPMM: DRAM Count	CPU 1											
	iMC1						iMCO					
	Channel 2		Channel 1		Channel 0		Channel 2		Channel 1		Channel 0	
	F2	F1	E2	E1	D2	D1	C2	C1	B2	B1	A2	A1
4 - 12(dual CPU)		DRAM		DRAM	DCPMM	DRAM		DRAM		DRAM	DCPMM	DRAM
8 - 12(dual CPU)		DRAM	DCPMM	DRAM	DCPMM	DRAM		DRAM	DCPMM	DRAM	DCPMM	DRAM
12 - 12(dual CPU)	DCPMM	DRAM	DCPMM	DRAM	DCPMM	DRAM	DCPMM	DRAM	DCPMM	DRAM	DCPMM	DRAM
DCPMM: DRAM Count	CPU 2											
	iMC1						iMCO					
	Channel 2		Channel 1		Channel 0		Channel 2		Channel 1		Channel 0	
	M2	M1	L2	L1	K2	K1	J2	J1	H2	H1	G2	G1
4 - 12(dual CPU)		DRAM		DRAM	DCPMM	DRAM		DRAM		DRAM	DCPMM	DRAM
8 - 12(dual CPU)		DRAM	DCPMM	DRAM	DCPMM	DRAM		DRAM	DCPMM	DRAM	DCPMM	DRAM
12 - 12(dual CPU)	DCPMM	DRAM	DCPMM	DRAM	DCPMM	DRAM	DCPMM	DRAM	DCPMM	DRAM	DCPMM	DRAM

Notes:

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

For detailed Intel DCPMM configurations, refer to [Server Installation and Service Guide](#)

- The C220,C240,B200 M5 server supports four different memory reliability, availability, and serviceability (RAS) modes:
 - Independent Channel Mode
 - Mirrored Channel Mode
- Below are the system level RAS Mode combination limitations:
 - Mixing of Non-Mirrored and Mirrored mode is not allowed per platform.
- Do not mix TSV-RDIMMs with any other DIMMS
- Do not mix RDIMMs with LRDIMMs
- Single-rank DIMMs can be mixed with dual-rank DIMMs in the same channel
- Do not mix quad-rank RDIMMs with single- or dual-rank RDIMMs in the same channel
- For best performance, observe the following:
 - When one DIMM is used, it must be populated in DIMM slot 1, the blue slot (farthest away from the CPU) of a given channel.
 - When single or dual Rank DIMMs are populated for 2DPC, always populate the higher number rank DIMM first (starting from the farthest slot). For a 2DPC example, first populate with quad-rank DIMMs in the DIMM slot 1. Then dual-rank DIMMs in the DIMM 2 slot.
- DIMMs for CPU 1 and CPU 2 (when populated) must always be configured identically.
- When using mirroring, DIMMs must be installed in identical pairs across paired DDR4 buses.
- Memory mirroring reduces the amount of available memory by 50% (quantity of DIMMs must be even for mirroring).
- Non-ECC DIMMs are not supported.
- Cisco memory from previous generation servers (DDR3) is not compatible with this server
- The maximum combined memory allowed in the 12 DIMM slots is 768 GB. To populate the 12 DIMM slots with more than 768 GB of combined memory, you need to use a CPU with a SKU that ends with an "M", for example, UCS-CPU-6134M

For more information regarding memory, see [Physical Layout, page 9](#).

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 shows how slots and channels are physically laid out on the motherboard. The DIMM slots on the right half of the motherboard (channels A, B, C, D, E, and F) are associated with CPU 1, while the DIMM slots on the left half of the motherboard (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

