

# S72WS-N Based MCP/PoP Products

1.8 Volt-only x16 Flash Memory and SDRAM on Split Bus  
256/512 Mb Simultaneous Read/Write, Burst Mode Flash Memory  
512 Mb NAND Flash  
1024 Mb NAND Interface ORNAND Flash Memory on Bus 1  
512/256/128 Mb (8M/4M/2M x 16-bit x 4 Banks) Mobile SDRAM on  
Bus 2



*Data Sheet (Advance Information)*

---

**Notice to Readers:** This document states the current technical specifications regarding the Spansion product(s) described herein. Each product described herein may be designated as Advance Information, Preliminary, or Full Production. See [Notice On Data Sheet Designations](#) for definitions.

## Notice On Data Sheet Designations

SpanSion Inc. issues data sheets with Advance Information or Preliminary designations to advise readers of product information or intended specifications throughout the product life cycle, including development, qualification, initial production, and full production. In all cases, however, readers are encouraged to verify that they have the latest information before finalizing their design. The following descriptions of SpanSion data sheet designations are presented here to highlight their presence and definitions.

### Advance Information

The Advance Information designation indicates that SpanSion Inc. is developing one or more specific products, but has not committed any design to production. Information presented in a document with this designation is likely to change, and in some cases, development on the product may discontinue. SpanSion Inc. therefore places the following conditions upon Advance Information content:

"This document contains information on one or more products under development at SpanSion Inc. The information is intended to help you evaluate this product. Do not design in this product without contacting the factory. SpanSion Inc. reserves the right to change or discontinue work on this proposed product without notice."

### Preliminary

The Preliminary designation indicates that the product development has progressed such that a commitment to production has taken place. This designation covers several aspects of the product life cycle, including product qualification, initial production, and the subsequent phases in the manufacturing process that occur before full production is achieved. Changes to the technical specifications presented in a Preliminary document should be expected while keeping these aspects of production under consideration. SpanSion places the following conditions upon Preliminary content:

"This document states the current technical specifications regarding the SpanSion product(s) described herein. The Preliminary status of this document indicates that product qualification has been completed, and that initial production has begun. Due to the phases of the manufacturing process that require maintaining efficiency and quality, this document may be revised by subsequent versions or modifications due to changes in technical specifications."

### Combination

Some data sheets contain a combination of products with different designations (Advance Information, Preliminary, or Full Production). This type of document distinguishes these products and their designations wherever necessary, typically on the first page, the ordering information page, and pages with the DC Characteristics table and the AC Erase and Program table (in the table notes). The disclaimer on the first page refers the reader to the notice on this page.

### Full Production (No Designation on Document)

When a product has been in production for a period of time such that no changes or only nominal changes are expected, the Preliminary designation is removed from the data sheet. Nominal changes may include those affecting the number of ordering part numbers available, such as the addition or deletion of a speed option, temperature range, package type, or  $V_{IO}$  range. Changes may also include those needed to clarify a description or to correct a typographical error or incorrect specification. SpanSion Inc. applies the following conditions to documents in this category:

"This document states the current technical specifications regarding the SpanSion product(s) described herein. SpanSion Inc. deems the products to have been in sufficient production volume such that subsequent versions of this document are not expected to change. However, typographical or specification corrections, or modifications to the valid combinations offered may occur."

Questions regarding these document designations may be directed to your local sales office.

# S72WS-N Based MCP/PoP Products

1.8 Volt-only x16 Flash Memory and SDRAM on Split Bus  
256/512 Mb Simultaneous Read/Write, Burst Mode Flash Memory  
512 Mb NAND Flash  
1024 Mb NAND Interface ORNAND Flash Memory on Bus 1  
512/256/128 Mb (8M/4M/2M x 16-bit x 4 Banks) Mobile SDRAM on Bus 2



*Data Sheet (Advance Information)*

## Features

- Power supply voltage of 1.7 to 1.95V

### High Performance

- Flash access time: 80 ns for NOR Flash, 25 ns for ORNAND Flash
- Flash burst frequencies: 54 MHz, 66MHz, 80MHz
- Mobile SDRAM burst frequency: 104 MHz, 133 MHz (DDR)

### Package:

- 9.0 x 12.0 mm MCP BGA
- 11.0 x 13.0 mm MCP BGA
- 15.0 x 15.0 x 1.2 mm MCP Package-on-Package (PoP)

### Operating Temperature

- -25°C to +85°C (wireless)

## General Description

The S72WS series is a product line of stacked Multi-Chip Product (MCP) packages and consists of:

- One or two NOR flash memory dies
- One NAND Interface ORNAND die
- Separate bus for one or more Mobile SDRAM die

The products covered by this document are listed in the table below.

| Device      | NOR Flash Density |       |       | NAND Flash Density |       | SDRAM Density |       |       |
|-------------|-------------------|-------|-------|--------------------|-------|---------------|-------|-------|
|             | 512Mb             | 256Mb | 128Mb | 1024Mb             | 512Mb | 512Mb         | 256Mb | 128Mb |
| S72WS256ND0 |                   | X     |       |                    |       |               |       | X     |
| S72WS256NDE | X                 |       |       |                    |       |               |       | X     |
| S72WS256NEE | X                 |       |       |                    |       |               | X     |       |
| S72WS512NFG | X                 |       |       | X                  |       | X             |       |       |
| S72WS512NEG | X                 |       |       | X                  |       |               | X     |       |
| S72WS512NEF | X                 |       |       |                    | X     |               | X     |       |
| S72WS512NFF | X                 |       |       |                    | X     | X             |       |       |

### Note

For a list of PoP OPNs, please contact the local sales representative or refer to the valid combinations tables.

For detailed specifications, please refer to the individual data sheets.

| Document                      | Publication Identification Number (PID) |
|-------------------------------|-----------------------------------------|
| S29WS256N                     | S29WS-N_00                              |
| S30MS01GP/512P                | S30MS-P_00                              |
| 128 Mb Mobile SDRAM Type 1    | SDRAM_01                                |
| 128 Mb Mobile SDRAM Type 2    | SDRAM_05                                |
| 128 Mb Mobile DDR-DRAM Type 5 | SDRAM_07                                |
| 256 Mb Mobile SDRAM Type 2    | SDRAM_05                                |
| 512 Mb Mobile DDR-DRAM Type 1 | SDRAM_09                                |
| 512 Mb Mobile SDRAM Type 4    | SDRAM_06                                |
| 512 Mb NAND Type 1            | NAND_01                                 |
| 512 Mb Mobile DDR-DRAM Type 5 | DRAM_04                                 |
| 512 Mb Mobile DDR-DRAM Type 2 | DRAM_05                                 |

Publication Number S72WS-N\_00      Revision A      Amendment 9      Issue Date May 8, 2007

This document contains information on one or more products under development at Spansion Inc. The information is intended to help you evaluate this product. Do not design in this product without contacting the factory. Spansion Inc. reserves the right to change or discontinue work on this proposed product without notice.

## Table of Contents

|                                                                                    |    |
|------------------------------------------------------------------------------------|----|
| <b>Features</b>                                                                    | 3  |
| <b>General Description</b>                                                         | 3  |
| <b>1. Product Selector Guide</b>                                                   | 5  |
| 1.1 NOR Flash + DRAM Products                                                      | 5  |
| 1.2 NOR Flash + ORNAND Flash + DRAM Products                                       | 6  |
| <b>2. MCP Block Diagram</b>                                                        | 7  |
| 2.1 NOR Flash + ORNAND Flash + DRAM Products                                       | 7  |
| <b>3. Connection Diagram</b>                                                       | 8  |
| 3.1 2 x 256Mb NOR Flash with 256Mb SDRAM                                           | 8  |
| 3.2 2 x 256Mb NOR Flash with 128Mb SDRAM                                           | 9  |
| 3.3 256Mb NOR Flash with 128Mb SDR/DDR-DRAM                                        | 10 |
| 3.4 512 Mb NOR Flash with 1024-Mb ORNAND on Bus 1 and 512 or 256-Mb SDRAM on Bus 2 | 11 |
| 3.5 512Mb NOR Flash with 1024-Mb ORNAND on Bus 1 and 512 or 256 Mb SDRAM on Bus 2  | 12 |
| 3.6 512Mb NOR Flash with 512-Mb NAND on Bus 1 and 512-Mb SDRAM on Bus 2            | 13 |
| 3.7 Lookahead Diagram on Split Bus                                                 | 15 |
| 3.8 NOR Flash and DRAM Input/Output Descriptions                                   | 16 |
| <b>4. Ordering Information</b>                                                     | 17 |
| 4.1 Valid Combinations                                                             | 17 |
| <b>5. Physical Dimensions</b>                                                      | 20 |
| <b>6. Revision History</b>                                                         | 27 |

## 1. Product Selector Guide

### 1.1 NOR Flash + DRAM Products

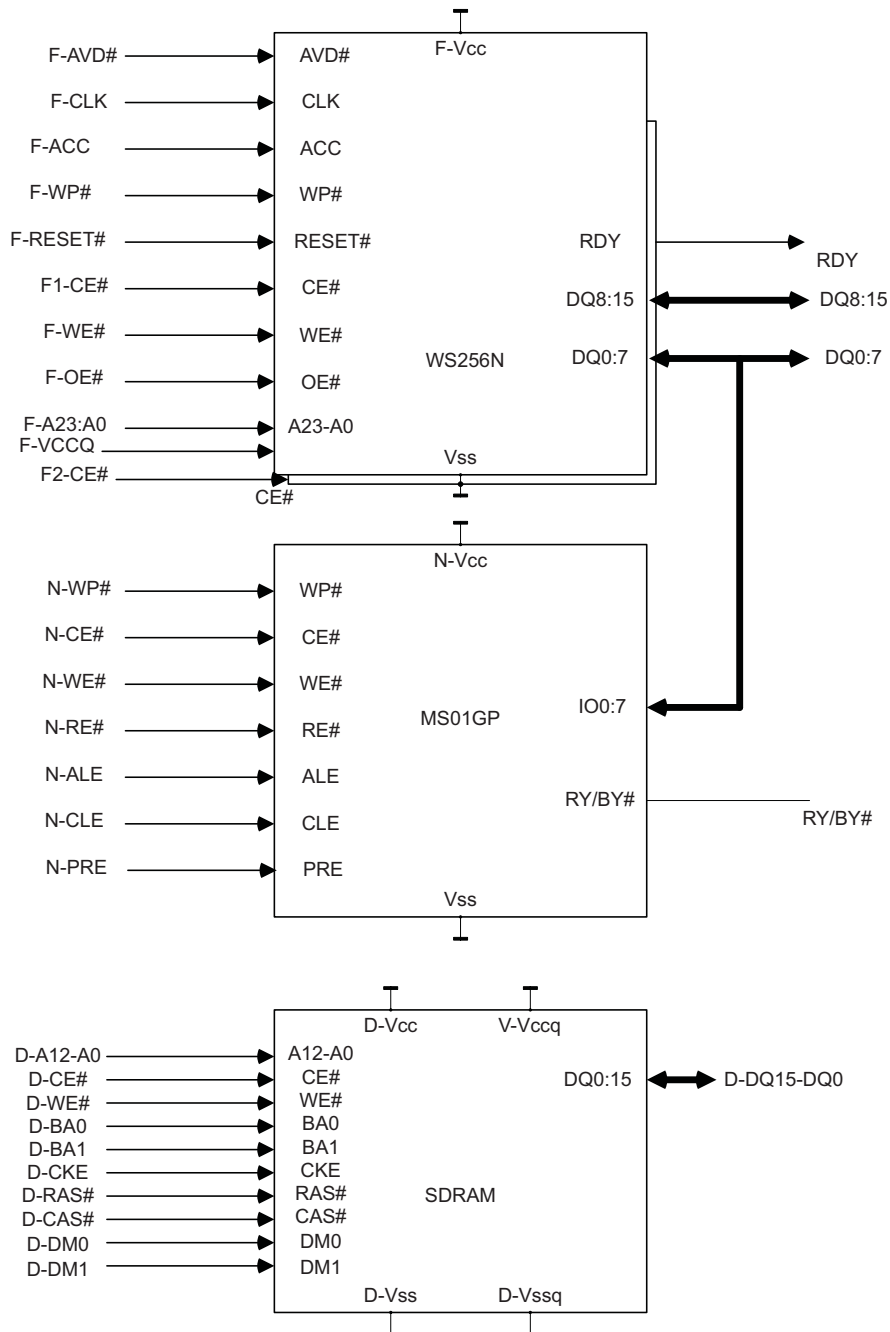
| Device-Model#    | Flash Density (Code) | Flash Density (Data) | Burst Speed (MHz) | SDRAM Density | SDRAM burst Speed (MHz) | DRAM Supplier | DYB                | Package    |
|------------------|----------------------|----------------------|-------------------|---------------|-------------------------|---------------|--------------------|------------|
| S72WS256ND0BAWB7 | 256 Mb               | —                    | 54 MHz            | 128           | 104 MHz                 | 1             | sector unprotected | 9x12x1.2   |
| S72WS256ND0BAWB8 |                      |                      |                   |               |                         | 2             |                    |            |
| S72WS256NDEBAWU7 | 256 Mb               | 256 Mb               | 54 MHz            | 128           | 104 MHz                 | 1             | sector unprotected | 9x12x1.4   |
| S72WS256NDEBAWUB |                      |                      |                   | 256           |                         | 2             |                    |            |
| S72WS256NEEBAWU7 |                      |                      |                   |               |                         | 1             |                    |            |
| S72WS256NEEBAWUB |                      |                      |                   |               |                         | 2             |                    |            |
| S72WS256ND0BFWB7 | 256 Mb               | —                    | 54 MHz            | 128           | 104 MHz                 | 1             | sector unprotected | 9x12x1.2   |
| S72WS256ND0BFWB8 |                      |                      |                   |               |                         | 2             |                    |            |
| S72WS256NDEBFWU7 | 256 Mb               | 256 Mb               | 54 MHz            | 128           | 104 MHz                 | 1             | sector unprotected | 9x12x1.4   |
| S72WS256NDEBFWUB |                      |                      |                   | 256           |                         | 2             |                    |            |
| S72WS256NEEBFWU7 |                      |                      |                   |               |                         | 1             |                    |            |
| S72WS256NEEBFWUB |                      |                      |                   |               |                         | 2             |                    |            |
| S72WS256ND0KFWD3 | 256 Mb               |                      | 66 MHz            | 128           | 133 MHz (DDR)           | 5             | sector unprotected | 15x15x1.25 |
| S72WS256ND0BFW93 |                      |                      |                   |               | 133 MHz (DDR)           |               | sector unprotected | 9x12x1.2   |

## 1.2 NOR Flash + ORNAND Flash + DRAM Products

| Device-Model#    | NOR Flash Density | ORNAND Flash Density | SDRAM Density | Flash Speed | DRAM Speed    | Supplier    | ORNAND Bus Width | ECC required? | Package       |             |  |  |  |
|------------------|-------------------|----------------------|---------------|-------------|---------------|-------------|------------------|---------------|---------------|-------------|--|--|--|
| S72WS512NFFBFWZ2 | 512 Mb            | 512 Mb (NAND)        |               | 66 MHz      | 133 MHz (DDR) | DRAM Type 1 | X16              | Yes           | 11x13x1.4 mm  |             |  |  |  |
| S72WS512NFFBFWZJ |                   |                      |               |             |               | DRAM Type 5 |                  |               |               |             |  |  |  |
| S72WS512NFG-L7   |                   | 1024Mb               | 512 Mb        | 54 MHz      | 104 MHz       | DRAM Type 4 | X8               | No            | 11x13x1.4 mm  |             |  |  |  |
| S72WS512NFG-L6   |                   |                      |               | 66 MHz      |               |             |                  |               |               |             |  |  |  |
| S72WS512NFG-L5   |                   |                      |               | 80 MHz      |               |             |                  |               |               |             |  |  |  |
| S72WS512NFG-47   |                   |                      |               | 54 MHz      |               |             |                  |               |               |             |  |  |  |
| S72WS512NFG-46   |                   |                      |               | 66 MHz      |               | DRAM Type 2 | X16              |               |               |             |  |  |  |
| S72WS512NFG-45   |                   |                      |               | 80 MHz      |               |             |                  |               |               |             |  |  |  |
| S72WS512NFG-LZ   |                   |                      |               | 54 MHz      |               |             |                  |               |               |             |  |  |  |
| S72WS512NFG-LY   |                   |                      |               | 66 MHz      |               |             |                  |               |               |             |  |  |  |
| S72WS512NFG-LW   |                   |                      |               | 80 MHz      |               |             |                  |               |               |             |  |  |  |
| S72WS512NFG-4Z   |                   |                      |               | 54 MHz      |               |             | X8               |               |               |             |  |  |  |
| S72WS512NFG-4Y   |                   |                      |               | 66 MHz      |               | DRAM Type 4 |                  | Yes           |               |             |  |  |  |
| S72WS512NFG-4W   |                   |                      |               | 80 MHz      |               |             |                  |               |               |             |  |  |  |
| S72WS512NFG-N7   |                   |                      |               | 54 MHz      |               | X16         |                  |               |               |             |  |  |  |
| S72WS512NFG-N6   |                   |                      |               | 66 MHz      |               |             |                  |               |               |             |  |  |  |
| S72WS512NFG-N5   |                   |                      |               | 80 MHz      |               |             |                  |               |               |             |  |  |  |
| S72WS512NFG-67   |                   |                      |               | 54 MHz      |               | X8          |                  |               |               |             |  |  |  |
| S72WS512NFG-66   |                   |                      |               | 66 MHz      |               | DRAM Type 2 |                  | No            |               |             |  |  |  |
| S72WS512NFG-65   |                   |                      |               | 80 MHz      |               |             |                  |               |               |             |  |  |  |
| S72WS512NFG-NZ   |                   |                      |               | 54 MHz      |               | X16         |                  |               |               |             |  |  |  |
| S72WS512NFG-NY   |                   |                      |               | 66 MHz      |               |             |                  |               |               |             |  |  |  |
| S72WS512NFG-NW   |                   |                      |               | 80 MHz      |               |             |                  |               |               |             |  |  |  |
| S72WS512NFG-6Z   |                   |                      |               | 54 MHz      |               | X8          |                  |               |               |             |  |  |  |
| S72WS512NFG-6Y   |                   |                      |               | 66 MHz      |               | DRAM Type 4 |                  | Yes           |               |             |  |  |  |
| S72WS512NFG-6W   |                   |                      |               | 80 MHz      |               |             |                  |               |               |             |  |  |  |
| S72WS512NEG-LZ   |                   |                      |               | 256 Mb      |               | 54 MHz      | X16              |               |               |             |  |  |  |
| S72WS512NEG-LY   |                   |                      |               |             |               | 66 MHz      | No               |               |               |             |  |  |  |
| S72WS512NEG-LW   |                   |                      |               |             |               | 80 MHz      |                  |               |               | DRAM Type 2 |  |  |  |
| S72WS512NEG-4Z   |                   |                      |               |             |               | 54 MHz      |                  |               |               | X8          |  |  |  |
| S72WS512NEG-4Y   |                   |                      |               |             |               | 66 MHz      |                  |               |               |             |  |  |  |
| S72WS512NEG-4W   |                   |                      |               |             |               | 80 MHz      |                  |               |               | X16         |  |  |  |
| S72WS512NEG-NZ   |                   |                      |               |             |               | 54 MHz      | Yes              |               |               |             |  |  |  |
| S72WS512NEG-NY   |                   |                      |               |             |               | 66 MHz      |                  |               |               | DRAM Type 2 |  |  |  |
| S72WS512NEG-NW   |                   |                      | 80 MHz        |             |               | X8          |                  |               |               |             |  |  |  |
| S72WS512NEG-6Z   |                   |                      | 54 MHz        |             |               |             |                  |               |               |             |  |  |  |
| S72WS512NEG-6Y   |                   |                      | 66 MHz        |             |               |             |                  |               |               |             |  |  |  |
| S72WS512NEG-6W   |                   |                      | 80 MHz        |             |               |             |                  |               |               |             |  |  |  |
| S72WS512NEFKFWHJ | 512 Mb            | 512 Mb (NAND)        | 256 Mb        | 66 MHz      | 133 MHz (DDR) | DRAM Type2  | x16              | Yes           | 15x15x1.25 mm |             |  |  |  |
| S72WS512NFFKFWZ2 |                   |                      | 512 Mb        |             |               | DRAM Type 1 |                  |               | 15x15x1.25 mm |             |  |  |  |
| S72WS512NFFKFWZJ |                   |                      |               |             |               | DRAM Type 5 |                  |               | 15x15x1.25 mm |             |  |  |  |

## 2. MCP Block Diagram

### 2.1 NOR Flash + ORNAND Flash + DRAM Products



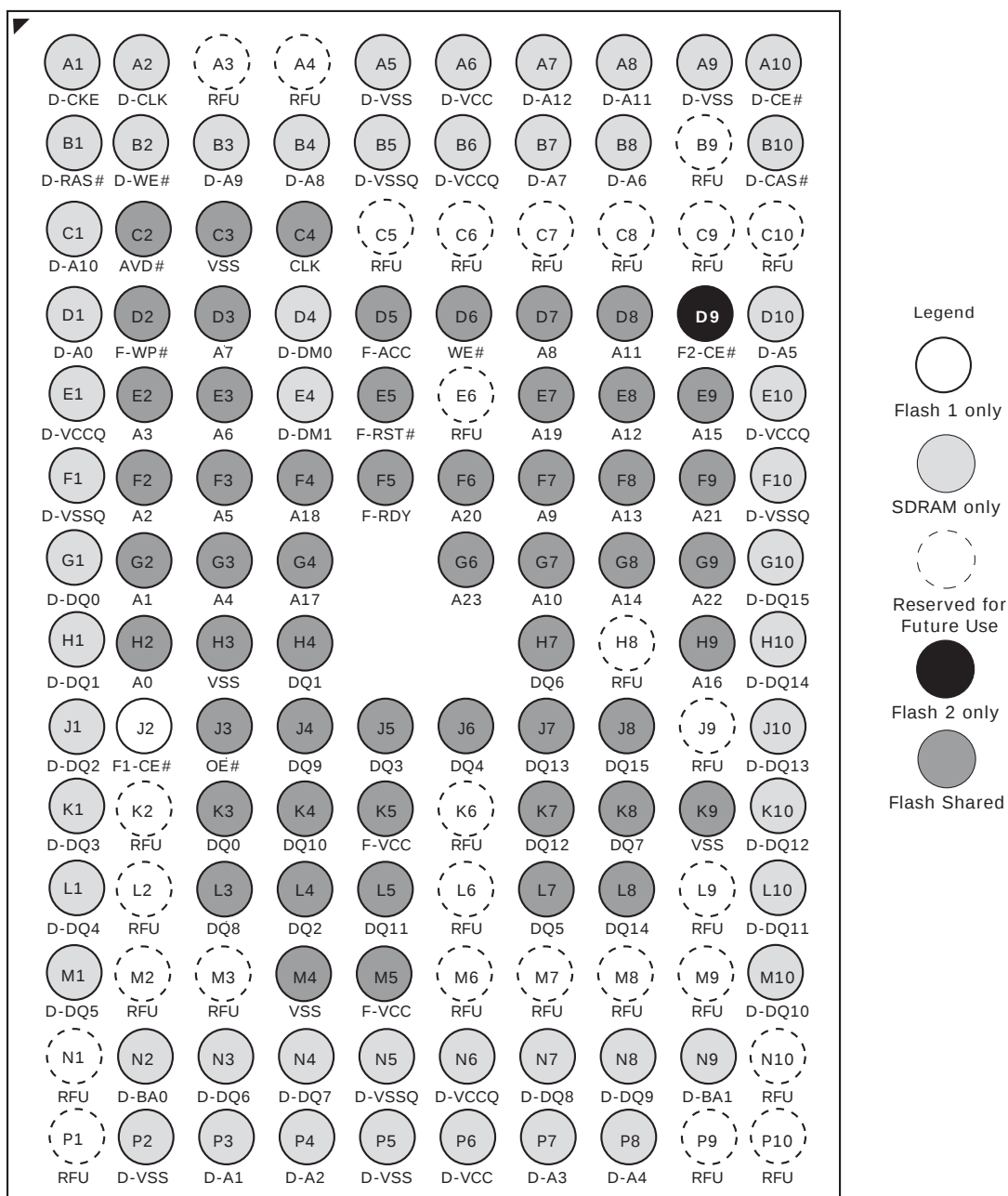
#### Notes

- For a one-Flash configuration, F1-CE# = CE#.  
For a two-Flash configuration, F1-CE# = CE for Flash 1 and F2-CE# = CE for Flash 2; F2-CE# is the chip-enable pin for the second Flash.
- If ORNAND is not present in the MCP, then the MS01GP block will not be present in the figure above. In that case, the common signals go only to the WS256N flash, while the SDRAM signals remain unchanged.
- If ORNAND supports a x16 bus, then NOR DQ0-DQ15 is shared with ORNAND I/O0-I/O15.

### 3. Connection Diagram

#### 3.1 2 x 256Mb NOR Flash with 256Mb SDRAM

137-ball Fine-Pitch Ball Grid Array  
(Top View, Balls Facing Down)

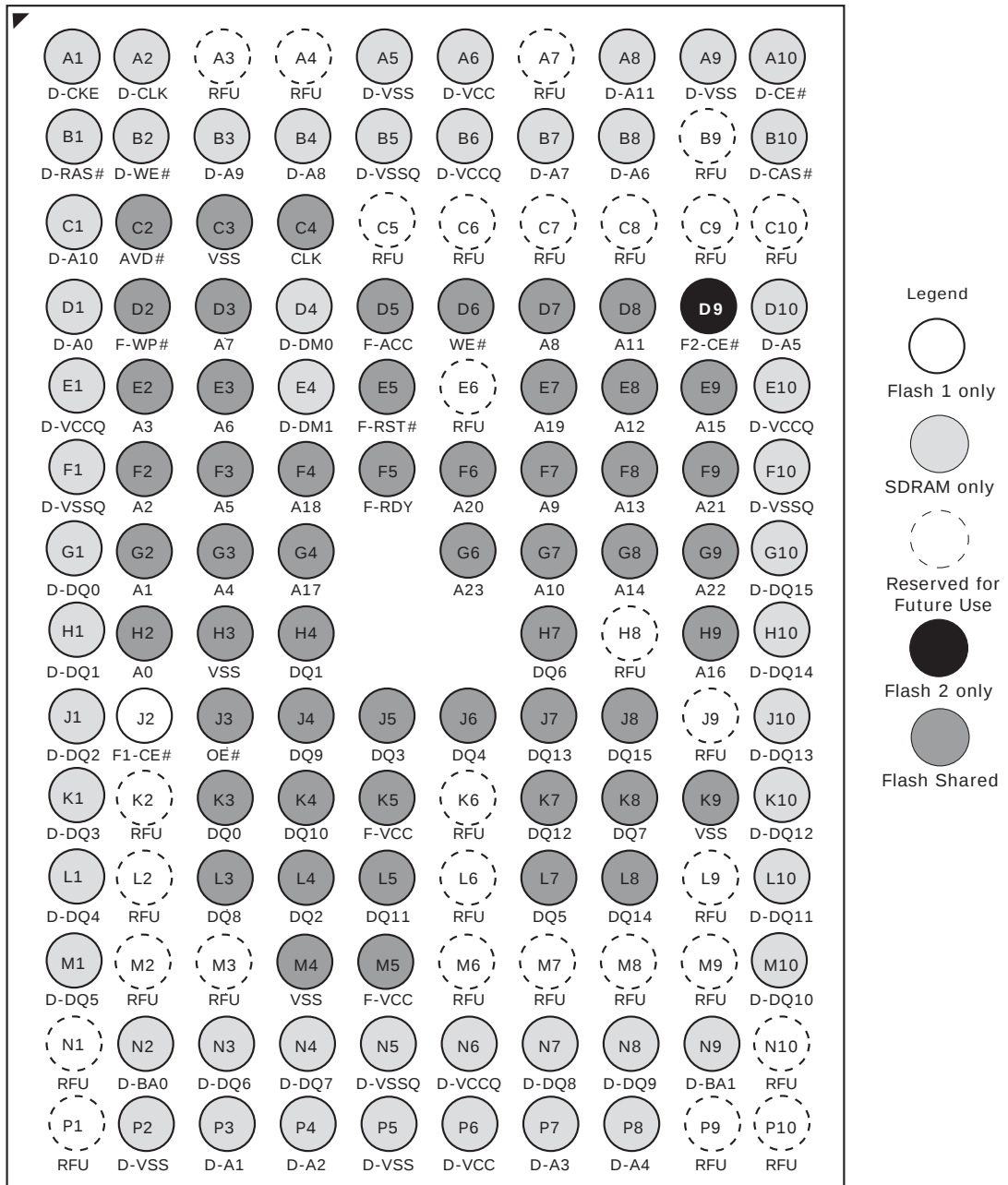


**Note**

M8 is RFU for SDR-DRAM and F-VCCQ for DDR-DRAM, as indicated in subsequent connection diagrams.

### 3.2 2 x 256Mb NOR Flash with 128Mb SDRAM

**137-ball Fine-Pitch Ball Grid Array**  
(Top View, Balls Facing Down)

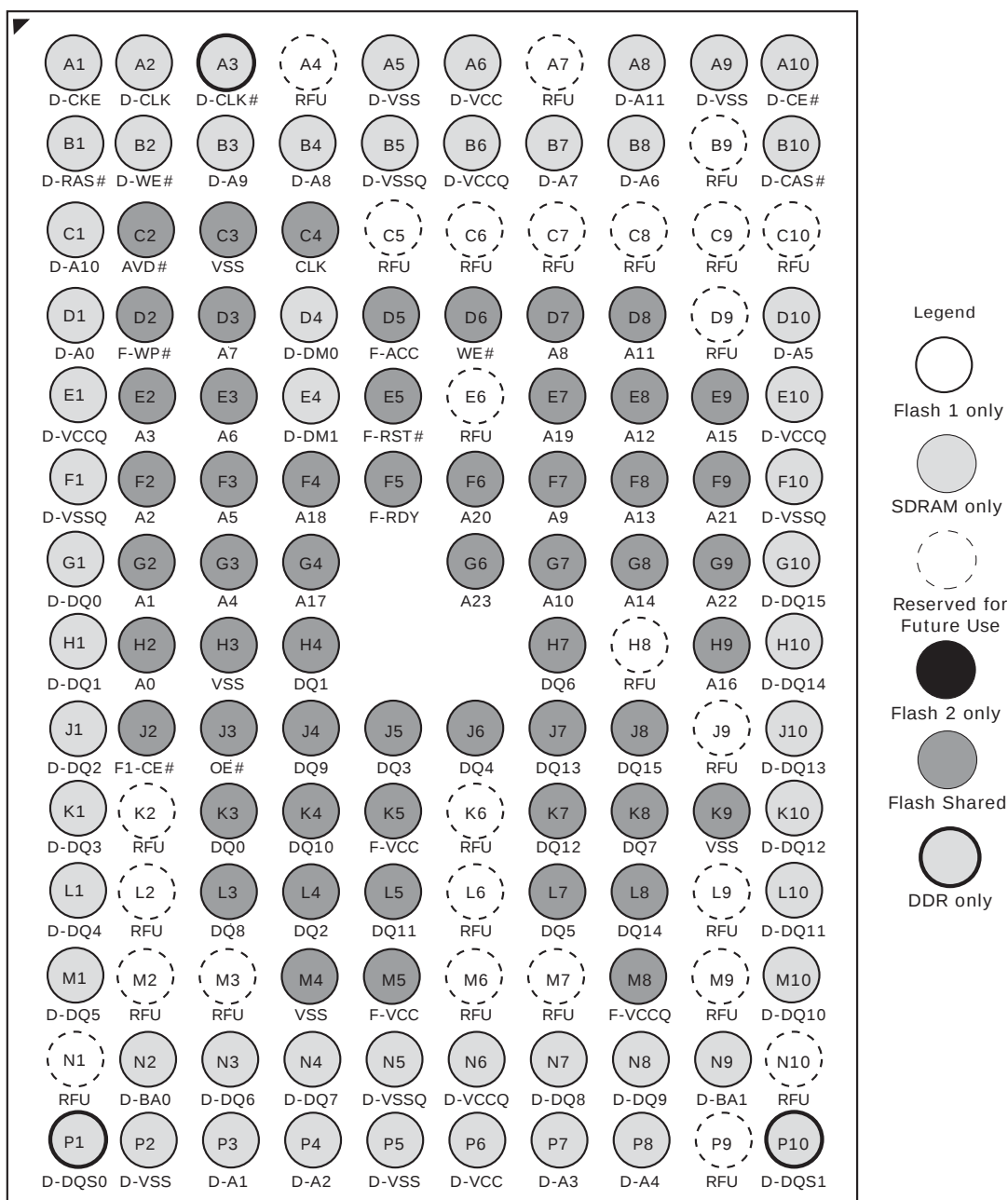


**Note**

M8 is RFU for SDR-DRAM and F-VCCQ for DDR-DRAM, as indicated in subsequent connection diagrams.

### 3.3 256Mb NOR Flash with 128Mb SDR/DDR-DRAM

137-ball Fine-Pitch Ball Grid Array  
(Top View, Balls Facing Down)



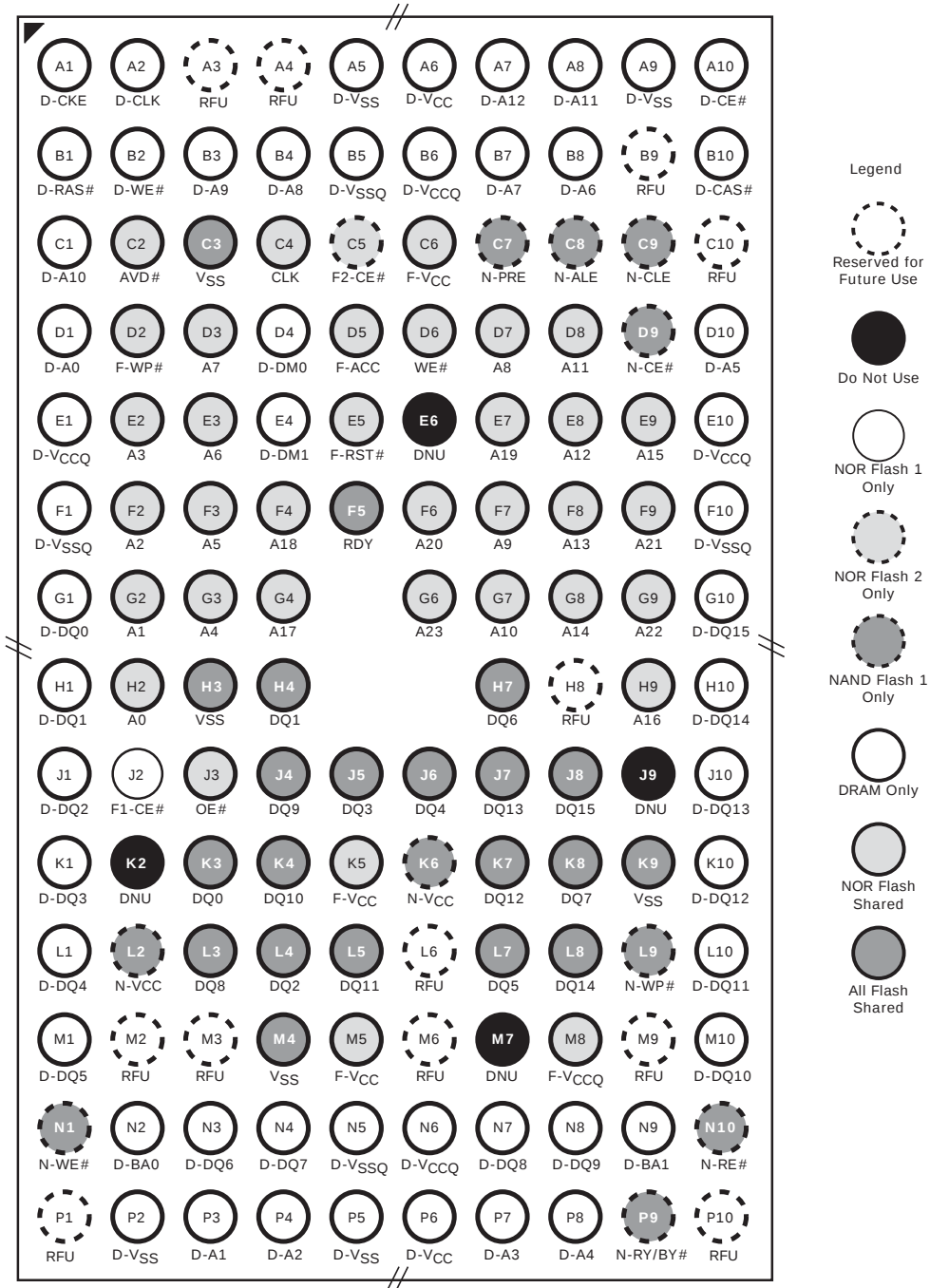
**Note**

DDR-only signals are RFUs in the case of the SDR-DRAM based MCPs.

### 3.4 512 Mb NOR Flash with 1024-Mb ORNAND on Bus 1 and 512 or 256-Mb SDRAM on Bus 2

#### 3.4.1 x16 ORNAND-based MCP

137-ball Fine-Pitch Ball Grid Array  
(Top View, Balls Facing Down)



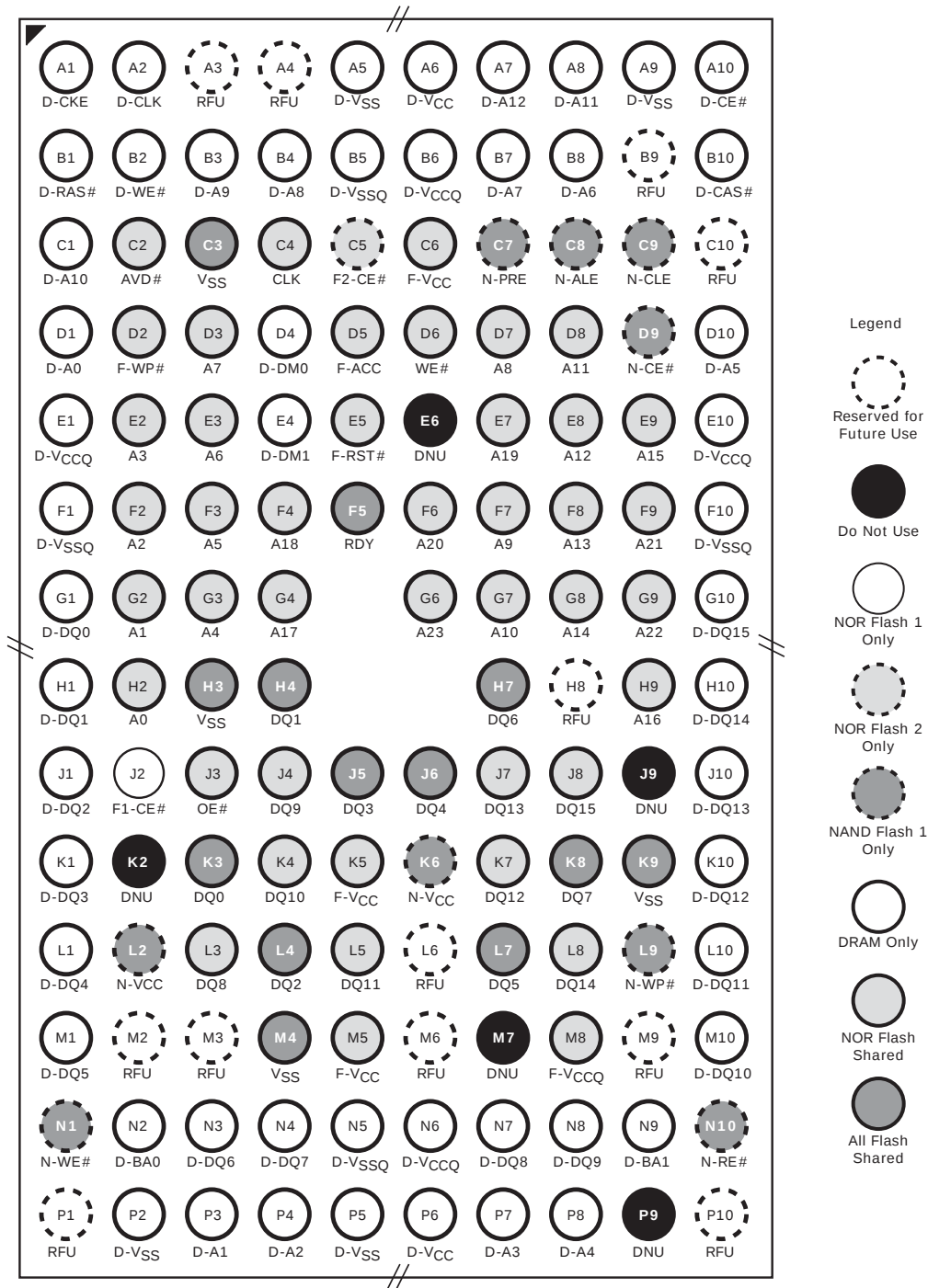
**Note**

DDR-only signals are RFU in the case of SDR-DRAM based MCPs.

### 3.5 512Mb NOR Flash with 1024-Mb ORNAND on Bus 1 and 512 or 256 Mb SDRAM on Bus 2

#### 3.5.1 x8 ORNAND-based MCP

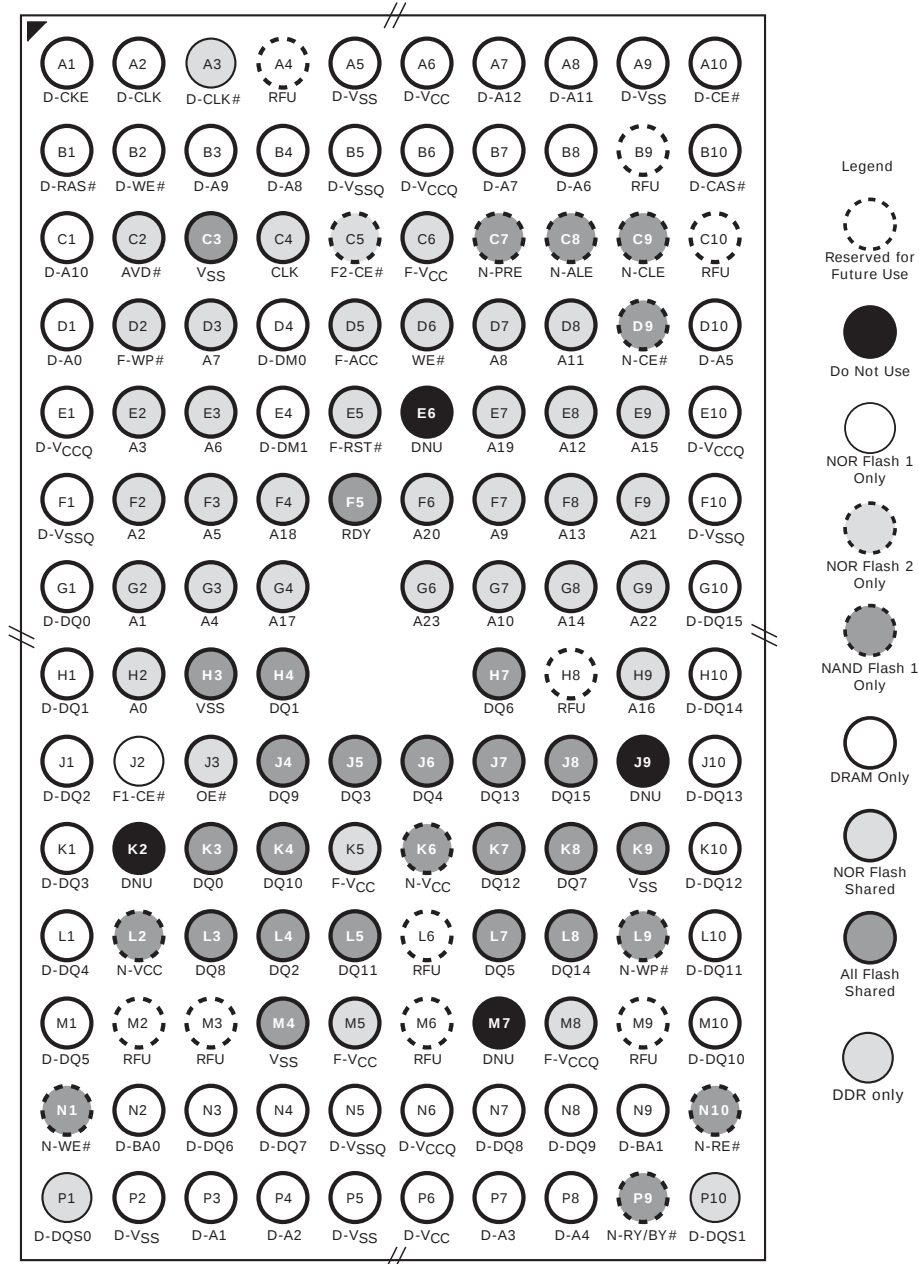
137-ball Fine-Pitch Ball Grid Array  
(Top View, Balls Facing Down)



### 3.6 512Mb NOR Flash with 512-Mb NAND on Bus 1 and 512-Mb SDRAM on Bus 2

#### 3.6.1 x16 ORNAND-based MCP

137-ball Fine-Pitch Ball Grid Array  
(Top View, Balls Facing Down)

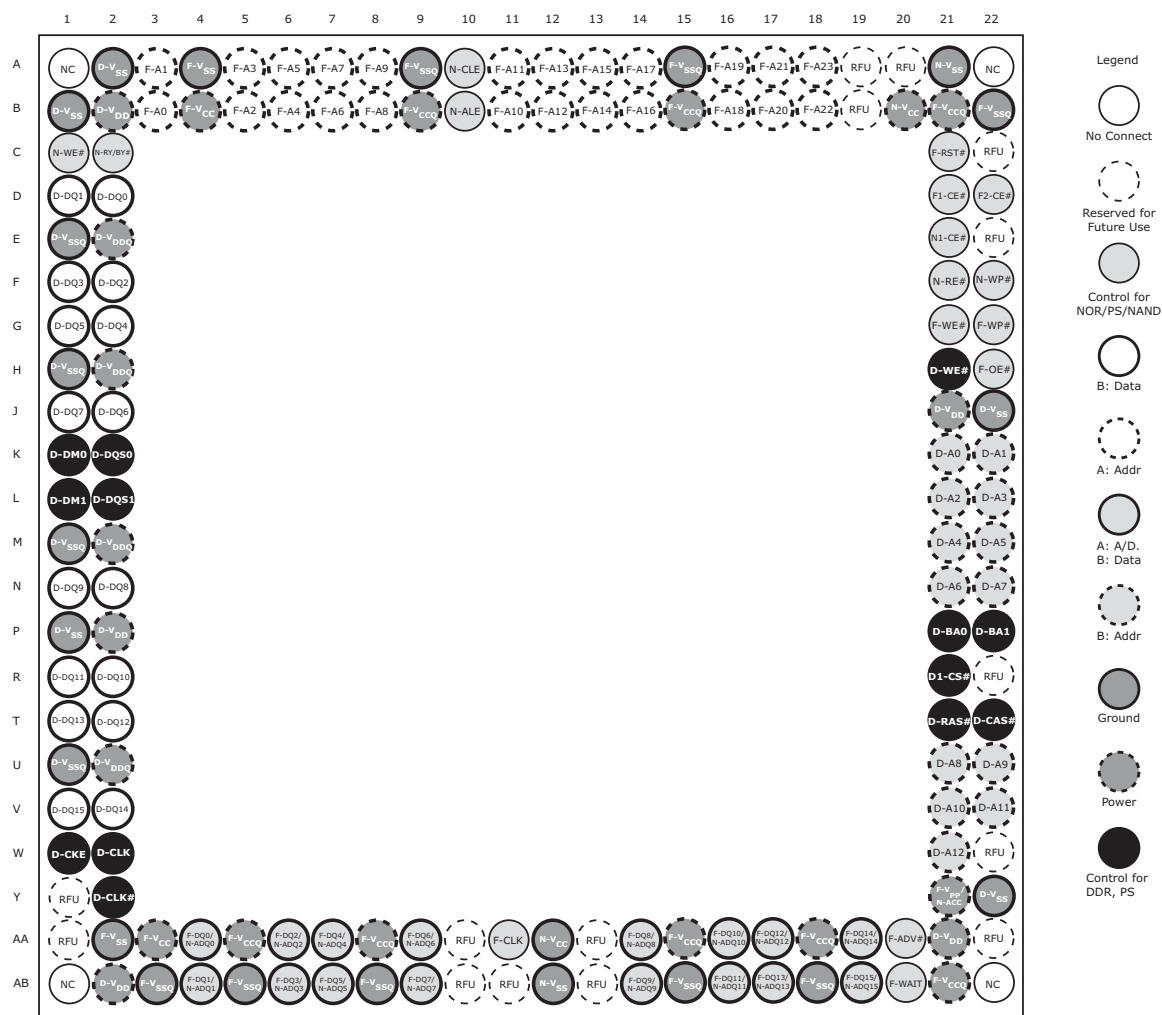


#### Special Handling Instructions For FBGA Package

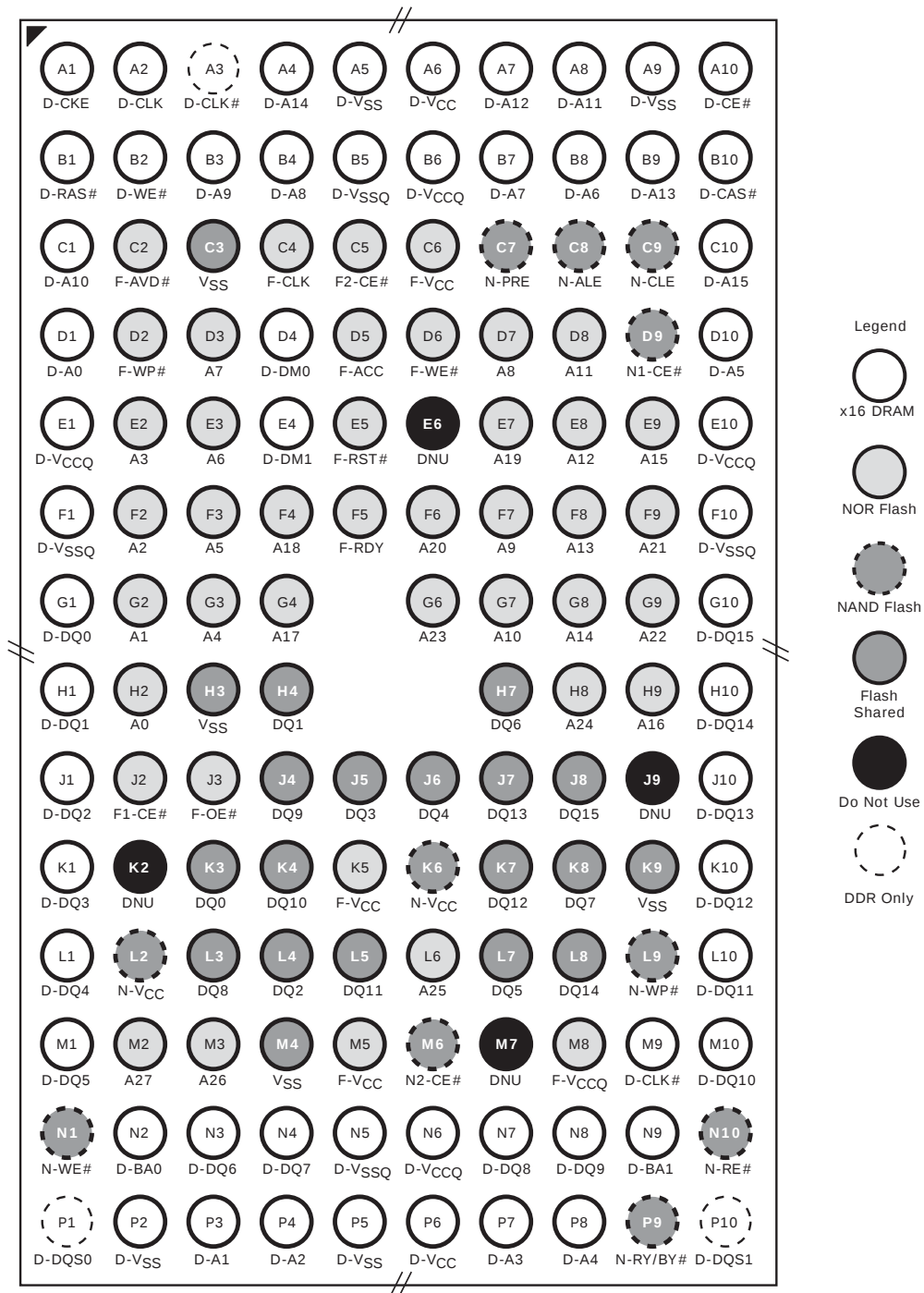
Special handling is required for Flash Memory products in FBGA packages.

Flash memory devices in FBGA packages may be damaged if exposed to ultrasonic cleaning methods. The package and/or data integrity may be compromised if the package body is exposed to temperatures above 150°C for prolonged periods of time.

### 3.6.2 Connection Diagram for 15 x 15 Package-on-Package



### 3.7 Lookahead Diagram on Split Bus



## 3.8 NOR Flash and DRAM Input/Output Descriptions

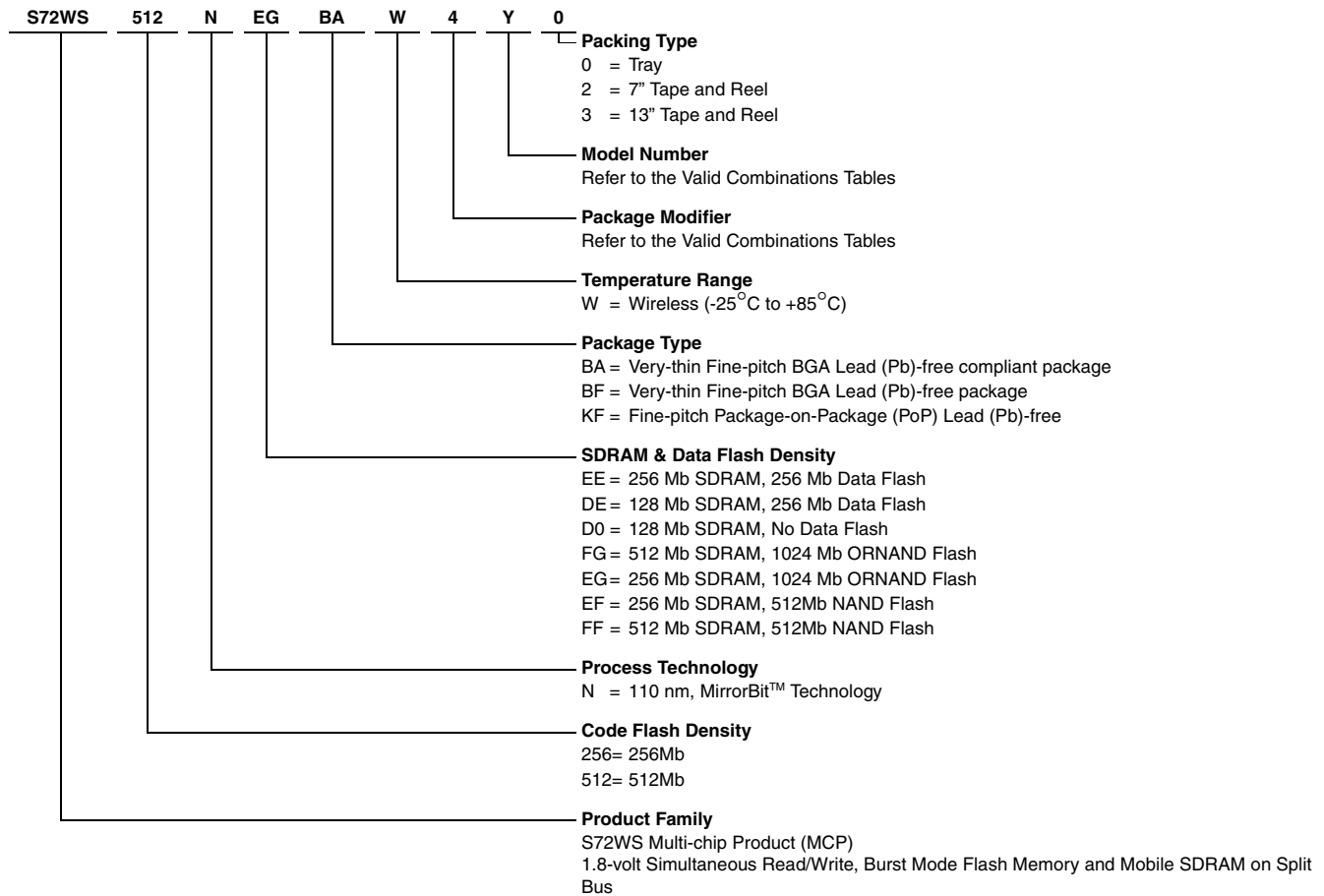
| Signal             | Description                                                                                                                                                                                                                                                                                                      |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A23-A0             | NOR Flash Address inputs                                                                                                                                                                                                                                                                                         |
| DQ15-DQ0           | Flash Data input/output, shared between NOR and ORNAND Flash. DQ0-DQ7 shared for x8 ORNAND                                                                                                                                                                                                                       |
| F2-CE#             | NOR Flash Chip-enable input # 2. Asynchronous relative to CLK for burst mode.                                                                                                                                                                                                                                    |
| F1-CE#             | NOR Flash Chip-enable input #1. Asynchronous relative to CLK for Burst Mode.                                                                                                                                                                                                                                     |
| OE#                | NOR Flash Output Enable input. Asynchronous relative to CLK for Burst mode.                                                                                                                                                                                                                                      |
| F-WE#              | NOR Flash Write Enable input.                                                                                                                                                                                                                                                                                    |
| F-V <sub>CC</sub>  | NOR Flash device power supply (1.7 V - 1.9 5 V).                                                                                                                                                                                                                                                                 |
| F-V <sub>CCQ</sub> | Input/Output Buffer power supply.                                                                                                                                                                                                                                                                                |
| V <sub>SS</sub>    | Ground                                                                                                                                                                                                                                                                                                           |
| RFU                | Reserved for Future Use                                                                                                                                                                                                                                                                                          |
| RDY                | Flash ready output. Indicates the status of the Burst read. V <sub>OL</sub> = data valid. Shared between NOR and ORNAND Flash.                                                                                                                                                                                   |
| CLK                | NOR Flash Clock. The first rising edge of CLK in conjunction with AVD# low latches the address input and activates burst mode operation. After the initial word is output, subsequent rising edges of CLK increment the internal address counter. CLK should remain low during asynchronous access.              |
| AVD#               | NOR Flash Address Valid input. Indicates to device that the valid address is present on the address inputs.<br>V <sub>IL</sub> = for asynchronous mode, indicates valid address; for burst mode, causes starting address to be latched on rising edge of CLK.<br>V <sub>IH</sub> = device ignores address inputs |
| F-RST#             | NOR Flash hardware reset input. V <sub>IL</sub> = device resets and returns to reading array data                                                                                                                                                                                                                |
| F-WP#              | NOR Flash hardware write protect input. V <sub>IL</sub> = disables program and erase functions in the four outermost sectors.                                                                                                                                                                                    |
| F-ACC              | NOR Flash accelerated input. At V <sub>IH</sub> , accelerates programming; automatically places device in unlock bypass mode. At V <sub>IL</sub> , disables all program and erase functions. Should be at V <sub>IH</sub> for all other conditions.                                                              |
| D-A12-D-A0         | SDRAM Address inputs                                                                                                                                                                                                                                                                                             |
| D-DQ15-D-DQ0       | SDRAM Data input/output                                                                                                                                                                                                                                                                                          |
| D-CLK              | SDRAM System Clock                                                                                                                                                                                                                                                                                               |
| D-CE#              | SDRAM Chip Select                                                                                                                                                                                                                                                                                                |
| D-CKE              | SDRAM Clock Enable                                                                                                                                                                                                                                                                                               |
| D-BA1-BA0          | SDRAM Bank Select                                                                                                                                                                                                                                                                                                |
| D-RAS#             | SDRAM Row Address Strobe                                                                                                                                                                                                                                                                                         |
| D-CAS#             | SDRAM Column Address Strobe                                                                                                                                                                                                                                                                                      |
| D-DM1-D-DM0        | SDRAM Data Input/Output Mask                                                                                                                                                                                                                                                                                     |
| D-WE#              | SDRAM Write Enable input                                                                                                                                                                                                                                                                                         |
| D-VSS              | SDRAM Ground                                                                                                                                                                                                                                                                                                     |
| D-VSSQ             | SDRAM Input/Output Buffer ground                                                                                                                                                                                                                                                                                 |
| D-VCCQ             | SDRAM Input/Output Buffer power supply                                                                                                                                                                                                                                                                           |
| D-VCC              | SDRAM device power supply                                                                                                                                                                                                                                                                                        |

