Product Specifications

Model: SN-406AB

12.7mm Slim SATA BD DVD COMBO Drive

Rev. 00

Performance Content – Se-Wan Park
Interface Content – Sang-Hun, Hyun
Mechanical Content – Hee-Deuk Park
Customer Engineering – Do-Kyu Park

APPROVAL AUTHORITIES	REVISION	CEG APPROVED	PM APPROVED
TSST R&D Manager OEM Eng. Manager	Rev. 00	DoKyu Park	Se-Wan Park

TOSHIBA SAMSUNG STORAGE TECHNOLOGY Co., Ltd.

Revision History

Date	Revision No	Revision Description	Approvals
2013.05.20	00	- Preliminary Spec Release	Se-Wan Park

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A. PRODUCT SPECIFICATIONS

A1. Features and General Specifications

A1.1 Features

SN-406AB Drive shall support DVD CSS (Contents Scramble Systems) Disc

SN-406AB Drive shall read and play the Digital Data of CD-ROM, DVD-ROM, BD-ROM and CD-Audio Disc

SN-406AB Drive shall read and write a Digital Data to CD-R, CD-RW, DVD±R/RW and DVD-RAM Disc

SN-406AB Drive shall read and play Φ120/80mm, Single/Dual layer, Single/Double side Disc

DVD-R (Ver1.0 / for Authoring, Ver2.0 / for General Ver2.0),

DVD+R, DVD+RW (Ver1.2), DVD-RW(Ver1.0,1.1), DVD-RAM(Ver1.0,1.1(2.6G),2.0,2.1(4.7G)), DVD±R Dual Layer

SN-406AB Drive shall read DVD-ROM, DVD±R/RW, DVD±R DL with max CAV 8X speed.

SN-406AB Drive shall read DVD-RAM data with max PCAV 5X speed

SN-406AB Drive shall read CD-ROM data with max CAV 24X speed

SN-406AB Drive shall record a data to CD-R with max 24X

SN-406AB Drive shall record a data to CD-RW with max 16X

SN-406AB Drive shall record a data to DVD+R/RW with max 8X

SN-406AB Drive shall record a data to DVD-R/RW with max 8X / 6X

SN-406AB Drive shall record a data to DVD+/-R DL with max PCAV 6X

SN-406AB Drive shall record a data to DVD-RAM with max PCAV 5X.

SN-406AB Drive shall support Buffer under-run free technology (Super Link)

SN-406AB Drive shall support DVD SFF-8090 Ver.7 Command, CD-R/RW MMC-6 Command

SN-406AB Drive shall support Vertical position or Horizontal position running without performance degradation

SN-406AB Drive shall support RPC-II

SN-406AB Drive shall support DVD-RW CPRM, DVD-R CPRM, DVD-RAM CPRM, DVD-R Dual Layer CPRM

SN-406AB Drive shall support DVD+RW VCPS

SN-406AB Drive supports Zero Power ODD function

SN-406AB Drive is applied Halogen Free

SN-406AB Drive base on Guidelines for Green Procurement」

A. 1.2 General Specifications

Category			Specification	Remarks
Interface			SATA	
Disc Diameter			8 Cm / 12 Cm	
Loading Type			Tray Type	
Drive Mounting			Horizontal / Vertical	
READ / WRITE	**READ Speed**	**CD-ROM/RW**	Max. 24X (3,600 KB/sec)	CAV 24X
		DVD-Single/Dual	Max. 8X (10,800 KB/sec)	CAV 8X
		DVD-RAM	Max. 5X (6,750 KB/sec)	PCAV 5X/3X/2X
		BD-ROM/R/RE(SL/ SL LTH/ DL)	Max. 6X(27,000 KB/sec)	CAV 6X/4X/2.2X
		BD-R/RE(TL,QL / TL)	Max. 5X(22,500 KB/sec)	CAV 5X/4X/2.2X
	WRITE Speed	**CD-R**	Max. 24X (3,600 KB/sec)	PCAV 24X/20X/16X, 10X
		LS CD-RW	Max. 4X (600 KB/sec)	CLV 4X
		HS CD-RW	Max. 10X (1,500 KB/sec)	CLV 10X
		US CD-RW	Max. 24X (3,600 KB/sec)	ZCLV 24X
		DVD±R	Max. 8X (10,800 KB/sec)	PCAV 8X/6X/3.3X, 2.4X
		DVD+RW	Max. 8X (10,800 KB/sec)	ZCLV 8X/6X/3.3X
		DVD-RW	Max. 6X (8,100 KB/sec)	ZCLV 6X/4X/ 2X
		DVD±R DUAL	Max. 6X (8,100 KB/sec)	PCAV 6X/4X/3X
		DVD-RAM	Max. 5X (6,750 KB/sec)	PCAV 5X, 3X/2X

