SPECIFICATIONS

OF

H/H Super Multi DVD Writer

Model GHB0N.AFCK101

for

Fujitsu Technology Solutions GmbH

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Checked by: S. M. Park
Authorized by: J. H. Lee
## Revision History

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<td>1</td>
<td>2013 09.09</td>
<td>[1st release]</td>
<td>T1.0</td>
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| 2   | 2013 11.13 | 1 page – Change Product name  
7 page – Add SATA Product Capability  
8 page – Change write speed  
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10 page – Change Automatic Acoustic Management  
19 page – Add Application Software  
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0. Attention

-To export this product-

The Shipment of this product is limited by the rules of export in each country.
The proper procedures should be taken when exporting this product.

1. Features

1.1 General

(1) Half-height Internal Super Multi Drive
(2) CD-R/RW, DVD-R/RW/RAM/ +R/RW +/-R DL read and write compatible, CD Family and DVD-ROM read compatible
(3) Enhanced IDE (ATAPI) interface: SATA interface
(4) Large buffer memory 0.5MB
(5) Buffer Under-run prevention function embedded
(6) Power loading and power eject of a disc. Bare media loading
(7) MTBF: 100 000 POH
(8) Vertical and Horizontal installable
(9) Compliance with RoHS/ Pb Free production
(10) Silent Play function supported

1.2 Supported disc formats

(1) Reads data in DVD-ROM
(2) Reads and writes in each DVD-R(Ver. 2.1 for General), DVD-R DL(Dual Layer), DVD-RW, DVD-RAM(Ver.2.2), DVD+R, DVD+R DL(Double Layer) and +RW
(3) Reads data in each CD-ROM, CD-ROM XA, CD-I, Video CD, CD-Extra and CD-Text
(4) Reads data in Photo CD (Single and Multi session )
(5) Reads standard CD-DA
(6) Support to read Super Audio CD (Compatible layer in Hybrid type)
(7) Reads and writes CD-R discs conforming to “Orange Book Part 2”
(8) Reads and writes CD-RW discs conforming to “Orange Book Part 3”
(9) Reads DVD-R / RW / RAM with CPRM

1.3 Supported write method

(1) DVD-R: Disc at Once and Incremental Recording
(2) DVD-R DL: Disc at Once, Format 4 (Layer Jump Recording)
(3) DVD-RW: Disc at Once, Incremental Recording and Restricted Overwrite
(4) DVD-RAM: Random Write
(5) DVD+R: Sequential Recording
(6) DVD+R DL: Sequential Recording
(7) DVD+RW: Random Write
(8) CD-R/RW: Disc at Once, Session at Once, Track at Once and Packet Write
1.4 Performance

(1) Average access time:
   - DVD-ROM: 145 ms
   - CD-ROM: 120 ms

(2) Write speed:
   - DVD-R: 2x, 4x CLV, 8x PCAV, 16x CAV
   - DVD-R DL: 2x, 4xCLV, 8x ZCLV
   - DVD-RW: 1x, 2x, 4x, 6x CLV
   - DVD-RAM (Ver.2.2): 2x, 3x, 5x ZCLV (12x media: not support)
     - DVD+R: 2.4x, 4x CLV, 8x PCAV, 16x CAV
   - DVD+R DL: 2.4x, 4x CLV, 6x, 8x ZCLV
   - DVD+RW: 2.4x, 4x, 6x CLV, 8x ZCLV
   - CD-R: 16x CLV, 32x, 40x PCAV, 48x CAV
   - CD-RW: 4x, 10x, 16x CLV, 24x ZCLV

(3) Read speed:
   - DVD-R/RW/ROM(SL/DL): 16x/13x/16x/12x max.
   - DVD-R DL: 12x max.
   - DVD-RAM (Ver.1.0/2.2): 2x ZCLV / 5x PCAV
   - DVD-Video (CSS Compliant Disc): 16x/12x max. (Single/Dual layer)
     - (6x for playback)
   - DVD+R/+RW: 16x / 13x max.
   - DVD+R DL: 12x max.
   - CD-R/RW/ROM: 48x/40x/48x max.
   - CD-DA (DAE: Ripping/Play): 24x/10x max.
   - 80 mm CD: 10x max.

(4) Sustained Transfer rate:
   - DVD-ROM: 22.16 Mbytes/s (16x) max.
   - CD-ROM: 6000 kB/s (40x) max.

