



U.S. Manufacturer of Specialty Memory Upgrades
for Laser Printers, Laptops, Fax Machines and more.

Product:
Product: DD59AFDxxx ATA Flash Disk (AFD)

FEATURES:

- 512 Bytes per sector
- ATA command set compatible
- Selectable Master/Slave Operation
- Support Data Transfer Speed up to PIO Mode-4
- **Capacities**
 - **32MB to 32GB**
- **Sequential Read Performance**
 - Up to 9.0 MB/sec (Max.)
- **Sequential Write Performance**
 - Up to 8.0 MB/sec (max.)
- **Single Voltage Read and Write Operation**
- **Low Power Consumption**
 - Active mode: 60 mA 5.0V (typical)
 - Sleep mode: 150 μ A 5.0V (typical)
- **Expanded Security Protection**
 - WP# pin configurable by firmware or through external jumper
- **Factory-Programmed, 20-Byte Unique ID number**
- **Supports Self Destruction command**
(software command from host required)
- **Zero Power Data Retention**
 - Batteries not required for data storage
- **Start Up Time**
 - Sleep to read: 200 ns (typical)
 - Sleep to write: 200 ns (typical)
 - Power-on to Ready: 200 ms (typical)
- **Temperature Range**
 - 0°C to +70°C for Operating Commercial
 - -50°C to +100°C for non-Operating (storage)
- **Rugged and Reliable**
 - Built-in ECC support corrects up to 3 random 12-bit symbols of error per 512 Byte sector
- **Intelligent ATA/IDE Controller**
 - Built-in microcontroller with intelligent firmware
- **Built-in Embedded Flash File System**
implements wear-leveling algorithms to substantially increase longevity of flash media
- **Power Management Unit**
- **Male IDE Connector**
44-pin (2mm)

PRODUCT DESCRIPTION

The ATA Flash Disk (AFD) is a low cost, high performance, embedded flash memory data storage system. This product is well suited for solid state mass storage applications offering new and expanded functionality while enabling cost-effective designs.

The AFD is a solid state disk drive that is designed to replace a conventional IDE hard disk drive, and can be plugged into a standard IDE connector commonly found in desktop or portable PC systems.

AFD has a built-in microcontroller and file management firmware that communicates with ATA standard interfaces; therefore, the AFD does not require additional or proprietary host software such as Flash File System (FFS) and Memory Technology Driver (MTD) software.



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The AFD is designed to work at 5V and is available in 32MB to 32GByte capacities. It uses a standard ATA driver that is part of all major operating systems such as Windows 95/98/2000/NT/CE/XP, MAC, and UNIX.

All signals, except WP#, are in compliance with the ATA specifications. WP# is used to write protect the information stored on the AFD. The WP# is connected to ground through a user selectable jumper located on the AFD. When JP1 is installed, the AFD is write protected to prohibit any inadvertent writes.

Every AFD comes with a factory-programmed, 20-Byte long, unique identification number for extended data protection. This feature prevents unauthorized duplication by allowing encryption of customer data.

The AFD integrates a standard 44-pin (2mm) male connector for easy and cost effective mounting. AFD also offers user selectable Master/Slave operation through an external jumper setting.



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1.0 GENERAL DESCRIPTION

The ATA-Flash Disk (AFD) contains a controller, embedded firmware, and Flash Media with a 44-pin male connector. Refer to Figure 1-1 for the AFD block diagram. The controller interfaces with the host system allowing data to be written to and read from the Flash Media.

1.1 Performance-optimized ATA Controller

The heart of the AFD is the ATA controller which translates standard ATA signals into Flash Media data and controls. The AFD contains a proprietary ATA controller specifically designed to attain high data throughput from host to flash. The following components contribute to the ATA controller's performance.

1.1.1 Microcontroller Unit (MCU)

The MCU translates ATA commands into data and control signals required for flash memory operation.

1.1.2 Internal Direct Memory Access (DMA)

The ATA controller inside the AFD uses DMA allowing instant data transfer from buffer to memory. This implementation eliminates microcontroller overhead associated with traditional, firmware based, memory control, increasing data transfer rate.

1.1.3 Power Management Unit (PMU)

The PMU controls the power consumption of the AFD. The PMU dramatically extends product battery life by putting the part of the circuitry that is not in operation into sleep mode.

