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ENGINEERING SPECIFICATIONS

Product Name: DH-24AFSH(iHAS124 F)

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Version	History	Date
1.0	First Release	2014/8/12
1.1	1. Modify supported transfer mode : Ultra DMA mode 6 2. Add Operation environment for “write / rewrite” application OS : Windows 8.1 3. Add Host Operating System Compatibility : Windows 8.1	2014/9/13
1.2	1. Add MKM 16x into Recommended Media 2. Add Windows 10 into Support Features	2015/10/15
2.0	1. Disable DVD-RAM support	2016/10/21

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1. INTRODUCTION

This document presents the engineering specifications of “Dual DH-24AFSH”, a Half Height SATA DVDRW drive. These specifications guarantee the features provided by our drives are delicately implemented.

DH-24AFSH is a versatile optical disk drive. For CD write function, it is capable to write data, which conforms to Orange Book: Part 2 CD-R Volume 1 / Part 2 CD-R Volume 2 Multi Speed / Part 3 CD-RW Volume 1 (known as Low Speed) / Part 3 CD-RW Volume2: High Speed / Part3 CD-RW Volume 3: Ultra Speed, into CD-R/RW disk in combination with write application software. For DVD write function, this drive confirms to DVD+R Version 1.3 / DVD+R9 Version 1.2 / DVD-R9 Version 3.01 / DVD+RW Part 1 Volume 1 Version 1.3 / DVD+RW Part 1 Volume 2 Version 1.0 / DVD-R Version 2.1 / DVD-RW Version 1.2. For read function, it is capable to read all of the following media: DVD single/dual layer (PTP, OTP), DVD-R, DVD+R, DVD+R9, DVD-R9, DVD-RW, DVD+RW. Besides, it reads all of CD formats and media: CD-DA, CD-TEXT, CD ROM Mode-1, CD-ROM/XA Mode-2 Form-1 and Form-2, CD-I FMV, Video-CD, Karaoke-CD, Photo-CD, Enhance CD, CD extra, UDF(fixed/variable Packet mode), Multi-session, CD Plus, CD-R, and CD-RW.

The drive supports a DVD-ROM data read transfer rate of 16X in the outer track, 6X in the inner track, and achieves 11X speed in average for a 12cm (4.7Gbyte, single layer or layer 0 of dual layer) disc. For CD-ROM data transfer rate, it supports 48X in the outer track, 20X in the inner track, and achieves 36X speed in average for a 74 min disc. Besides, **SMART-X** function smartly adjusts CD-DA / VCD / DVD data extraction to a fastest allowable speed according to both data request rate from host and disk quality. Regarding to CD write speed, it supports 48X (Max.) writing and 24X re-writing. For writing / rewriting, **Seamless Link**® function can avoid buffer under run as well as get the best writing quality by smartly adjusting writing strategy.

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2. FEATURES

1. 5 ¼", half height, SATA interface internal CD-ROM / CD-R / CD-RW / DVD-ROM / DVD+R / DVD+RW / DVD+R9 / DVD-R / DVD-RW / DVD-R9 combination drive
2. Fast access time and high data transfer rate, could be vertical mounted
3. Max. 16X DVD-ROM CAV (Constant Angular Velocity) reading
4. Max. 48X CD-ROM CAV reading
5. Max. 24X DVD+R CAV writing and Max. 8X DVD+RW Zone CLV rewriting
6. Max. 24X DVD-R CAV writing and Max. 6X DVD-RW CLV rewriting
7. Max. 8X DVD+R9 CAV writing and Max. 8X DVD-R9 CAV writing.
8. Max. 48X CD-R CAV writing
9. Max. 24X CD-RW Zone-CLV rewriting
10. **SMART-X** Smart Monitoring & Adjusting Read-speed Technology for eXtraction
11. **Seamless Link**® Smart Monitoring & Adapting Recording Technology for Burning
12. Buffer under run free
13. Conform to Orange Book: Part 2 CD-R Volume 1, Part 2 CD-R Volume 2 Multi Speed, Part 3 CD-RW Volume 1 (1x, 2x, and 4x), Part 3 CD-RW Volume2: High Speed, Part 3 CD-RW Volume 3: Ultra Speed. Support Fixed packet, Variable packet, Disc-at-once, Session-at-once and Track-at-once
14. Support Raw mode, and Over-Burn copy
15. DVD read compliant: DVD single / dual layer (PTP, OTP), DVD-R(4.7G), DVD-R multi-borders, DVD-R9, DVD+R / DVD+R9 single/multi sessions, DVD-RW, DVD+RW discs with diameter of 8 or 12 cm
16. CD read compliant: CD-DA, CD-ROM, CD-ROM/XA , Photo-CD, Multi-session, Karaoke-CD, Video-CD, CD-I FMV, CD Extra, CD Plus, CD-R , and CD-RW discs of 8 or 12 cm diameter
17. Support DOS 6.xx, Windows 10 / 8 / 7 / XP / 2003 / Vista and Linux operating system
18. Serial ATA Revision 2.6, ATA-8, MMC-6, SFF-8090 V7, and IMAPI compliant
19. MPC level 3, PC2001 System Design Guide, MultiRead/UDF compliant
20. Motor driven tray open/close without caddy system
21. 3 tray-eject methods: eject button, software, and emergency eject
22. Supported transfer mode: Ultra DMA mode 6
23. ACPI compliant for power saving
24. MTBF 70,000 POH
25. Flash ROM support on line programming capability
26. Support RPC II (Region Playback Control)

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3. SPECIFICATIONS

3.1 Disc

Applicable Formats	CD-DA, CD-TEXT, CD ROM Mode-1, CD-ROM/XA Mode-2 Form-1 and Form-2, CD-I Ready, Video-CD, Photo-CD, Enhance CD, CD extra, UDF (fixed/variable Packet mode), DVD-ROM, DVD-Video, DVD-Audio, DVD-R/DVD-R9 single/multi border(s), DVD+R/DVD+R9 single/multi session(s) DVD-RW DVD+RW
Applicable Media Type	CD-ROM, CD-R and CD-RW DVD-ROM (4.7G) DVD-ROM dual layer (PTP/OTP) (8.54G) DVD-R (4.7G for General), DVD-R DL DVD-RW, DVD+RW (4.7G), DVD+R, DVD+R DL
Disc Diameter	12cm and 8cm
Capacity	2,048 bytes/block (Mode-1 and Mode-2 Form-1), 2,336 bytes/block (Mode-2) 2,328 bytes/block (Mode-2 Form-2) 2,048 bytes/sector (DVD-ROM,DVD-R/RW, DVD+R/RW)

3.2 Operation environment for “write / rewrite” application

OS	DOS 6.xx, Windows 10 / Windows 8.1 / Windows 8 / Windows 7 / XP / 2003 / Vista and Linux operating system
Hard disk	Empty Storage Capacity: 100 MB or more Average access time: 20 ms or less
Disc Diameter (Capacity)	8cm and 12cm
Recommended Media	CD-R: CMC, Daxon, Gigastorage, Leaddata, MBI, MCC, Princo, Prodisc, Ritek, SONY, TDK, TY, SONY, Plasmon Low Speed CD-RW: CMC, MCC, Ritek High Speed CD-RW: CMC, MCC, Prodisc, Ritek, Princo, Ultra Speed CD-RW: Mitsubishi Ultra plus Speed CD-RW: Mitsubishi

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	DVD+R 24X : TY, MKM DVD+R 22X : TY, MKM DVD+R 20X : TY, Ritek, MKM DVD+R 16X : SONY, MCC, CMC, Ritek, Maxell, TY, TDK, Prodisc, OPTODISC, MBI, GIGASTORAGE, UmeDisc, FTI, MKM DVD+RW 4X: MCC, SONY, RITEK, MBI DVD+RW 8X: MKM DVD+R9 2.4X : MKM, Ritek, CMC DVD+R9 8X : MKM, Ritek, CMC, MBI, UMEDISC DVD-R 24X : TY DVD-R 22X : TY DVD-R 20X : TY, Ritek DVD-R 16X: SONY, MCC, CMC, TY, Ritek, Prodisc, MBI, OPTODISC, TDK, Maxell, MBI, FTI, Princo, GIGASTORAGE DVD-RW4X: TDK, RITEK, CMC DVD-RW 6X: MKM , Ritek DVD-R9 4X : MKM, CMC, Ritek DVD-R9 8X : MKM, TY
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3.3 Mechanism

Item	Specification
Pick-up	NA: CD: 0.53 DVD: 0.665 Focusing: CD: Astigmatic Detection Method DVD: Differential Astigmatic Detection and Astigmatic Detection Method Tracking: CD: DPP DVD: DPD DVDR/RW: DPP Wave length: CD: 785 nm (typical) DVD: 661 nm (typical) Output power: Read CD: 0.82mW @ objective lens DVD: 1.13mW @ objective lens Write CD: 131mW @ objective lens DVD: 134mW @ objective lens
Traverse mechanism	Stepping motor driven
Spindle motor	DC brushless motor
Loading mechanism	Motor driven tray open/close without caddy system

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3.4 Supported Read/Write/Labeling speed

Media type for write	Write speed selected	Disc spin method for write
CD-R	16x	CLV
	24x	17x ~ 24x PCAV
	32x	17x ~ 32x PCAV
	40x	17x ~ 40x CAV
	48x	20x ~ 48x CAV
Low speed CD-RW	4x	CLV
High speed CD-RW	10x	CLV
Ultra speed CD-RW	16x	CLV
	24x	16x-24x Zone-CLV ¹
Ultra speed CD-RW plus	16x	CLV
	24x	16x-24x Zone CLV ²
DVD+R	4x / 6x	CLV
	8x	PCAV
	12x / 16x / 18x / 20x / 22x / 24x	CAV
DVD+R9	2.4x / 4x	CLV
	6x / 8x	PCAV
DVD+RW	2.4x / 4x / 6x	CLV
	8x	Zone CLV
DVD-R	4x / 6x	CLV
	8x	PCAV
	12x / 16x / 18x / 20x / 22x / 24x	CAV
DVD-R9	4x	CLV
	6x / 8x	PCAV
DVD-RW	2x / 4x	CLV
	6x	Zone CLV

Read (or data extraction for copy)	CLV	CAV
CD-ROM / Finalized CD-R Data /CD-DAE /Video CD	N/A	4x~10x / 6.4x~16x / 9.6x~24x / 12.8x~32x / 16x~40x / 19.2x~48x
Finalized CD-RW	N/A	4x~10x / 6.4x~16x / 9.6x~24x / 12.8x~32x / 16x~40x
Unfinalized CD-R/RW	N/A	N/A.
DVD-ROM (single layer)	N/A	1.6x~4x / 2.4x~6x / 3.2x~8x / 4.8x~12x / 6.4x~16x

¹ For Ultra speed CD-RW Zone-CLV 24X-writing starts from 24 min 00 sec 00 block

² For Ultra speed plus CD-RW Z-CLV writing , 24X-writing is starting from 24 min 00 sec 00 block

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DVD-ROM (dual layer)	N/A	1.6x~4x / 2.4x~6x / 3.2x~8x / 4.8x~12x
DVD+R	N/A	1.6x~4x / 2.4x~6x / 3.2x~8x / 4.8x~12x / 6.4x~16x
DVD-R	N/A	1.6x~4x / 2.4x~6x / 3.2x~8x / 4.8x~12x / 6.4x~16x
DVD+RW	N/A	1.6x~4x / 2.4x~6x / 3.2x~8x / 4.8x~12x
DVD-RW	N/A	1.6x~4x / 2.4x~6x / 3.2x~8x / 4.8x~12x
DVD+R9	N/A	1.6x~4x / 2.4x~6x / 3.2x~8x / 4.8x~12x
DVD-R9	N/A	1.6x~4x / 2.4x~6x / 3.2x~8x / 4.8x~12x
Play	CLV	CAV
Video CD	N/A	4x~10x / 6.4x~16x
CD-DA	N/A	4x~10x / 6.4x~16x
DVD single/ dual layer	N/A	1.6x~4x / 2.4x~6x
DVD+R/RW,	N/A	2.4x~6x
DVD-R/RW	N/A	2.4x~6x

3.5 Supported Write Method

Following write methods are supported by this drive

For CD-R/RW disc

1. Disc At Once (DAO)
2. Session At Once (SAO)
3. Track At Once (TAO)
4. Variable Packet Write
5. Fixed Packet Write

For DVD+R / DVD+R9

1. Incremental.

For DVD+RW

1. Random Access Write.

For DVD-R

1. Disc-At-Once (un-interrupted)
2. Incremental.

For DVD-RW

1. Sequential recording : Disc-At-Once (un-interrupted) and Incremental.
2. Restricted overwrite

For DVD-R9

1. Disc-At-Once (un-interrupted)
2. Incremental
3. Layer Jump recording

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3.6 Performance

Item	Min	Typical	Max
Data Buffer (MB)			0.5
Burst Data Transfer Rate (MB/s)			150
Spin Speed (rpm)			
CD-ROM read		9660	
DVD-ROM read		9360	
Sustained Data Transfer Rate (KB/s)			
CD-ROM outside ³	7150		
CD-ROM inside ⁴	2950		
DVD-ROM outside ⁵	21350		
DVD-ROM inside ⁶	8100		
Access Time (ms)			
CD 1/3 Stroke ⁷		110	140
Full Stroke ⁸		160	230
Random Access ⁹		100	140
DVD 1/3 Stroke ¹⁰		110	160
Full Stroke ¹¹		170	250
Random Access ¹² (SL / DL)		100	160 / 180
Start Up Time ¹³ (s)			
CD-ROM			18.0
DVD			18.0
Stop Time ¹⁴ (s)			
CD-ROM			9.0
DVD			9.0

³ Test disc: ABEX TCDR-704 @73 min 00 sec 00 block

⁴ Test disc: ABEX TCDR-704 @00 min 02 sec 00 block

⁵ Test disc: ABEX TDR-820B @ 0X22F000

⁶ Test disc: ABEX TDR-820B @ 0X00

⁷ It is computed by averaging 100 or more measures of the access time from 24 min 00 sec 00 block to 48 min 00 sec 00 block, including latency and error correction time.

Test Disc: A-BEX TCDR-704

⁸ It is computed by averaging 100 or more measures of the access time from 0 min 02 sec 00 block to 73 min 00 sec 00 block, including latency and error correction time.

Test Disc: A-BEX TCDR-704

⁹ It is computed by averaging 100 or more measures of random access time from 0 min 02 sec 00 block to 73 min 00 sec 00 blk, including latency and error correction time.

Test Disc: A-BEX TCDR-704

¹⁰ It is computed by averaging 100 or more measures of the access time from 0XBA550 to 0X174AA0, including latency and error correction time.

Test Disc: A-BEX TDR-820B

¹¹ It is computed by averaging 100 or more measures of the access time from 0X00 to 0X22F000, including latency and error correction time.

Test Disc: A-BEX TDR-820B

¹² It is computed by averaging 100 or more measures of random access time from 0X00 to 0X22F000, including latency and error correction time.

Test Disc: A-BEX TDR-820B

¹³ It includes tray in, spin up and read TOC

Test Disc: A-BEX TCDR-704 CD / TDR-820B DVD

¹⁴ It includes spin down and tray eject

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Spindle			
Spin Up Time (s)			6.0
Spin Down Time (s)			8.0
Tray In Time (s)			4.0
Tray Out Time (s)			4.0

3.7 Error Rate

For CD-ROM

Mode-1 (ECC on)

10^{-12} Block/Bit

Mode-2 (ECC off)

10^{-9} Block/Bit

For DVD-ROM

10^{-15} Block/Bit

3.8 CD-DA Playability

Item	Min.
Scratch (mm)	2.0
Interruption (mm)	0.8
Black Dot (mm)	0.8
Fingerprint (μm)	65
Eccentric (μm)	210
Vertical Deviation (mm)	0.8
Unbalance (g-mm)	3 (at Max. speed, w/o down speed) 7.5 (No read error, down speed)

Note: No track jump in the above tests

Unbalance disc : Eighty-five percent (85 %) of drive samples must be capable of playing and extracting the specified tracks on the listed test media without error.

3.9 CD-ROM Playability

Item	Min.
Scratch (mm)	1.4
Black Dot (mm)	0.8
Fingerprint (μm)	65
Eccentric (μm)	210
Vertical Deviation (mm)	0.8
Unbalance (g-mm)	2.5 (at Max. speed, w/o down speed) 7.5 (No read error, down speed)

Note: No read error in the above tests.

Unbalance disc : Eighty-five percent (85 %) of drive samples must be capable of playing and extracting the specified tracks on the listed test media without error.

3.10 DVD-ROM Playability

Item	Min.
Scratch (mm)	2.0
Black Dot (mm)	0.8

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Fingerprint	(μ m)	65
Eccentric	(μ m)	100
Vertical Deviation	(mm)	0.8
Unbalance	(g-mm)	2.5 (at Max. speed, w/o down speed) 7.5 (No read error, down speed)

Note: No read error in the above tests

Unbalance disc : Eighty-five percent (85 %) of drive samples must be capable of playing and extracting the specified tracks on the listed test media without error.

3.11 Environmental Conditions

Operating Condition	Min	Max
Ambient Temperature	5°C	50°C
Relative Humidity	20%	80%

Non operating Condition	Min	Max
Ambient Temperature	-40°C	65°C
Relative Humidity	5%	95%

Shock (11ms half-sine, 6 sec between shocks, 5 times per orientation)

Operating :	8 G (Data, No damage, No read error)
	3 G (Audio, No track jump)
	3 G (CD Write, No write/rewrite error)
	2 G (DVD Write, No write/rewrite error)

Shock, one shock each direction.

Non-Operating (half-Sine 10ms)	150G
(Square Wave 180 in/sec velocity change)	50G

Random Vibration from 10 to 500 Hz.

Operating	0.5g RMS (Audio, No track jump)
	0.5g RMS (Data, No damage, No read error)
	0.3g RMS (Write, No write/rewrite error)

Random Vibration from 10 to 500 Hz, 30min/axis.

Non-Operating	2.0g RMS
---------------	----------

Altitude

Operating	0 ~ 3,500 m
Non-Operating	0 ~ 12,500 m

3.12 Reliability

MTBF	70,000 POH at 25% duty cycle in room temp.
MTTR	30 minutes
Loading Operation	30,000 cycles
Actuator Mechanism	1,000,000 full stroke seeks

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ElectroStatic Discharge Susceptibility 4 KV (Contact Discharge) No read/write/rewrite error
(330Ω, 150pF) 8 KV (Air Discharge) No read/write/rewrite error
8 KV (Contact Discharge) No damage
15 KV (Air Discharge) No damage

3.13 Acoustic Noise

Sound pressure (sequential read) 52.5 dB (follow ISO-7779)
(random read) 52.5 dB (follow ISO-7779)
Playing A-BEX SCD-3228 2.5g-mm unbalance
(24X write) 55 dB (follow ISO-7779)
Playing TY normal disc

3.14 Regulations and Standards

Safety

cUL

UL60950

TUV

EN60950, EN60825-1

CB

IEC60950, IEC60825-1

EMC

FCC(USA)

FCC CFR 47 Part 15 Class B, CISPR22, ANSI C63.4

CE (European Countries)

EN55022, EN50024, EN61000, IEC61000

C-TICK (Australia)

AS/NZS CISPR22

BSMI (Taiwan)

CNS13438(C6537)

KCC(Optional)

KN61000

Laser Safety

DHHS (USA)

21CFR Subchapter J

3.15 Host Operating System Compatibility

DOS 6.xx,

Windows 10 / Windows 8.1 / Windows 8 / Windows 7 / Windows XP / 2003 / Vista

Linux

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4. MECHANICAL

4.1 Material

The front bezel, push button and tray lid are modeled. Additional specifications of these components are described in the following table.

ITEMS	Front Bezel/Button/Door	Tray
Material	ABS PA-765A	ABS+PBT/ABS
Flammability	UL94V0	UL94V2

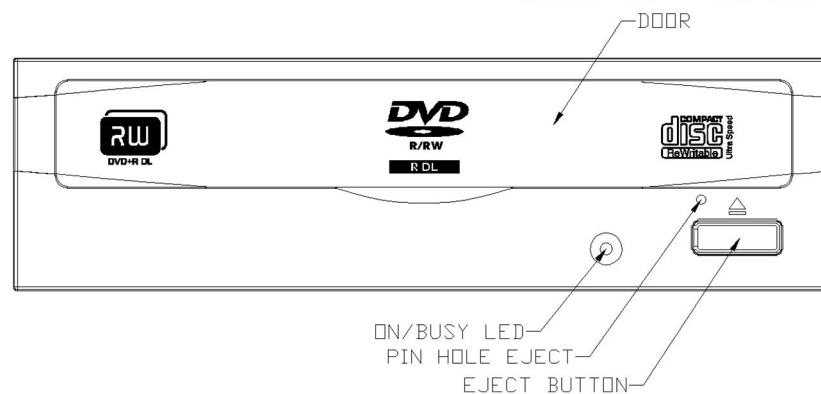
4.2 Physical Dimensions

Height	41.3 ± 0.5 mm
Width	146.0 ± 0.5 mm
Depth	170.0 ± 0.5 mm
Weight	< 0.9 Kg

4.3 Drive mounting spec

Mount the drive horizontally within ±10° tilt.

4.4 Front Panel



Door

Door of the tray to hold the disc.

On/Busy LED

Indication of drive's operation status

Pin Hole Eject

To eject the locked tray caused by loss of power.

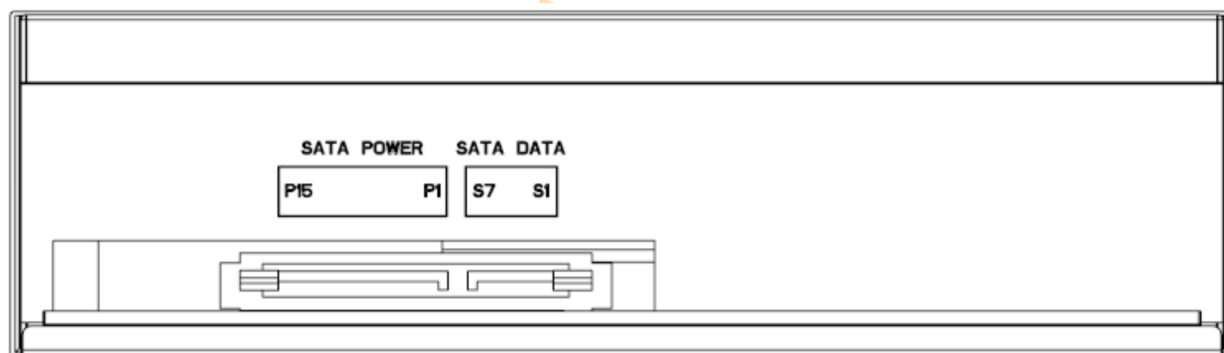
Eject

Push button would eject the tray.

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4.5 Rear Panel

The rear panel of the drive is a SATA connector which consists of DC power and signal connector. The following layout illustrates the rear panel.



Power Connector Pin segment

15 pin connector for DC power input.

Power segment	P1	V ₃₃	3.3 V power
	P2	V ₃₃	3.3 V power
	P3	V ₃₃	3.3 V power, pre-charge, 2 nd mate
	P4	Gnd	1 st mate
	P5	Gnd	2 nd mate
	P6	Gnd	2 nd mate
	P7	V ₅	5 V power, pre-charge, 2 nd mate
	P8	V ₅	5 V power
	P9	V ₅	5 V power
	P10	Gnd	2 nd mate
	P11	Reserved	1. The pin corresponding to P11 in the backplane receptacle connector is also reserved 2. The corresponding pin to be mated with P11 in the power cable receptacle connector shall always be grounded
	P12	Gnd	1 st mate
	P13	V ₁₂	12 V power, pre-charge, 2 nd mate
	P14	V ₁₂	12 V power
	P15	V ₁₂	12 V power

SATA Interface Connector Pin Segment

7-pin connector for SATA interface.

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Signal Segment Key			
Signal segment	S1	Gnd	2 nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Gnd	2 nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
	S7	Gnd	2 nd mate

4.6 Disc Eject Mechanism

The drive can eject the disc by any one of the following three methods.

Eject Button

When the power is on, the user can push this key to eject the tray.

Software Eject

The tray can be ejected by commands from the host computer.

Pin Hole Eject

A pin hole eject mechanism is available on the front bezel to eject the disc in an emergency situation. To eject a disc manually, insert a steel rod with 1.2 mm in diameter into this emergency eject hole and push softly. The rod must be inserted into the drive at least 20mm from the surface of bezel.

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5. ELECTRICAL

5.1 Voltage Requirements

- +5V: $\pm 5\%$ and less than 100 mVp-p ripple voltage from 10Hz to 10MHz
+12V: $\pm 10\%$ and less than 200 mVp-p ripple voltage from 10Hz to 10MHz

5.2 Current Requirements

Operation	Half Height Current (mA)		Maximum Power (W)
	5 V Average	12 V Average	
Sleep Interface: not functional; context lost Interface mode: not preserved Spindle motor: stopped Laser: Off	--	--	1
Standby Interface: functional Interface mode context: preserved Spindle motor: stopped Laser: Off	--	--	1
Worst case mode (Note 1)	1400	2300	34.85

Note : For each voltage supply line, the current draw may increase by as much as 10 % above the limit in the table, provided that the total power consumption remains at or below 34.85 W.

5.3 Host Interface

The interface is based on Serial ATA 2.6 (High Speed Serialized AT Attachment Revision 2.6), and SFF-8090i Rev. 7 (Mt. Fuji Commands for Multimedia Devices)

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Signal Segment Key			
Signal segment	S1	Gnd	2 nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Gnd	2 nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
	S7	Gnd	2 nd mate
Signal Segment "L"			
Central Connector Polarizer			
Power Segment "L"			
Power segment	P1	V ₃₃	3.3 V power
	P2	V ₃₃	3.3 V power
	P3	V ₃₃	3.3 V power, pre-charge, 2 nd mate
	P4	Gnd	1 st mate
	P5	Gnd	2 nd mate
	P6	Gnd	2 nd mate
	P7	V ₅	5 V power, pre-charge, 2 nd mate
	P8	V ₅	5 V power
	P9	V ₅	5 V power
	P10	Gnd	2 nd mate
	P11	Reserved	1. The pin corresponding to P11 in the backplane receptacle connector is also reserved 2. The corresponding pin to be mated with P11 in the power cable receptacle connector shall always be grounded
	P12	Gnd	1 st mate
	P13	V ₁₂	12 V power, pre-charge, 2 nd mate
	P14	V ₁₂	12 V power
	P15	V ₁₂	12 V power
Power Segment Key			

5.4 ATA Commands List

Code	Command	Type
00h	NOP	Mandatory
08h	DEVICE RESET	Mandatory
90h	EXECUTE DEVICE DIAGNOSTIC	Mandatory
A0h	PACKET	Mandatory
A1h	IDENTIFY PACKET DEVICE	Mandatory
E0h	STANDBY IMMEDIATE	Mandatory
E1h	IDLE IMMEDIATE	Mandatory
E2h	STANDBY	Mandatory
E3h	IDLE	Mandatory
E5h	CHECK POWER MODE	Mandatory
E6h	SLEEP	Mandatory
E7h	FLUSH CACHE	Mandatory
EFh	SET FEATURES	Mandatory

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5.5 ATAPI Commands List

Code	Command	Type
00h	TEST UNIT READY	Mandatory
03h	REQUEST SENSE	Mandatory
04h	FORMAT UNIT	Mandatory
12h	INQUIRY	Mandatory
1Bh	START STOP UNIT	Mandatory
1Eh	PREVENT/ALLOW MEDIUM REMOVAL	Mandatory
23h	READ FORMAT CAPACITY	Mandatory
25h	READ CAPACITY	Mandatory
28h	READ (10)	Mandatory
2Ah	WRITE	Mandatory
2Bh	SEEK	Mandatory
2Eh	WRITE AND VERIFY (10)	Mandatory
2Fh	VERIFY(10)	Mandatory
35h	SYNCHRONIZE CACHE	Mandatory
3Bh	WRITE BUFFER	Mandatory
3Ch	READ BUFFER	Mandatory
42h	READ SUB-CHANNEL	Mandatory
43h	READ TOC/PMA/ATIP	Mandatory
44h	READ HEADER	Mandatory
45h	PLAY AUDIO (10)	Mandatory
46h	GET CONFIGURATION	Mandatory
47h	PLAY AUDIO MSF	Mandatory
4Ah	GET EVENT STATUS NOTIFICATION	Mandatory
4Bh	PAUSE/RESUME	Mandatory
4Eh	STOP PLAY / SCAN	Mandatory
51h	READ DISK INFORMATION	Mandatory
52h	READ TRACK INFORMATION	Mandatory
53h	RESERVE TRACK	Mandatory
54h	SEND OPC INFORMATION	Mandatory
55h	MODE SELECT (10)	Mandatory
5Ah	MODE SENSE (10)	Mandatory
5Bh	CLOSE TRACK SESSION	Mandatory
5Ch	READ BUFFER CAPACITY	Mandatory
5Dh	SEND CUE SHEET	Mandatory
A1h	BLANK	Mandatory
A3h	SEND KEY	Mandatory
A4h	REPORT KEY	Mandatory
A5h	PLAY AUDIO (12)	Mandatory
A7h	SET READ AHEAD	Mandatory
A8h	READ (12)	Mandatory
AAh	WRITE(12)	Mandatory
ACh	GET PERFORMANCE	Mandatory

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ADh	READ DVD STRUCTURE	Mandatory
B6h	SET STREAMING	Mandatory
B9h	READ CD MSF	Mandatory
BBh	SET CD SPEED	Mandatory
BDh	MECHANISM STATUS	Mandatory
BEh	READ CD	Mandatory
BFh	SEND DVD STRUCTURE	Mandatory

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5.6 Profile Support List

Profile List	Number
Removable Disk	0002h
CD-ROM	0008h
CD-R	0009h
CD-RW	000Ah
DVD-ROM	0010h
DVD-R Sequential Recording	0011h
DVD-RW Restricted Overwrite	0013h
DVD-RW Sequential Recording	0014h
DVD-R Dual Layer Sequential Recording	0015h
DVD-R Dual Layer Jump Recording	0016h
DVD+RW	001Ah
DVD+R	001Bh
DVD+R Double Layer	002Bh

5.7 Feature Support List

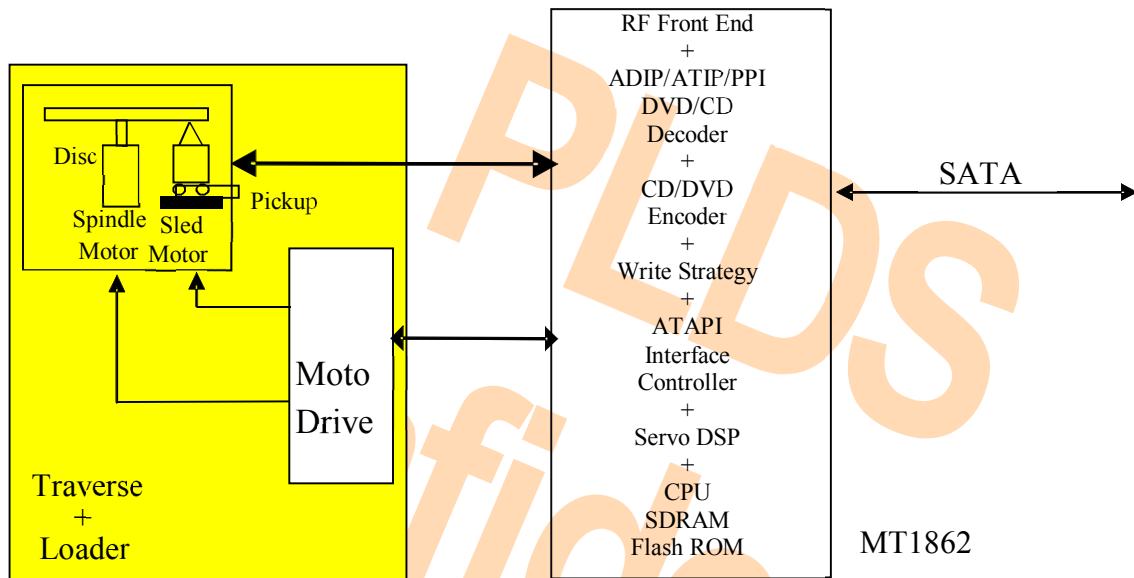
Feature	Number
Profile List	0000h
Core	0001h
Morphing	0002h
Removable Medium	0003h
Random Readable	0010h
MultiRead	001Dh
CD Read	001Eh
DVD Read	001Fh
Random Writable	0020h
Incremental Streaming Writable	0021h
Formattable	0023h
Hardware Defect Management	0024h
Restricted Overwrite	0026h
CD-RW CAV Write	0027h
DVD+RW	002Ah
DVD+R	002Bh

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Feature	Number
Rigid Restricted Overwrite	002Ch
CD Track at Once	002Dh
CD Mastering (Session at Once)	002Eh
DVD-R/-RW Write	002Fh
CD-RW Media Write Support	0037h
DVD+R Double Layer	003Bh
Power Management	0100h
CD Audio External Play	0103h
Time-out	0105h
DVD-CSS	0106h
Real Time Streaming	0107h
Drive Serial Number	0108h
Media Serial Number	0109h
Disc Control Blocks	010Ah
DVD CPRM	010Bh

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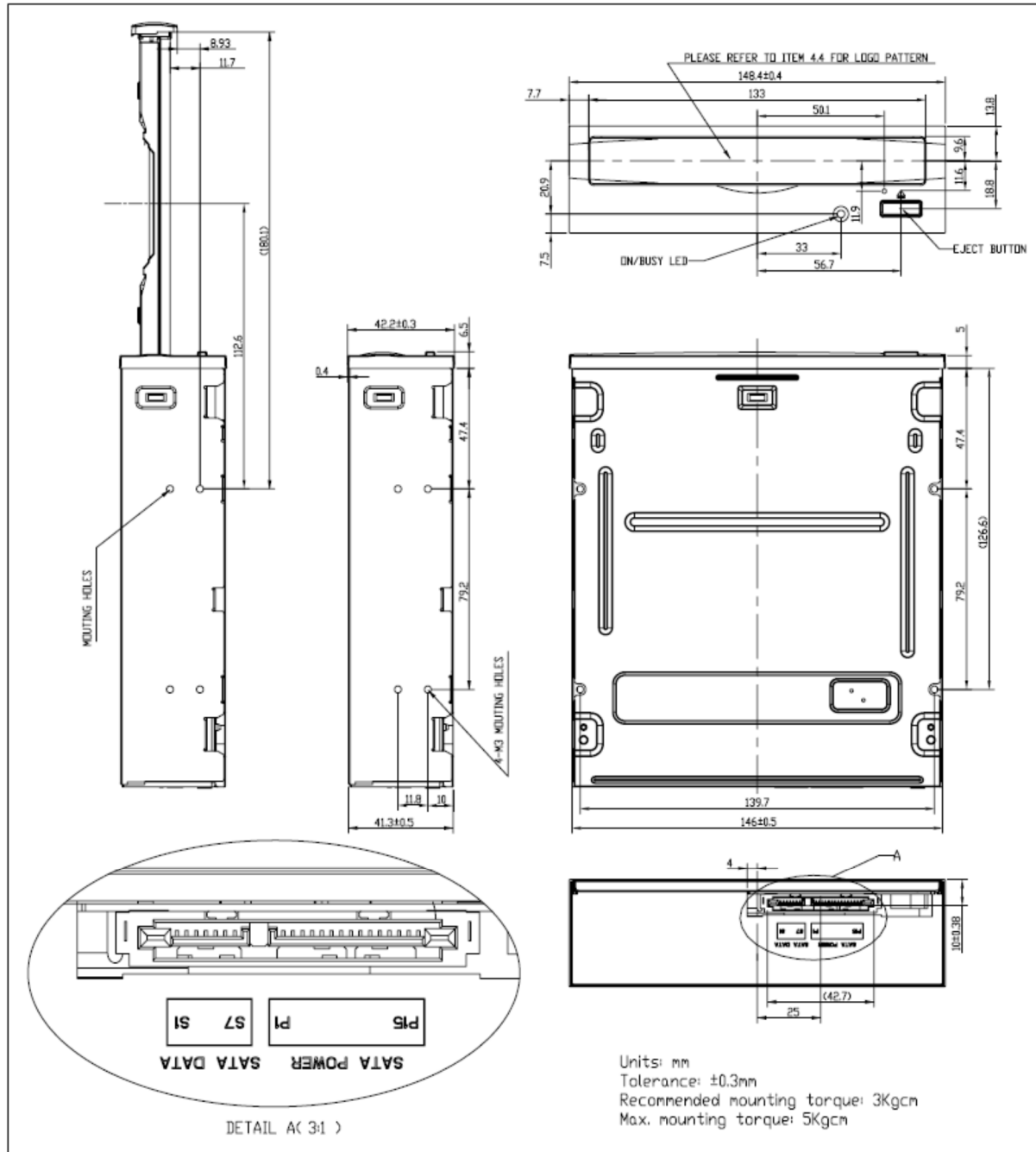
6. BLOCK DIAGRAM



DH-24AFSH Block Diagram

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7. MECHANICAL DRAWING



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