

# JEDEC STANDARD

---

## FBDIMM: Advanced Memory Buffer (AMB)

---

**JESD82-20**

**MARCH 2007**

**SPECIAL DISCLAIMER:** JEDEC has received information that certain patents or patent applications may be relevant to this standard, and, as of the publication date of this standard, no statements regarding an assurance or refusal to license such patents or patent applications have been provided.

<http://www.jedec.org/download/search/FBDIMM/Patents.xls>

JEDEC does not make any determination as to the validity or relevancy of such patents or patent applications. Prospective users of the standard should act accordingly.

---

**JEDEC SOLID STATE TECHNOLOGY ASSOCIATION**



## NOTICE

JEDEC standards and publications contain material that has been prepared, reviewed, and approved through the JEDEC Board of Directors level and subsequently reviewed and approved by the JEDEC legal counsel.

JEDEC standards and publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for use by those other than JEDEC members, whether the standard is to be used either domestically or internationally.

JEDEC standards and publications are adopted without regard to whether or not their adoption may involve patents or articles, materials, or processes. By such action JEDEC does not assume any liability to any patent owner, nor does it assume any obligation whatever to parties adopting the JEDEC standards or publications.

The information included in JEDEC standards and publications represents a sound approach to product specification and application, principally from the solid state device manufacturer viewpoint. Within the JEDEC organization there are procedures whereby a JEDEC standard or publication may be further processed and ultimately become an ANSI standard.

No claims to be in conformance with this standard may be made unless all requirements stated in the standard are met.

Inquiries, comments, and suggestions relative to the content of this JEDEC standard or publication should be addressed to JEDEC at the address below, or call (703) 907-7559 or [www.jedec.org](http://www.jedec.org)

Published by  
©JEDEC Solid State Technology Association 2007  
2500 Wilson Boulevard  
Arlington, VA 22201-3834

This document may be downloaded free of charge; however JEDEC retains the copyright on this material. By downloading this file the individual agrees not to charge for or resell the resulting material.

**PRICE: Please refer to the current  
Catalog of JEDEC Engineering Standards and Publications online at  
<http://www.jedec.org/Catalog/catalog.cfm>**

Printed in the U.S.A.  
All rights reserved

PLEASE!

DON'T VIOLATE  
THE  
LAW!

This document is copyrighted by the JEDEC Solid State Technology Association  
and may not be reproduced without permission.

Organizations may obtain permission to reproduce a limited number of copies  
through entering into a license agreement. For information, contact:

JEDEC Solid State Technology Association  
2500 Wilson Boulevard  
Arlington, Virginia 22201-3834  
or call (703) 907-7559

# Special Disclaimer

JEDEC has received information that certain patents or patent applications may be relevant to this standard, and, as of the publication date of this standard, no statements regarding an assurance or refusal to license such patents or patent applications have been provided.

<http://www.jedec.org/download/search/FBDIMM/Patents.xls>

JEDEC does not make any determination as to the validity or relevancy of such patents or patent applications. Prospective users of the standard should act accordingly.

§

## Table of Contents

Table of Contents .....	i
List of Tables .....	v
List of Figures .....	vii
<b>1</b> Introduction .....	<b>1</b>
1.1 Advanced Memory Buffer Overview .....	1
1.2 Advanced Memory Buffer Functionality .....	1
1.2.1 Advanced Memory Buffer .....	1
1.2.2 Transparent Mode for DRAM Test Support .....	1
1.2.3 Debug and Logic Analyzer Interface .....	2
1.2.4 DDR SDRAM .....	2
1.3 Advanced Memory Buffer Block Diagram .....	2
1.4 Interfaces .....	4
1.4.1 FBD High-Speed Differential Point-to-Point Link (at 1.5 V) Interfaces .....	4
1.4.2 DDR2 Channel .....	4
1.4.3 SMBus Slave Interface .....	4
1.5 References .....	5
1.6 Glossary .....	5
<b>2</b> FBD Channel Interface .....	<b>9</b>
2.1 Advanced Memory Buffer Support for FBD Operating Modes .....	9
2.2 Channel Initialization .....	9
2.3 Channel Protocol .....	9
2.3.1 General .....	9
2.3.2 Timeouts during TSO .....	9
2.3.3 Recalibrate state considerations .....	9
2.3.4 Address Mapping of DDR Commands to DRAMs .....	11
2.3.5 FBD L0s State .....	11
2.4 Reliability, Availability, and Serviceability .....	12
2.4.1 General .....	12
2.4.2 Channel Error Detection and Logging .....	12
2.5 Channel Configuration .....	12
2.5.1 Re-sync and Resample Modes .....	12
2.5.2 Other Channel Configuration Modes .....	13
2.5.3 Lane to Lane Skew on a Channel .....	13
2.6 Repeater Mode .....	13
2.7 Performance .....	14
2.7.1 Idle Memory Read Latency .....	14
2.8 AMB Components of Channel Latency .....	15
2.8.1 Command to Data Delay Calculation .....	15
2.8.2 Channel Throughput .....	18
<b>3</b> DDR Interface .....	<b>19</b>
3.1 Advanced Memory Buffer DDR Interface Overview .....	19
3.2 Data Mapping .....	19
3.2.1 Data Mask .....	19
3.3 Command / Address Outputs .....	20
3.3.1 CKE Output Control .....	21
3.3.2 Memory Controller / BIOS requirements .....	21
3.4 DQS IO and DM Outputs .....	21

# Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

## Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

## Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

## Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

## API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

## LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

## FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

## E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.