

Technical Note

Summary of Common DRAM Module Form Factors

Introduction

Seamless memory upgrades and replacements have always been requirements for modern digital systems, and industry-standard memory modules have helped fulfill those requirements. Modules have enabled the integration of multiple DRAM components on a single PCB, creating an efficient and cost-effective means of implementing memory in a system. In addition, multiple form factors are available to accommodate the requirements of different systems.

This technical note provides a comparison of the most common module form factors, beginning with a summary of the module form factors in Table 1 on page 2. All the module form factors discussed in this technical note have been manufactured by Micron; however, some modules may not be in current production.

Mechanical Outlines

JEDEC specifies mechanical outlines (MOs) to provide an industry standard that can be used by any module manufacturer. These specifications can be accessed on the JEDEC Web site and are referenced by numbers. For example, the MO for DDR3 standard-length modules is MO-269.

MOs are referenced throughout this technical note and are organized by size. Dimensions provided represent only one variation of the JEDEC standard and are intended for general reference; they are not meant to be substitutes for the dimensions in JEDEC MOs.

Each MO specifies at least one alignment notch placed in a technology-specific location (see Figure 1 on page 3).¹ This prevents modules from being installed in nonsupported systems.

Notes: 1. The SDR module includes two alignment notches.

Table 1: Comparison of Module Form Factors

| Form Factor | Figure Ref. | H x W (mm) | Number of Pins | Voltage(s) | Buffered/Registered | Bus Width(s) | JEDEC MO Number |
|-----------------------------|-------------|------------------------|----------------|------------|--------------------------|--------------|---------------------|
| Standard DDR3 | Figure 1 | 30 x 133.35 | 240 | 1.5V/1.35V | Unbuffered or registered | x64/x72 | MO-269 |
| Standard DDR2 | Figure 2 | 30 x 133.35 | 240 | 1.8V/1.5V | Unbuffered or registered | x64/x72 | MO-237 |
| Standard DDR | Figure 3 | 30.48 x 133.35 | 184 | 2.5V/2.6V | Unbuffered or registered | x64/x72 | MO-206 |
| Standard SDR | Figure 4 | 25.4 to 43.18 x 133.35 | 168 | 3.3V | Unbuffered or registered | x64/x72 | MO-161 |
| DDR2 FBDIMM | Figure 5 | 30.48 x 133.35 | 240 | 1.8V/1.5V | Fully buffered | x72 | MO-256 |
| DDR3 Very Low-Profile (VLP) | Figure 6 | 18.75 x 133.35 | 240 | 1.5V/1.35V | Unbuffered or registered | x64/x72 | MO-269 |
| DDR3 VLPx | Figure 7 | 19.5 x 133.35 | 240 | 1.5V/1.35V | Unbuffered or registered | x64/x72 | MO-269 |
| DDR2 VLP | Figure 8 | 17.9 x 133.35 | 240 | 1.8V | Unbuffered or registered | x64/x72 | MO-237 (Height n/a) |
| DDR Low-Profile (LP) | Figure 9 | 28.58 x 133.35 | 184 | 2.5V | Unbuffered or registered | x64/x72 | MO-206 |
| DDR3 SODIMM | Figure 10 | 30 x 67.6 | 204 | 1.5V | Unbuffered | x64 | MO-268 |
| DDR2 SODIMM | Figure 11 | 30 x 67.6 | 200 | 1.8V | Unbuffered | x64 | MO-224 |
| DDR2 VLP SODIMM | Figure 12 | 17.9 x 67.6 | 200 | 1.8V | Registered | x72 | MO-224 (Height n/a) |
| DDR SODIMM | Figure 13 | 30 x 67.6 | 200 | 2.5V | Unbuffered | x64/x72 | MO-224 |
| SDR SODIMM | Figure 14 | 30 x 67.6 | 200 | 3.3V | Unbuffered or registered | x64/x72 | MO-190 |
| DDR2 Mini-DIMM | Figure 15 | 30 x 82 | 244 | 1.8V | Registered | x72 | MO-244 |
| DDR2 VLP Mini-DIMM | Figure 16 | 18.2 x 82 | 244 | 1.8V | Registered | x72 | MO-244 (Height n/a) |

