DVD/CD-Rewritable Drive
Product Specification
Model : DV-W5500S-000

Drive Specification

Confidential

Revision 0.94

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TEAC Corporation

Planned by _____ _____

Authorized by _____ _____

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1 INTRODUCTION AND SCOPE

This document contains information for OEM customer to purchase the internal are DVD/CD-Rewritable drive model DV-W5500S that is a half height 5.25' form factor with a Serial ATA interface. The drive is capable to write DVD-RAM(Ver.2) discs, DVD+R discs, DVD+R Double Layer(DVD+R DL) discs, DVD+RW discs, DVD-R discs, DVD-R Dual Layer(DVD-R DL) discs, DVD-RW discs, CD-R discs and CD-RW discs, and also havs the same function as ordinary DVD-ROM drive. The drive has 5xCAV speed DVD-RAM(Ver.2) writing, 24xCAV speed DVD+R writing, 12xCAV speed DVD+R DL writing, 8xZCLV speed DVD+RW writing, 24xCAV speed DVD-R writing, 12xCAV speed DVD-R DL writing, 6xCLV speed DVD-RW writing, 48x CAV speed CD-R writing and 32xZCLV speed CD-RW writing, 16xCAV speed DVD-ROM reading and 48xCAV speed CD-ROM reading capabilites, and supports various DVD and CD formats. The drive have a power tray disc loading mechanism. The drive will be mounted and used in the horizontal orientation and vertical orientation.
The drive has Busy LED.

2 APPLICABLE DOCUMENTS

DV-W5500S ATAPI/IDE(SATA) Command Set Specification
CD-Audio "Red Book" Reference (Reference Only)
CD-ROM "Yellow Book" Reference (Reference Only)
CD-ROM XA Reference (Reference Only)
CD-I "Green Book" Reference (Reference Only)
CD-WO "Orange Book, Part 2" Reference (Reference Only)
CD-RW "Orange Book, Part 3" Reference (Reference Only)
Video CD "White Book" Reference (Reference Only)
ATAPI CD-ROM specification :SFF-8020i Rev 2.6(Reference only)
CD-TEXT “Red Book” Reference (Reference Only)
ANSI Document, AT Attachment with Packet Interface -7 Volume1-3 (ATA/ATAPI-7)
T13/1532D Rev.4b 21-Apr-2004
CD-TEXT "Red Book" Reference (Reference Only)
DVD Specifications for Read-Only Disc Ver. 1.0 August 1996 (Reference Only)
DVD Specifications for Recordable Disc for General Ver 2.0 May 2000 (Reference Only)

DVD Specifications for Re-recordable Disc Ver 1.2 December 2003 (Reference Only)
DVD +R 4.7Gbytes Basic Format Specifications Ver 1.2 July 2003 (Reference Only)

DVD+R 8.5GBytes Basic Format Specifications Ver 1.0 March 2004 (Reference Only)
DVD Specifications for Recordable Disc for Dual Layer Version 3.0 February 2005 (Reference Only)
DVD +ReWritable 4.7Gbytes Basic Format Specifications Ver 1.2 December 2002 (Reference Only)
SFF8090iv5 Rev.0.7; Mt. Fuji Commands for Multimedia Devices (Reference Only)
ANSI Document, SCSI Multimedia Commands -5 (MMC-5)
T10/1363D Rev.10g Nov. 12, 2001 (Reference Only)
DVD-RAM Part1 Physical Specifications Version 2.0
DVD Specifications for Re-recordable Disc for Dual Layer Part1 Ver 1.9 Nov. 29 2005 (Reference Only)
Serial ATA: High Speed Serialized AT Attachment Revision 1.0a.
Serial ATA: International Organization Serial ATA Rev2.6

3 PRODUCT DEFINITION

3.1 GENERAL

This drive unit is compatible of playing DVD-ROM, DVD+R, DVD+R DL, DVD+RW, DVD-R, DVD-R DL, DVD-RW, DVD-RAM(Ver.2), CD-Audio, CD-ROM(mode 1 and mode 2), CD-ROM XA(mode 2, form 1 and form 2), Photo CD(single and multiple sessions), CD Extra, CD-R, CD-RW, CD-TEXT discs. This drive unit can playback CD-I (FMV) and VIDEO CD with special hardware. This drive unit can also play DVD-Video with special function, such as MPEG decoder. This drive unit can operate in 6.6-16xCAV(Constant Angular Velocity) speed at DVD-ROM data and 20-48xCAV speed at reading CD-ROM for data tracks with a sustained mode 1 data transfer rate of 7200kBytes/sec. (outside track), respectively. This drive supports these writing modes and methods as below:

5xCAV speed DVD-RAM (Ver.2) writing
: Random and Sequential.

24xCAV speed DVD+R writing and 12xCAV speed DVD+R DL writing and 8xZCLV speed DVD+RW writing
: Random, Sequential and Multi-Session.

24xCAV speed DVD-R writing and 12xCAV speed DVD-R DL writing and 6xCLV speed DVD-RW writing
: Disc at Once, Incremental, and Multi-Border. Restricted overwrite (DVD-RW only)

48xCAV speed CD-R writing and 32xZCLV speed CD-RW writing
: Disc at Once, Track at Once, Session at Once Variable size Packets and Fixed size Packets.

This drive does not have CD-DA audio circuitry, and ADPCM audio circuitry required to support audio modes other than CD-DA specified in CD-ROM XA. Also the audio circuitry inside this drive is not for DVD-Audio. This drive unit is designed with a sealed construction to ensure dust free operation. This drive unit accepts a standard CD disc using a power tray for both loading and unloading, and can operate in both the horizontal and vertical orientation. This drive unit is used inside the host computer.

3.2 PRODUCT DESCRIPTION

The drive unit has an optical pickup head, servo electronics to maintain correct focus, tracking. feed position, radial tilt and spindle speed, digital electronics to recover the recorded data and provide error correction in Mode 1 and Mode 2 Form 1 to the maximum capabilities of the CD-ROM ECC, and a Serial ATA interface to the host computer. This drive has hardware layered error correction (LECC) for the main channel data of the CD-ROM. This drive unit also provides error correction of the DVD-Video and DVD-ROM. This device supports 6.6-16xCAV speed for DVD-ROM data tracks transfer rate of 22MBytes/sec. (outside track) and 20-48xCAV speed for data tracks with a sustained mode 1 data transfer rate of 7200kBytes/sec. (outside track), respectively. The Serial ATA controller has a 1Mbytes data buffer, and insures that in all cases a full block of data is transferred at the designated data transfer rate on the Serial ATA bus as specified in section 4.3.7. As for the drive, it is equipped with the buffer under run protection feature in writing.

The mechanical design of this drive is a completely sealed construction to prevent any air passage through the unit and dust contamination. All of the through holes especially, the openings around the connectors in the rear panel is sealed.

4 PERFORMANCE AND FUNCTIONAL REQUIREMENTS

4.1 GENERAL

The performance and functionality of the DVD/CD rewritable drive system is determined in part by the world-wide standards. It is the intention of this document to adhere to these standards unless otherwise specifically noted. A summary of these standard specifications are presented here for reference purposes only. Refer to the applicable documents for additional detail.

4.2 SUMMARY OF STANDARD PERFORMANCE

Below is a brief summary of performance and functional specifications as set for by the standards cited above, to be used as quick reference information.

4.2.1 DVD medium

USER DATA CAPACITY*	4.7GBytes,	Single layer 12cm
(1 GBytes = 1000 x 1000 x 1000)	8.54GBytes,	Dual(Double) layer 12cm
	1.46Gbytes,	Single layer 8cm
	2.66Gbytes,	Dual layer 8cm

USER DATA/BLOCK (Excluding sync, header, and ECC bytes)	2048Bytes
ADDRESS DESCRIPTION	Block
RECORDING SURFACES	2
LAYER	Single or Dual
DISC DIAMETER	120 mm or 80 mm
DISC CENTER HOLE	15 mm diameter
THICKNESS	1.2 mm
TRACK PITCH	0.74 microns, typical
SCANNING VELOCITY	3.49 meters/sec, Single layer(Normal Speed) 3.84 meters/sec, Dual layer(Normal Speed)
ROTATION SPEED	Varies over radius. ~1388 to 574 rpm (Normal Speed). Variable

4.2.2 CD medium

The following specification marked with an * is a calculated and practical maximum figure based on a 1.6um track pitch.

USER DATA CAPACITY*	656MBytes, Mode 1
(1 MBytes = 1024 x 1024)	748MBytes, Mode 2
RECORDING/PLAYING TIME	74 minutes and 42 seconds
NUMBER OF BLOCKS/DISC*	336,150
USER DATA/BLOCK (Excluding sync, header, subheader, and ECC bytes)	2048 Bytes, Mode 1 and Mode 2 Form 1 2336 Bytes, Mode 2 2328 Bytes, Mode 2 Form 2
ADDRESS DESCRIPTION	Min.,Sec.,Frame
BLOCK RATE	1500 ~ 3600 Blocks/Sec., (20-48x CAV speed)

AUDIO

PLAYING TIME*	74 minutes and 42 seconds

DISC

RECORDING SURFACES	1
DISC DIAMETER	120 mm or 80 mm
DISC CENTER HOLE	15 mm diameter
THICKNESS	1.2 mm
TRACK PITCH	1.6 microns (15,875 TPI), typical
SCANNING VELOCITY	1.2 ~ 1.4 meters/sec (Normal Speed)
ROTATION SPEED	Varies over radius. ~535 to 198 rpm (Normal Speed). Variable
LATENCY (AVERAGE)	~55 to 150 msec (Normal Speed), Variable
BLOCKS/ROTATION	~9.1 to 21.1 blocks/rotation , Variable

4.3 PERFORMANCE REQUIREMENTS

Unless otherwise indicated, the following performance specifications will be met over the temperature, humidity, and voltage range called out in section 5.0 and 10.0 of this document and will be verified using a test disc.

The drive can write in maximum 24X CAV speed for DVD+R and DVD-R discs, 8X ZCLV speed for DVD+RW discs, 6X ZCLV speed for DVD-RW discs, 12X CAV speed for DVD+R DL discs, 12X CAV speed for DVD-R DL discs, 5xCAV speed for DVD-RAM(Ver.2) discs, 48X CAV speed for CD-R discs and 32X ZCLV for CD-RW discs. The drive can operate in maximum 16X speed for DVD data tracks and maximum 48X speed for CD-ROM data tracks. The drive can read 5x CAV for DVD-RAM discs.（Note: The drive can read 12x speed for the DVD-RAM that was written at 12x by the drive which supports 12x write for DVD-RAM.） The drive changes operating speed automatically based on the disc quality. The default setting is maximum speed.

4.3.1 DVD MODES AND BLOCK LENGTH SUPPORTED

4.3.1.1 DVD READABLE FORMAT, MODES AND BLOCK LENGTH SUPPORTED

a) Format and Modes Supported
   DVD-Video(8cm/12cm, Single and Dual Layer), DVD-ROM(8cm/12cm, Single and Dual Layer), Multi-Border, Multi-Session
b) Block Length Supported
   2048 bytes/sector

4.3.1.2 DVD WRITABLE FORMAT, MODES AND BLOCK LENGTH SUPPORTED

a) Format and Modes Supported
   DVD-Video, DVD-ROM, Multi-Border(DVD-R/-RW), Multi-Session(DVD+R)
b) Block Length Supported
   2048 bytes/sector

4.3.2 DVD WRITE METHOD SUPPORTED

a) Uninterrupted Write
   Disc at Once
b) Interrupted Write
   Random write(DVD+RW, DVD-RAM Ver.2)
   Sequential write(DVD+R/+RW, DVD-RAM Ver.2)
   Incremental(DVD-R/-RW)
   Multi-Border(DVD-R/-RW)
   Restricted overwrite (DVD-RW)

4.3.3 DVD WRITABLE MEDIA

Refer to “Support Media List” for details of media and recording speed.

a) DVD+R Media (max.16x Media)
   Mitsubishi (Verbatim), Taiyo-Yuden
b) DVD+R DL Media(max.16x Media)
   Mitsubishi (Verbatim)
c) DVD+RW Media (max.8x Media)
   Mitsubishi (Verbatim), Sony
d) DVD-R Media (max.16x Media)
   Mitsubishi (Verbatim), Taiyo-Yuden
e) DVD-R DL Media(max.12x Media)
   Mitsubishi (Verbatim) , Taiyo-Yuden
f) DVD-RW Media (max.6x Media)
   JVC, Mitsubishi (Verbatim)
g) DVD-RAM – Ver.2 Media (max.5x Media)
   Panasonic, Hitachi maxell

4.3.4 CD MODES AND BLOCK LENGTH SUPPORTED

4.3.4.1 CD READABLE FORMAT, MODES AND BLOCK LENGTH SUPPORTED

a) Format and Modes Supported
   CD-Audio(8cm/12cm), CD-ROM(mode 1 and mode 2), CD-ROM XA(mode 2, form 1 and form 2), Photo CD(single or multiple sessions), CD-I(FMV), Video CD, CD Extra., CD TEXT

b) Block Length Supported

CD-Audio		2352 and 2368 Bytes
CD-ROM(mode 1)		2048 and 2352 Bytes
CD-ROM XA/CD-I	form 1	2048, 2328, 2336, 2340 and 2352 Bytes
	form 2	2328, 2336, 2340 and 2352 Bytes

4.3.4.2 CD WRITABLE FORMAT, MODES AND BLOCK LENGTH SUPPORTED

a) Format and Modes Supported
   CD-Audio(8cm/12cm), CD-ROM(mode 1 and mode 2), CD-ROM XA(mode 2, form 1 and form 2), Photo CD(single or multiple sessions), CD-I(FMV), Video CD, CD Extra., CD TEXT

b) Block Length Supported

CD-Audio		2352 Bytes
CD-ROM(mode 1)		2048 Bytes
CD-ROM XA/CD-I	form 1	2048 and 2332 Bytes
	form 2	2332 Bytes

4.3.5 CD WRITE METHOD SUPPORTED

a) Uninterrupted Write
   Disc at Once

b) Interrupted Write
   Track at Once
   Session at Once
   Packet Writing (Fixed size Packets, Variable size Packets)

4.3.6 CD WRITABLE MEDIA

Refer to “Support Media List” for details of media and recording speed.

a) CD-R Media (max.52x Media)
   Mitsubishi (Verbatim), Taiyo-Yuden

b) CD-RW Media (max.32x Media)
   Mitsubishi (Verbatim)

4.3.7 TRANSFER RATE

4.3.7.1 READ SPEED AND TRANSFER RATE

USER BYTES/SEC. (SUSTAINED) (1 kBytes = 1024 Bytes, 1Mbyte = 1024KByte)

a) DVD-ROM Read Speed and Transfer Rate

Single Layer	6.6-16x CAV	8.7 - 21.1 MBytes/sec
Dual Layer	5-12x CAV	6.6 - 15.8 MBytes/sec

b) DVD+/-R Data tracks Read Speed and Transfer Rate

6.6-16x CAV	8.7 - 21.1 MBytes/sec

c) DVD+/-R DL Data tracks Read Speed and Transfer Rate

5-12x CAV	6.6 - 15.8 MBytes/sec

d) DVD+/-RW Data tracks Read Speed and Transfer Rate

5-13x CAV	6.6 - 17.2 MBytes/sec

e) DVD-Video with CSS protection Read Speed and Transfer Rate

SL	6.6-16x CAV	8.7 - 21.1 MBytes/sec
DL	5-12x CAV	6.6 - 15.8 MBytes/sec

f) DVD-RAM Data tracks Read Speed and Transfer Rate

5x CAV	6.6 MBytes/sec

g) CD-ROM/CD-R Read Speed and Transfer Rate
Mode 1 and Mode 2 Form 1 (2048 Bytes)

20-48x CAV	3000 - 7200 kBytes/sec

h) CD-RW Read Speed and Transfer Rate
Mode 1 and Mode 2 Form 1 (2048 Bytes)

17-40xPCAV	2550- 6000 kBytes/sec

i) DAE Read Speed and Transfer Rate

17-40x PCAV	2550-6000 kBytes/sec

j) Mode 2 and Mode 2 Form2 Read Speed and Transfer Rate

8-20x CAV	1200-3000 kBytes/sec

4.3.7.2 WRITE SPEED AND TRANSFER RATE

a) DVD+R Write Speed

24x CAV	13.2 - 31.7 MBytes/sec
20x CAV	11.0 - 26.4 MBytes/sec
18x CAV	9.9 - 23.8 MBytes/sec
16x CAV	8.7 - 21.1 MBytes/sec
13x CAV	6.6 - 17.2 MBytes/sec
12x ZCLV	7.9 - 15.8 MBytes/sec
8x ZCLV	7.9 - 10.6 MBytes/sec
6x CLV	7.9 MBytes/sec
4x CLV	5.3 MBytes/sec
2.4x CLV	3.2 MBytes/sec

b) DVD+R DL Write Speed

12x CAV	6.6 - 15.8 MBytes/sec
8x ZCLV	5.3 - 10.6 Mbytes/sec
6x ZCLV	5.3 - 8.7 MBytes/sec
4x CLV	5.3 MBytes/sec
2.4x CLV	3.2 MBytes/sec

c) DVD+RW Write Speed

8x ZCLV	7.9 - 10.6 MBytes/sec
6x CLV	7.9 MBytes/sec
4x CLV	5.3 MBytes/sec
2.4x CLV	3.2 MBytes/sec

d) DVD-R Write Speed

24x CAV	13.7 - 33 MBytes/sec
20x CAV	11.0 - 26.4 MBytes/sec
18x CAV	9.9 - 23.8 MBytes/sec
16x CAV	8.7 - 21.1 MBytes/sec
13x CAV	6.6 - 17.2 MBytes/sec
12x ZCLV	7.9 - 15.8 MBytes/sec
8x ZCLV	7.9 - 10.6 MBytes/sec
6x CLV	7.9 MBytes/sec
4x CLV	5.3 MBytes/sec

2x CLV	2.6 MBytes/sec

e) DVD-R DL Write Speed

12x CAV	6.6 - 15.8 MBytes/sec
8x ZCLV	5.3 - 10.6 MBytes/sec
6x ZCLV	5.3 - 8.7 MBytes/sec
4x CLV	5.3 MBytes/sec
2x CLV	2.6 MBytes/sec

f) DVD-RW Write Speed

6x CLV	7.9 MBytes/sec
4x CLV	5.3 MBytes/sec
2x CLV	2.6 MBytes/sec
1x CLV	1.3 MBytes/sec

g) DVD-RAM(Version.2) Write Speed

5x CAV	6.6 MBytes/sec
3x CLV	4.0 MBytes/sec
2x CLV	2.6 MBytes/sec

h) CD-R Write Speed

48x CAV	3000-7200 kBytes/sec
40x CAV	2550-6000 kBytes/sec
32x ZCLV	3000-4800 kBytes/sec
24x ZCLV	3000-3600 kBytes/sec
16x CLV	2400 kBytes/sec
8x CLV	1200 kBytes/sec

i) CD-RW Write Speed

32x ZCLV	2400-4800 kBytes/sec
24x ZCLV	2400-3600 kBytes/sec
16x CLV	2400 kBytes/sec
10x CLV	1500 kBytes/sec
4x CLV	600 kBytes/sec

4.3.8 Serial ATA Interface

PIO	support
DMA	support

4.3.9 ROTATION SPEED

4.3.9.1 DVD Rotation Speed

a) 10-24x CAV	13900 rpm Constant
b) 8.3-20x CAV	11500 rpm Constant
c) 7.5-18x CAV	10350 rpm Constant
d) 6.6-16x CAV	9200 rpm, Constant
e) 5-13x CAV(SL), 5-12xCAV(DL)	7400 rpm, Constant
f) 12x ZCLV	[6600 ~ 8800 rpm]
g) 8x ZCLV(SL)	[4400 ~ 8800 rpm]
h) 8x ZCLV(DL)	[4400 ~ 6600 rpm]
i) 6x CLV(SL)	3450 ~ 8300 rpm
j) 6x ZCLV(DL)	[3450 ~ 6600 rpm]
k) 3.3-8x CAV(DL)	5100 rpm, Constant
l) 3.3-8x CAV(SL)	4580 rpm, Constant
m) 2-5x CAV(DL)	3200 rpm, Constant
n) 2-5x CAV(SL)	2900 rpm, Constant
o) 4x CLV	2298 ~ 5554 rpm
p) 2.4x CLV	1379 ~ 3333 rpm
q) 2x CLV	1149 ~ 2777 rpm
r) 1x CLV	574 ~ 1389 rpm

4.3.9.2 DVD-RAM (Version.2) Rotation Speed

a) 12x PCAV	8253 ~ 9738 rpm
b) 5x CAV	3439 ~ 8115 rpm
c) 3x CLV	2063 ~ 4869 rpm

d) 2x CLV 1375 ~ 3246 rpm

4.3.9.3 CD Rotation Speed

a) 20-48x CAV	9600 rpm, Constant
b) 20-48x ZCLV	[7970 ~ 9600 rpm]
c) 17-40x PCAV	8350 rpm, Constant
d) 20-40x ZCLV	[7930 ~ 9600 rpm]
e) 13-32x CAV	6950 rpm, Constant
f) 17-32x PCAV	[6350 ~ 8350 rpm]
g) 20-32x ZCLV(CD-R)	[6350 ~ 9600 rpm]
h) 16-32x ZCLV(CD-RW)	[4940 ~ 7400 rpm]
i) 10-24x CAV	5460 rpm, Constant
j) 17-24x PCAV	[4760 ~ 8350 rpm]
k) 20-24x ZCLV(CD-R)	[4760 ~ 9600 rpm]
l) 16-24x ZCLV(CD-RW)	[4760 ~ 7400 rpm]
m) 8-20x CAV	4200 rpm, Constant
n) 4-10x CAV	2100 rpm, Constant
o) 16x CLV	3424 ~ 7952 rpm
p) 10x CLV	2140 ~ 4970 rpm
q) 8x CLV	1712 ~ 3976 rpm
r) 4x CLV	856 ~ 1988 rpm

4.3.10 ACCESS TIME (INCLUDING LATENCY)

Access time is the time from the raising edge of /DA0 of the last command byte to the falling edge of /IOCS16 of after the first data byte returned to host (assumes no disconnect) at horizontal operation. This measurement is done per 200 times of random seeks after a disc insertion. Access time specifications will be met at horizontal operation and in the following environmental conditions.

Temperature	: +10 deg C ~ +30 deg C
Reliative humidity	: < 85% (no condensation)

4.3.10.1 DVD medium

FULL STROKE

Average 200 seeks after 10 seeks from LBA 0 to 2,293,759 and from block 2,293,759 to block 0
A total of 400 seeks

6.6-16x CAV(Spindown to 5-13xCAV without sequential access) 250 msec (typical)

1/3 STROKE

Average over 100 seeks after 10 seeks from LBA 532,480 to 1,265,664

6.6-16x CAV(Spindown to 5-13xCAV without sequential access) 160 msec (typical)

RANDOM STROKE

Average over 500 random access after 10 seeks

6.6-16x CAV(Spindown to 5-13xCAV without sequential access) 160 msec (typical)

4.3.10.2 CD medium

FULL STROKE

Average 200 seeks after 10 seeks from block 0 to block 269,999 and from block 269,999 to block 0
A total of 400 seeks

20-48x CAV(Spindown to 8-20xCAV without sequential access) 230 msec (typical)

1/3 STROKE

Average over 100 seeks after 10 seeks from block 67,350 to 157,350

20-48x CAV(Spindown to 8-20xCAV without sequential access) 140 msec (typical)

RANDOM STROKE

Average over 500 random access after 10 seeks

20-48x CAV(Spindown to 8-20xCAV without sequential access) 140 msec (typical)

4.3.10.3 DVD-RAM medium

FULL STROKE

Average 200 seeks after 10 seeks from LBA 0 to 2,293,759 and from block 2,293,759 to block 0
A total of 400 seeks

5x CAV 700 msec (typical)

1/3 STROKE

Average over 100 seeks after 10 seeks from LBA 532,480 to 1,265,664

5x CAV	300 msec (typical)

RANDOM STROKE

Average over 500 random access after 10 seeks

5x CAV	300 msec (typical)

4.3.11 SPIN UP AND TRAY OPEN TIME

Drive's firmware has 10 seconds time out for the Start/Stop Unit command for spin up, spin down and tray open.

SPIN UP TIME (Spin up to drive ready)
(Time to pause position from disc complete stop. Tested with disc without scratches or dust.)

Normal Speed or 20-48xCAV	6.5 sec (Max.)

SPIN DOWN TIME

Normal Speed or 20-48xCAV	6 sec (Max.)
TRAY OPEN TIME (not include spin down time)	5 sec (Max.)
TRAY CLOSE TIME (not include spin up time)	5 sec (Max.)

4.3.12 USER ERROR RATES

Hard Error Rate : DVD and CD Mode 1 (with up to 5 retries and layered ECC on)	$< 10^{-12}$ Block/bit
Soft Error Rate : CD Mode 2 (with up to 5 retries)	$< 10^{-9}$ Block/bit
Seek Error Rate	$< 10^{-6}$ Block/bit

4.3.13 MPC3 COMPLIANCE

This drive complies with the Microsoft specification for MPC3. The CPU utilization is less than 40% at data rate of 600 KB/sec, less than 20% at data rate of 300 KB/sec, and no less than 16 KB of block size.

4.3.14 FLASH ROM UPDATE

The firmware is updated via Serial ATA interface with Flash ROM Utility.

4.3.15 DVD Content Scramble System Authentication

This drive fully complies with the ATAPI DVD Key Exchange and Authentication specification, which is a digital cryptograph.

4.3.16 Region Playback Control

This drive supports RPC phase II provided by SFF8090v4 Rev. 1.5.
The user can change the region code, which is stored in the drive up to 5 times by sending the appropriate command. Usually, the command is issued by MPEG Player application.

4.3.17 Maximum Playback Speed with various Disc

The maximum playback speed with various disc is limited as follows.

DVD-ROM (Dual Layer):		5-12x CAV
DVD-Video with CSS protection:	SL	3.3-8x CAV
	DL	3.3-8x CAV
DVD+/-R DL (Data tracks)		5-12x CAV
DVD+/-RW (Data tracks)		5-13x CAV
DVD-RAM (Data tracks)		5x CAV
CD-DA(DAE):		8-20x CAV
CDROM (mode2 form2):		8-20x CAV
CD-RW (mode1, mode2 form1):		17-40x PCAV

In addition, the drive will limit the maximum playback speed automatically by the quality of the disc. The drive may playback with lower speed than the speed mentioned above.

4.3.18 Tolerance pertaining to Media

The drive can read the following Media

	Black dot	Finger Print
CD:	less than 0.6 mm	less than 65 um
DVD:	less than 0.6 mm	less than 65 um

5 ENVIRONMENTAL

This section establishes the environmental and physical conditions which apply to the product. The CD-R/RW meet the following environmental requirements under normal operating conditions.

5.1 TEMPERATURE (NON-CONDENSING)

5.1.1 NON-OPERATING

–40 deg C to +65 deg C

5.1.2 OPERATING

5 deg C to +50 deg C

5.2 HUMIDITY

5.2.1 NON-OPERATING

5% to 95% (No condensation, Maximum wet bulb temp 38 deg C)

5.2.2 OPERATING

20% to 80% (No condensation, Maximum wet bulb temp 29 deg C)

5.3 VIBRATION

5.3.1 OPERATING

The drive unit meet specification described below with continuous random vibration.

Acceleration	CD	: Read 0.45Grms, Write 0.2Grms
	DVD	: Read 0.45Grms, Write 0.2Grms
Vibration		: Random mode(5 to 500 Hz)
Direction of vibration		: X,Y and Z axis

5.3.2 NON-OPERATING

The drive unit meet specification described below with continuous random vibration.

Acceleration	: 0.712GRMS
Direction of vibration	: X, Y and Z axis
Frequeccy	: 7-800Hz

Hz	G^2/Hz
7	0.0003
20	0.00275
140	0.00275
312	0.00013
400	0.00008
600	0.00008
700	0.00007
800	0.000045

5.4 SHOCK

5.4.1 NON-OPERATING

The drive unit can withstand shock with a 1/2 sine wave shape.
Discs are not in the drive at all and the drive is powered off.

Pulse Duration and Peak level	: 10ms / 100G and 2ms / 200G
Direction of shock	: +/-X, +/-Y, and +/-Z axes (2 directions per axis, so a total of 6shocks)

5.4.2 OPERATING

The drive unit can withstand shock with a 1/2 sine wave shape.
Data read with retry (Not specified about audio play)

Pulse Duration	: 11 msec
Peak level	: CD Read 6G, Write 1.5G
	: DVD Read 6G, Write 1G
Direction of shock	: +/-X, +/-Y, and +/-Z axes (2 directions per axis, so a total of 6shocks)
Pulse Duration and Peak level	: 2ms / 60G (Read) CD & DVD

Direction of shock : Horizontal (-Z), Left side down (-Z), Right side down (-Z)

5.5 VIBRATION AND DROP (PACKAGED)

5.5.1 VIBRATION (PACKAGED)

The unit meets the specification described below.

Test time : 30 minutes/side
Test Axes : 6 surface
Vibration : Random mode

Spectrum Break Points

Frequency	G2/Hz
1Hz	0.0001
4Hz	0.01
100Hz	0.01
200Hz	0.001

*Total random vibration spectrum energy shall be 1.146 Grms.

Packaged : Bulk Carton (20 sets)

5.5.2 DROP (PACKAGED)

The unit meets the specification described below.

Height : 76cm(6 surfaces / 1 corners / 3 edges)
Packaged : Bulk Carton (20 sets)

6 QUALITY AND RELIABILITY

6.1 COSMETIC

No scratches, cracks, stains and damages are visible on the front panel in case that you take a look at them at the distance of 400 mm from away it. No scratches, cracks, stains and damages are visible on the top, bottom, side and rear panel in case that a look at them at the distance of 600 mm from away it.

6.2 TRAY LOADER MECHANISM LIFE

This drive shall have a power tray to load and unload the disc.
The drive is capable of at least 30,000 tray loading/unloading operations without degradation or failure. Both motions of extending and retracting the tray from the drive is smooth and quiet.

6.3 MTBF

The MTBF is 70,000 power on hours(POH) when operated at 25 deg C temperature, nominal voltage, and other environmental limits, based on the following assumptions:

- the operating duty cycle is 10% of power on time. During this time, the drive is either reading or seeking (random multiple block read).
- the drive is in dormant mode (i.e. the laser diode is off and spindle motor not spinning, the drive is power on) for 90% of power on time.

The spindle motor is a brushless-motor.

6.4 OPTICAL PICKUP ACTUATOR MECHANISM

The drive is capable at least 4,000,000 Random seeks.

6.5 MTTR (MEAN TIME TO REPAIR)

30 minutes.

6.6 ELECTROSTATIC DISCHARGE SUSCEPTIBILITY (ESD)

6.6.1 GENERAL

The drive installed in specified shielded case meet the ESD specified as below.
Tested in the IEC 61000-4-2 (EN61000-4-2).

Contact discharge :	+/-6kV (No performance degradation or failure.)
	+/-8kV (Temporary performance degradation or failure. No destroy.)
Air discharge :	+/-12kV (No performance degradation or failure.)
	+/-15kV (Temporary performance degradation or failure. No destroy.)
Energy storage capacitance :	150pF +/-10%
Discharge resistance :	330 ohm +/-10%

7 REGULATIONS AND STANDARDS

7.1 SAFETY APPROVAL

UL(UL60950), C-UL(cUL C22.2 NO.60950), TUV(EN60950,EN60825), CB(IEC60950,IEC60825)

7.2 EMC AND COMPLIANCE

CE Marking(EN55022 Class B, EN55024), C-tick(AS/NZS CISPR 22 ,2006 ClassB), BSMI, MIC

7.3 FDA COMPLIANCE

The product satisfies all the requirements specified in the Code of Federal Regulation 21CFR part 1040.10 and 1040.11.

7.4 RoHS COMPLIANCE

The product complies with EU Directive 2002/95/EC RoHS.

8 ACOUSTIC NOISE

8.1 GENERAL

Noise measurement must conform to the testing procedure for measuring Acoustic Noise on office equipment as specified by the:

ISO Standard ISO 7779 Seated Operator Position

8.2 TEST CONDITION

The test condition is free field condition over are flexing plane. This condition can be simulated in an echoic chamber with the disc drive sitting on a reflecting plane. The drive is acoustically isolated from the plane with: e.g. a polyurethane foam.

Test Media : 0.3gfcm unbalanced media
Mode : Read DVD at 16x CAV speed.

8.3 NOISE SPECIFICATION

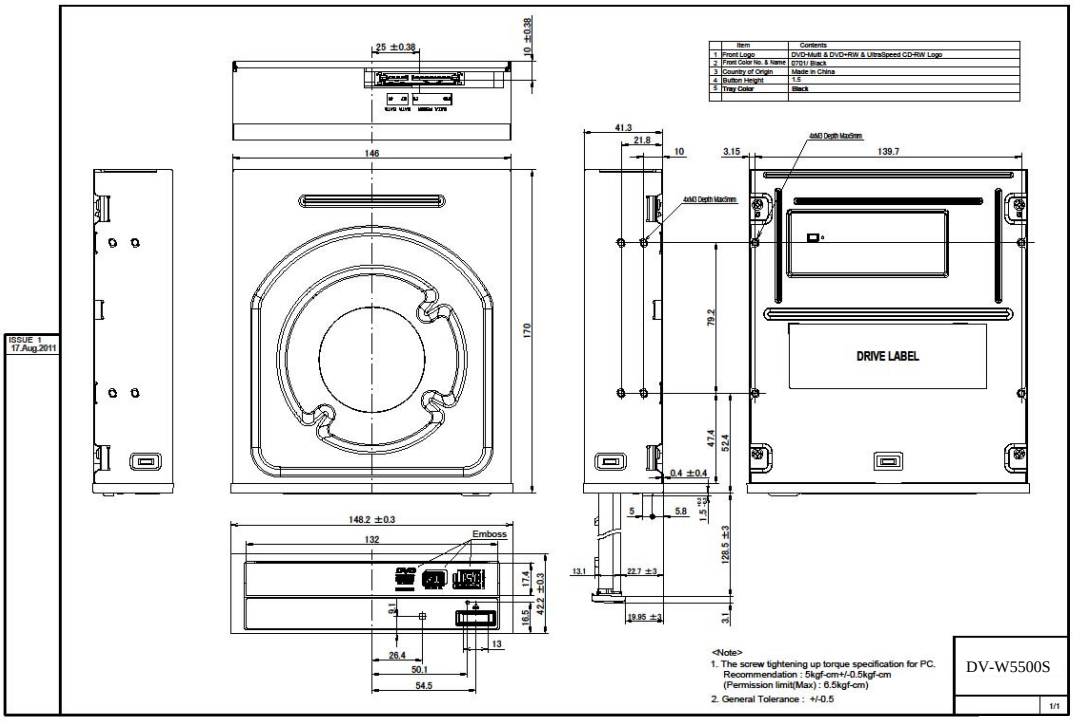
A - Weighted RMS. - Slow.

Drive On (Seeking)	45dB(A) : Average,	47.5dB(A) : Max.
Drive On (non-seek)	45dB(A) : Average,	47.5dB(A) : Max.

9 MECHANICAL

9.1 DIMENSIONS AND MOUNTING ORIENTATION

9.1.1 DIMENSIONS



9.1.2 MOUNTING ORIENTATION

This drive unit shall be installed and operated in the horizontal and vertical orientation.
The drive operates in the horizontal and vertical orientation within the angular tolerance range described below:

Horizontal	: front side up or down	+/-15 deg
	: left side up or down	+/-15 deg
Vertical	: front side up or down	+/-15 deg
	: top side up or down	+/-15 deg

9.1.3 WEIGHT

0.630Kg

9.2 COLOR

9.2.1 EJECT BUTTON, FRONT BEZEL AND TRAY DOOR

Manual eject button, front bezel and tray door shall be molded as follows:

Material:	PC/ABS
Flame Retardant Grade:	UL94-5V (Tray door : 94V-0)
Color:	BLACK
Finish:	Mat

9.2.2 TRAY

Tray shall be molded as follows:

Material:	ABS
Frame Retardant Grade:	UL94V-2
Color:	BLACK
Finish:	Mat

9.2.3 ACTIVITY LED

Busy:	Green

9.3 APPLICABLE CABLE

9.3.1 SIGNAL CABLE

The signal cable is a 7-wire flat ribbon cable. It has a 7-pin female connector on one side to connect to the 7-pin shrouded male Serial ATA connector on the PC mother board or else. The pin out of the Serial ATA connector is shown in section 10.2.2.2.

9.4 DRIVE CONNECTORS

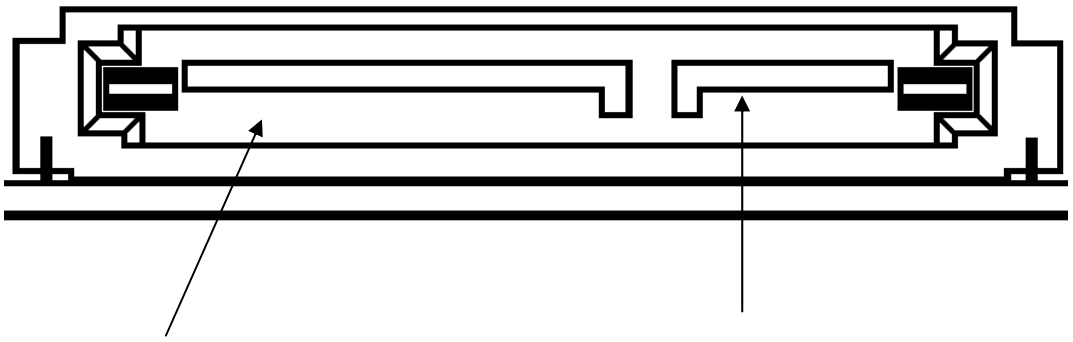
There are 2 connectors DC power connector(section 9.4.1) and Serial ATA signal connector(section 9.4.2). DC power connector and Serial ATA signal connector are molded to a piece of connector.

9.4.1 POWER CONNECTOR

The dirve has a DC power connector assembly, which consists of a 15-pin shrouded, keyed, male power connector as shown below.

9.4.2 Serial ATA CONNECTOR

The drive has a standard 7-pin shrouded, keyed, male connector for Serial ATA signal. For pin out description of Serial ATA interface, refer to section 10.2.2.2, Serial ATA interface connectors.



Part of Power

Part of serial ATA signal connector

9.5 DISC TRAY LOAD MECHANISM

This drive uses motor powered tray mechanism to extend and retract the tray for loading and removing the disc from the drive. When the drive is mounted in the vertical orientation, only 120 mm discs can be used.

9.5.1 MANUAL EJECT BUTTON

The front bezel of the drive unit has a manual eject button to open and close the tray. This manual eject button is enabled upon power up.

9.5.2 PIN HOLE (EMERGENCY) EJECT

A pin hole eject mechanism is required to open the tray in emergency situation. Maximum force required is 1.5kg. The pin hole is located on the front bezel.

9.5.3 EJECT COMMAND

The host can also open the tray load from the drive through a ATAPI command.

9.5.4 PUSH TRAY IN POSITION

In addition to the eject button for closing the tray, the tray will automatically close, when the tray is in the open (extended) position, by pushing the tray in 10 mm typical distance with a 500 g typical force.

9.5.5 OPEN/CLOSE TIME OUT

TRAY OPEN TIME OUT:

If there is a physical obstruction that prevents the tray from opening(extending) all the way, the power tray will remain on for two seconds. If tray is still prevented from opening at the end of two seconds, the drive will try to close the tray. If tray is prevented to close, after two seconds the power tray is turned off, The user has to either push the manual eject button or send a ATAPI CD-ROM eject command to reset the power tray.

TRAY CLOSE TIME OUT:

If there is a physical obstruction that prevents the tray from closing(retracting) all the way, the power tray will remain on for two seconds. If tray is still prevented from closing at the end of two seconds, the drive will try to open the tray. If tray is prevented to open, then after two seconds the power tray is turned off. The user has to either push the manual eject button or send a ATAPI eject command to reset the power tray.

10 ELECTRICAL

10.1 POWER

10.1.1 VOLTAGE

This drive requires two power supplies : +5V (DC) / +12V (DC).

10.1.1.1 VOLTAGE TOLERANCE

+5V (DC)	+/– 5%
+12V (DC)	+/– 10%

10.1.1.2 RIPPLE AND NOISE TOLERANCE

+5V (DC)	< 120 mV (peak to peak)
+12V (DC)	< 200 mV (peak to peak)

10.1.2 CURRENT (max/average)

Spinup	
+5V (DC)	< 1050/1000 (mA)
+12V (DC)	< 2400/2300 (mA)
Seek(CD 20-48x CAV)	
+5V (DC)	< 1000/ 800 (mA)
+12V (DC)	< 1200/1000 (mA)
Read(CD 20-48x CAV)	
+5V (DC)	< 1000/ 800 (mA)
+12V (DC)	< 1200/1000 (mA)
Read(DVD 6.6-16x CAV)	
+5V (DC)	< 1100/ 900 (mA)
+12V (DC)	< 1200/1000 (mA)
Write (CD 20-48x CAV)	
+5V (DC)	< 1300/1200 (mA)
+12V (DC)	< 1000/ 900 (mA)
Write (DVD+R 10-24x CAV)	
+5V (DC)	< 1450/1400 (mA)
+12V (DC)	< 2300/2200 (mA)
Tray Open Close	
+5V (DC)	< 700/ 600 (mA)
+12V (DC)	< 1000/ 300 (mA)
Idle (CD 4-10x CAV Pause)	
+5V(DC)	< 750/ 650 (mA)
+12V(DC)	< 500/ 400 (mA)
Standby (laser & motor off)	
+5V(DC)	< 300/ 300 (mA)
+12V(DC)	< 50/ 30 (mA)
Sleep	
+5V (DC)	< 300/ 300 (mA)
+12V (DC)	< 50/ 30 (mA)

Note:
"Average" current is the arithmetic mean value of the current measured during a typical 4 second period.
"Maximum" current is the arithmetic mean value of the current measured during a typical 0.5 second period.

10.2 Serial ATA INTERFACE

10.2.1 GENERAL

This drive unit used Serial ATA interface, which conforms to the Mt. Fuji Commands for CD and DVD Devices : SFF8090v4 rev. 1.00 to communicate with the host computer. IDE interface(ISO X3T9.2 791D) addresses the electrical interface. The ATAPI CD-ROM specification : SFF-8020 Rev.2.6 addresses command protocol.

10.2.2 ELECTORICAL

The Serial ATA bus uses differential drivers and receivers.

10.2.2.1 CONNECTORS.

A standard 7-pin flat ribbon cable.

10.2.2.2 CONNECTOR PIN DIFINITION

7-pin Serial ATA male connector.

Signal	n	Description	
S1	1	GND	2nd mate
S2	2	A+	Differential signal pair A from Phy
S3	3	A-	
S4	4	GND	2nd mate
S5	5	B-	Differential signal pair B from Phy
S6	6	B+	
S7	7	GND	2nd mate

10.2.2.3 SIGNAL CHARACTERITICS

	Nom	Min	Max	units	Comments
Vcm dc	250	200	450	mV	Common mode DC level measured at Receiver connector.

10.2.3 COMMANDS

10.2.3.1 GENERAL

This drive unit implements The ATAPI DVD-R/-RW/+R/+RW/RAM and CD-R/RW commands and features. The following is a brief description of the ATAPI DVD-R/-RW/+R/+RW and CD-R/RW features to be implemented.

Command description is provided by the ATAPI CD-R/RW specification:

ATA Packet Interface for CD-ROMs ; SFF-8020i Revision 2.6
SCSI-3 Multimedia Commands ; X3T10/1048D Revision10A
SCSI Multimedia Commands - 2 ; T10/1228-D Revision10a
SCSI Multimedia Commands - 5 (MMC-5)
SFF8090iv5 Rev.0.7 ; Mt. Fuji Commands for Multimedia Devices
DV-W5500S ATAPI/IDE(SATA) Command Set Specification

10.2.3.2 TASK FILE RESISTER

10.2.3.3 TASK FILE COMMANDS

Command	Op-code	Remark
Execute drive diagnostic	90h	
NOP	00h	
ATAPI Packet Command	A0h	
ATAPI Identify Device	A1h	
ATAPI Soft Reset	08h	
Check Power Mode	E5h	
Idle Immediate	E1h	
Idle	E3h	
Set Features	EFh	
Standby immediate	E0h	
Standby	E2h	
Sleep	E6h	

10.2.3.4 PACKET COMMANDS

Command	Op-code	Remark
BLANK	A1h	
CLOSE TRACK/SESSION	5Bh	
FORMAT UNIT	04h	
GET CONFIGURATION	46h	
GET PERFORMANCE	ACh	
GET EVENT/STATUS NOTIFICATION	4Ah	
INQUIRY	12h	
MECHANISM STATUS	BDh	
MODE SELECT(10)	55h	
MODE SENSE(10)	5Ah	
PREVENT/ALLOW MEDIUM REMOVAL	1Eh	
READ(10)	28h	
READ(12)	A8h	
READ BUFFER CAPACITY	5Ch	
READ CAPACITY	25h	
READ CD	BEh	
READ CD MSF	B9h	
READ DISC INFORMATION	51h	
READ DVD STRUCTURE	ADh	
READ FORMAT CAPACITIES	23h	
READ HEADER	44h	
READ SUB-CHANNEL	42h	
READ TOC/PMA/ATIP	43h	
READ TRACK INFORMATION	52h	
REPAIR TRACK	58h	
REPORT KEY	A4h	
REQUEST SENSE	03h	
RESERVE TRACK	53h	
REZERO UNIT	01h	
SEND DVD STRUCTURE	BFh	
SEEK	2Bh	
SEND CUE SHEET	5Dh	
SEND EVENT	A2h	
SEND KEY	A3h	
SEND OPC INFORMATION	54h	
SET CD-ROM SPEED	BBh	
SET STREAMING	B6h	
START STOP UNIT	1Bh	
SYNCHRONIZE CACHE	35h	
TEST UNIT READY	00h	
VERIFY(10)	2Fh	
WRITE(10)	2Ah	
WRITE(12)	AAh	
WRITE AND VERIFY(10)	2Eh	

10.3 DATA BUFFER

The drive electronics includes 1 MBytes read ahead data buffer in the Serial ATA System controller.

11 PACKAGING

11.1 GENERAL

The drives (20 sets) will be packed in a bulk carton using a foam insert to protect against shock and vibration.

*Revision

1.00	2011 Oct 28th	Released