(5) Burst Transfer rate:
   - SATA, Ultra DMA Mode 5
   - Multi word DMA Mode 2, PIO Mode 4

(6) Multimedia MPC-3 compliant

1.5 Audio

(1) 16 bit digital data output through ATA interface

*Definition

Transfer Rate: 1x (DVD) = 1 385 Mbytes/s,  Mbytes/s = 10^8 bytes/s
1x (CD) = 150 kB/s,  kB/s = 2^10 bytes/s

(SATA): 1.5 Gbps = 1.5 x 10^9 bit/s = 150 MB/s (1B = 10 bits/s)
Capacity: MB = 2^20 bytes, kB = 2^10 bytes
2. General description

2.1 Applicable disc formats

**DVD**
- **DVD-ROM:** 4.7 GB (Single Layer)
- 8.5 GB (Dual Layer)
- **DVD-R:** 4.7 GB (Ver. 2.1 for General: read & write)
- (DL) 8.5 GB (Ver. 3.0)
- **DVD-RW:** 4.7 GB (Ver. 1.2/ Rev 1.0, 2.0, 3.0)
- **DVD-RAM:** 1.46 GB/side, 4.7 GB/side (Ver. 2.2)
- **DVD+R:** 4.7 GB (Ver. 1.3)
- (DL) 8.5 GB (Ver. 1.2)
- **DVD+RW:** 4.7 GB (Vol. 1/Ver.1.3, Vol. 2/Ver.1.0)

**CD**
- CD-ROM Mode-1 data disc
- CD-ROM Mode-2 data disc
- CD-ROM XA, CD-I, Photo-CD Multi-Session, Video CD
- CD-Audio Disc
- Mixed mode CD-ROM disc (data and audio)
- CD-Extra
- CD-Text
- CD-R (Conforming to "Orange Book Part 2": read & write)
- CD-RW (Conforming to "Orange Book Part 3": read & write)

2.2 Writing method

(1) **DVD-R/RW** Disc at Once, Incremental Recording, Restricted Overwrite (DVD-RW only)
(2) **DVD-R DL** Disc at Once (DAO), Format 4(Layer Jump Recording)
(3) **DVD-RAM/+RW** Random Write
(4) **DVD+R** Sequential Recording
(5) **DVD+R DL** Sequential Recording
(6) **CD-R/RW** Disc at Once (DAO), Session at Once (SAO), Tack at Once (TAO) Packet Writing

2.3 Disc diameter

120 mm
80 mm

2.4 Data capacity

User data / Block **DVD-ROM/R/RW/RAM /+R/+RW**
- 2048 bytes/block
**CD (Yellow Book)**
- 2048 bytes/block (Mode1 & Mode2 Form1)
- 2336 bytes/block (Mode2)
- 2328 bytes/block (Mode2 Form2)
- 2352 bytes/block (CD-DA)

2.5 SATA Product Capability

Feature Support
- Asynchronous Signal Recovery: Support
- Software Settings Preservation: Support
- Interface Power Management (device initiated): Support
- Interface Power Management (host initiated): Support
- Asynchronous Notification: Support
- Spread Spectrum Clocking (SSC): Support
- COMRESET treatment during SSP active: same as software reset
## 3. Drive performance