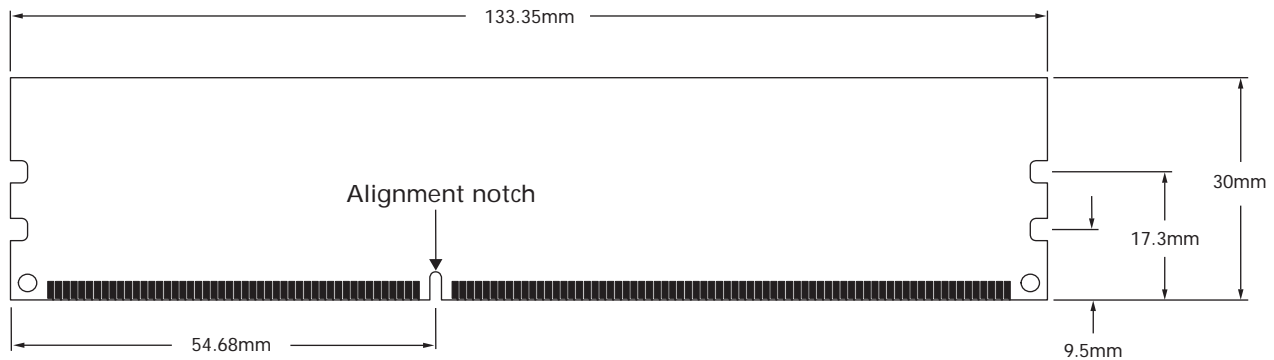
Standard-Length Modules

The standard-length module is the most commonly used module form factor. With a typical length of 133.35mm, these modules can accommodate the highest number of DRAM components. Standard-length modules exist for all memory technologies, and are typically the first modules designed after a new memory technology is developed.

Standard-length modules are available in different heights, with the early SDR modules having the greatest vertical dimensions. Because early systems typically had plenty of available space, managing height was not as critical as it has become for more recent designs.

Standard-length modules approximately 30mm high are used in applications where space is plentiful. Desktop PCs, servers, and workstations are not usually constrained by vertical space; thus, the 30mm height is easy to accommodate without restricting other mechanical variables such as airflow or chassis dimensions.

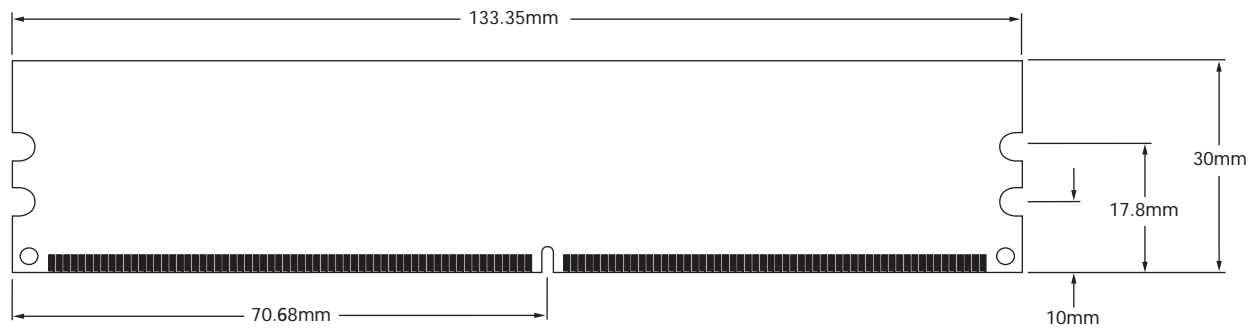
Figure 1: Standard DDR3 Module



Features

- 30mm x 133.35mm
- 240 pins
- 1.5V/1.35V
- Unbuffered or registered
- x64/x72
- MO-269

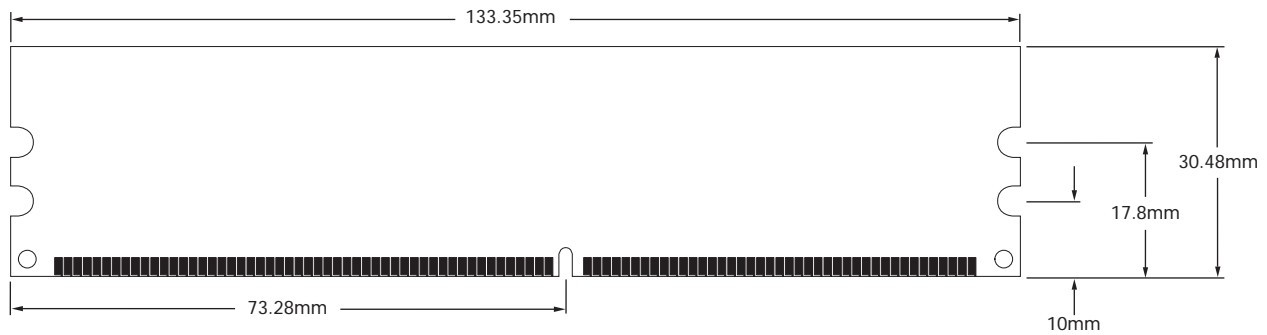
Figure 2: Standard DDR2 Module



Features

- 30mm x 133.35mm
- 240 pins
- 1.8V/1.5V
- Unbuffered or registered
- x64/x72
- MO-237