### 3.8.1 ORNAND Signal Descriptions

| Signal         | Description                                                                       |
|----------------|-----------------------------------------------------------------------------------|
| N-PRE          | ORNAND Power-On Read Enable. Tie to V <sub>SS</sub> on customer board if not used |
| N-ALE          | ORNAND Address Latch Enable                                                       |
| N-CLE          | ORNAND Command Latch Enable                                                       |
| N-CE#          | ORNAND Chip-enable                                                                |
| N-WP#          | ORNAND Write-protect                                                              |
| N-WE#          | ORNAND Write-enable                                                               |
| N-RE#          | ORNAND Read-enable                                                                |
| N-RY/BY#       | ORNAND Ready-Busy—this is shared with NOR RDY                                     |
| N-I/O0-N-I/O15 | ORNAND I/O Signals (I/O0-I/O7 for x8 bus width)                                   |
| N-VCC          | ORNAND Power Supply                                                               |

## 4. Ordering Information

The order number is formed by a valid combinations of the following:



### 4.1 Valid Combinations

Valid Combinations list configurations planned to be supported in volume for this device. Consult your local sales office to confirm availability of specific valid combinations and to check on newly released combinations.

| S72WS256ND0 Valid Combinations |                       |              |                     | NOR Flash Burst Speed | SDRAM Supplier | SDRAM Burst Speed | Package Type          | Package Marking |
|--------------------------------|-----------------------|--------------|---------------------|-----------------------|----------------|-------------------|-----------------------|-----------------|
| Base Ordering Part Number      | Package & Temperature | Model Number | Packing Type        |                       |                |                   |                       |                 |
| S72WS256ND0                    | BFW                   | 93           | 0, 2, 3<br>(Note 1) | 66 MHz                | Supplier 5     | 133 MHz           | 9x12x1.2mm 137-ball   | (Note 2)I       |
|                                | BAW, BFW              | B7           |                     | 54 MHz                | Supplier 1     | 104 MHz           |                       |                 |
|                                |                       | BB           |                     |                       | Supplier 2     |                   |                       |                 |
|                                | KFW                   | D3           |                     | 66 MHz                | Supplier 5     | 133 MHz           | 15x15x1.25mm 160-ball |                 |

| S72WS256NDE Valid Combinations |                       |              |                     | NOR Flash Burst Speed | SDRAM Supplier | SDRAM Burst Speed | Package Type        | Package Marking |
|--------------------------------|-----------------------|--------------|---------------------|-----------------------|----------------|-------------------|---------------------|-----------------|
| Base Ordering Part Number      | Package & Temperature | Model Number | Packing Type        |                       |                |                   |                     |                 |
| S72WS256NDE                    | BAW, BFW              | U7           | 0, 2, 3<br>(Note 1) | 54 MHz                | Supplier 1     | 104 MHz           | 9x12x1.4mm 137-ball | (Note 2)        |
|                                |                       | UB           |                     |                       | Supplier 2     |                   |                     |                 |

| S72WS256NEE Valid Combinations |                       |              |                     | Flash Burst Speed | SDRAM Supplier | SDRAM Burst Speed | Package Type        | Package Marking |
|--------------------------------|-----------------------|--------------|---------------------|-------------------|----------------|-------------------|---------------------|-----------------|
| Base Ordering Part Number      | Package & Temperature | Model Number | Packing Type        |                   |                |                   |                     |                 |
| S72WS256NEE                    | BAW, BFW              | U7           | 0, 2, 3<br>(Note 1) | 54 MHz            | Supplier 1     | 104 MHz           | 9x12x1.4mm 137-ball | (Note 2)        |
|                                |                       | UB           |                     |                   | Supplier 2     |                   |                     |                 |

| S72WS512NFF Valid Combinations |                       |              |                     | Flash Speed | DRAM Supplier | DRAM Speed | Package                 | Package Marking |
|--------------------------------|-----------------------|--------------|---------------------|-------------|---------------|------------|-------------------------|-----------------|
| Base Ordering Part Number      | Package & Temperature | Model Number | Packing Type        |             |               |            |                         |                 |
| S72WS512NFF                    | BAW, BFW              | ZJ           | 0, 2, 3<br>(Note 1) | 66 MHz      | DRAM Type 1   | 133 MHz    | 11 x 13 mm<br>137-ball  | (Note 2)        |
|                                | KFW                   |              |                     |             |               |            | 15 x 15 5mm<br>160-ball |                 |
|                                | BAW, BFW              | Z2           |                     |             | DRAM Type 5   |            | 11 x 13 mm<br>137-ball  |                 |
|                                | KFW                   |              |                     |             |               |            | 15 x 15 5mm<br>160-ball |                 |
|                                | BAW, BFW              | ZT           |                     |             | DRAM Type 2   |            | 11 x 13 mm<br>137-ball  |                 |
|                                | KFW                   |              |                     |             |               |            | 15 x 15 5mm<br>160-ball |                 |

| S72WS512NFG Valid Combinations |                       |              |                     | Flash Burst Speed | SDRAM Supplier | SDRAM Burst Speed | Package Type         | Package Marking |
|--------------------------------|-----------------------|--------------|---------------------|-------------------|----------------|-------------------|----------------------|-----------------|
| Base Ordering Part Number      | Package & Temperature | Model Number | Packing Type        |                   |                |                   |                      |                 |
| S72WS512NFG                    | BAW, BFW              | L7           | 0, 2, 3<br>(Note 1) | 54 MHz            | DRAM Type 4    | 104 MHz           | 11x13x1.4mm 137-ball | (Note 2)        |
|                                |                       | L6           |                     |                   |                |                   |                      |                 |
|                                |                       | L5           |                     |                   |                |                   |                      |                 |
|                                |                       | 47           |                     |                   |                |                   |                      |                 |
|                                |                       | 46           |                     |                   |                |                   |                      |                 |
|                                |                       | 45           |                     |                   |                |                   |                      |                 |
|                                |                       | LZ           |                     |                   |                |                   |                      |                 |
|                                |                       | LY           |                     |                   |                |                   |                      |                 |
|                                |                       | LW           |                     |                   |                |                   |                      |                 |
|                                |                       | 4Z           |                     |                   |                |                   |                      |                 |
|                                |                       | 4Y           |                     |                   |                |                   |                      |                 |
|                                |                       | 4W           |                     |                   |                |                   |                      |                 |
|                                |                       | N7           |                     |                   |                |                   |                      |                 |
|                                |                       | N6           |                     |                   |                |                   |                      |                 |
|                                |                       | N5           |                     |                   |                |                   |                      |                 |
|                                |                       | 67           |                     |                   |                |                   |                      |                 |
|                                |                       | 66           |                     |                   |                |                   |                      |                 |
|                                |                       | 65           |                     |                   |                |                   |                      |                 |
|                                |                       | NZ           |                     |                   |                |                   |                      |                 |
|                                |                       | NY           |                     |                   |                |                   |                      |                 |
|                                |                       | NW           |                     |                   |                |                   |                      |                 |
|                                |                       | 6Z           |                     |                   |                |                   |                      |                 |
|                                |                       | 6Y           |                     |                   |                |                   |                      |                 |
|                                |                       | 6W           |                     |                   |                |                   |                      |                 |

| S72WS512NEG Valid Combinations |                       |              |                     | Flash Burst Speed | SDRAM Supplier | SDRAM Burst Speed | Package Type              | Package Marking |
|--------------------------------|-----------------------|--------------|---------------------|-------------------|----------------|-------------------|---------------------------|-----------------|
| Base Ordering Part Number      | Package & Temperature | Model Number | Packing Type        |                   |                |                   |                           |                 |
| S72WS512NEG                    | BAW, BFW              | LZ           | 0, 2, 3<br>(Note 1) | 54 MHz            | DRAM Type 2    | 104 MHz           | 11x13.1x1.4mm<br>137-ball | (Note 2)        |
|                                |                       | LY           |                     |                   |                |                   |                           |                 |
|                                |                       | LW           |                     |                   |                |                   |                           |                 |
|                                |                       | 4Z           |                     |                   |                |                   |                           |                 |
|                                |                       | 4Y           |                     |                   |                |                   |                           |                 |
|                                |                       | 4W           |                     |                   |                |                   |                           |                 |
|                                |                       | NZ           |                     |                   |                |                   |                           |                 |
|                                |                       | NY           |                     |                   |                |                   |                           |                 |
|                                |                       | NW           |                     |                   |                |                   |                           |                 |
|                                |                       | 6Z           |                     |                   |                |                   |                           |                 |
|                                |                       | 6Y           |                     |                   |                |                   |                           |                 |
|                                |                       | 6W           |                     |                   |                |                   |                           |                 |

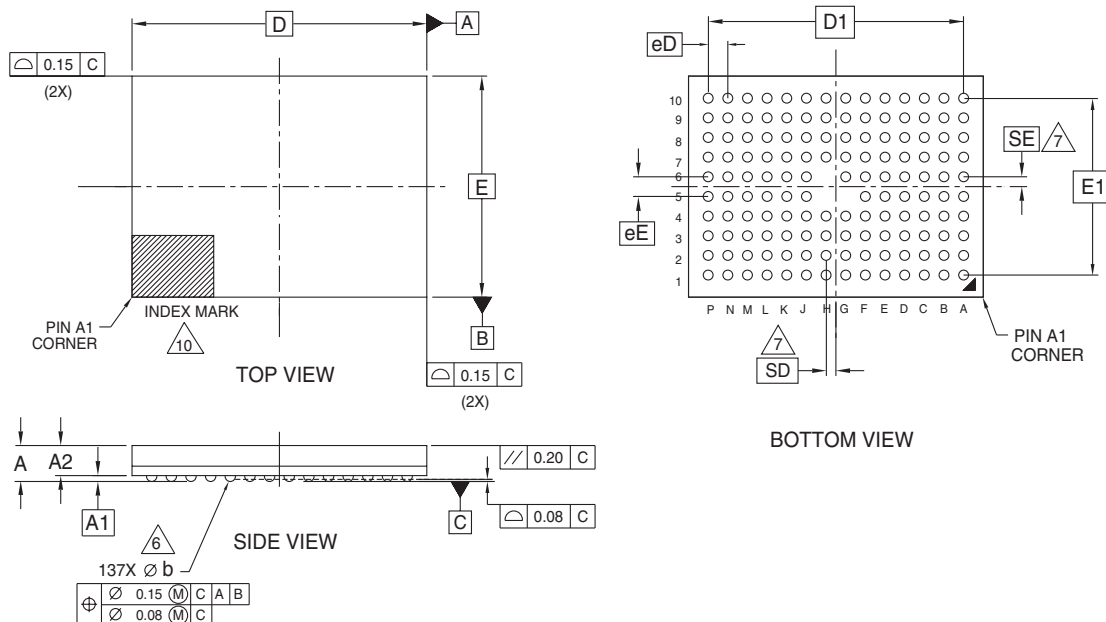
| S72WS512NEF Valid Combinations |                       |              |                     | Flash Burst Speed | SDRAM Supplier | SDRAM Burst Speed | Package Type          | Package Marking |
|--------------------------------|-----------------------|--------------|---------------------|-------------------|----------------|-------------------|-----------------------|-----------------|
| Base Ordering Part Number      | Package & Temperature | Model Number | Packing Type        |                   |                |                   |                       |                 |
| S72WS512NEF                    | KFW                   | HJ           | 0, 2, 3<br>(Note 1) | 66 MHz            | DRAM Type 2    | 133 MHz           | 15x15x1.2 mm 160-ball | (Note 2)        |

**Notes**

1. Packing Type 0 is standard. Specify other options as required.
2. BGA package marking omits leading "S" and packing type designator from ordering part number.

## 5. Physical Dimensions

### TLD137—137-ball Fine-Pitch Ball Grid Array (FBGA) 12 x 9 mm Package



|          |                               |      |                          |                         |
|----------|-------------------------------|------|--------------------------|-------------------------|
| PACKAGE  | TLD 137                       |      |                          |                         |
| JEDEC    | N/A                           |      |                          |                         |
| D x E    | 12.00 mm x 9.00 mm<br>PACKAGE |      |                          |                         |
| SYMBOL   | MIN                           | NOM  | MAX                      | NOTE                    |
| A        | ---                           | ---  | 1.20                     | PROFILE                 |
| A1       | 0.17                          | ---  | ---                      | BALL HEIGHT             |
| A2       | 0.81                          | ---  | 0.97                     | BODY THICKNESS          |
| D        | 12.00 BSC.                    |      |                          | BODY SIZE               |
| E        | 9.00 BSC.                     |      |                          | BODY SIZE               |
| D1       | 10.40 BSC.                    |      |                          | MATRIX FOOTPRINT        |
| E1       | 7.20 BSC.                     |      |                          | MATRIX FOOTPRINT        |
| MD       | 14                            |      |                          | MATRIX SIZE D DIRECTION |
| ME       | 10                            |      |                          | MATRIX SIZE E DIRECTION |
| n        | 137                           |      |                          | BALL COUNT              |
| φb       | 0.35                          | 0.40 | 0.45                     | BALL DIAMETER           |
| eE       | 0.80 BSC.                     |      |                          | BALL PITCH              |
| eD       | 0.80 BSC.                     |      |                          | BALL PITCH              |
| SD / SE  | 0.40 BSC.                     |      |                          | SOLDER BALL PLACEMENT   |
| G5,H5,H6 |                               |      | DEPOPULATED SOLDER BALLS |                         |

#### NOTES:

1. DIMENSIONING AND TOLERANCING METHODS PER ASME Y14.5M-1994.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. BALL POSITION DESIGNATION PER JESD 95-1, SPP-010.
4. [e] REPRESENTS THE SOLDER BALL GRID PITCH.
5. SYMBOL "MD" IS THE BALL MATRIX SIZE IN THE "D" DIRECTION.

SYMBOL "ME" IS THE BALL MATRIX SIZE IN THE "E" DIRECTION.

n IS THE NUMBER OF POPULATED SOLDER BALL POSITIONS FOR MATRIX SIZE MD X ME.

6. DIMENSION "b" IS MEASURED AT THE MAXIMUM BALL DIAMETER IN A PLANE PARALLEL TO DATUM C.

7. SD AND SE ARE MEASURED WITH RESPECT TO DATUMS A AND B AND DEFINE THE POSITION OF THE CENTER SOLDER BALL IN THE OUTER ROW.

WHEN THERE IS AN ODD NUMBER OF SOLDER BALLS IN THE OUTER ROW SD OR SE = 0.000.

WHEN THERE IS AN EVEN NUMBER OF SOLDER BALLS IN THE OUTER ROW, SD OR SE = [e/2]

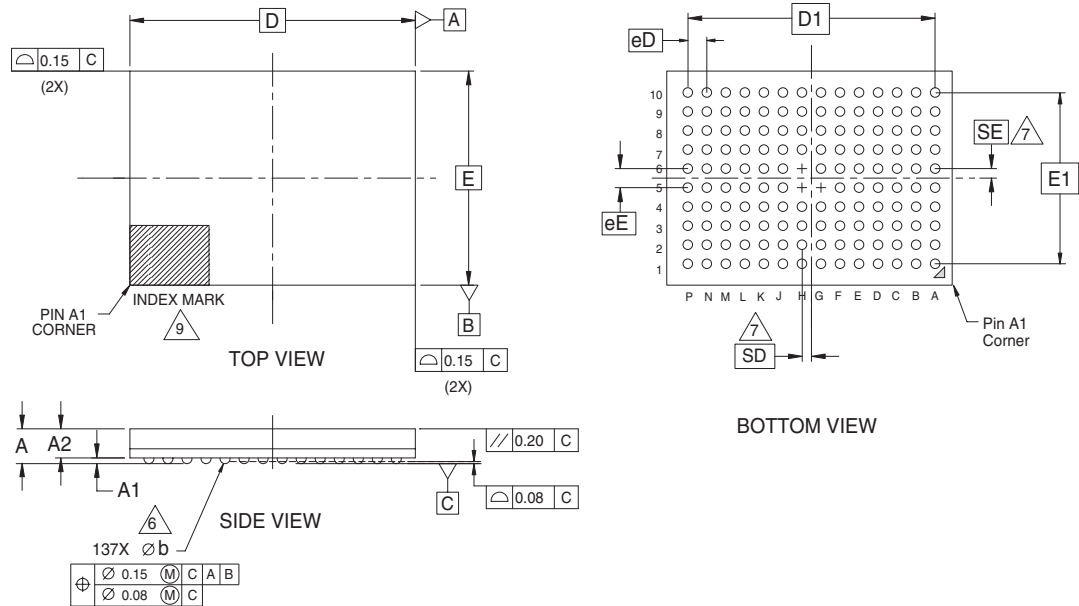
8. "+" INDICATES THE THEORETICAL CENTER OF DEPOPULATED BALLS.

9. N/A

10. A1 CORNER TO BE IDENTIFIED BY CHAMFER, LASER OR INK MARK, METALLIZED MARK INDENTATION OR OTHER MEANS.

3393; 16-038.22a

## FEA137—137-ball Fine-Pitch Ball Grid Array (FBGA) 13 x 11 mm Package

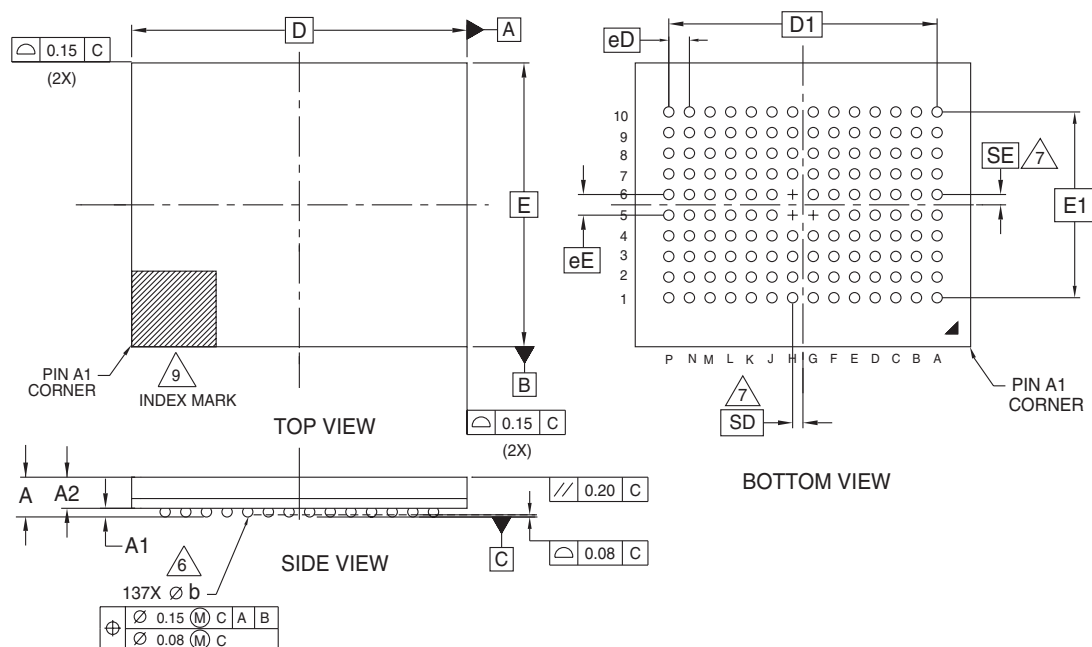


|                                                                                     |                          |      |      |                          |
|-------------------------------------------------------------------------------------|--------------------------|------|------|--------------------------|
| PACKAGE                                                                             | FEA 137                  |      |      | NOTE                     |
| JEDEC                                                                               | N/A                      |      |      |                          |
| D X E                                                                               | 12.00mm X 9.00mm PACKAGE |      |      |                          |
| SYMBOL                                                                              | MIN.                     | NOM. | MAX. |                          |
| A                                                                                   | -                        | -    | 1.40 | PROFILE                  |
| A1                                                                                  | 0.10                     | -    | -    | BALL HEIGHT              |
| A2                                                                                  | 1.11                     | -    | 1.26 | BODY THICKNESS           |
|  | 12.00 BSC                |      |      | BODY SIZE                |
|  | 9.00 BSC                 |      |      | BODY SIZE                |
|  | 10.40 BSC                |      |      | MATRIX FOOTPRINT         |
|  | 7.20 BSC                 |      |      | MATRIX FOOTPRINT         |
| MD                                                                                  | 14                       |      |      | MATRIX SIZE D DIRECTION  |
| ME                                                                                  | 10                       |      |      | MATRIX SIZE E DIRECTION  |
| n                                                                                   | 1.37                     |      |      | BALL COUNT               |
| Øb                                                                                  | 0.35                     | 0.40 | 0.45 | BALL DIAMETER            |
|  | 0.80 BSC                 |      |      | BALL PITCH               |
|  | 0.80 BSC                 |      |      | BALL PITCH               |
| SD/SE                                                                               | 0.40 BSC                 |      |      | SOLDER BALL PLACEMENT    |
| G5, H5, H8                                                                          |                          |      |      | DEPOPULATED SOLDER BALLS |

## NOTES:

- DIMENSIONING AND TOLERANCING METHODS PER ASME Y14.5M-1994.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- BALL POSITION DESIGNATION PER JEP95, SECTION 4.3, SPP-010.
- $\boxed{e}$  REPRESENTS THE SOLDER BALL GRID PITCH.
- SYMBOL "MD" IS THE BALL MATRIX SIZE IN THE "D" DIRECTION.  
SYMBOL "ME" IS THE BALL MATRIX SIZE IN THE "E" DIRECTION.  
n IS THE NUMBER OF POPULATED SOLDER BALL POSITIONS FOR MATRIX SIZE MD X ME.
- DIMENSION "b" IS MEASURED AT THE MAXIMUM BALL DIAMETER IN A PLANE PARALLEL TO DATUM C.
- SD AND SE ARE MEASURED WITH RESPECT TO DATUMS A AND B AND DEFINE THE POSITION OF THE CENTER SOLDER BALL IN THE OUTER ROW.  
WHEN THERE IS AN ODD NUMBER OF SOLDER BALLS IN THE OUTER ROW SD OR SE = 0.000.  
WHEN THERE IS AN EVEN NUMBER OF SOLDER BALLS IN THE OUTER ROW, SD OR SE =  $\boxed{e}/2$
- "+" INDICATES THE THEORETICAL CENTER OF DEPOPULATED BALLS.
- A1 CORNER TO BE IDENTIFIED BY CHAMFER, LASER OR INK MARK, METALLIZED MARK INDENTATION OR OTHER MEANS.

# FVD137—137-ball Fine-Pitch Ball Grid Array (FBGA) 11 x 13 mm Package



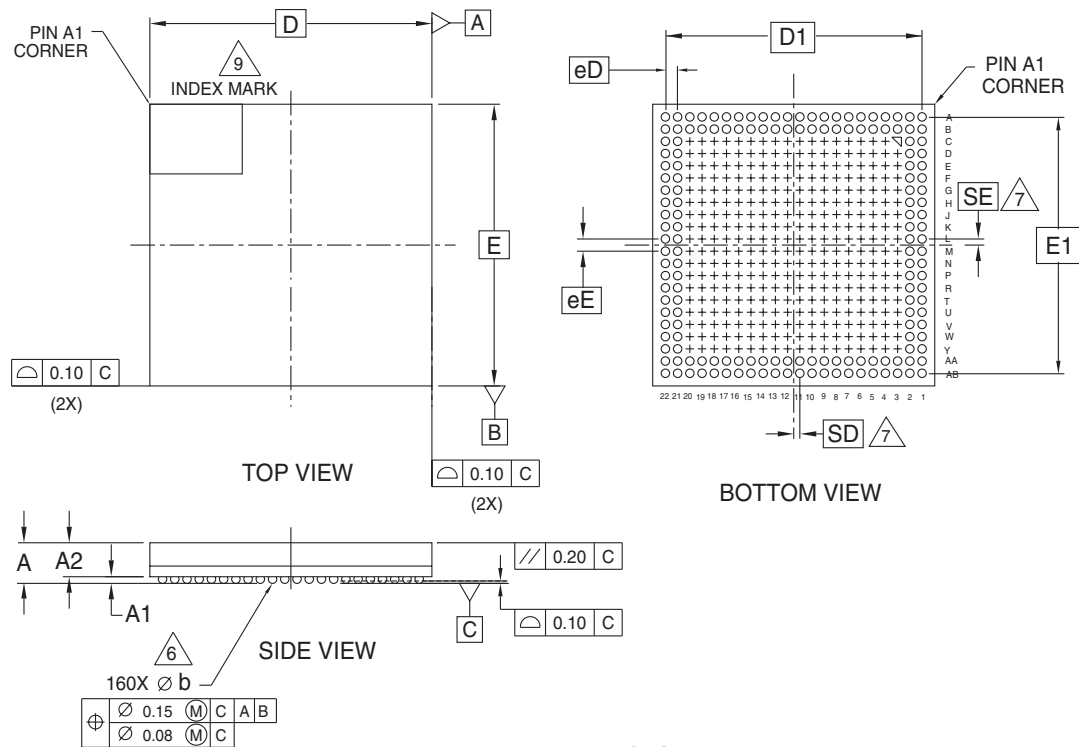
|         |                                |      |      |                          |
|---------|--------------------------------|------|------|--------------------------|
| PACKAGE | FVD 137                        |      |      | NOTE                     |
| JEDEC   | N/A                            |      |      |                          |
| D x E   | 13.00 mm x 11.00 mm<br>PACKAGE |      |      |                          |
| SYMBOL  | MIN                            | NOM  | MAX  |                          |
| A       | ---                            | ---  | 1.40 | PROFILE                  |
| A1      | 0.10                           | ---  | ---  | BALL HEIGHT              |
| A2      | 1.09                           | ---  | 1.24 | BODY THICKNESS           |
| D       | 13.00 BSC.                     |      |      | BODY SIZE                |
| E       | 11.00 BSC.                     |      |      | BODY SIZE                |
| D1      | 10.40 BSC.                     |      |      | MATRIX FOOTPRINT         |
| E1      | 7.20 BSC.                      |      |      | MATRIX FOOTPRINT         |
| MD      | 14                             |      |      | MATRIX SIZE D DIRECTION  |
| ME      | 10                             |      |      | MATRIX SIZE E DIRECTION  |
| n       | 137                            |      |      | BALL COUNT               |
| Øb      | 0.35                           | 0.40 | 0.45 | BALL DIAMETER            |
| eE      | 0.80 BSC.                      |      |      | BALL PITCH               |
| eD      | 0.80 BSC                       |      |      | BALL PITCH               |
| SD SE   | 0.40 BSC.                      |      |      | SOLDER BALL PLACEMENT    |
|         | G5,H5,H6                       |      |      | DEPOPULATED SOLDER BALLS |

## NOTES:

- DIMENSIONING AND TOLERANCING METHODS PER ASME Y14.5M-1994.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- BALL POSITION DESIGNATION PER JEP95, SECTION 4.3, SPP-010.
- [e] REPRESENTS THE SOLDER BALL GRID PITCH.
- SYMBOL "MD" IS THE BALL MATRIX SIZE IN THE "D" DIRECTION.  
SYMBOL "ME" IS THE BALL MATRIX SIZE IN THE "E" DIRECTION.  
n IS THE NUMBER OF POPULATED SOLDER BALL POSITIONS FOR MATRIX SIZE MD X ME.
- DIMENSION "b" IS MEASURED AT THE MAXIMUM BALL DIAMETER IN A PLANE PARALLEL TO DATUM C.
- SD AND SE ARE MEASURED WITH RESPECT TO DATUMS A AND B AND DEFINE THE POSITION OF THE CENTER SOLDER BALL IN THE OUTER ROW.
- WHEN THERE IS AN ODD NUMBER OF SOLDER BALLS IN THE OUTER ROW SD OR SE = 0.000.
- WHEN THERE IS AN EVEN NUMBER OF SOLDER BALLS IN THE OUTER ROW, SD OR SE =  $\frac{e}{2}$
- "+" INDICATES THE THEORETICAL CENTER OF DEPOPULATED BALLS.
- A1 CORNER TO BE IDENTIFIED BY CHAMFER, LASER OR INK MARK, METALLIZED MARK INDENTATION OR OTHER MEANS.