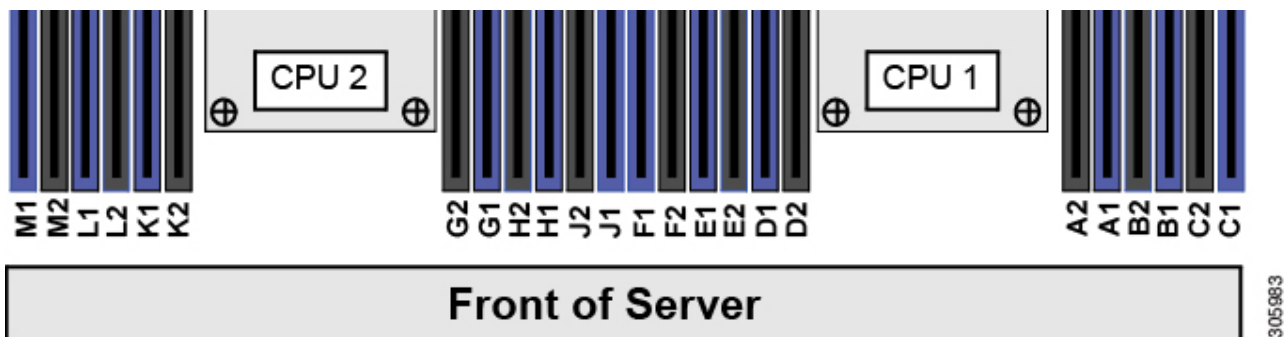
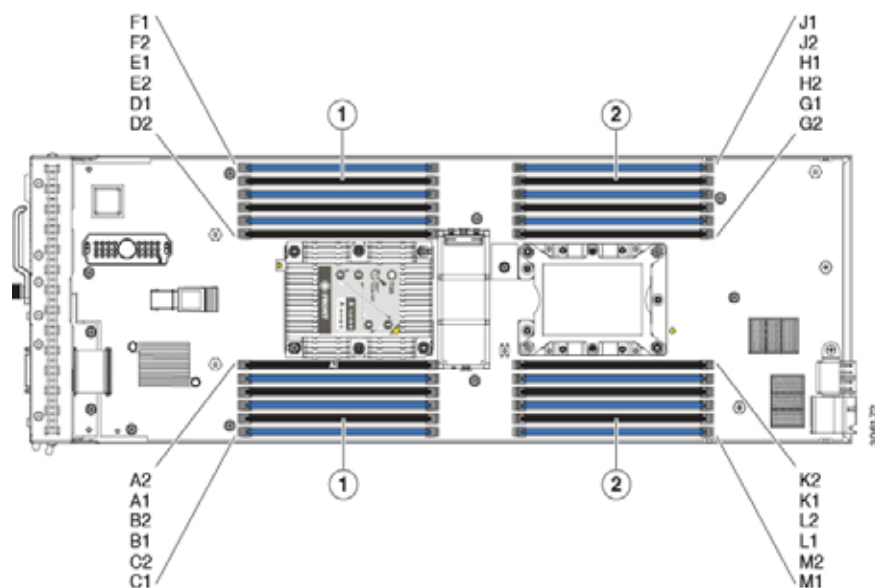


Figure 3 Physical Layout of B200 M5 CPU DIMM Channels and Slots



Memory 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).
- Any DIMM installed in a DIMM socket for which the CPU is absent is not recognized.
- Observe the DIMM mixing rules shown in [Table 5](#)

Table 5 DIMM Rules for C220, C240, B200 M5 Servers

DIMM Parameter	DIMMs in the Same Channel	DIMM in the Same Slot ¹
<u>DIMM Capacity</u> RDIMM = 8, 16, 32, 64, or 128 GB LRDIMM = 64 GB TSV-RDIMM = 64 GB, 128GB	DIMMs in the same channel (for example, A1 and A2) can have different capacities. Do not mix TSV-RDIMMS with LRDIMMs nor RDIMMs	For best performance, DIMMs in the same slot (for example, A1, B1, C1, D1, E1, F1) should have the same capacity. Do not mix TSV-RDIMMS with LRDIMMs nor RDIMMs
<u>DIMM Speed</u> 2666-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> TSV-RDIMMS, RDIMMs, or LRDIMMs	Do not mix DIMM types in a channel	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 6](#).

Table 6 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, K1)	-
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.

Recommended Memory Configuration

This section explains the recommended DIMM population order rules for the C220, C240 and B200 M5 servers.

- All DIMMs must be DDR4 DIMMs.
- Do not mix:
 - DIMMs with different clock rates in a channel
 - RDIMMs and LRDIMMs or TSV-RDIMMs 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.

Many memory configurations are possible. For best results, follow [Table 7](#) when populating DIMMs.



NOTE: These tables list only some recommended and suggested configurations. There are numerous other possible configurations supported by Cisco. Cisco supports all mixing and population configurations of the Cisco DIMMs as long as the mixing does not violate the few fundamental rules noted in this document.