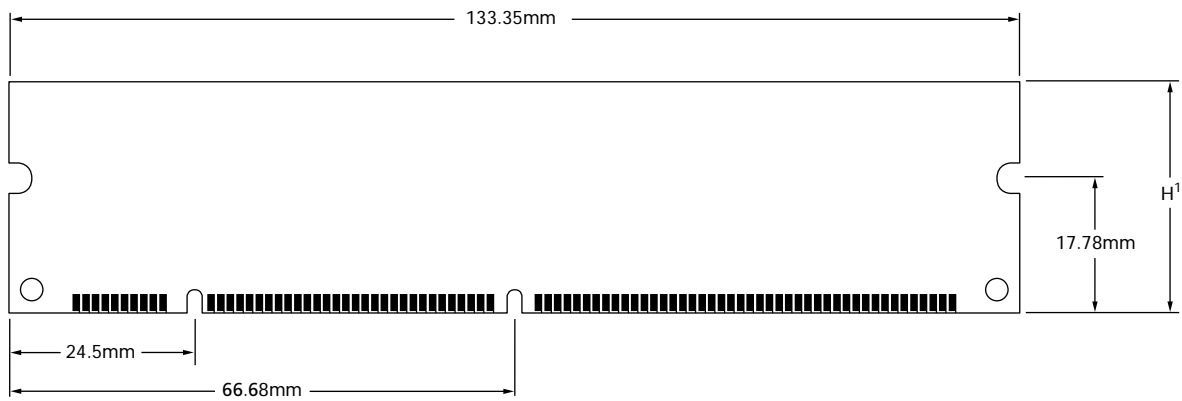
Figure 3: Standard DDR Module



Features

- 30.48mm x 133.35mm
- 184 pins
- 2.5V/2.6V
- Unbuffered or registered
- x64/x72
- MO-206

Figure 4: Standard SDR Module

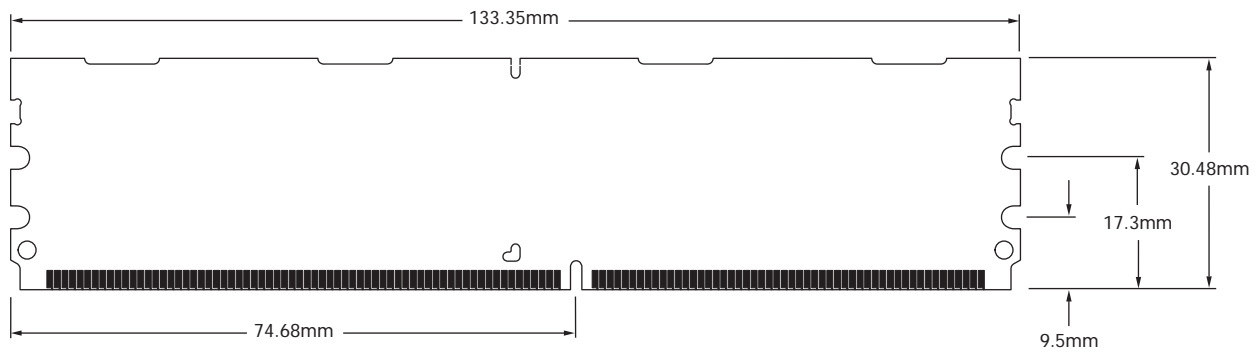


Features

- H¹ x 133.35mm
- 168 pins
- 3.3V
- Unbuffered or registered
- x64/x72
- MO-161

Notes: 1. Height varies between 25.4mm and 43.18mm; refer to data sheet for specific heights offered.

