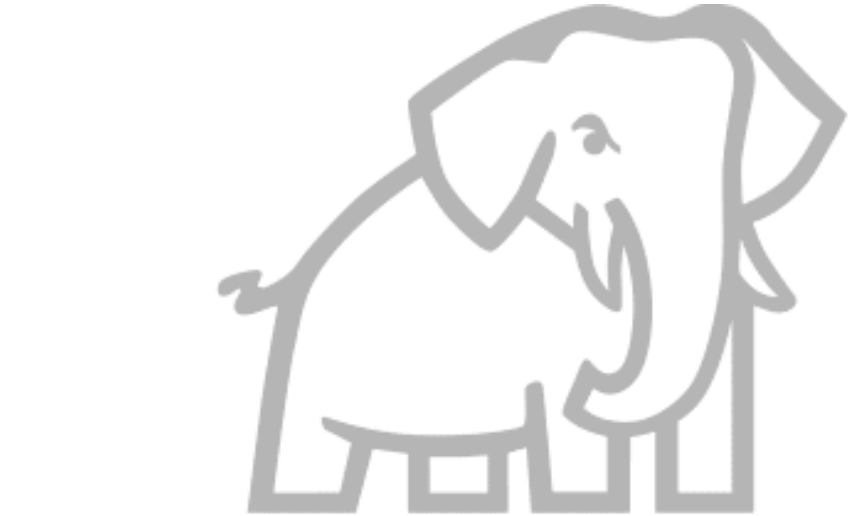

AT3515 3.5” Bulldog

3.5” IDE Solid State Flash Drive

User Guide

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Revision 1.1
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1. HIGHLIGHTS

- 128 Mbyte to 8 Gbyte uncompressed capacity
- Full -40°C to +85°C operating temperature range
- 5 volt, low power operation
- Completely solid state - no moving parts and no batteries
- Extremely Rugged - 1000G operating shock, 15G operating vibration
- 3.5” drive form factor with a 40-pin, 0.1in standard IDE interface
- 72-bit Reed-Solomon ECC for exceptional data reliability
- Power hold-up circuit
- 0.3 millisecond access time
- 6 Mbyte/secon sustained Read throughput
- 6 Mbyte/second sustained Write throughput
- Pending CE and CSA Safety Compliance

2. INTRODUCTION

The AT3515 is the low-cost, 3.5” member of the Bulldog Family of drives available today. With a maximum capacity of 8 Gbytes in a standard 3.5” drive form factor, it delivers exceptional value for its features. It is completely solid state, with no moving parts. This accounts for the unit’s exceptional ruggedness and wide operating temperature range.

The AT3515 employs sector erasable NAND EEPROMs (Flash) to deliver up to 8 Gbytes of uncompressed, non-volatile solid state storage in an extremely small, rugged form factor. Sustained host data throughput is a 6 Mbytes per seconds for reads and 6 Mbytes/second for writes. The drive is 100% IDE compatible and requires no special drivers to operate. It is essentially a drop in replacement for standard rotating media.

The IDE interface is implemented using an application specific IDE Flash controller with an integrated 72-bit Reed-Solomon error detection and on-the-fly correction mechanism that enhance data reliability. The ECC circuitry, in conjunction with the controller’s remapping algorithms, makes for a virtually bulletproof medium for data retention.

The drive is available in a number of standard capacities ranging from 128 Mbytes to 8 Gbytes. Please contact the factory with your capacity requirements. Disk compression utilities may be used to effectively double the usable capacity of the drive.

Each drive is fully tested under environmental and voltage extremes, to guarantee data integrity in even the harshest conditions.

3. INSTALLATION

3.1 PROCEDURE

3.1.1 ESD PRECAUTIONS

Static electricity kills... electronics! Before handling the AT3515, please observe the following precautions to avoid ESD damage to the unit:

- Keep the drive in its shielded bag until ready to install.
- Ground yourself by touching a grounded chassis frame of the computer, or use a grounded wrist strap before and during the installation process.
- Do not touch the exposed drive electronics or connectors. Always handle the drive by the edges or mounting rails.

3.1.2 CONFIGURATION

Configure the drive using the jumper diagrams given in Section 3.2. The drive is shipped configured for a single drive system or as the master in a two-drive system. Change the configuration as required. Never attempt to change the jumpers while the drive is plugged in and the computer is on.

3.1.3 CONNECTOR

The drive may be interfaced directly to a standard 3.5", 0.1inch IDE socket connector or a standard 40pin IDE ribbon and AT power cable. See drawing below for pin 1 location. Care should be taken when installing the AT3515 into the system, as misalignment can permanently damage the drive interface connector or electronics.

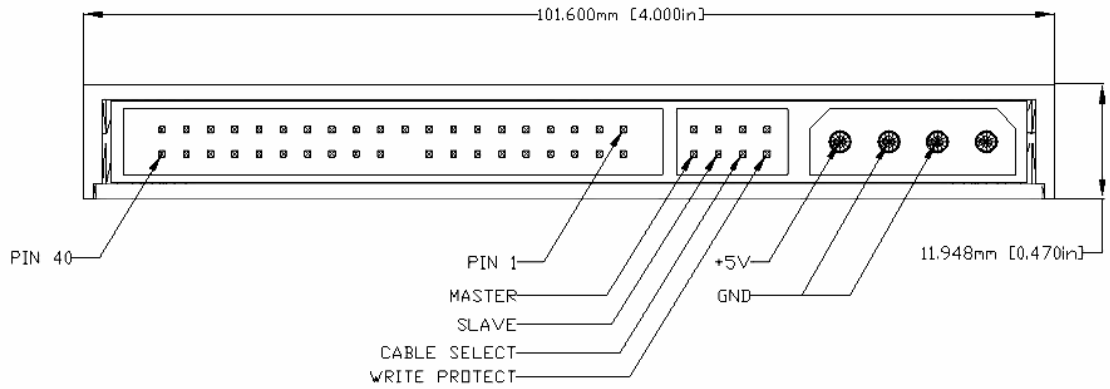


Figure 1 - Drive Connector

3.1.4 MOUNTING

The AT3515 may be mounted in any orientation. A total of four bottom and six side mounting holes are available for installation. The mounting holes require 6-32 screws with a maximum depth of 0.25 inch.

The diagram given below is valid for all capacities of the AT3515 drive. The overall outside dimensions are 4 inches (101.6 mm) wide, 5.56 inches (141.22mm) long, and 0.473 inches (12 mm) tall. Please refer to the following drawing for dimensions and mounting-hole locations.

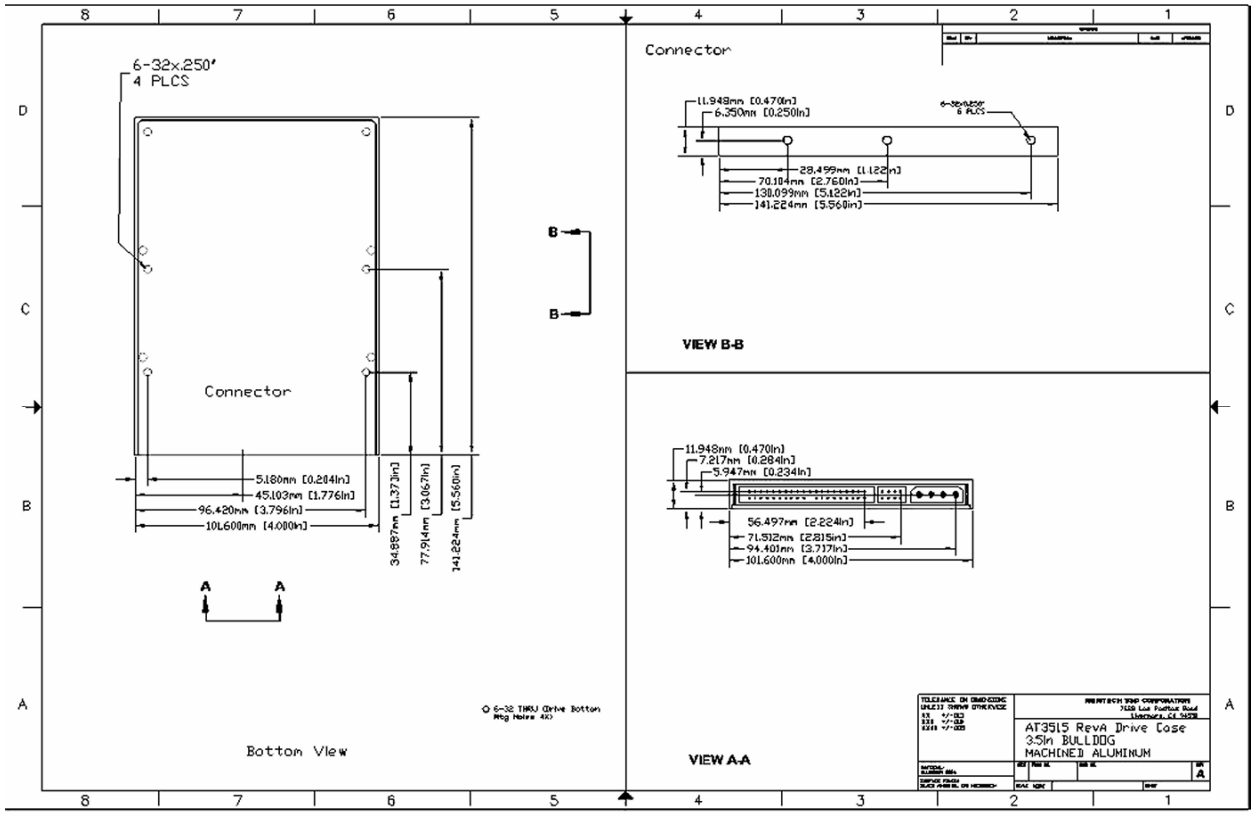


Figure 2 - Mechanical Dimensions

3.1.5 COMPUTER SETUP

To be recognized by the computer, the drive translation information must typically be entered into the System Setup or CMOS Setup utility. For non-PC compatible computers, this may not apply. The AT3515 supports automatic detection and configuration if offered by the BIOS. If the drive configuration must be manually entered, select drive type USER and use the table below to determine proper setup parameters. Automatic CHS translation and LBA mode is supported. Note that a MB is equal to 1024*1024 bytes.

Drive Type	Physical Capacity	Cylinders	Heads	Sectors	Available Capacity
AT3515-128	128 MB	977	8	32	122 MB
AT3515-256	256 MB	980	16	32	245 MB
AT3515-384	384 MB	745	16	63	366 MB
AT3515-512	512 MB	993	16	63	489 MB
AT3515-768	768 MB	1489	16	63	732 MB
AT3515-1024	1024 MB	1986	16	63	977 MB
AT3515-2048	2048 MB	3969	16	63	1953MB
AT3515-3072	3072MB	5953	16	63	2930 MB
AT3515-4096	4096MB	7937	16	63	3906.5 MB
AT3515-6144	6144MB	11628	16	63	5723.2 MB
AT3515-8192	8192MB	15504	16	63	7630.9 MB

3.1.6 PARTITION

The drive must be partitioned using the system's FDISK utility. For operating systems other than DOS, please refer to your OS operating guides. Note that changing the partition information will erase all data currently on the drive. Refer to your OS manual for information regarding partitioning a hard disk.

3.1.7 FORMAT

The AT3515 is low-level formatted at the factory, which establishes the 512-byte sector size. A high-level format is required after the partition has been established on the drive. Refer to your OS manual for information regarding hard disk drive format procedures.

3.2 JUMPERS

The following diagram illustrates the location of the drive selection jumper on the AT3515. The jumper configuration controls the drive selection and write protection. The jumper required is a 2-pin shorting plug on 0.1in centers.

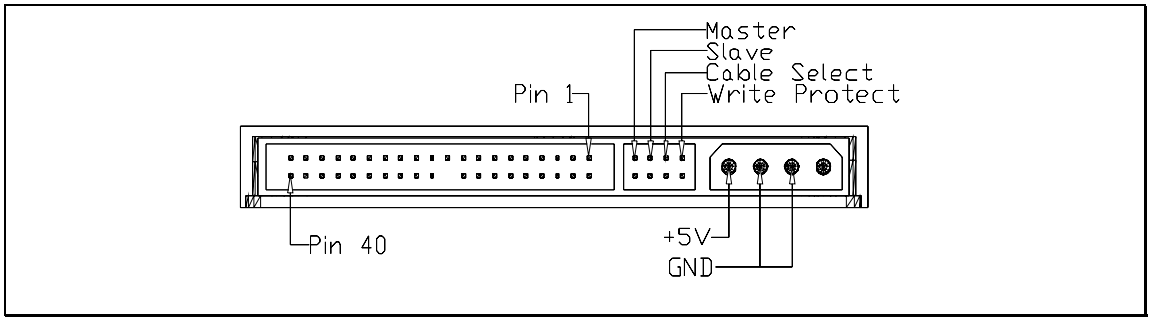
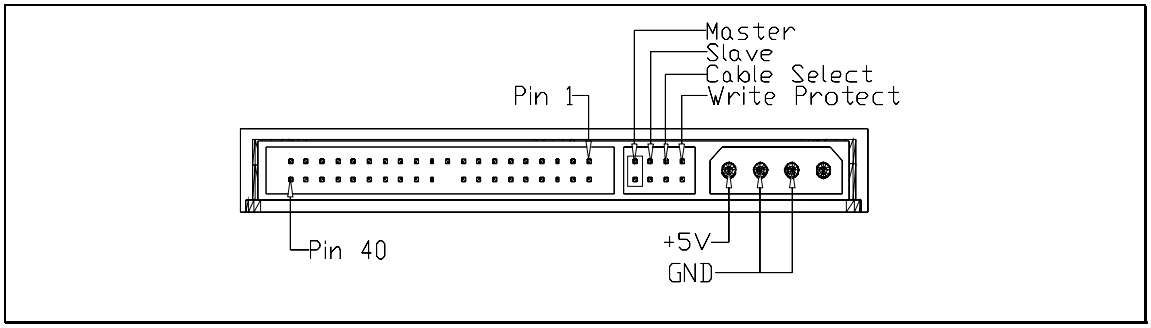


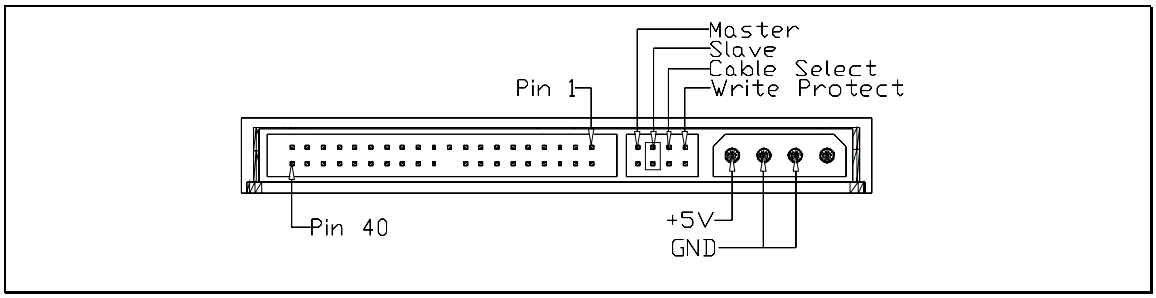
Figure 3 - Configuration Jumpers

3.2.1 MASTER



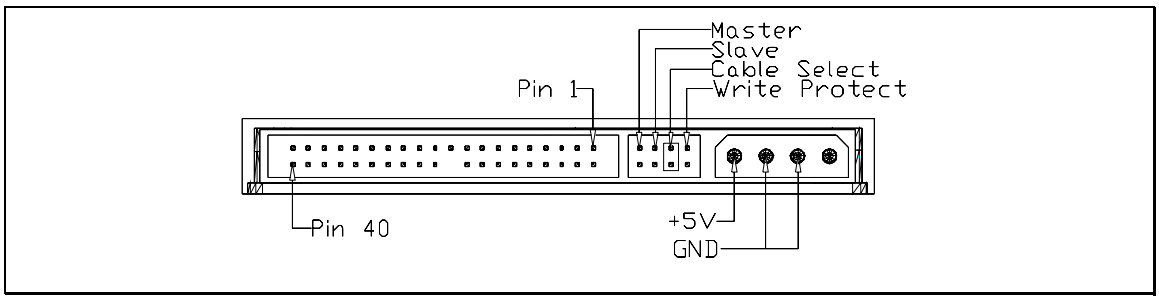
The drive is configured as a master device if no jumper is installed or if the jumper is installed on the master jumper block.

3.2.2 SLAVE



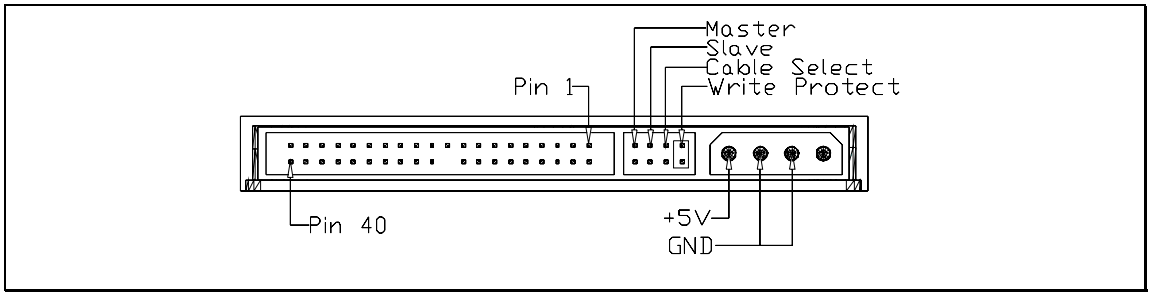
The slave jumper allows the drive to be configured as a slave.

3.2.3 CABLE SELECT



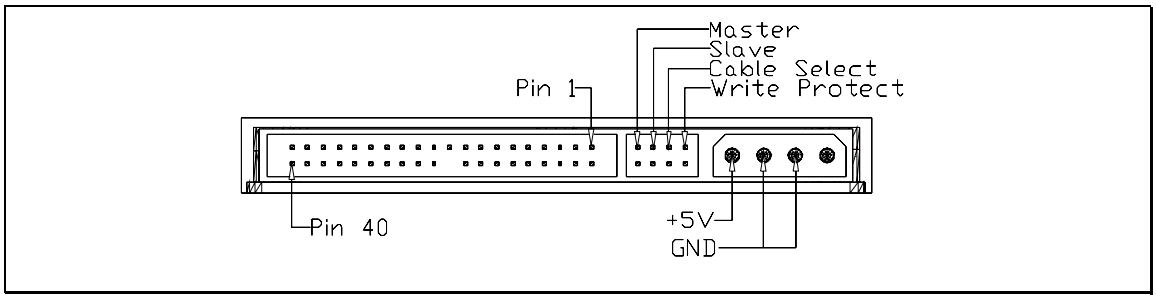
The Cable Select jumper allows the drive to be configured as a master or slave as determined by the drive's position on an IDE cable. A maximum of two drives may be connected to one standard IDE cable.

3.2.4 WRITE PROTECT



The Write Protect jumper prevents data from being written to the drive.

3.2.5 FACTORY DEFAULT



The factory default configuration is master. No jumpers are installed.

3.3 IDE INTERFACE

The AT3515 uses a unitized signal and power connector. Maximum cable length is 18 inches. Recommended cable length is 12 inches or less, especially if advanced PIO or DMA transfer modes are used.

3.3.1 IDE CONNECTOR PINOUT

The signal to pin assignment for the 40-pin IDE interface connector is listed in the following table.

PIN	SIGNAL	PIN	SIGNAL
1	RESET-	2	GND
3	DATA7	4	DATA8
5	DATA6	6	DATA9
7	DATA5	8	DATA10
9	DATA4	10	DATA11
11	DATA3	12	DATA12
13	DATA2	14	DATA13
15	DATA1	16	DATA14
17	DATA0	18	DATA15
19	GND	20	KEY (NO PIN)
21	DMARQ	22	GND
23	IOW-	24	GND
25	IOR-	26	GND
27	IOCHRDY	28	CSEL
29	DMACK-	30	GND
31	IRQ	32	IOCS16-
33	ADDR1	34	PDIAG-
35	ADDR0	36	ADDR2
37	CS0-	38	CS1-
39	DASP-	40	GND

4. OPERATION

4.1 ECC

The IDE controller utilizes a 72-bit Reed-Solomon Error Detection Code (EDC) and Error Correction Code (ECC), which provides the 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.

4.2 MTBF

The MTBF can be logically calculated in hours using the following formula.

$$MTBF = \frac{\#\text{ Flash Chips} * \#\text{ Blocks} * \text{Re-programming Cycles} * \text{Area Rate}}{\text{Average Programming Sectors per hour (1 sector = 512 bytes)}}$$

Note: The program area is the area that is not changed once it has been programmed. The remainder of the drive is thus considered “Reprogrammable”. In the case where 32 Kbytes (64 sectors) are written every 5 minutes into an area occupying 30% of a 512 MB disk (1 Gbit x 4 chips), the MTBF is calculated as shown below:

MTBF = (4*8192*250,000*0.3)/(64*12)
= 3.2 million hours (350 years)

4.3 POWER

4.3.1 POWER DOWN

The AT3515 is shipped with Memtech’s proprietary Kicker™ hold-up circuit. The Kicker™ provides enough residual power for the drive to complete a write sequence, thus avoiding data corruption.

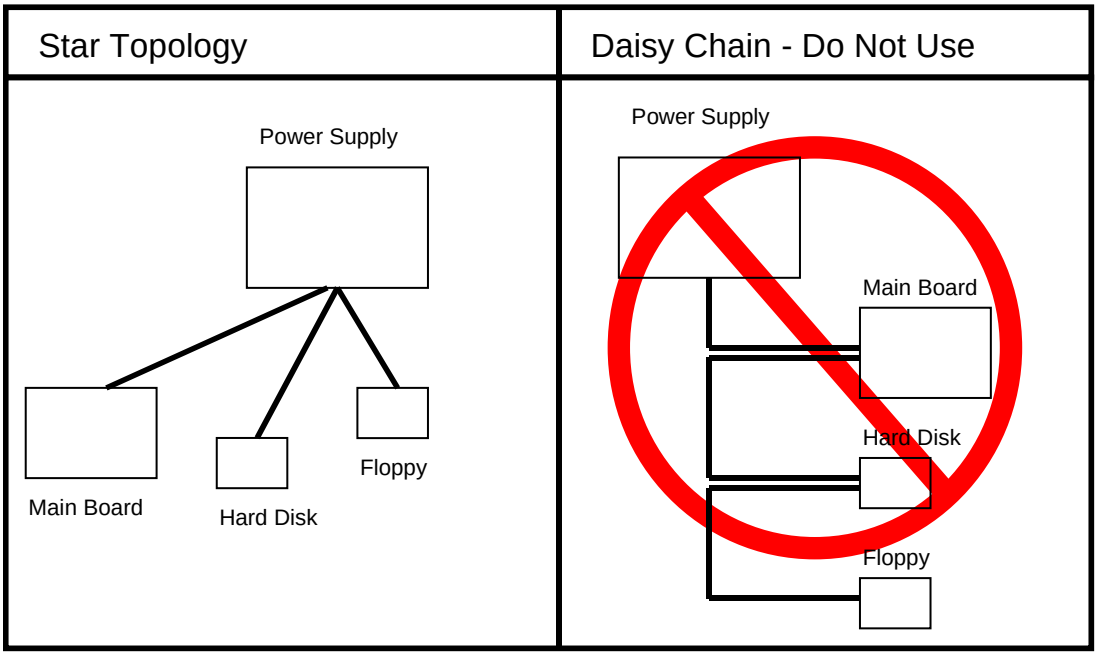
Still, it is recommended that power not be removed from any mass storage device while a write sequence is in progress. This is especially true when disk-caching programs are being used. Though the Kicker™ protects against data corruption and media errors, it cannot prevent OS or file errors from occurring. These types of errors arise when the OS breaks a large transfer into many smaller ones, and only part of the transfer arrives from the host.

4.3.2 POWER SUPPLY

The AT3515 voltage requirement is specified at +5 volts, +/- 5%. Operation outside of these limits is not guaranteed. Note that the drive will “operate” below this voltage, but reliability issues such as uncorrectable errors or invalid data reads may occur. An on board voltage monitor will inhibit writes when the on-board supply voltage falls below 3 volts, thus preserving data integrity on the drive.

4.3.3 POWER ROUTING

Bad power can lead to bad data. To avoid “glitches” or noise on the Vcc and ground lines, power in the system should be routed so that all peripherals are sourced from the power supply in a star configuration, as opposed to routing a single continuous supply line to each device in the system. Routing power in the star configuration, as is done on most desktop PCs, will minimize the effect on one device’s current draw on another device. This is key to maintaining data integrity on the AT3515. See diagrams below.



5. MAINTENANCE

No maintenance is required during the normal use of this drive.

If data is to be archived for long periods of time (> 10 years), it is recommended that the data on the drive be refreshed every 5 to 10 years. The manufacturer of the NAND E^2PROM devices will only guarantee data integrity for a period of 10 years. Programs such as Norton Speedisk©, which reallocates all sectors on the drive, or Microsoft® Scandisk, which writes and reads every sector on the disk during its surface test, achieve this end very well.

6. SPECIFICATIONS

6.1 INTERFACE

IDE Compatibility	ATA-3 compliant
IDE Drive Number	Drive 0 or 1
Physical Capacity	128 Mbytes to 8 Gbytes
Physical Sector Size	512 bytes

6.2 PERFORMANCE

Average Access	0.3 ms
Track/Track Access	0.3 ms
Sequential Read	6 Mbytes/sec sustained
Sequential Write	6 Mbytes/sec sustained
Random Read	6 Mbytes/sec sustained
Random Write	6 Mbytes/sec sustained
Weighted Average	6 Mbytes/sec

6.3 ENVIRONMENTAL

Commercial Temperature Range	
Operating	0^{o} to 70^{o} C
Storage	-55^{o}C to 125^{o} C
Extended Temperature Range	
Operating	-20^{o}C to 75^{o}C
Storage	-55^{o}C to 125^{o} C
Industrial Temperature Range	
Operating	-40^{o} to 85^{o} C
Storage	-55^{o} to 125^{o} C
Shock - operating	1000G Operating
Vibration - operating	15G Random
Airflow	None required
Humidity	5% to 95% Non-condensing

6.4 POWER REQUIREMENTS

Voltage	5V +/- 5%
Current	AT3515-2048
Idle	1.5 mA
Read	25 mA
Write	35 mA

6.5 MECHANICAL

Length	5.56 inches (141.22 mm)
Width	4.00 inches (101.60 mm)
Height	0.47 inches (12.01 mm)
Cable Interface	40-pin, 0.1in
Max. Cable Length	18 inches (457 mm)
Rec. Cable Length	12 inches (305 mm)
Weight	(2048 Mbytes) 7.3 oz (208 g)

7. APPENDIX

7.1 CONTACT INFORMATION

For Technical Support or Warranty Repair information, please contact Memtech at:

Memtech SSD Corporation
2107 N. First Street, Suite 415
San Jose, CA 95131
phone: (408) 452-1277 or (800) 445-5511
fax: (408) 452-7936

7.2 ATA SPECIFICATION INFORMATION

Information regarding the ATA-3 specification may be obtained from the following locations:

AT-Attachment Document Distribution
Global Engineering
15 Inverness Way East
Englewood, Co. 80112-5704
Phone: (303) 792-2181 or (800) 854-7179
Fax: (303) 792-2192

ATA Anonymous FTP Site
http://fission.dt.wdc.com
ATA3 directory is: "/pub/standards/ata/ata-3"

7.3 LIMITED LIFETIME WARRANTY

Memtech warrants your AT3515 against defects in material and workmanship for the life of the drive. The warranty is void in the case of misuse, accident, alteration, improper installation, misapplication or the result of unauthorized service or repair.

The implied warranties of merchantability and fitness for a particular purpose, and all other warranties, expressed or implied, except as set forth in this warranty, shall not apply to the products delivered.

In no event shall Memtech be liable for any lost profits, lost savings or other incidental or consequential damages arising out of the use of, or inability to use, this product.

BEFORE RETURNING PRODUCT, A RETURN MATERIAL AUTHORIZATION (RMA) MUST BE OBTAINED FROM MEMTECH.

Product shall be returned to Memtech with shipping prepaid. If the product fails to conform and warranty repair is necessary, Memtech will reimburse customer for the transportation charges incurred.