Mounting Orientation	Horizontal / Vertical	All angles
Buffer Under Run	BURF Technology used	Super Link
Buffer Size	2MB	
Power	DC +5V +5%, +5V – 5% (Operating) DC +5V +8%, +5V – 8% (Start-up)	
Power Consumption	DC +5V / 1.5A	

A2. Performance

Item	Condition		Specification	Remark
Burst Transfer Rate	SATA (GEN1)		Max 145 MB/sec	
Sustained Transfer Rate	CD-ROM/R/RW Read (Mode1)		Max 3,600 KB/sec	CAV 24X
	DVD-Single/Dual Read		Max 10,800 KB/sec	CAV 8X
	DVD-RAM Read		Max 6,750 KB/sec	PCAV 5X
	BD-ROM/R/RE (SL/SL LTH/DL)		Max. 6X(27,000 KB/sec)	CAV 6X (BLX-103/BLX-203)
	BD-R/RE(TL,QL / TL)		Max. 5X(22,500 KB/sec)	CAV 5X
Read Speed	CD-DA (Audio Play)		CAV 10X	CAV 10X
	CD-DA (DAE)		CAV 24X	24X/20X/16X/10X
	Mixed CD	Audio	CAV 24X (DAE) CAV10X (Audio Play)	24/20/16/10(DAE) 10(Audio Play)
		Data	Max CAV 24X	24X/20X/16X/10X/4X
	Video-CD		CAV 16X (Video Play)	CAV 16X
	DVD-Video Play		CAV 4X (SINGLE, DUAL)	
	DVD±R/RW/±R DL Read		CAV 8X	CAV 8X/6X/4X
	TOC Read		CD : CAV 10X, DVD : CAV 4X, BD: CAV 3X	
	Idle (Pause)		CD : CAV 10X, DVD : CAV 4X, BD: CAV 3X	
	Unbalance	~ 0.3gcm	CD: CAV 24X, DVD: CAV 8X, BD: CAV 6X	
		0.5 ~ 0.75gcm	CD: CAV 10X, DVD: CAV 4X, BD: CAV 3X	
		Over 0.75gcm	CD: CAV 10X, DVD: CAV 4X, BD: CAV 3X	
	Eccentricity (CD)	140um	CAV 24X(CD)	
		210um	CAV 16X(CD)	
	Eccentricity (DVD)	150um	CAV 4X(DVD SL/DL), 2X(RAM)	