Figure 5: DDR2 FBDIMM



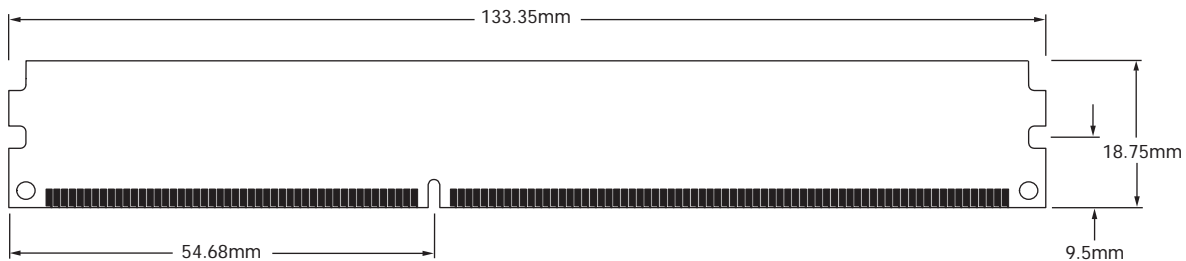
Features

- 30.48mm x 133.35mm
- 240 pins
- 1.8V/1.5V
- Fully buffered
- x72
- MO-256

Standard-Length LP Modules

Some systems require a lower vertical height to meet space requirements within a system. Blade servers, computer network hardware, and rack-mounted telecommunications equipment are examples of systems where space constraints require a low-profile (LP) or very low-profile (VLP) module.

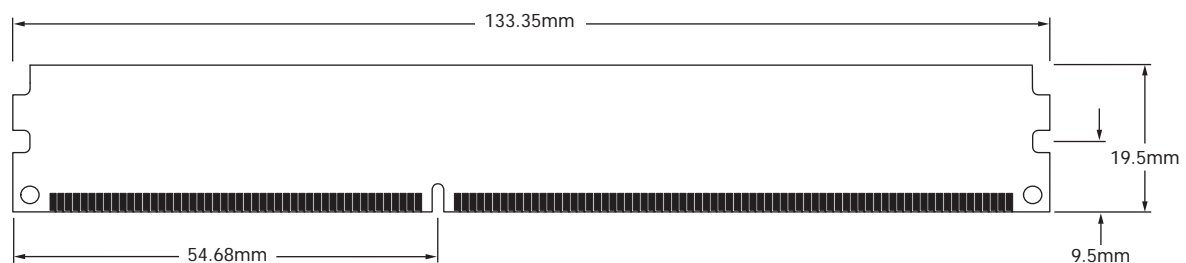
Figure 6: DDR3 VLP Module



Features

- 18.75mm x 133.35mm
- 240 pins
- 1.5V/1.35V
- Unbuffered or registered
- x64/x72
- MO-269

Figure 7: DDR3 VLPx Module

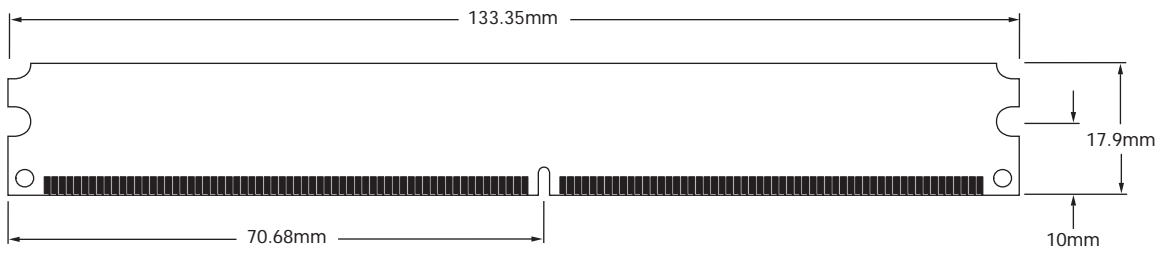


The VLPx module is a custom-height module used for 2Gb DRAM devices. This Micron design is used as an interim solution for specific customers. It is a JEDEC-compliant design, although this height is not specified in JEDEC MO-269.