1.1.4 SRAM Buffer

A key contributor to the ATA controller performance is an SRAM buffer. The buffer optimizes the data writes to Flash.

1.1.5 Embedded Flash File System

The Embedded Flash File System is an integral part of the ATM controller. It contains MCU Firmware that performs the following tasks:

1. Translates host side signals into flash media Writes and Reads.
2. Provides dynamic flash media wear leveling to spread the Flash writes across all unused memory address space to increase the longevity of flash media.
3. Keeps track of data file structures.

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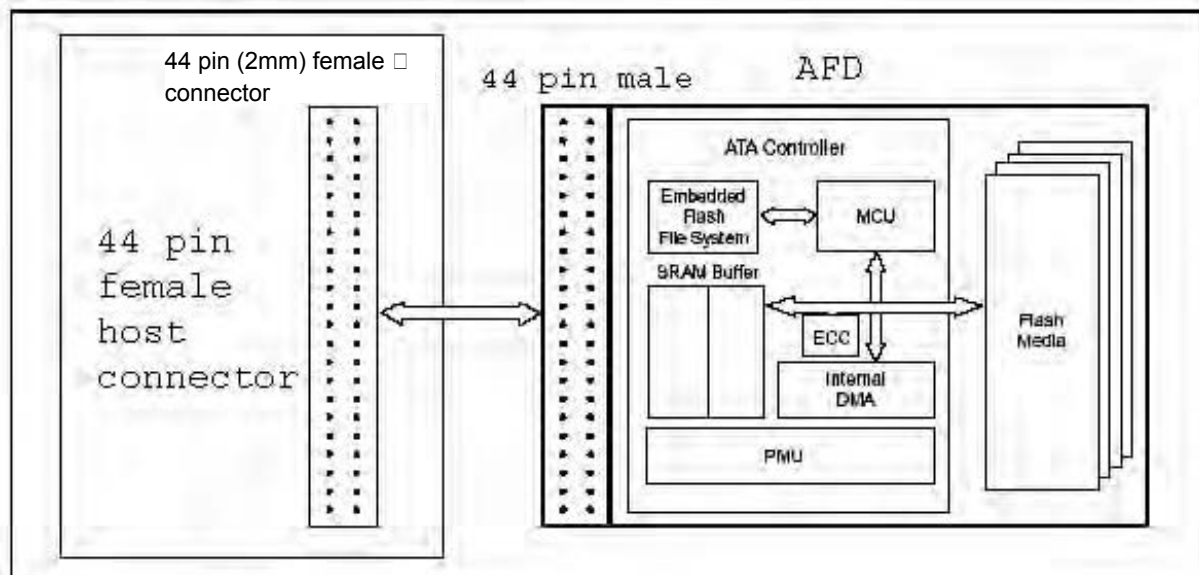
1.1.6 Error Correction Code (ECC)

The ATA controller utilizes 72-bit Reed-Solomon Error Detection Code (EDC) and Error Correction Code (ECC), which provides following error immunity for each 512-Byte block of data:

1. Corrects up to three random 12-bit symbol errors
2. Corrects single bursts up to 25 bits
3. Detects single bursts up to 61 bits and double bursts up to 15 bits
4. Detects up to six random 12-bit symbol errors

1.1.7 Multi-tasking Technology

Multi-tasking technology enables fast sustained write performance by allowing concurrent Read, Program, and Erase operations to multiple flash media devices.



1.3 AFD Drive Configuration

The ADM can be configured for SLAVE or MASTER operation with the use of JP2.

The ADM write protect mode can be enabled by installing JP1.
Please see Figure 2-1 for jumper settings.

When the device is configured in the Write-Protect mode, the AFD offers extended data protection. This feature can protect the stored data from inadvertent system writes or erases, and viruses. The Write-Protect feature protects the full address space of the flash media.