Table 7 Best-Recommended Memory Configurations for B200 M5, C220 M5 and C240 M5

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)		
96 GB	6x8 GB	-	6x8 GB	-	R	12
192 GB	6x8 GB	6x8 GB	6x8 GB	6x8 GB	R	24
192 GB	6x16 GB	-	6x16 GB	-	R	12
288 GB	6x16 GB	6x8 GB	6x16 GB	6x8 GB	R	24
384 GB	6x16 GB	6x16 GB	6x16 GB	6x16 GB	R	24
384 GB	6x32 GB	-	6x32 GB	-	R	12
384 GB	6x32 GB	-	6x32 GB	-	LR	12
480 GB	6x32 GB	6x8 GB	6x32 GB	6x8 GB	R	24
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	6x32 GB	6x32 GB	6x32 GB	6x32 GB	LR	24
768 GB	6x64 GB	-	6x64 GB	-	LR	12
768 GB	6x64 GB	-	6x64 GB	-	TSV-R	12

Table 7 Best-Recommended Memory Configurations for B200 M5, C220 M5 and C240 M5

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)		
1152 GB	6x64 GB	6x32 GB	6x64 GB	6x32 GB	LR	24
1536 GB	6x64 GB	6x64 GB	6x64 GB	6x64 GB	LR	24
1536 GB	6x64 GB	6x64 GB	6x64 GB	6x64 GB	TSV-R	24
1536 GB	6x128 GB	-	6x128 GB	-	TSV-R	12
2304 GB	6x128 GB	6x64 GB	6x128 GB	6x64 GB	TSV-R	24
3072 GB	6x128 GB	6x128 GB	6x128 GB	6x128 GB	TSV-R	24

Additional DIMM Populations

The list in [Table 8](#) is not a complete list of all supported DIMM populations, but highlights common configuration options.

Table 8 C220, C240, B200 M5 Supported DIMM Configurations

CPU 1 DIMMs	Total DIMMs for CPU 1	CPU 1 Capacity	CPU 2 DIMMs	Total DIMMs for CPU 2	CPU 2 Capacity	Total Capacity for 2 CPUs
1 x 8 GB*	1	8 GB	1 x 8 GB	1	8 GB	16 GB
2 x 8 GB*	2	16 GB	2 x 8 GB	2	16 GB	32 GB
1 x 16 GB	1	16 GB	1 x 16 GB	1	16 GB	32 GB
3 x 8 GB*	3	24 GB	3 x 8 GB	3	24 GB	48 GB
4 x 8 GB*	4	32 GB	4 x 8 GB	4	32 GB	64 GB
2 x 16 GB	2	32 GB	2 x 16 GB	2	32 GB	64 GB
1 x 32 GB	1	32 GB	1 x 32 GB	1	32 GB	64 GB
6 x 8 GB*	6	48 GB	6 x 8 GB	6	48 GB	96 GB
3 x 16 GB	3	48 GB	3 x 16 GB	3	48 GB	96 GB
8 x 8 GB*	8	64 GB	8 x 8 GB	8	64 GB	128 GB
4 x 16 GB	4	64 GB	4 x 16 GB	4	64 GB	128 GB
2 x 32 GB	2	64 GB	2 x 32 GB	2	64 GB	128 GB
1 x 64 GB	1	64GB	1 x 64 GB	1	64 GB	128 GB
3 x 32 GB	3	96 GB	3 x 32GB	3	96GB	192 GB
6 x 16 GB	6	96 GB	6 x 16 GB	6	96 GB	192 GB
12 x 8 GB*	12	96 GB	12 x 8 GB	12	96 GB	192 GB

Table 8 C220, C240, B200 M5 Supported DIMM Configurations

CPU 1 DIMMs	Total DIMMs for CPU 1	CPU 1 Capacity	CPU 2 DIMMs	Total DIMMs for CPU 2	CPU 2 Capacity	Total Capacity for 2 CPUs
8 x 16 GB	8	128 GB	8 x 16 GB	8	128 GB	256 GB
4 x 32 GB	4	128 GB	4 x 32 GB	4	128 GB	256 GB
2 x 64 GB	2	128 GB	2 x 64 GB	2	128 GB	256 GB
1 x 128 GB	1	128 GB	1 x 128 GB	1	128 GB	256 GB
6 x 32GB	6	192 GB	6 x 32 GB	6	192 GB	384 GB
12 x 16 GB	12	192 GB	12 x 16 GB	12	192 GB	384 GB
3 x 64 GB	3	192 GB	3 x 64 GB	3	192 GB	384 GB
8 x 32 GB	8	256 GB	8 x 32 GB	8	256 GB	512 GB
4 x 64GB	4	256 GB	4 x 64 GB	4	256 GB	512 GB
2 x 128 GB	2	256 GB	2 x 128 GB	2	256 GB	512 GB
12 x 32 GB	12	384 GB	12 x 32 GB	12	384 GB	768 GB
6 x 64 GB	6	384 GB	6 x 64 GB	6	384 GB	768 GB
3 x 128 GB	3	384 GB	3 x 128 GB	3	384 GB	768 GB
8 x 64 GB	8	512 GB	8 x 64 GB	8	512 GB	1024 GB
4 x 128 GB	4	512 GB	4 x 128 GB	4	512 GB	1024 GB
12 x 64 GB	12	768 GB	12 x 64 GB	12	768 GB	1536 GB
6 x 128 GB	6	768 GB	6 x 128 GB	6	768 GB	1536 GB
8 x 128 GB	8	1024 GB	8 x 128 GB	8	1024 GB	2048 GB
12 x 128 GB	12	1536 GB	12 x 128 GB	12	1536 GB	3072 GB

* 8 GB is for C220M5 and C240M5 servers only



NOTE: When possible, use the best recommended Memory Configurations listed in [Table 7](#).

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.

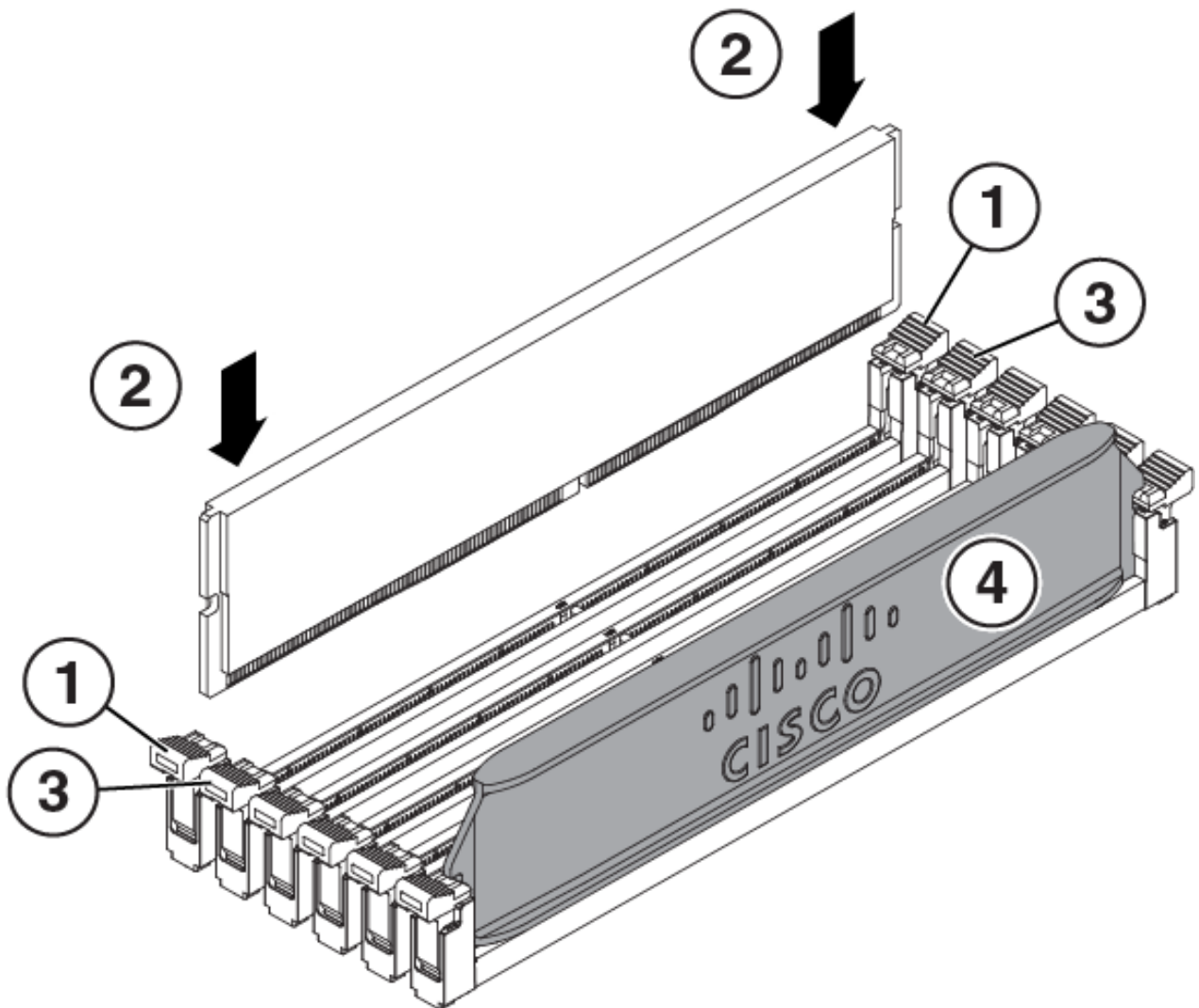
Step 2 Press evenly on both ends of the DIMM until it clicks into place in its slot

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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