Features

- 19.5mm x 133.35mm
- 240 pins
- 1.5V/1.35V
- Unbuffered or registered
- x64/x72
- MO-269

Figure 8: DDR2 VLP Module

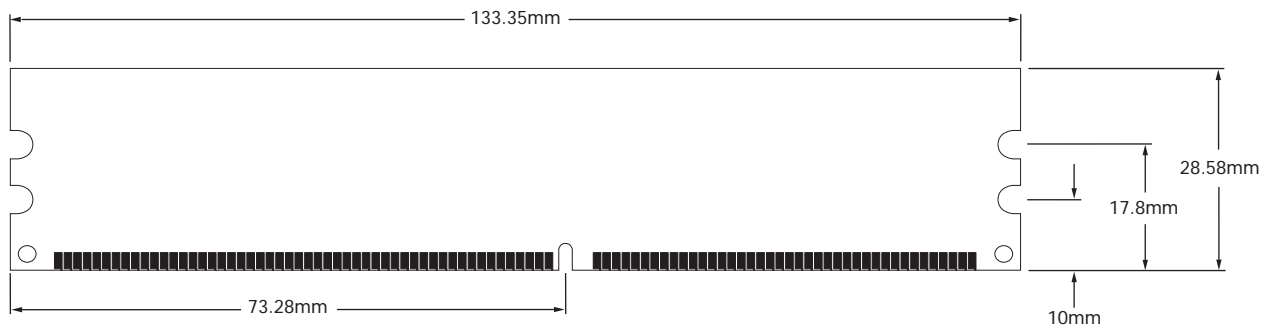


The lowest profile DDR2 module design is 17.9mm high. This module is designed for telecommunications equipment that use a low-profile ATCA-compliant chassis.

Features

- 17.9mm x 133.35mm
- 240 pins
- 1.8V
- Unbuffered or registered
- x64/x72
- MO-237 (Height not applicable)

Figure 9: DDR LP Module



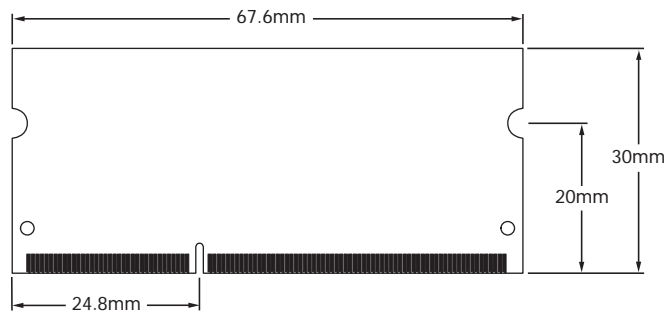
Features

- 28.58mm x 133.35mm
- 184 pins
- 2.5V
- Unbuffered or registered
- x64/x72
- MO-206

SODIMMs

SODIMMs were designed to fit into notebook PCs and other small systems. Note that the SODIMM's size can restrict the maximum density of the module compared to full-length modules.

Figure 10: DDR3 SODIMM

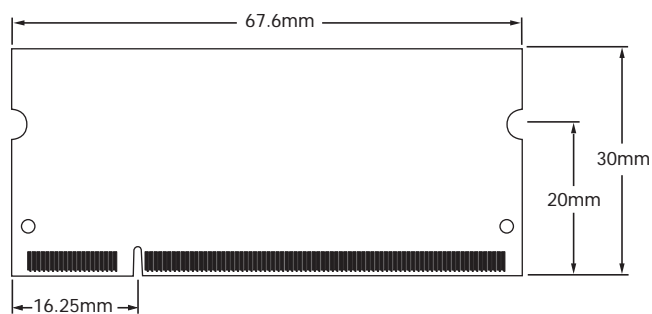


DDR3 SODIMMs have the same 30mm height as standard modules.

Features

- 30mm x 67.6mm
- 204 pins
- 1.5V
- Unbuffered
- x64
- MO-268

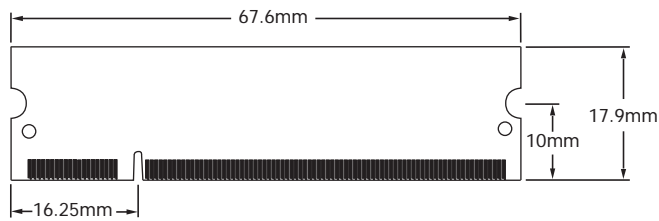
Figure 11: DDR2 SODIMM



Features

- 30mm x 67.6mm
- 200 pins
- 1.8V
- Unbuffered
- x64
- MO-224

Figure 12: DDR2 VLP SORDIMM

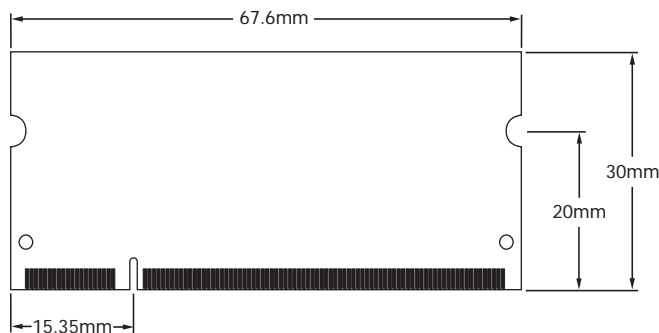


The DDR2 VLP SORDIMM was designed primarily for use in networking hardware such as routers and switches. Its low 17.9mm height is compatible with the ATCA specification for telecommunications and networking equipment.

Features

- 17.9mm x 67.6mm
- 200 pins
- 1.8V
- Registered
- x72
- MO-224 (Height not applicable)

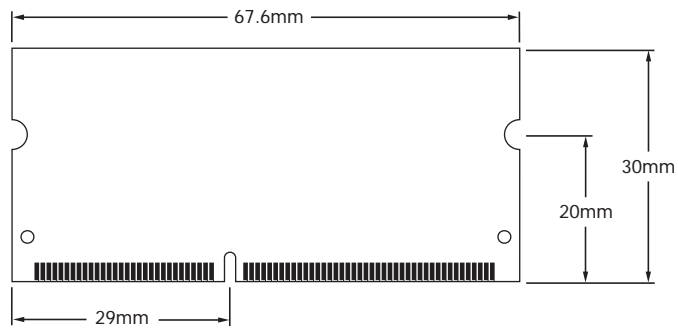
Figure 13: DDR SODIMM



Features

- 30mm x 67.6mm
- 200 pins
- 2.5V
- Unbuffered
- x64/x72
- MO-224

Figure 14: SDR SODIMM



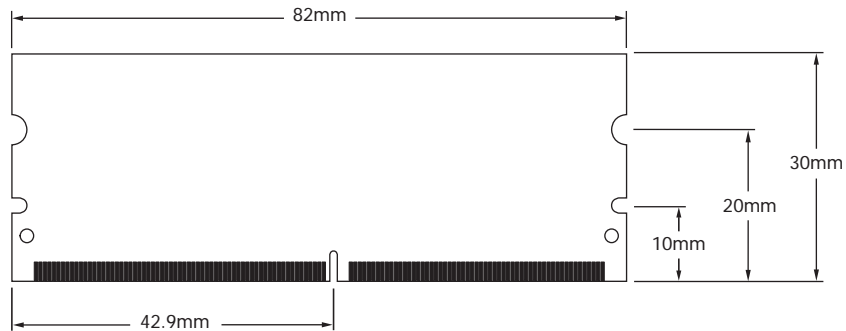
Features

- 30mm x 67.6mm
- 200 pins
- 3.3V
- Unbuffered or registered
- x64/x72
- MO-190

Mini-DIMMs

The Mini-DIMM form factor was developed to accommodate a register and a PLL in a small form factor. The pin count is maintained by decreasing pin width providing space for the additional signal lines required to buffer the clock, command, address, and control lines.

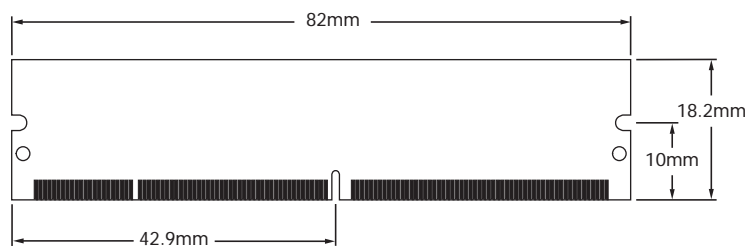
Figure 15: DDR2 Mini-DIMM



Features

- 30mm x 82mm
- 244 pins
- 1.8V
- Registered
- x72
- MO-244

Figure 16: DDR2 VLP Mini-DIMM



The DDR2 VLP Mini-DIMM was designed for small systems requiring registered modules.

Features

- 18.2mm x 82mm
- 244 pins
- 1.8V
- Registered
- x72
- MO-244 (Height not applicable)

8000 S. Federal Way, P.O. Box 6, Boise, ID 83707-0006, Tel: 208-368-3900
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Revision History

| | |
|---|--------------|
| Rev. B | 09/09 |
| <ul style="list-style-type: none">• Corrected reference to MO-274 on DDR2 SODIMMs. Should have been MO-224• Figure 1: "Standard DDR3 Module," on page 3: Added alignment notch | |
| Rev. A | 11/08 |
| <ul style="list-style-type: none">• Initial release | |