In the Write-Protect mode, the AFD is protected from the following destructive commands: Format-Track, Write-Buffer, Write-Long-Sector, Write-Multiple, Write-Sector(s), or Write-Verify. This will force the ADM to reject any destructive commands from the ATA interface. All destructive commands will

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Jumper Settings ATA Flash Diskk	
JP1 OFF	Disk is NOT Write Protected
JP1 ON	Disk is Write Protected
JP2 OFF	Disk in SLAVE mode
JP2 ON	Disk in MASTER mode

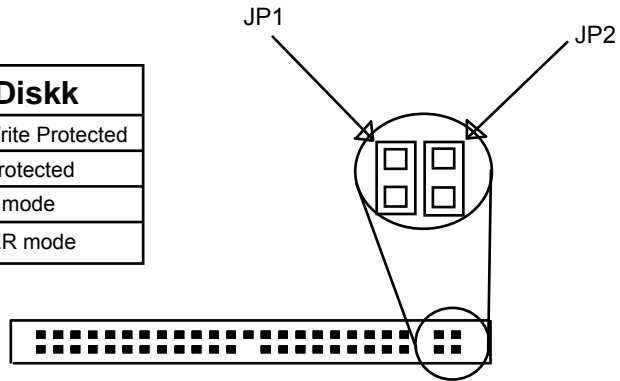


Figure 2-1: Jumper setting/ Drive Configuration

1.3.1 Purge Command

The AFD supports a unique Purge Command feature. After this instruction is generated by the host, the purge command automatically erases the Flash media on the AFD to a customer unique state.



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1.4 The ATA Flash Disk Capacity Specification

The DD59AFDxxx ATA Flash Disk product family is available in 32MB to 32GByte capacities. The following table shows the specific capacity, default number of cylinder heads, sectors and cylinders for each product line.

TABLE 1-1 ATA Flash DISK CAPACITY SPECIFICATION (1 OF 2)

Capacity	Total Bytes	Cylinders	Heads	Sectors
32 MB	32,047,104	489	4	32
48 MB	48,037,888	733	4	32
64 MB	64,028,672	977	4	32
96 MB	96,075,776	733	8	32
128 MB	128,057,344	977	8	32
192 MB	192,413,696	734	16	32
256 MB	256,901,120	980	16	32
384 MB	384,491,520	745	16	63
512 MB	512,483,328	993	16	63
640 MB	640,475,136	1241	16	63
704 MB	704,471,040	1365	16	63
768 MB	768,466,944	1489	16	63
896 MB	896,974,848	1738	16	63
1024 MB	1,024,966,656	1986	16	63
1152 MB	1,152,442,368	2233	16	63
1280 MB	1,280,434,176	2481	16	63
1408 MB	1,408,425,984	2729	16	63
1536 MB	1,536,417,792	2977	16	63
1664 MB	1,664,409,600	3225	16	63
1792 MB	1,792,401,408	3473	16	63
1920 MB	1,920,393,216	3721	16	63
2048 MB	2,048,385,024	3969	16	63
2176 MB	2,176,376,832	4217	16	63
2304 MB	2,304,368,640	4465	16	63
2432 MB	2,432,360,448	4713	16	63
2560 MB	2,560,352,256	4961	16	63
2688 MB	2,688,344,064	5209	16	63
2816 MB	2,816,335,872	5457	16	63
2944 MB	2,944,327,680	5705	16	63
3072 MB	3,072,319,488	5953	16	63
3200 MB	3,200,311,296	6201	16	63
3328 MB	3,328,303,104	6449	16	63
3456 MB	3,456,294,912	6697	16	63
3584 MB	3,584,286,720	6945	16	63



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TABLE 1-1: DEFAULT ATA FLASH DRIVE SETTINGS (CONTINUED) (2 OF 2)

Capacity	Total Bytes	Cylinders	Heads	Sectors
3712 MB	3,712,278,528	7193	16	63
3840 MB	3,840,270,336	7441	16	63
3968 MB	3,968,262,144	7689	16	63
4096 MB	4,096,253,952	7937	16	63
6 GB	6,001,164,288	11628	16	63
8 GB	8,001,552,384	15504	16	63
10 GB	10,001,940,480	na	16	63
12 GB	12,001,296,384	na	16	63
14 GB	14,001,684,480	na	16	63
16 GB	16,001,040,384	na	16	63
32 GB	32,001,048,576	na	16	63



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2.0 ELECTRICAL INTERFACE

2.0.1 Pin Assignment and Pin Type

The signal/pin assignments are listed in Table 2-1

2.1 Electrical Description

The ADM functions in ATA Mode, which is compatible with IDE hard disk drives.

Signals whose source is the host are designated as inputs while signals that the ADM sources are outputs. All outputs from the ADM are totem pole except the data bus signals which are in the bi-directional tri-state.