### 3.2 Host interface

#### 3.2 Write Speed

<table>
<thead>
<tr>
<th>Media (Media Speed)</th>
<th>Writing Speed</th>
<th>Media (Media Speed)</th>
<th>Writing Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVD-R (1-2x)</td>
<td>2x CLV</td>
<td>DVD-R DL (2-4x)</td>
<td>4x CLV</td>
</tr>
<tr>
<td>-R (1-4x)</td>
<td>4x CLV</td>
<td>-R DL (2-8x)</td>
<td>4x CLV, 4+6+8x*2 ZCLV</td>
</tr>
<tr>
<td>-R (1-8x)</td>
<td>4x CLV, 5-8x PCAV</td>
<td>-R (2-6x)</td>
<td>4x, 6x CLV</td>
</tr>
<tr>
<td>-R (1-16x)</td>
<td>5-8x PCAV, 6-16x CAV</td>
<td>-R (8cm)</td>
<td>2x CLV</td>
</tr>
<tr>
<td>DVD-R DL (2-4x)</td>
<td>4x CLV</td>
<td>DVD-RW (1x)</td>
<td>1x CLV</td>
</tr>
<tr>
<td>-R DL (2-8x)</td>
<td>4x CLV, 4+6+8x*2 ZCLV</td>
<td>DVD-RW (1x)</td>
<td>1x CLV</td>
</tr>
<tr>
<td>DVD-RW (1-2x)</td>
<td>2x CLV</td>
<td>DVD-RW (1-6x)</td>
<td>2x CLV</td>
</tr>
<tr>
<td>-R (1-8x)</td>
<td>4x CLV</td>
<td>DVD-RW (1-16x)</td>
<td>5-8x PCAV, 6-16x CAV</td>
</tr>
<tr>
<td>DVD-RAM (Ver.2.2)</td>
<td>2x ZCLV</td>
<td>DVD-RAM (Ver.2.2)</td>
<td>2x ZCLV</td>
</tr>
<tr>
<td>-RAM (3x)</td>
<td>3x ZCLV</td>
<td>-RAM (5x)</td>
<td>5x ZCLV</td>
</tr>
<tr>
<td>-RAM (6-12x)</td>
<td>not support</td>
<td>-RAM (8cm)</td>
<td>2x ZCLV</td>
</tr>
<tr>
<td>DVD+R (2.4x)</td>
<td>2.4x CLV</td>
<td>DVD+R DL (2.4x)</td>
<td>2.4x CLV</td>
</tr>
<tr>
<td>+R (2.4-4x)</td>
<td>4x CLV</td>
<td>+R DL (2.4-8x)</td>
<td>4x CLV, 4+6+8x ZCLV</td>
</tr>
<tr>
<td>+R (2.4-8x)</td>
<td>4x CLV, 5-8x PCAV</td>
<td>+R (2.4-16x)</td>
<td>5-8x PCAV, 6-16x CAV</td>
</tr>
<tr>
<td>+R (2.4-16x)</td>
<td>5-8x PCAV, 6-16x CAV</td>
<td>+R (8cm)</td>
<td>4x CLV</td>
</tr>
<tr>
<td>DVD+R DL (2.4x)</td>
<td>2.4x CLV</td>
<td>DVD+RW (2.4x)</td>
<td>2.4x CLV</td>
</tr>
<tr>
<td>+R DL (2.4-8x)</td>
<td>4x CLV, 4+6+8x ZCLV</td>
<td>+RW (2.4-4x)</td>
<td>4x CLV</td>
</tr>
<tr>
<td>+R (2.4-8x)</td>
<td>6x CLV, 6+8x ZCLV</td>
<td>+RW (2.4-8x)</td>
<td>6x CLV, 6+8x ZCLV</td>
</tr>
<tr>
<td>+RW (8cm) 4x CLV</td>
<td>5.54</td>
<td>+RW (8cm) 4x CLV</td>
<td>5.54</td>
</tr>
<tr>
<td>DVD+RW DL (2x)</td>
<td>Not support</td>
<td>DVD+RW DL (2x)</td>
<td>Not support</td>
</tr>
<tr>
<td>CD-R 16x CLV</td>
<td>2,400 kB/s</td>
<td>CD-R 16x CLV</td>
<td>2,400 kB/s</td>
</tr>
<tr>
<td>21-32x PCAV</td>
<td>3,150-4,800</td>
<td>CD-R (8cm) 16x CLV</td>
<td>2,400 kB/s</td>
</tr>
<tr>
<td>21-40x PCAV</td>
<td>3,150-6,000</td>
<td>CD-RW (MS:1,2,4x)</td>
<td>4x CLV</td>
</tr>
<tr>
<td>48x CAV</td>
<td>7,200</td>
<td>-RW (HS:4-10x) 10x CLV</td>
<td>1500</td>
</tr>
<tr>
<td>-RW (US:8-24x) 16x CLV</td>
<td>2,400, 2,400+3,600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-RW (US:+8-32x) 16x CLV</td>
<td>2,400, 2,400+3,600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CD-RW (8cm) 4x CLV</td>
<td>600</td>
<td>CD-RW (8cm) 4x CLV</td>
<td>600</td>
</tr>
<tr>
<td>10x CLV</td>
<td>1,500 kB/s</td>
<td>10x CLV</td>
<td>1,500 kB/s</td>
</tr>
</tbody>
</table>

* Rotational speed (CLV, ZCLV)
  DVD-R/RW/ROM, +R/RW 1x: Approx. 1390 (Inside) - 580 r/min (Outside)
  DVD-RAM Ver. 2.2 2x: Approx. 3250 (Inside) - 1380 r/min (Outside)
  CD-R/RW/ROM 1x: Approx. 500 (Inside) - 210 r/min (Outside)

*1) *-*: continuous change, for CAV, PCAV
*2) +*: change by step for ZCLV
### 3.3 Read Speed

#### <Read> Media (Media Speed) Read Speed

<table>
<thead>
<tr>
<th>Media</th>
<th>Transfer rate (DVD: Mbytes/s, CD: kB/s)</th>
<th>Rotational speed (Approx. r/min)</th>
</tr>
</thead>
</table>

#### 3.3.1 Data , DVD-Video, Video Format and CD-DA

- **AAM High**
  - **DVD-ROM SL** 6.6 - 16x CAV
    - Read Speed: 9.14-22.16 Mbytes/s
    - Transfer rate: 6.92-16.62
    - Rotational speed: 9,360 r/min
  - **DVD-ROM DL** 5.0 - 12x CAV
    - Read Speed: 9.14-22.16
    - Transfer rate: 6.92-16.62
    - Rotational speed: 9,360
  - **DVD+R** 6.6 - 16x CAV
    - Read Speed: 9.14-22.16
    - Transfer rate: 6.92-16.62
    - Rotational speed: 9,360
  - **DVD-R** 6.6 - 16x CAV
    - Read Speed: 9.14-22.16
    - Transfer rate: 6.92-16.62
    - Rotational speed: 9,360
  - **DVD+R DL** 5.0 - 12x CAV
    - Read Speed: 6.92-16.62
    - Transfer rate: 6.92-16.62
    - Rotational speed: 9,360
  - **DVD-R DL** 5.0 - 12x CAV
    - Read Speed: 6.92-16.62
    - Transfer rate: 6.92-16.62
    - Rotational speed: 9,360
  - **DVD+RW** 5.4 - 13x CAV
    - Read Speed: 7.48-18.00
    - Transfer rate: 7.48-18.00
    - Rotational speed: 7,670
  - **DVD-RW** 5.4 - 13x CAV
    - Read Speed: 7.48-18.00
    - Transfer rate: 7.48-18.00
    - Rotational speed: 7,670
  - **FTS**: CD-R/ROM*1 20 - 48x CAV
    - Read Speed: 3,000-7,200 kB/s
    - Transfer rate: 9,660 r/min
  - **FJ**: CD-R/ROM*1 17 - 40x CAV
    - Read Speed: 2,590-6,000 kB/s
    - Transfer rate: 8,050 r/min
  - **CD-RW** 17 - 40x CAV
    - Read Speed: 2,590-6,000
    - Transfer rate: 8,050

- **AAM Middle (Default)**
  - **DVD-ROM SL** 5.0 - 12x CAV
    - Read Speed: 6.92-16.62
    - Transfer rate: 6.92-16.62
    - Rotational speed: 7,050 r/min
  - **DVD-ROM DL** 5.0 - 12x CAV
    - Read Speed: 6.92-16.62
    - Transfer rate: 6.92-16.62
    - Rotational speed: 7,050
  - **DVD+R** 5.0 - 12x CAV
    - Read Speed: 6.92-16.62
    - Transfer rate: 6.92-16.62
    - Rotational speed: 7,050
  - **DVD-R** 5.0 - 12x CAV
    - Read Speed: 6.92-16.62
    - Transfer rate: 6.92-16.62
    - Rotational speed: 7,050
  - **DVD+R DL** 5.0 - 12x CAV
    - Read Speed: 6.92-16.62
    - Transfer rate: 6.92-16.62
    - Rotational speed: 7,050
  - **DVD-R DL** 5.0 - 12x CAV
    - Read Speed: 6.92-16.62
    - Transfer rate: 6.92-16.62
    - Rotational speed: 7,050
  - **DVD+RW** 5.4 - 13x CAV
    - Read Speed: 7.48-18.00
    - Transfer rate: 7.48-18.00
    - Rotational speed: 7,670
  - **DVD-RW** 5.4 - 13x CAV
    - Read Speed: 7.48-18.00
    - Transfer rate: 7.48-18.00
    - Rotational speed: 7,670
  - **CD-R/ROM*1** 13.3 - 32x CAV
    - Read Speed: 1,995 - 4,800 kB/s
    - Transfer rate: 6,480 r/min
  - **CD-RW** 13.3 - 32x CAV
    - Read Speed: 1,995 - 4,800
    - Transfer rate: 6,480

- **AAM Low**
  - **DVD-ROM SL** 3.3 - 8x CAV
    - Read Speed: 4.57 - 11.08
    - Transfer rate: 4,750 r/min
  - **DVD-ROM DL** 3.3 - 8x CAV
    - Read Speed: 4.57 - 11.08
    - Transfer rate: 5,200
  - **DVD+R** 3.3 - 8x CAV
    - Read Speed: 4.57 - 11.08
    - Transfer rate: 4,750
  - **DVD-R** 3.3 - 8x CAV
    - Read Speed: 4.57 - 11.08
    - Transfer rate: 4,750
  - **DVD+R DL** 3.3 - 8x CAV
    - Read Speed: 4.57 - 11.08
    - Transfer rate: 5,200
  - **DVD-R DL** 3.3 - 8x CAV
    - Read Speed: 4.57 - 11.08
    - Transfer rate: 5,200
  - **DVD+RW** 3.3 - 8x CAV
    - Read Speed: 4.57 - 11.08
    - Transfer rate: 4,750
  - **DVD-RW** 3.3 - 8x CAV
    - Read Speed: 4.57 - 11.08
    - Transfer rate: 4,750
  - **CD-R/ROM*1** 10 - 24x CAV
    - Read Speed: 1500 - 3600 kB/s
    - Transfer rate: 4,860 r/min
  - **CD-RW** 10 - 24x CAV
    - Read Speed: 1500 - 3600
    - Transfer rate: 4,860

- **No change by AAM setting**
  - **DVD-RAM (Ver. 1.0)** 2x ZCLV
    - Read Speed: 2.77 Mbytes/s
    - Transfer rate: 4,780-2,020 r/min
  - **-RAM (Ver. 2.x)** 3 - 5x PCAV
    - Read Speed: 4.16-6.93
    - Transfer rate: 4,880-3,450
  - **RAM (8cm)** 3 - 5x PCAV
    - Read Speed: 4.16-6.93
    - Transfer rate: 4,880-3,450
  - **CD-DA (Ripping)** 10 - 24x CAV
    - Read Speed: 1,500-3,600 kB/s
    - Transfer rate: 4,860 r/min
  - **CD-DA (Audio Play)** 4.2 - 10x CAV
    - Read Speed: 630 - 1,500
    - Transfer rate: 1,900
  - **CD (8cm)** 6.6 - 10x CAV
    - Read Speed: 990 – 1,500
    - Transfer rate: 3,240

*1) Fully recorded CD-R should be used.
3.4 Burst transfer rate

SATA Gen.1 1.5 G bps

3.5 Access time (Random)

- DVD-ROM 145 ms typ. *(Note 1)
- DVD-ROM DL 220 ms typ. *(Note 1)
- CD-ROM 125 ms typ. *(Note 1)
- DVD-RAM (Ver.2.2) 270 ms typ.

Note:
1) Average access time is the typical value of more than 2000 times including latency and error correction time.
   Test Disc: DVD-ROM: ALMEDIO TDV-520 / TDR-820
   DVD-ROM DL: ALMEDIO TDV-540 / TDR-840
   CD: ALMEDIO TCDR-701 / HITACHI HCD-1

*) Typical value defines a measured value in normal temperature (20 °C) and horizontal position.

3.6 Data error rate (Measured with 5 retries maximum)

- DVD-R/RW/ROM/RAM <10^-12
- DVD+R/+RW <10^-12
- CD-R/RW/ROM <10^-12 (Mode-1)
- <10^-9 (Mode-2)

Condition: It is assumed that the worst case raw error rate of the disc is 10^-3

3.7 Spin up, Load time without Multi-session

Spin up time (Time to drive ready mode from standby mode)
5 s typ.

Load time (Time to drive ready mode from tray loading)
- DVD-ROM 10 s typ.
- DVD-R 22 s typ. (Disc At Once, Ver. 2.0 for General)
- DVD-RW 22 s typ. (Disc At Once, Ver. 1.2)
- DVD-RAM 40 s typ. (60 s Limit)
- DVD+R/RW 22 s typ.
- CD-ROM 10 s typ.
- DVD±R DL 22 s typ.

3.8 Data buffer capacity

0.5 MB

3.9 Automatic Acoustic Management (AAM)

<table>
<thead>
<tr>
<th>Performance Level</th>
<th>Sector Count Register</th>
<th>CD</th>
<th>DVD</th>
<th>BD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>80h</td>
<td>20x-24x</td>
<td>6x-8x</td>
<td></td>
</tr>
<tr>
<td>Medium (default)</td>
<td>82h</td>
<td>32x</td>
<td>12x</td>
<td></td>
</tr>
<tr>
<td>Max speed (FTS)</td>
<td>FEh</td>
<td>48x</td>
<td>16x</td>
<td></td>
</tr>
<tr>
<td>Max speed (Fujitsu)</td>
<td>FAh</td>
<td>40x</td>
<td>16x</td>
<td></td>
</tr>
</tbody>
</table>
4. Environmental conditions

4.1 Ambient temperature

Operating: 5 °C to 50 °C **
Storage / Transportation: -30 °C to 60 °C

**. Note1) Criteria is “No write failure and No read failure” under 50degC.

Note2) Each test Media uses standard media of production line

4.2 Approval temperature rise 62 °C max. at the center of bottom cover

4.3 Temperature gradient 10 °C/h

4.4 Relative humidity

Operating: 10 % to 80 % (Non-Condensing)
Storage / Transportation: 10 % to 90 % (Non-Condensing)

4.5 Dew point temperature restrictions Less than 29 degC

4.6 Altitude

Operating: 0 m to 3000 m
Non-operating: 0 m to 12000 m

4.7 Vibration

(1) Operating:
Read: No unrecoverable error
Audio: 3.43 m/s² (0.35 G)
Data: 3.43 m/s² (0.35 G)
(10 - 500) Hz Sine sweep, 1 Oct/min
at X(left and right), Y(back and front), Z(top and bottom) axis.

Write: No recording stop
CD-R/RW: 2.94 m/s² (0.3 G)
DVD±R/RW: 0.98 m/s² (0.1 G)
(10 - 500) Hz sine sweep, 1 Oct/min
at X(left and right), Y(back and front), Z(top and bottom) axis.

(2) Non-Operating: No damage must result
19.6 m/s² (2 G)
(10 - 500) Hz sine sweep, 1 Oct/min
at X(left and right), Y(back and front), Z(top and bottom) axis.
40 min/axis.