3522 \ 16-038.21 \ 09.29.05

## BWA160—160-ball Fine-Pitch Ball Grid Array (FBGA) 15 x 15 mm Package



|                                                                                                                                           |                                |      |      |                           |
|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------|------|---------------------------|
| PACKAGE                                                                                                                                   | BWA 160                        |      |      | NOTE                      |
| JEDEC                                                                                                                                     | N/A                            |      |      |                           |
| D x E                                                                                                                                     | 15.00 mm x 15.00 mm<br>PACKAGE |      |      |                           |
| SYMBOL                                                                                                                                    | MIN                            | NOM  | MAX  |                           |
| A                                                                                                                                         | ---                            | ---  | 1.25 | PROFILE                   |
| A1                                                                                                                                        | 0.35                           | ---  | ---  | BALL HEIGHT               |
| A2                                                                                                                                        | 0.74                           | ---  | 0.84 | BODY THICKNESS            |
| D                                                                                                                                         | 15.00 BSC.                     |      |      | BODY SIZE                 |
| E                                                                                                                                         | 15.00 BSC.                     |      |      | BODY SIZE                 |
| D1                                                                                                                                        | 13.65 BSC.                     |      |      | MATRIX FOOTPRINT          |
| E1                                                                                                                                        | 13.65 BSC.                     |      |      | MATRIX FOOTPRINT          |
| MD                                                                                                                                        | 22                             |      |      | MATRIX SIZE D DIRECTION   |
| ME                                                                                                                                        | 22                             |      |      | MATRIX SIZE E DIRECTION   |
| n                                                                                                                                         | 160                            |      |      | BALL COUNT                |
| N                                                                                                                                         | 160                            |      |      | MAXIMUM NUMBER OF BALLS   |
| R                                                                                                                                         | 2                              |      |      | NUMBER OF LAND PARAMETERS |
| Øb                                                                                                                                        | 0.40                           | 0.45 | 0.50 | BALL DIAMETER             |
| eE                                                                                                                                        | 0.65 BSC.                      |      |      | BALL PITCH                |
| eD                                                                                                                                        | 0.65 BSC.                      |      |      | BALL PITCH                |
| SD SE                                                                                                                                     | 0.325 BSC.                     |      |      | SOLDER BALL PLACEMENT     |
| C3~C20,D3~D20,E3~E20,F3~F20<br>G3~G20,H3~H20,J3~J20,K3~K20<br>L3~L20,M3~M20,N3~N20,P3~P20<br>R3~R20,T3~T20,U3~U20,V3~V20<br>W3~W20,Y3~Y20 |                                |      |      | DEPOPULATED SOLDER BALLS  |

## NOTES:

- DIMENSIONING AND TOLERANCING METHODS PER ASME Y14.5M-1994.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- BALL POSITION DESIGNATION PER JEP95, SECTION 4.3, SPP-010.
- [e] REPRESENTS THE SOLDER BALL GRID PITCH.
- SYMBOL "MD" IS THE BALL MATRIX SIZE IN THE "D" DIRECTION.

SYMBOL "ME" IS THE BALL MATRIX SIZE IN THE "E" DIRECTION.

n IS THE NUMBER OF POPULATED SOLDER BALL POSITIONS FOR MATRIX SIZE MD X ME.

6 DIMENSION "b" IS MEASURED AT THE MAXIMUM BALL DIAMETER IN A PLANE PARALLEL TO DATUM C.

7 SD AND SE ARE MEASURED WITH RESPECT TO DATUMS A AND B AND DEFINE THE POSITION OF THE CENTER SOLDER BALL IN THE OUTER ROW.

WHEN THERE IS AN ODD NUMBER OF SOLDER BALLS IN THE OUTER ROW SD OR SE = 0.000.

WHEN THERE IS AN EVEN NUMBER OF SOLDER BALLS IN THE OUTER ROW, SD OR SE = [e/2]

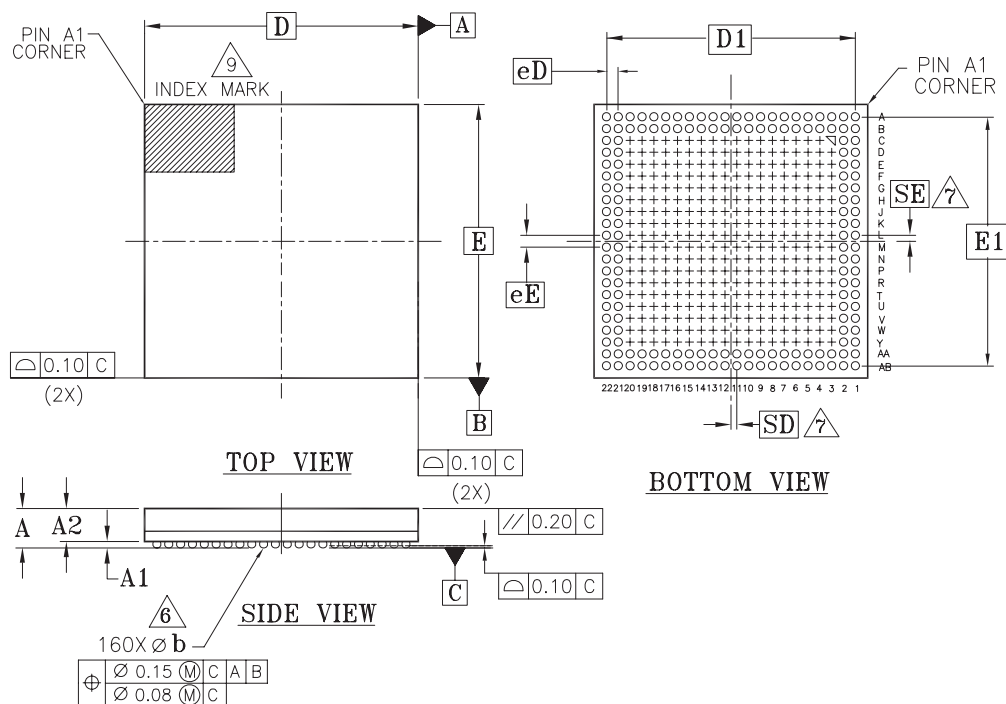
8 "+" INDICATES THE THEORETICAL CENTER OF DEPOPULATED BALLS.

9 A1 CORNER TO BE IDENTIFIED BY CHAMFER, LASER OR INK MARK, METALLIZED MARK INDENTATION OR OTHER MEANS.

10. OUTLINE AND DIMENSIONS PER CUSTOMER REQUIREMENT.

3518 \ 16-038.46 \ 02.23.06

# BWB160—160-ball Fine-Pitch Ball Grid Array (FBGA) 15 x 15 mm Package

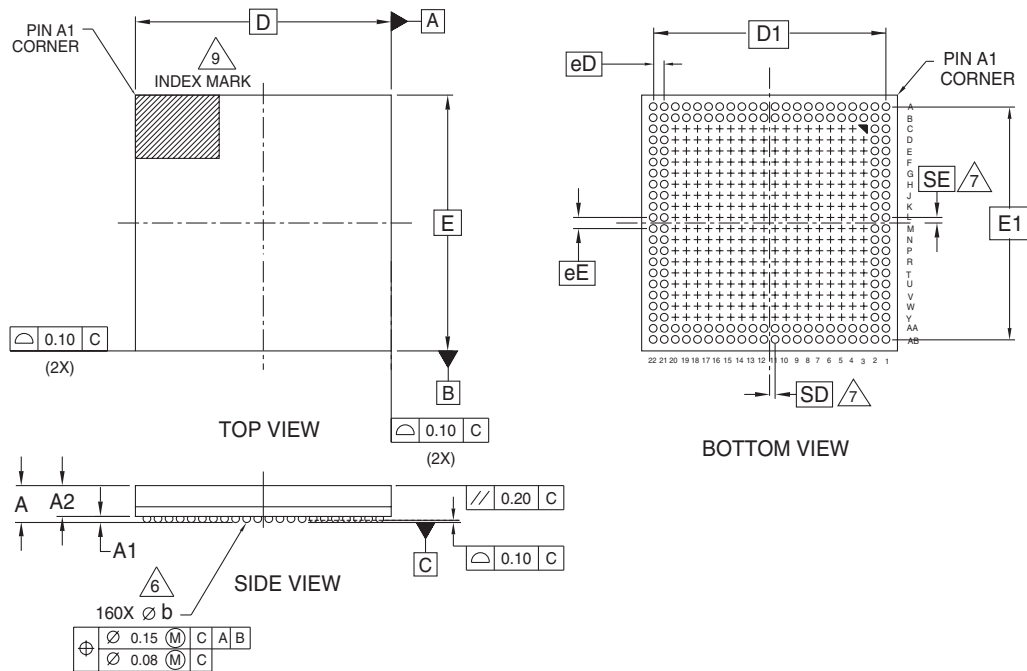


|                                                                                                                                                                                                      |                                |      |      |                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------|------|---------------------------|
| PACKAGE                                                                                                                                                                                              | BWB 160                        |      |      | NOTE                      |
| JEDEC                                                                                                                                                                                                | N/A                            |      |      |                           |
| D x E                                                                                                                                                                                                | 15.00 mm x 15.00 mm<br>PACKAGE |      |      |                           |
| SYMBOL                                                                                                                                                                                               | MIN                            | NOM  | MAX  |                           |
| A                                                                                                                                                                                                    | ---                            | ---  | 1.30 | PROFILE                   |
| A1                                                                                                                                                                                                   | 0.38                           | ---  | ---  | BALL HEIGHT               |
| A2                                                                                                                                                                                                   | 0.74                           | ---  | 0.84 | BODY THICKNESS            |
| D                                                                                                                                                                                                    | 15.00 BSC.                     |      |      | BODY SIZE                 |
| E                                                                                                                                                                                                    | 15.00 BSC.                     |      |      | BODY SIZE                 |
| D1                                                                                                                                                                                                   | 13.65 BSC.                     |      |      | MATRIX FOOTPRINT          |
| E1                                                                                                                                                                                                   | 13.65 BSC.                     |      |      | MATRIX FOOTPRINT          |
| MD                                                                                                                                                                                                   | 22                             |      |      | MATRIX SIZE D DIRECTION   |
| ME                                                                                                                                                                                                   | 22                             |      |      | MATRIX SIZE E DIRECTION   |
| n                                                                                                                                                                                                    | 160                            |      |      | BALL COUNT                |
| N                                                                                                                                                                                                    | 160                            |      |      | MAXIMUM NUMBER OF BALLS   |
| R                                                                                                                                                                                                    | 2                              |      |      | NUMBER OF LAND PARAMETERS |
| Øb                                                                                                                                                                                                   | 0.43                           | 0.48 | 0.53 | BALL DIAMETER             |
| eE                                                                                                                                                                                                   | 0.65 BSC.                      |      |      | BALL PITCH                |
| eD                                                                                                                                                                                                   | 0.65 BSC.                      |      |      | BALL PITCH                |
| SD / SE                                                                                                                                                                                              | 0.325 BSC.                     |      |      | SOLDER BALL PLACEMENT     |
| C3 ~ C20, D3 ~ D20, E3 ~ E20, F3 ~ F20<br>G3 ~ G20, H3 ~ H20, I3 ~ I20, J3 ~ J20<br>K3 ~ K20, L3 ~ L20, M3 ~ M20, N3 ~ N20, P3 ~ P20<br>R3 ~ R20, T3 ~ T20, U3 ~ U20, V3 ~ V20<br>W3 ~ W20, Y3 ~ Y20 |                                |      |      | DEPOPULATED SOLDER BALLS  |

## NOTES:

- DIMENSIONING AND TOLERANCING METHODS PER ASME Y14.5M-1994.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- BALL POSITION DESIGNATION PER JEP95, SECTION 4.3, SPP-010.
- [e] REPRESENTS THE SOLDER BALL GRID PITCH.
- SYMBOL "MD" IS THE BALL MATRIX SIZE IN THE "D" DIRECTION.  
SYMBOL "ME" IS THE BALL MATRIX SIZE IN THE "E" DIRECTION.  
n IS THE NUMBER OF POPULATED SOLDER BALL POSITIONS FOR MATRIX SIZE MD X ME.
- DIMENSION "b" IS MEASURED AT THE MAXIMUM BALL DIAMETER IN A PLANE PARALLEL TO DATUM C.
- SD AND SE ARE MEASURED WITH RESPECT TO DATUMS A AND B AND DEFINE THE POSITION OF THE CENTER SOLDER BALL IN THE OUTER ROW.  
WHEN THERE IS AN ODD NUMBER OF SOLDER BALLS IN THE OUTER ROW SD OR SE = 0.000.  
WHEN THERE IS AN EVEN NUMBER OF SOLDER BALLS IN THE OUTER ROW, SD OR SE = [e/2]
- "+" INDICATES THE THEORETICAL CENTER OF DEPOPULATED BALLS.
- A1 CORNER TO BE IDENTIFIED BY CHAMFER, LASER OR INK MARK, METALLIZED MARK INDENTATION OR OTHER MEANS.
- OUTLINE AND DIMENSIONS PER CUSTOMER REQUIREMENT.

3523.3 \ 16-038.46 \ 5.7.7

**BTA160—160-ball Fine-Pitch Ball Grid Array (FBGA) 15 x 15 mm Package**


|                                                                                                                                                        |                                |      |      |      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------|------|------|
| PACKAGE                                                                                                                                                | BTA 160                        |      |      | NOTE |
| JEDEC                                                                                                                                                  | N/A                            |      |      |      |
| D x E                                                                                                                                                  | 15.00 mm x 15.00 mm<br>PACKAGE |      |      |      |
| SYMBOL                                                                                                                                                 | MIN                            | NOM  | MAX  |      |
| A                                                                                                                                                      | ---                            | ---  | 1.30 |      |
| A1                                                                                                                                                     | 0.40                           | ---  | ---  |      |
| A2                                                                                                                                                     | 0.74                           | ---  | 0.84 |      |
| D                                                                                                                                                      | 15.00 BSC.                     |      |      |      |
| E                                                                                                                                                      | 15.00 BSC.                     |      |      |      |
| D1                                                                                                                                                     | 13.65 BSC.                     |      |      |      |
| E1                                                                                                                                                     | 13.65 BSC.                     |      |      |      |
| MD                                                                                                                                                     | 22                             |      |      |      |
| ME                                                                                                                                                     | 22                             |      |      |      |
| n                                                                                                                                                      | 160                            |      |      |      |
| N                                                                                                                                                      | 160                            |      |      |      |
| R                                                                                                                                                      | 2                              |      |      |      |
| Ø b                                                                                                                                                    | 0.45                           | 0.50 | 0.55 |      |
| eE                                                                                                                                                     | 0.65 BSC.                      |      |      |      |
| eD                                                                                                                                                     | 0.65 BSC.                      |      |      |      |
| SD                                                                                                                                                     | 0.325 BSC.                     |      |      |      |
| SE                                                                                                                                                     |                                |      |      |      |
| C3-C20, D3-D20, E3-E20, F3-F20<br>G3-G20, H3-H20, J3-J20, K3-K20<br>L3-L20, M3-M20, N3-N20, P3-P20<br>R3-R20, T3-T20, U3-U20, V3-V20<br>W3-W20, Y3-Y20 |                                |      |      |      |

## NOTES:

- DIMENSIONING AND TOLERANCING METHODS PER ASME Y14.5M-1994.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- BALL POSITION DESIGNATION PER JEP95, SECTION 4.3, SPP-010.
- e REPRESENTS THE SOLDER BALL GRID PITCH.
- SYMBOL "MD" IS THE BALL MATRIX SIZE IN THE "D" DIRECTION.

SYMBOL "ME" IS THE BALL MATRIX SIZE IN THE "E" DIRECTION.

n IS THE NUMBER OF POPULATED SOLDER BALL POSITIONS FOR MATRIX SIZE MD X ME.

6 DIMENSION "b" IS MEASURED AT THE MAXIMUM BALL DIAMETER IN A PLANE PARALLEL TO DATUM C.

7 SD AND SE ARE MEASURED WITH RESPECT TO DATUMS A AND B AND DEFINE THE POSITION OF THE CENTER SOLDER BALL IN THE OUTER ROW.

WHEN THERE IS AN ODD NUMBER OF SOLDER BALLS IN THE OUTER ROW SD OR SE = 0.000.

WHEN THERE IS AN EVEN NUMBER OF SOLDER BALLS IN THE OUTER ROW, SD OR SE =  $\frac{e}{2}$

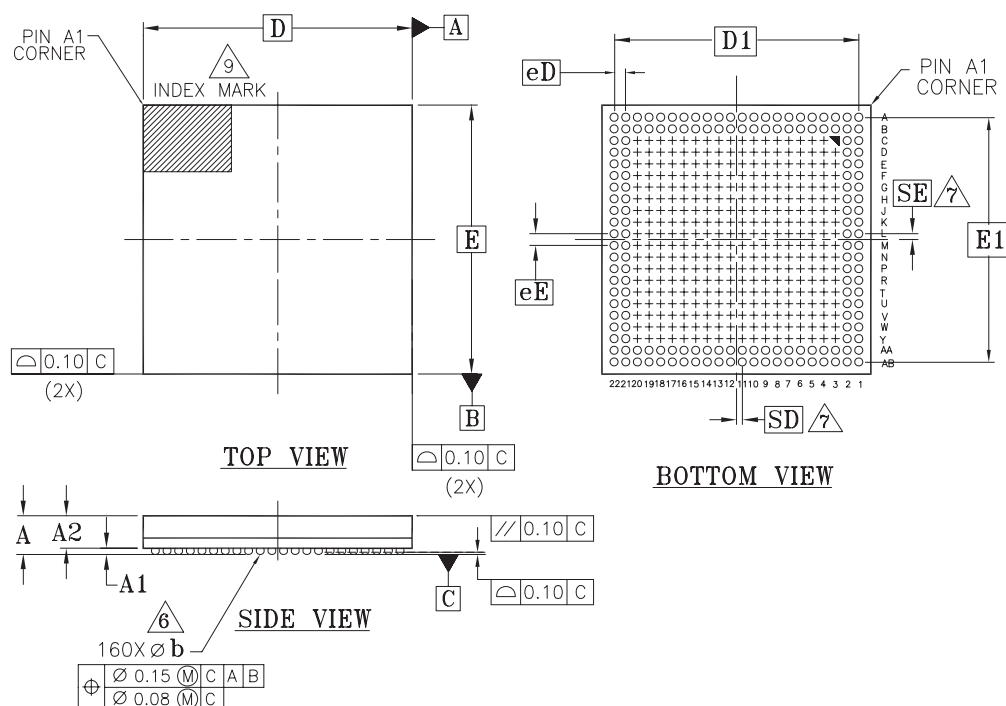
8 "+" INDICATES THE THEORETICAL CENTER OF DEPOPULATED BALLS.

9 A1 CORNER TO BE IDENTIFIED BY CHAMFER, LASER OR INK MARK, METALLIZED MARK INDENTATION OR OTHER MEANS.

10. OUTLINE AND DIMENSIONS PER CUSTOMER REQUIREMENT.

3550 \ 16-038.55 \ 02.23.06

## ALH160—160-ball Fine-Pitch Ball Grid Array (FBGA) 15 x 15 mm Package



|                                                                                                                                                                                                           |                                |      |      |                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------|------|---------------------------|
| PACKAGE                                                                                                                                                                                                   | ALH 160                        |      |      |                           |
| JEDEC                                                                                                                                                                                                     | N/A                            |      |      |                           |
| D x E                                                                                                                                                                                                     | 15.00 mm x 15.00 mm<br>PACKAGE |      |      |                           |
| SYMBOL                                                                                                                                                                                                    | MIN                            | NOM  | MAX  | NOTE                      |
| A                                                                                                                                                                                                         | ---                            | ---  | 1.10 | PROFILE                   |
| A1                                                                                                                                                                                                        | 0.38                           | ---  | ---  | BALL HEIGHT               |
| A2                                                                                                                                                                                                        | 0.53                           | ---  | 0.65 | BODY THICKNESS            |
| D                                                                                                                                                                                                         | 15.00 BSC.                     |      |      | BODY SIZE                 |
| E                                                                                                                                                                                                         | 15.00 BSC.                     |      |      | BODY SIZE                 |
| D1                                                                                                                                                                                                        | 13.65 BSC.                     |      |      | MATRIX FOOTPRINT          |
| E1                                                                                                                                                                                                        | 13.65 BSC.                     |      |      | MATRIX FOOTPRINT          |
| MD                                                                                                                                                                                                        | 22                             |      |      | MATRIX SIZE D DIRECTION   |
| ME                                                                                                                                                                                                        | 22                             |      |      | MATRIX SIZE E DIRECTION   |
| n                                                                                                                                                                                                         | 160                            |      |      | BALL COUNT                |
| N                                                                                                                                                                                                         | 160                            |      |      | MAXIMUM NUMBER OF BALLS   |
| R                                                                                                                                                                                                         | 2                              |      |      | NUMBER OF LAND PERIMETERS |
| Øb                                                                                                                                                                                                        | 0.43                           | 0.48 | 0.53 | BALL DIAMETER             |
| eE                                                                                                                                                                                                        | 0.65 BSC.                      |      |      | BALL PITCH                |
| eD                                                                                                                                                                                                        | 0.65 BSC.                      |      |      | BALL PITCH                |
| SD SE                                                                                                                                                                                                     | 0.325 BSC.                     |      |      | SOLDER BALL PLACEMENT     |
| R3 C3 ~ C20, D3 ~ D20, E3 ~ E20, F3 ~ F20, G3 ~ G20, H3 ~ H20, I3 ~ I20, J3 ~ J20, K3 ~ K20, L3 ~ L20, M3 ~ M20, N3 ~ N20, P3 ~ P20, Q3 ~ Q20, R3 ~ R20, S3 ~ S20, T3 ~ T20, U3 ~ U20, V3 ~ V20, W3 ~ W20 |                                |      |      | DEPOPULATED SOLDER BALLS  |

### NOTES:

- DIMENSIONING AND TOLERANCING METHODS PER ASME Y14.5M-1994.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- BALL POSITION DESIGNATION PER JEP95, SECTION 4.3, SPP-010.
- [e] REPRESENTS THE SOLDER BALL GRID PITCH.
- SYMBOL "MD" IS THE BALL MATRIX SIZE IN THE "D" DIRECTION.  
SYMBOL "ME" IS THE BALL MATRIX SIZE IN THE "E" DIRECTION.  
n IS THE NUMBER OF POPULATED SOLDER BALL POSITIONS FOR MATRIX SIZE MD X ME.
- DIMENSION "b" IS MEASURED AT THE MAXIMUM BALL DIAMETER IN A PLANE PARALLEL TO DATUM C.
- SD AND SE ARE MEASURED WITH RESPECT TO DATUMS A AND B AND DEFINE THE POSITION OF THE CENTER SOLDER BALL IN THE OUTER ROW.
- WHEN THERE IS AN ODD NUMBER OF SOLDER BALLS IN THE OUTER ROW SD OR SE = 0.000.  
WHEN THERE IS AN EVEN NUMBER OF SOLDER BALLS IN THE OUTER ROW, SD OR SE = [e/2]
- "+" INDICATES THE THEORETICAL CENTER OF DEPOPULATED BALLS.
- A1 CORNER TO BE IDENTIFIED BY CHAMFER, LASER OR INK MARK, METALLIZED MARK INDENTATION OR OTHER MEANS.

## 6. Revision History

| Section                                                        | Description                                                                                                                                     |
|----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Revision A (August 26, 2004)</b>                            |                                                                                                                                                 |
|                                                                | Initial release                                                                                                                                 |
| <b>Revision A 1 (June 1, 2005)</b>                             |                                                                                                                                                 |
| Global                                                         | Added SDRAM Type 2 module<br>Added Lead (Pb)-free options<br>Added FEA137 package diagram                                                       |
| <b>Revision A2 (October 7, 2005)</b>                           |                                                                                                                                                 |
| Global                                                         | Updated the S29WS-N NOR Flash Module<br>Added the S30MS-P ORNAND Flash Module<br>Added SDRAM Type 4 module                                      |
| Product Selector Guide                                         | Updated the Product Selector Guide                                                                                                              |
| Connection Diagrams                                            | Added two diagrams for the x8 and x16 ORNAND connections                                                                                        |
| Pin Descriptions                                               | Updated descriptions and added descriptions for ORNAND signals                                                                                  |
| Ordering Information                                           | Added new options<br>Added Package-on-Package (PoP) options                                                                                     |
| Valid Combinations                                             | Updated the valid combinations tables                                                                                                           |
| Physical Dimensions                                            | Added the FGA137 package diagram<br>Added the BWA160 package diagram<br>Added the BWB160 package diagram                                        |
| <b>Revision A3 (November 9, 2005)</b>                          |                                                                                                                                                 |
| Global                                                         | Updated the SDRAM Type 1 module<br>Changed the status of all RAM modules to Preliminary from Advanced.                                          |
| <b>Revision A4 (December 14, 2005)</b>                         |                                                                                                                                                 |
| Product Selector Guide                                         | Updated the tables                                                                                                                              |
| Connection Diagrams                                            | Added the 512 Mb NOR Flash with 512 Mb NAND on Bus 1 and 512 Mb SDRAM on Bus 2 diagram                                                          |
| Ordering Information                                           | Added new model number, package modifier and SDRAM & Data Flash density options                                                                 |
| Valid Combinations                                             | Updated all tables with new options                                                                                                             |
| <b>Revision A5 (December 16, 2005)</b>                         |                                                                                                                                                 |
| Connection Diagrams                                            | Updated the pinouts to include DDR signals<br>Qualified 133 MHz as DDR based frequency                                                          |
| <b>Revision A6 (March 21, 2006)</b>                            |                                                                                                                                                 |
| NOR Flash + ORNAND Flash + DRAM<br>MCPs Product Selector Guide | Updated the model numbers                                                                                                                       |
| Ordering Information                                           | Updated the table                                                                                                                               |
| Valid Combinations                                             | Updated the tables                                                                                                                              |
| Physical Dimensions                                            | Added the ALH160 package                                                                                                                        |
| <b>Revision A7 (April 18, 2006)</b>                            |                                                                                                                                                 |
| Connection Diagrams                                            | Updated the pinouts                                                                                                                             |
| <b>Revision A8 (June 1, 2006)</b>                              |                                                                                                                                                 |
| Global                                                         | Added 2 OPNs for products with DRAM Type 5<br>Updated product selector guide<br>Updated valid combination table<br>Added BTA160 package diagram |
| <b>Revision A9 (May 8, 2007)</b>                               |                                                                                                                                                 |
| Physical Dimensions                                            | Added the ALH 160 package diagram                                                                                                               |

### **Colophon**

The products described in this document are designed, developed and manufactured as contemplated for general use, including without limitation, ordinary industrial use, general office use, personal use, and household use, but are not designed, developed and manufactured as contemplated (1) for any use that includes fatal risks or dangers that, unless extremely high safety is secured, could have a serious effect to the public, and could lead directly to death, personal injury, severe physical damage or other loss (i.e., nuclear reaction control in nuclear facility, aircraft flight control, air traffic control, mass transport control, medical life support system, missile launch control in weapon system), or (2) for any use where chance of failure is intolerable (i.e., submersible repeater and artificial satellite). Please note that Spansion will not be liable to you and/or any third party for any claims or damages arising in connection with above-mentioned uses of the products. Any semiconductor devices have an inherent chance of failure. You must protect against injury, damage or loss from such failures by incorporating safety design measures into your facility and equipment such as redundancy, fire protection, and prevention of over-current levels and other abnormal operating conditions. If any products described in this document represent goods or technologies subject to certain restrictions on export under the Foreign Exchange and Foreign Trade Law of Japan, the US Export Administration Regulations or the applicable laws of any other country, the prior authorization by the respective government entity will be required for export of those products.

### **Trademarks and Notice**

The contents of this document are subject to change without notice. This document may contain information on a Spansion product under development by Spansion. Spansion reserves the right to change or discontinue work on any product without notice. The information in this document is provided as is without warranty or guarantee of any kind as to its accuracy, completeness, operability, fitness for particular purpose, merchantability, non-infringement of third-party rights, or any other warranty, express, implied, or statutory. Spansion assumes no liability for any damages of any kind arising out of the use of the information in this document.

Copyright © 2004-2007 Spansion Inc. All rights reserved. Spansion®, the Spansion Logo, MirrorBit®, MirrorBit® Eclipse™, ORNAND™, HD-SIM™ and combinations thereof, are trademarks of Spansion LLC in the US and other countries. Other names used are for informational purposes only and may be trademarks of their respective owners.