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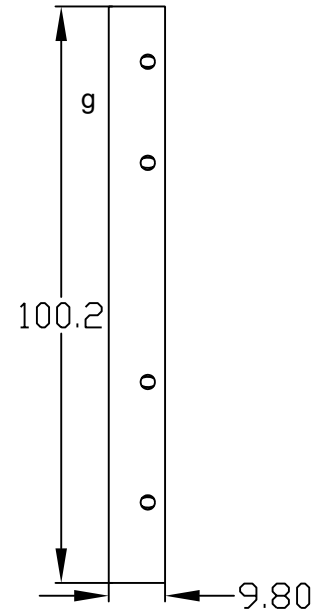
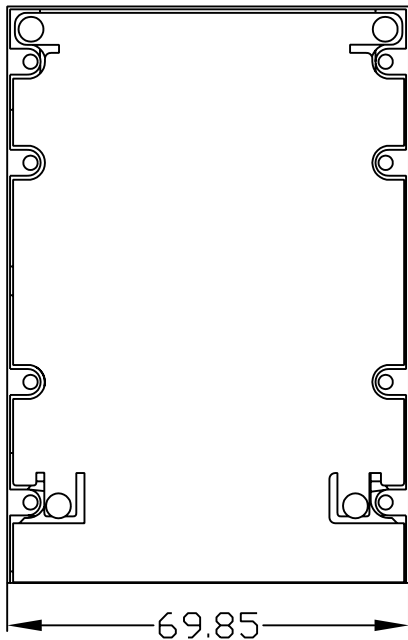
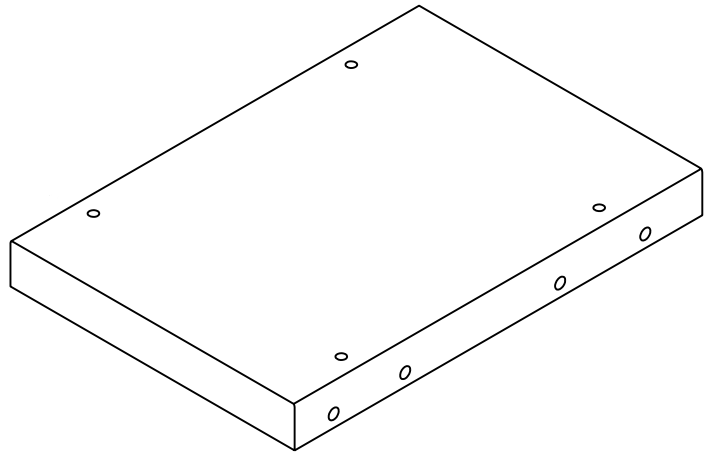
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TABLE 2-1: 44-PIN PIN ASSIGNMENT

Pin No.	Signal Name	Pin Type	I/O Type
1	RESET#	I	I3U
2	GND	-	Ground
3	D7	I/O	I1D, O2
4	D8	I/O	I1D, O2
5	D6	I/O	I1D, O2
6	D9	I/O	I1D, O2
7	D5	I/O	I1D, O2
8	D10	I/O	I1D, O2
9	D4	I/O	I1D, O2
10	D11	I/O	I1D, O2
11	D3	I/O	I1D, O2
12	D12	I/O	I1D, O2
13	D2	I/O	I1D, O2
14	D13	I/O	I1D, O2
15	D1	I/O	I1D, O2
16	D14	I/O	I1D, O2
17	D0	I/O	I1D, O2
18	D15	I/O	I1D, O2
19	GND	-	Ground
20	NC	-	-
21	NC	-	-
22	GND	-	Ground
23	IOWR#	I	I2U
24	GND	-	Ground
25	IORD#	I	I2U
26	GND	-	Ground
27	NC	-	-
28	NC	-	-
29	NC	-	-
30	NC	-	-
31	INTRQ	O	O1
32	IOCS16#	O	O2
33	A1	I	I1D
34	PDIAG#	I/O	I1U, O1
35	A0	I	I1D
36	A2	I	I1D
37	CS1FX#	I	I2U
38	CS3FX#	I	I2U
39	DASP#	I/O	I1U, O1
40	GND	-	Ground
41	V _{cc}	-	Power
42	V _{cc}	-	Power
43	GND	-	Ground
44	NC	-	-

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3.0 PHYSICAL DIMENSIONS



Drives available in standard sheet metal housing or ruggedized machined 6061-T6 Aluminum



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Evaluation NOTES: