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# *1.8" Super Small Slim HDD*



*Digital Media Network Company  
Storage Device Division*

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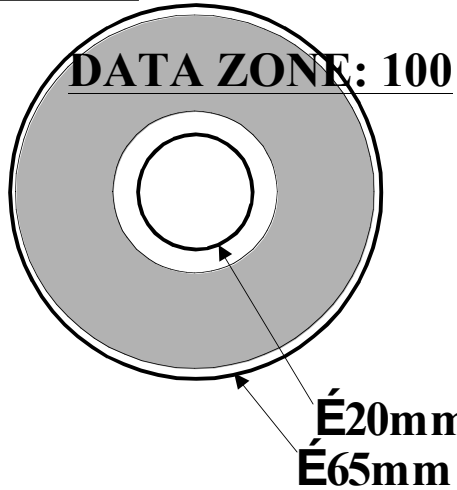
## *Why 1.8" HDD?*

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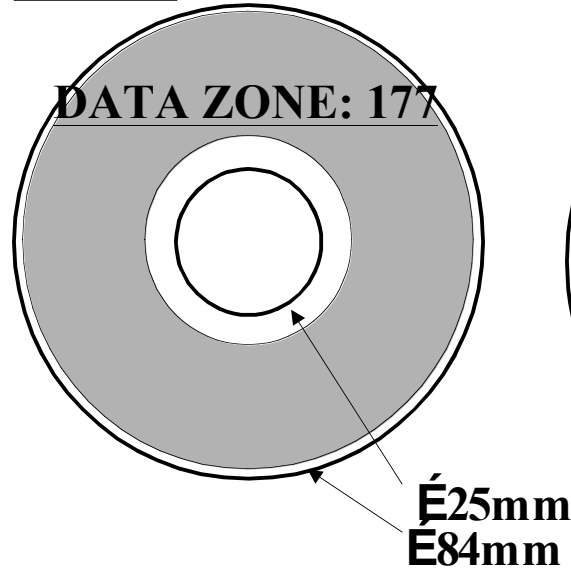
- *Larger Capacity*
  - About half of the 2.5" drive's capacity
  - Can record about 1 hour MPEG2 SDTV (with 2.0GB)
- *Lower Power Consumption*
  - Will be better storage for mobile devices
- *Standard Interface*
  - PC-Card is a standard interface in notebook PCs
  - Used as a bridging media between notebook PCs
  - Can be used as an embedded storage device

# Form Factor : Media Size

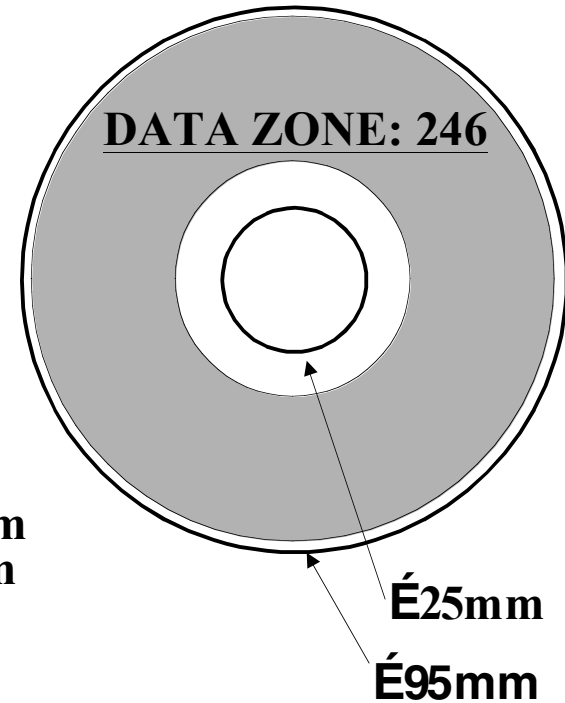
2.5"



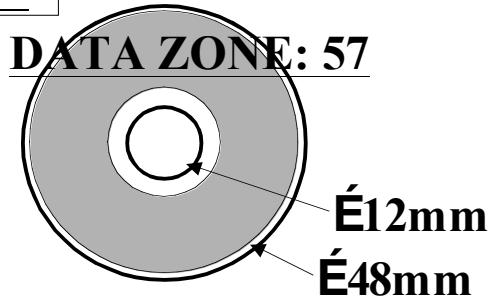
3.0"



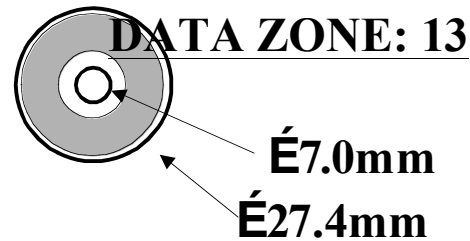
3.5"



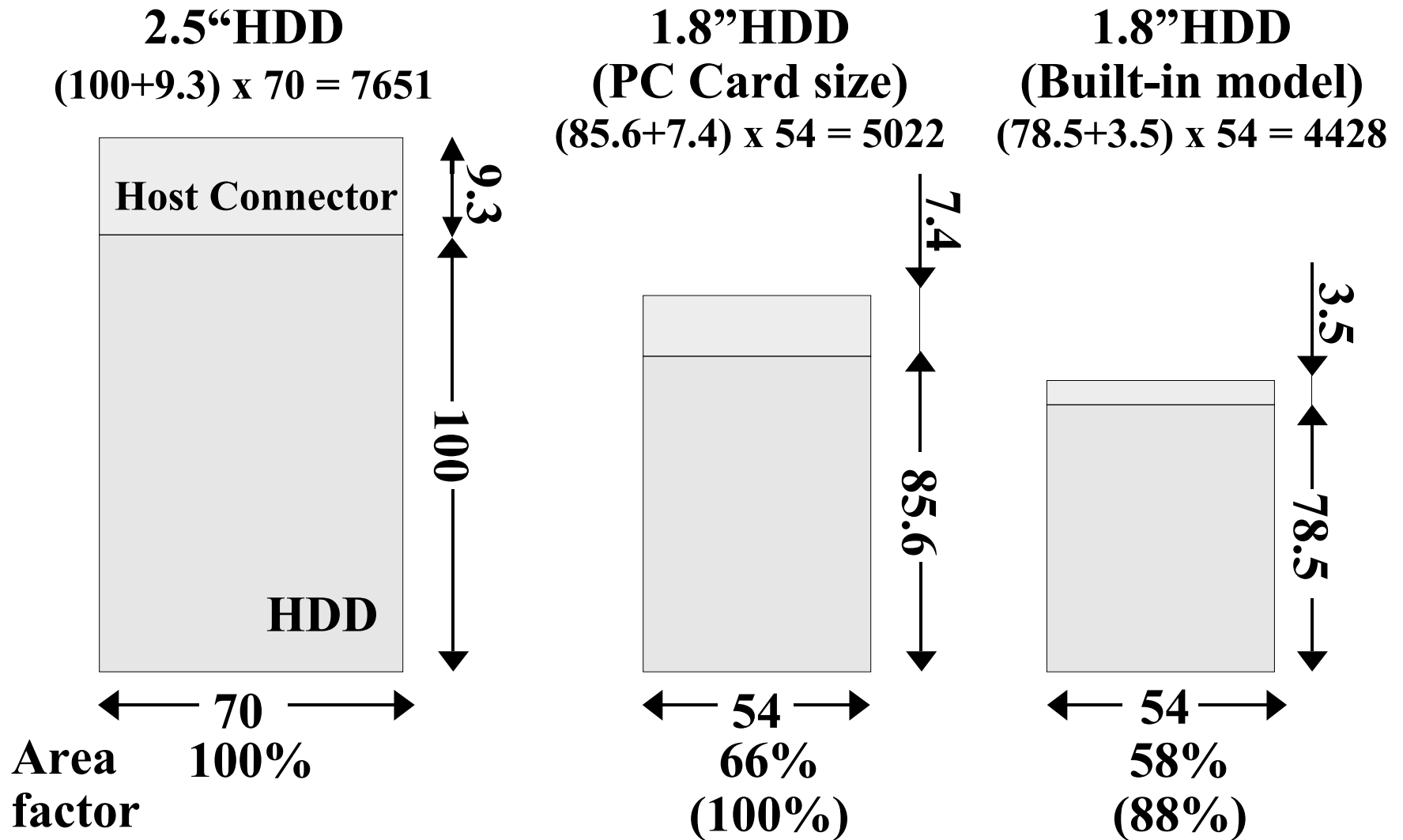
1.8"



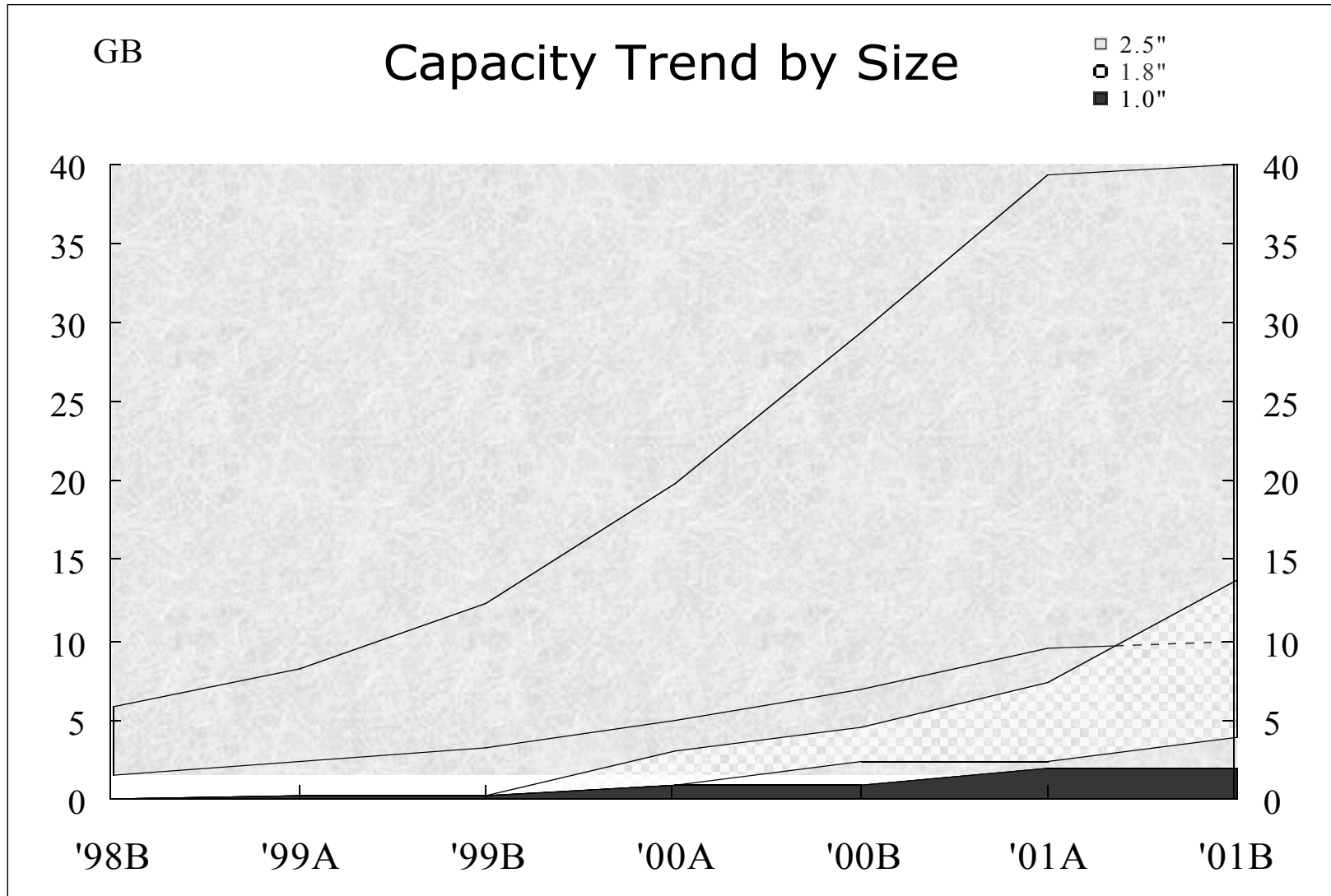
1.0"



# Form Factor : Comparison of Foot Print



# Capacity Trend by Form Factor



## *Product Concept*

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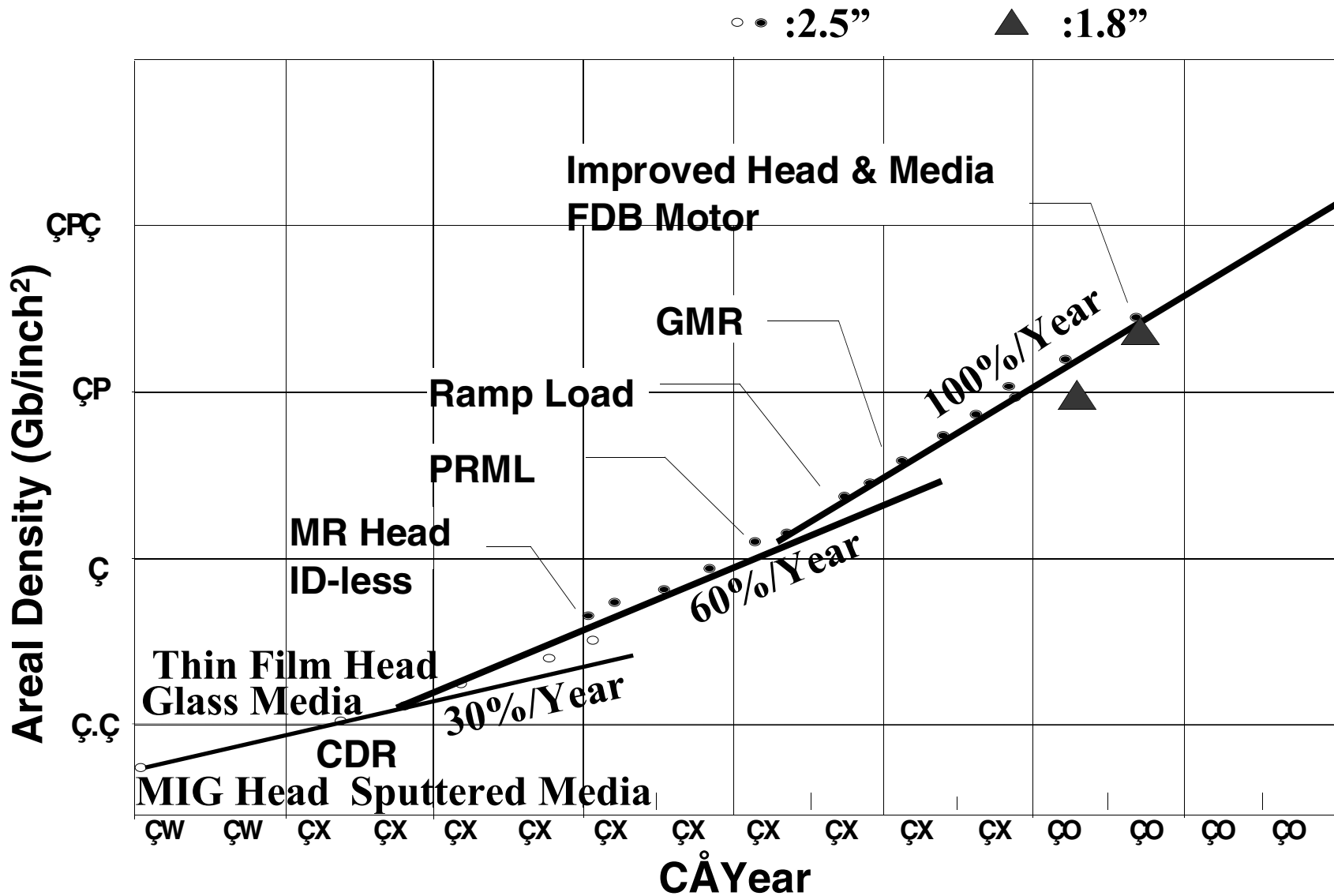
- *Provides small, light, silent and low power HDD with sufficiently large capacity.*
  - For PC-Card as a bridging media
- *Provides further small footprint HDD with abundantly large capacity for advanced usage.*
  - For built-in drive as ATA interface embedded storage of mobile products
- *Use the same technology (head, media, channel) proven on the former generation 2.5” HDD*
  - Development was focused on mechanical design and production equipment.
  - Parts mounting technology as well as chip size IC package are important.

## *Key Technologies*

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- *High Recording Density*
  - 5GB/Disk : 22.4Gbps ( 41.6KTPI, 538KBPI )
  - Advanced servo control
- *Small Form Factor*
  - LSI : Ball Grid Array, Low profile package
  - Mechanical parts: Thinner SPM, VCM, etc.
- *Low Power Consumption*
  - 3.3 Volt operation
  - High efficiency VCM and lower inertia carriage
- *Mechanics*
  - Inertia latch mechanism with ramp-load
  - High stiffness base plate and SPM
- *Low Acoustics*
  - About 10dB less than those of 2.5”

# Recording Density



## *Small and slim form factor*

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- *Printed Circuits Board*

- Use of integrated LSI's
- Low profile package of 0.5mm thickness BGA
- PCB of 0.45mm thickness

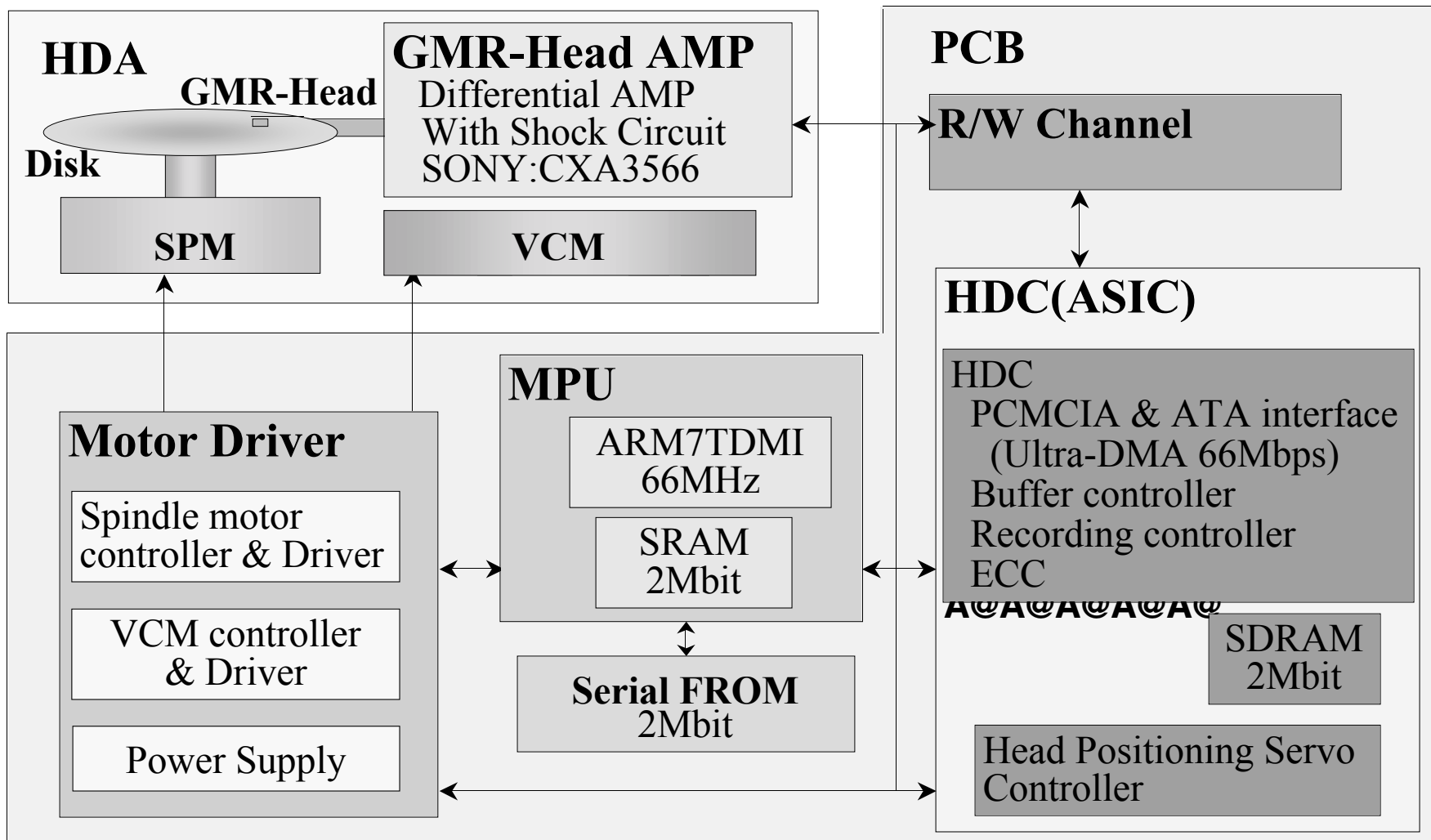
- *Base plate*

- Sheet metal of 0.6mm thickness
- Steel base plate by press process
- Used as a yoke of magnet

- *Spindle Motor*

- Spindle motor of 4.05mm thickness
- Inner rotor type with ball bearings
- Same size of balls used in 2.5" HDD  
for higher shock resistance

# Block Diagram : 5GB Card type



## *LSI's (1/2)*

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- **HDC(ASIC)**
  - **0.25um CMOS, 5.5x5.5mm, 2Mbit SDRAM+220K gates**
  - **PC Card Bus & ATA interface, 5V Tolerant Inputs/Outputs**  
**7Burst - 3Way interleave ECC, Ultra-DMA 66Mbps**  
**Servo Controller, Cache & Buffer controller**
- **MPU**
  - **0.15um CMOS, 5.0x5.0mm**
  - **ARM7 Core, 2Mbits SRAM, 16Kbits ROM & Peripherals**
- **R/W Channel : Marvell - 88C4310**
  - **0.25um CMOS, 3.5x3.5mm**
  - **32-34/64-66 ENDEC with Post-Processor**  
**Modified EE PRML**  
**Servo Detector & Demodulator for Digital Servo Control**  
**Data Rate : Up to 550Mbps ( Drive's Data Rate: 90-130Mbps )**

## *LSI's (2/2)*

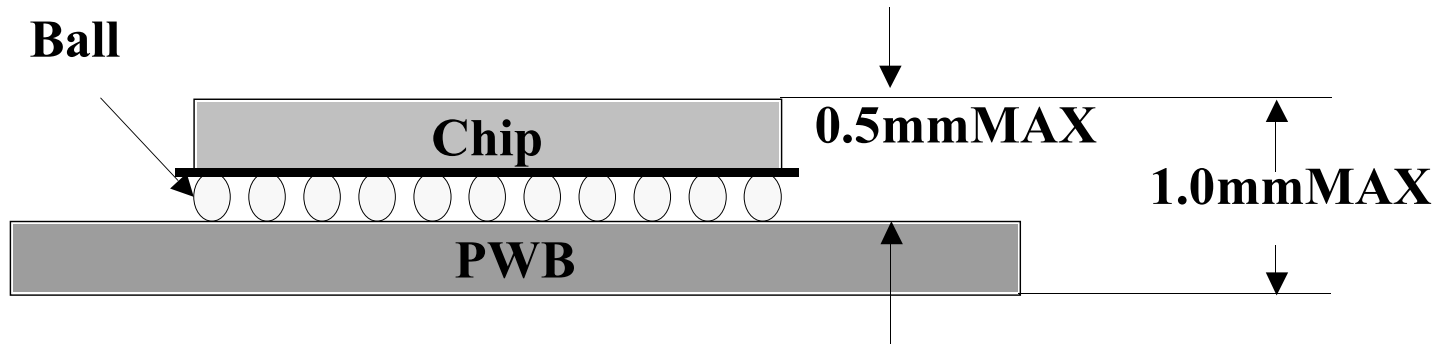
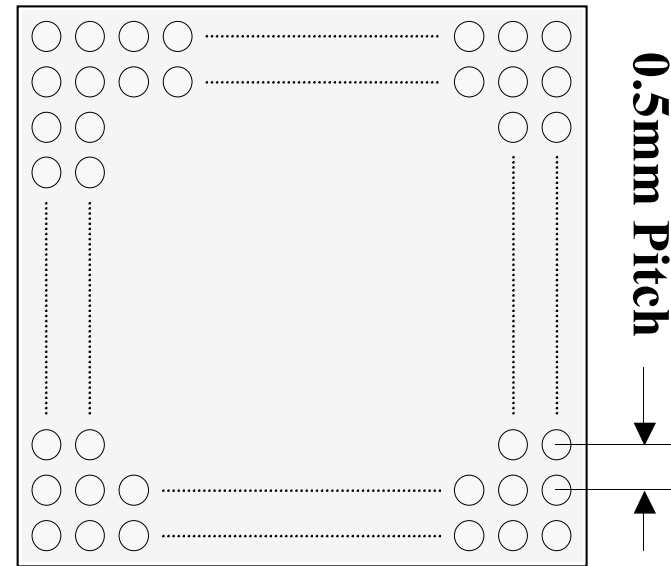
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- **Motor Driver : TI - TLS2256(Toki)**
  - **0.8um Linear Bi-CMOS**
  - **Spindle Motor Controller with 600mA Driver**
    - FLL & PLL Speed Controller**
    - Voice Coil Motor Controller with 400mA Driver**
    - 12bit DAC/ADC**
    - Ramp Load Control & Emergency Retract Circuits**
    - Power Controller**
      - 3.3, 2.5 & 1.8V Outputs for 5 or 3.3V Input**
      - Power Monitor for Input & Output Voltages**
    - Shock Sensor & Detector Circuits**

# Package

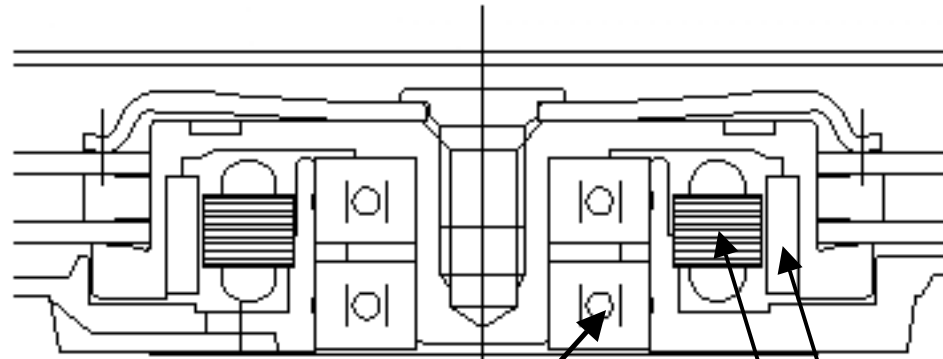
## Smaller & Low Profile Package

- et-BGA  
(Extremely Thin Ball Grid Array)
- Wafer Level BGA  
(Chip Size Package)
- 0.5mm height



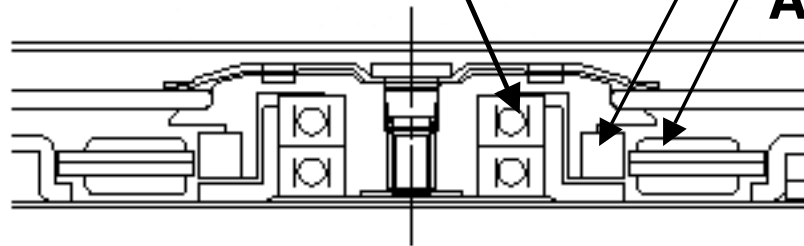
# Spindle Motor

2.5 inch HDD



Same size  
of Ball A

1.8 inch HDD



Rotor Magnet  
A

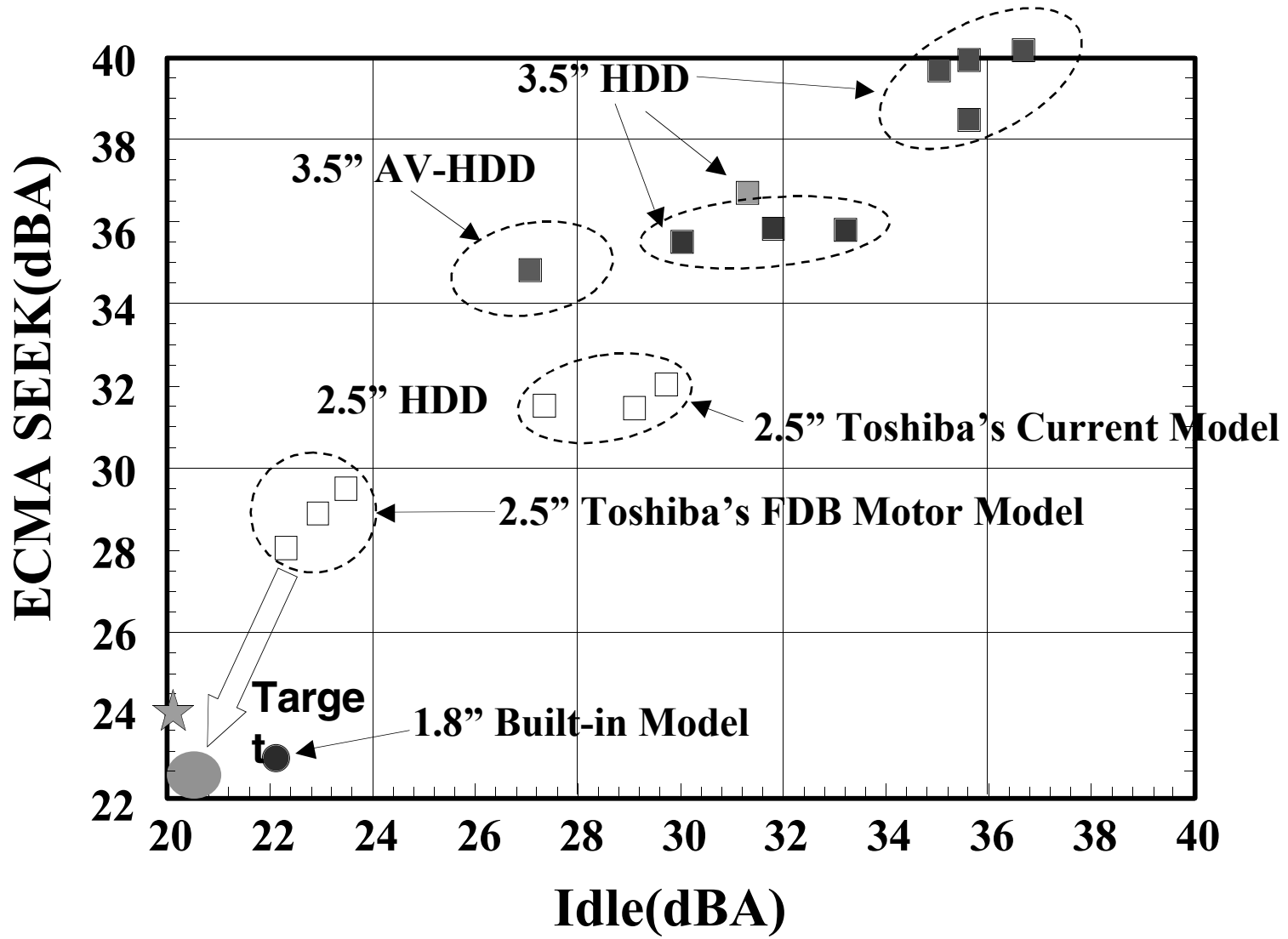
Stator Coil  
A

# *Advanced Tracking Technology*

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- *Adaptive Feed-forward Control*
  - **Compensating large media shift and disk deflection**
- *High Performance Servo Controller*
  - **Improving servo stability by reduced output delay**
- *Multi-rate Control*
  - **Extending servo bandwidth by reduced phase delay**
  - **Canceling arm-suspension vibratory mode**

# Acoustic Noise(Sound Power)



**Table-1 1.8” HDD, Major specifications**

		PC Card Type		Built- in Type		2.5”
Model		2GB 1 Disk	5GB 1 Disk	5GB 1 Disk	10GB 2 Disks	10GB 1 Disk
Capacity ( Gbytes)		2.0	5.0	5.0	10.0	10.1
Number of disks		1	←	←	2	1
Number of heads		2	←	←	4	2
TPI (k)		24.2	41.6	←	←	36.0
BPI (k)		372	507	538	←	489
Recording density (Gbps)		9.0	21.1	22.4	←	17.6
Rotation speed (RPM)		4,200	3,990	4,200	←	←
Transfer Rate	Internal (Mbits/sec)	75 - 130	94 - 123	118 - 175	←	121 - 234
	Host (Mbytes/sec)					
	ATA					
	Ultra DMA mode	66.7	←	←	←	←
	PIO mode	16.6	←	←	←	←
	PC Card					
	Memory mode	20	←			
	I/O mode	5.2	←			
Buffer size (kbytes)		256	1,024	←	←	←
Average seek time( msec)		15	←	←	←	13

***Table-1 1.8” HDD, Major specifications***

		PC Card Type		Built-in Type		2.5”
Model		2GB 1 Disk	5GB 1 Disk	5GB 1 Disk	10GB 2 Disks	10GB 1 Disk
Supply voltage (volts)		3.3 or 5	←	3.3	←	5
Power consumption (W Typ.)	Read/Write	1.2 / 1.3	←	1.3 / 1.3	←	2.2/2.2
	Low power Idle	0.5	←	←	←	0.7
	Stand-by	0.23	←	←	←	0.3
Shock (G's)	Operation	150	200	←	←	150
	Non-operation	1,000	←	←	←	700
Acoustics idle mode (dB Typ.)		22	←	←	←	32
Dimension (mm)	Width	54	←	←	←	69.85
	Depth	85.6	←	78.5	78.5	100
	Height	5	←	←	8	9.5
Weight (gram)		55	←	50	60	94

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END

Thank you

Y. Hashimoto