4.8 Shock

(1) Operating
Read: No unrecoverable error
Audio: 19.6 m/s² (2 G)
Data: 58.8 m/s² (6 G)
11 ms, 1/2 sine wave (5 time shocks, 6 s between shocks)
at X(left and right), Y(back and front), Z(top and bottom) axis

Write: No recording stop
CD-R/RW: 9.8 m/s² (1 G)
DVD±R/RW: 4.9 m/s² (0.5 G)
11 ms, 1/2 sine wave (5 time shocks, 6 s between shocks)
at X(left and right), Y(back and front), Z(top and bottom) axis
(2) Non-Operating : No damage after shock
140 G
2 ms, 1/2 sine wave
at X(left and right), Y(back and front), Z(top and bottom) axis

4.9 Drop impact
Less than 60 cm, No performance and physical damage
Note: Bulk package, 1 corner, 3 edges, 6 faces.

5. Quality and Reliability
5.1 MTBF
100 000 Power On Hours (POH)
- Assumption : Used in a normal office environment at room temperature.
- POH per year : 3000
- ON / OFF cycles per year : 600
- Operating duty cycle : 20 % of power on time  (Seek: 5 % of operating time)

5.2 Tray cycle test
30000 times
No degeneration in the mechanical part after test
(1cycle ; one loading and one ejecting)

5.3 Actuator mechanism
1 000 000 full stroke seek

5.4 MTTR (Mean Time To Repair)
0.5 h

5.5 Component life
5 years or 2000 h of Laser radiating time
Assumption: Used in a normal office environment

6. Electro Static Discharge susceptibility (ESD)
0 to 5 kV With no user detectable data read errors
From 5 kV to 8 kV No catastrophic failure or damage
* Test conditions : C = 150 pF, R = 330 ohms, 50 times discharge except connector

7. Power requirements
7.1 Source voltage
+ 5 V +/- 5 % tolerance, less than 100 mVp-p Ripple voltage
+12 V +/- 10 % tolerance, less than 100 mVp-p Ripple voltage

7.2 Current
Idle (Hold track state) + 5 V DC 0.9 A typ. < 1.0 A max.
+12 V DC 0.5 A typ. < 1.0 A max.
Write (Active) + 5 V DC 1.3 A typ. < 1.5 A max.
+12 V DC 1.5 A typ. < 2.0 A max.
Read (Active) + 5 V DC 1.2 A typ. < 1.5 A max.
+12 V DC 0.9 A typ. < 1.5 A max.
Seek (Access) +5 V DC 1.0 A typ. < 1.5 A max.
+12 V DC 1.2 A typ. < 2.0 A max.

7.3 Standby
Sleep mode (No disc) 1.0 W typ.
8. Acoustic noise

Less than 50 dB, A scale, at 0.5 m away from the drive and 0.45m height away

Note: 1. Disc: Less than imbalance 0.3 x 10^-4 Nm
2. Installation: Horizontal
3. Ambient temperature: Normal temperature
4. Except loading, unloading and seek

9. Dimensions

External dimensions (W x H x D) (146 x 41.3 x 165) mm (w/o Bezel, Refer to Section 14.)
Front bezel (W x H x D) (148 x 42 x 5) mm

10. Mass

640 ± 30 g

11. Mechanical

11.1 Disc loading

Tray type, Auto loading

11.2 Mounting requirements

-Note-

Operation with postures other than the above drawings is not guaranteed.
12. Controls and Functions

12.1 Front side

Refer to Appendix 1. for Front design (Logo, color, material, etc.)

![Diagram of front side controls and functions]

1. Tray
2. Door
3. Front bezel
4. Eject button
5. Emergency eject hole
6. LED

Logo: Enboss

12.2 Rear side

![Diagram of rear side connections]

1. 7-pin signal connector
2. 15-pin power connector

< Rear view >
13. Connector Pin define

SATA Drive consist of two connectors.
First, Power connector supply 5 V and 12 V Power. 3.3 V was not supplied.

Second, Signal Connector has 2 pairs.

### Power
- S1: GND
- S2: R+
- S3: R-
- S4: GND
- S5: T-
- S6: T+
- S7: GND

### Signal
- P1: 3.3V
- P2: 3.3V
- P3: 3.3V
- P4: GND
- P5: GND
- P6: GND
- P7: 5V
- P8: 5V
- P9: 5V
- P10: GND
- P11: Reserved
- P12: GND
- P13: 12V
- P14: 12V
- P15: 12V

< SATA Connector Pin Assignment >
14. Mechanical dimensions

Mechanical Drawing (Front & Back of Drive)

Unit: mm  Allowance: +/- 0.5 unless otherwise stated

Host bracket recommend holes size: 3.2~3.5mm
Torque spec.
MIN. 4Kgf, Max. : 7Kgf
Recommend spec: 5~6Kgf.
15. Supported Command List

15.1 ATA Commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATAPI Packet Command</td>
<td>A0h</td>
</tr>
<tr>
<td>ATAPI Soft Reset</td>
<td>08h</td>
</tr>
<tr>
<td>Check Power Mode</td>
<td>E5h</td>
</tr>
<tr>
<td>Execute Drive Diagnostics</td>
<td>90h</td>
</tr>
<tr>
<td>Flush Cache</td>
<td>E7h</td>
</tr>
<tr>
<td>Identify Packet Device</td>
<td>A1h</td>
</tr>
<tr>
<td>Idle Immediate</td>
<td>E1h</td>
</tr>
<tr>
<td>NOP</td>
<td>00h</td>
</tr>
<tr>
<td>Set Features</td>
<td>EFh</td>
</tr>
<tr>
<td>Sleep</td>
<td>E6h</td>
</tr>
<tr>
<td>Standby Immediate</td>
<td>E0h</td>
</tr>
</tbody>
</table>

15.2 ATAPI Packet Commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLANK</td>
<td>A1h</td>
</tr>
<tr>
<td>CLOSE TRACK/RZONE/SESSION/BORDER</td>
<td>5Bh</td>
</tr>
<tr>
<td>FORMAT UNIT</td>
<td>04h</td>
</tr>
<tr>
<td>GET CONFIGURATION</td>
<td>46h</td>
</tr>
<tr>
<td>GET EVENT STATUS NOTIFICATION</td>
<td>4Ah</td>
</tr>
<tr>
<td>GET PERFORMANCE</td>
<td>ACCh</td>
</tr>
<tr>
<td>INQUIRY</td>
<td>12h</td>
</tr>
<tr>
<td>LOG SELECT</td>
<td>4Ch</td>
</tr>
<tr>
<td>LOG SENSE</td>
<td>4Dh</td>
</tr>
<tr>
<td>MECHANISM STATUS</td>
<td>BDh</td>
</tr>
<tr>
<td>MODE SELECT (10)</td>
<td>55h</td>
</tr>
<tr>
<td>MODE SENSE (10)</td>
<td>5Ah</td>
</tr>
<tr>
<td>PAUSE/RESUME</td>
<td>4Bh</td>
</tr>
<tr>
<td>PLAY AUDIO (10)</td>
<td>45h</td>
</tr>
<tr>
<td>PLAY AUDIO (12)</td>
<td>A5h</td>
</tr>
<tr>
<td>PLAY AUDIO MSF</td>
<td>47h</td>
</tr>
<tr>
<td>PLAY AUDIO TRACK RELATIVE (10)</td>
<td>49h</td>
</tr>
<tr>
<td>PLAY AUDIO TRACK RELATIVE (12)</td>
<td>A9h</td>
</tr>
<tr>
<td>PREVENT ALLOW MEDIUM REMOVAL</td>
<td>1Eh</td>
</tr>
<tr>
<td>READ (10)</td>
<td>28h</td>
</tr>
<tr>
<td>READ (12)</td>
<td>A8h</td>
</tr>
<tr>
<td>READ BUFFER</td>
<td>3Ch</td>
</tr>
<tr>
<td>READ BUFFER CAPACITY</td>
<td>5Ch</td>
</tr>
<tr>
<td>READ CAPACITY</td>
<td>25h</td>
</tr>
<tr>
<td>READ CD</td>
<td>BEh</td>
</tr>
<tr>
<td>READ CD MSF</td>
<td>B9h</td>
</tr>
<tr>
<td>READ DISC INFORMATION</td>
<td>51h</td>
</tr>
<tr>
<td>READ DVD STRUCTURE</td>
<td>ADh</td>
</tr>
<tr>
<td>READ FORMAT CAPACITIES</td>
<td>23h</td>
</tr>
<tr>
<td>READ HEADER</td>
<td>44h</td>
</tr>
<tr>
<td>READ SUB-CHANNEL</td>
<td>42h</td>
</tr>
<tr>
<td>READ TOC/PMA/ATIP</td>
<td>43h</td>
</tr>
<tr>
<td>READ TRACK/RZONE INFORMATION</td>
<td>52h</td>
</tr>
<tr>
<td>REPAIR RZONE</td>
<td>58h</td>
</tr>
<tr>
<td>REPORT KEY</td>
<td>A4h</td>
</tr>
<tr>
<td>REQUEST SENSE</td>
<td>03h</td>
</tr>
<tr>
<td>RESERVE TRACK/RZONE</td>
<td>53h</td>
</tr>
<tr>
<td>&lt; Command &gt;</td>
<td>&lt; Code &gt;</td>
</tr>
<tr>
<td>-------------</td>
<td>---------</td>
</tr>
<tr>
<td>(38) REZERO UNIT</td>
<td>01h</td>
</tr>
<tr>
<td>(39) SCAN</td>
<td>BAh</td>
</tr>
<tr>
<td>(40) SEEK</td>
<td>2Bh</td>
</tr>
<tr>
<td>(41) SEND CUE SHEET</td>
<td>5Dh</td>
</tr>
<tr>
<td>(42) SEND DVD STRUCTURE</td>
<td>BFh</td>
</tr>
<tr>
<td>(43) SEND KEY</td>
<td>A3h</td>
</tr>
<tr>
<td>(44) SEND OPC INFORMATION</td>
<td>54h</td>
</tr>
<tr>
<td>(45) SET CD SPEED</td>
<td>BBh</td>
</tr>
<tr>
<td>(46) SET READ AHEAD</td>
<td>A7h</td>
</tr>
<tr>
<td>(47) SET STREAMING</td>
<td>B6h</td>
</tr>
<tr>
<td>(48) START/STOP UNIT</td>
<td>1Bh</td>
</tr>
<tr>
<td>(49) STOP PLAY/SCAN</td>
<td>4Eh</td>
</tr>
<tr>
<td>(50) SYNCHRONIZE CACHE</td>
<td>35h</td>
</tr>
<tr>
<td>(51) TEST UNIT READY</td>
<td>00h</td>
</tr>
<tr>
<td>(52) VERIFY(10)</td>
<td>2Fh</td>
</tr>
<tr>
<td>(53) VERIFY(12)</td>
<td>AFh</td>
</tr>
<tr>
<td>(54) WRITE(10)</td>
<td>2Ah</td>
</tr>
<tr>
<td>(55) WRITE(12)</td>
<td>AAh</td>
</tr>
<tr>
<td>(56) WRITE AND VERIFY(10)</td>
<td>2Eh</td>
</tr>
<tr>
<td>(57) WRITE AND VERIFY(12)</td>
<td>Aeh</td>
</tr>
<tr>
<td>(58) WRITE BUFFER</td>
<td>3Bh</td>
</tr>
</tbody>
</table>
16. Regulations and Standards

16.1 Safety

The product will satisfy the safety standards outlined below.

UL: UL 60950-1 First Edition
CSA: CSA C22.2 No. 60950-1-03
TÜV: EN 60950-1 / EN60825-1
SEMKO: EN 60950-1 / EN60825-1

16.2 EMC / EMI

The product complies with applicable technical requirements as specified below

FCC Part15 Class B
CE Marking,
C-Tick Mark
Taiwan EMC (BSMI)
VCCI

16.3 Laser safety

The product will satisfy all the requirements for the laser specified below.

Class 1 laser product comply with DHHS rules 21 CFR Subchapter J
Class 1 laser product to EN60825-1 / IEC 60825-1

17. Supporting Operating System & Application Software

17.1 Operating System

Windows VISTA x86/x64
Windows 7 x86/x64
Windows 8 x86/x64
Windows 8.1 x86/x64

17.2 Application Software

CyberLink Power2Go
Appendix 1. Front design, RPC and others

1. Front design

2. Chassis
   - Top cover: Steel
   - Bottom cover: Steel

3. RPC (Regional Playback Control)
   - No Region (Phase2)

4. Drive serial number:
   Drive serial number is stored in EEPROM and can be got with GET CNFIGURATION CMD (Feature 0108h).
   Drive serial number between Label and EEPROM must be match.

Appendix 2. Caution

1. We can't guarantee about dirt in the state without a bezel or a tray panel.
   The guarantee environment of dirt is a thing under the environment of 0.15 mg/m³.
Appendix 3. Rating Label

FTS LABEL INFORMATION

Standard Label

LABEL SIZE : Ø57 x 0.1(t)
Label P/N : MEZ64812519

Barcode Label

LABEL SIZE : 80(W) x 16(H) x 0.1(t)
Printing Information : Blue, Red Part
Label P/N : MEZ64588001

* Label Detail Printed Information *

1. Product Name : Super Multi DVD Writer
2. Model Name : MODEL : GHB0N
   Suffix : (AFCK101)
3. Ampere : 5 V / 12 V = 1.5 A / 2.0 A
   You must have A SPACE before the "SI UNIT". Voltage, Ampere, Hz
4. KC No : KCC-REM-HLD-GH24NSB0
5. MANUFACTURED : JANUARY 2012
6. ROM VER : XXXX
   Please apply the latest F/W version, which should be shown in SWO by the F/W engineer.
7. Hardware Version : H/W : A
8. MECHA Version : MECHA : A
   S/N : YMMFL000001
   - MM : Month
   - FL : Factory Line Code
   - 000001 : Serial Number
10. FDA No. : 0622198-081
11. Bezel Color : BL
    AN : Anthracite bezel color
    BL : Satin Black bezel color
Appendix 4. Packaging Spec

1. Packaging spec

* Pallet (4 stack): 360
Size: 1,140 x 1,000 x 1,020 mm

Area of box label
Destination label (Only HEPM)

Box Label Spec
#0. MES Barcode
#1. Product Name:
#2. Model Name
#3. Customer P/N: Refer to the PR
#4. Origin:

Super Multi DVD Writer
GHB0N (AFCK101)
ABG: 10601769884
MADE IN CHINA