	Eccentricity (BD)	50um	6X		
		75um	4X		
		100um	4X		
Write Speed	CD-Recordable		Max 24X (3,600 KB/sec)		PCAV 24X/20X/16X, 10X
	CD-Rewritable (Standard Speed)		Max 4X (600 KB/sec)		CLV 4X
	CD-Rewritable (High Speed)		Max 10X (1,500 KB/sec)		CLV 10X
	CD-Rewritable (Ultra Speed)		Max 24X (3,600 KB/sec)		ZCLV 24X
	DVD±R		Max 8X (10,800 KB/sec)		PCAV 8X/6X/3.3X, 2.4X
	DVD+RW		Max 8X (10,800 KB/sec)		ZCLV 8X/6X/3.3X
	DVD-RW		Max 6X (8,100 KB/sec)		ZCLV 6X/4X/2X
	DVD±R DL		Max 6X (8,100 KB/sec)		PCAV 6X/4X/3X
	DVD-RAM		MAX 5X (6,750 KB/sec)		PCAV 5X, 3X/2X
CPU Utilization	PIO Mode4		85% (Max)		
Spin Up Time/ Lead-in Time	From Spindle Stop to CAV 24X		8 sec (Typ)		
	DVD-RAM		38 sec		
Spin Down Time	From CAV 24X to Spindle Stop		7 sec (Typ)		
	Spin Down & Eject		5.5 sec (Typ)		
Access time	Random	CD-ROM/RW	170 ms (Best)	190 ms (Typ)	150~314850,1000 Times
		DVD-Single	160 ms (Best)	180 ms (Typ)	TDV-520,150~2200000,1000 Times
		DVD-Dual	180 ms (Best)	200 ms (Typ)	STD-1100,150~3900000(OTP),1000 Times

		DVD±R/RW	160 ms (Best)	180 ms (Typ)	150~2200000,1000 Times
		DVD±R Dual	200 ms (Best)	220 ms (Typ)	150~3900000, 1000 Times
		DVD-RAM	250 ms (Best)	350 ms (Typ)	150~2200000,1000 Times
	1/3 Stroke	CD-ROM/RW	190 ms (Best)	210 ms (Typ)	68500~157485,1000 Times
		DVD-Single	200 ms (Best)	220 ms (Typ)	540000~1200000, 1000 Times
		DVD-Dual	200 ms (Best)	220 ms (Typ)	540000~1200000, 1000 Times
		DVD±R/RW	200 ms (Best)	220 ms (Typ)	540000~1200000, 1000 Times
		DVD±R Dual	220 ms (Best)	240 ms (Typ)	540000~1200000, 1000 Times
		DVD-RAM	250 ms (Best)	300 ms (Typ)	540000~1200000,1000 Times
	Full Stroke	CD-ROM/RW	300 ms (Best)	320 ms (Typ)	150~314850,1000 Times
		DVD-Single	300 ms (Best)	320 ms (Typ)	150~2200000, 1000 Times
		DVD-Dual	330 ms (Best)	350 ms (Typ)	150~2024500(OTP),1000 Times
		DVD±R/RW	350 ms (Best)	400 ms (Typ)	150~2200000, 1000 Times
		DVD±R Dual	400 ms (Best)	450 ms (Typ)	150~2024500, 1000 Times
		DVD-RAM	400 ms (Best)	450 ms (Typ)	150~2200000,1000 Times

□ In case of some abnormal discs(ex. Eccentric, Unbalance & Deviation disc) which used to cause transfer rate down, they have additional 200msec(full access: 300msec) at seek time and 8sec at Lead-in time specification, unless any fail occurs.

□ In case of deviation(over 1.0mm) discs it allows speed down because of drive`s vibration.

※ Max rotational frequency of slim drive is 82~86Hz. So, RPM = 82Hz*60sec ~ 86Hz*60sec = 4920RPM ~ 5160RPM

A3. Readability & Playability

Item	Condition		Specification	Remark
			Typ	
Audio Playability (Analog/DAE)	Interruption	TCD-725A	1.0mm	TCD-726
	Black Dot	TCD-725A	1.0mm	TCD-726
	Finger Print	TCD-725A	75μm	TCD-726
	Scratch (Analog)	TCD-721R	3.0mm	3.0mm
	Scratch (DAE)	TCD-721R	2.6mm	2.6mm
	Eccentricity	TCD-712 / 713	210μm	TCD-713R
	Deviation	TCD-731R	1.0mm	TCD-732R
CD-ROM Readability	Black Dot	SCD-2382	1.0mm	
	Finger Print	SCD-2382	75μm	
	Scratch	SCD-2944	2.0mm	
	Eccentricity	SCD-2943	210μm	
	Deviation	SCD-2940	1.0mm	

Item	Condition		Specification	Remark
			Typ	
CD MPEG1 Playability	Black Dot		0.8mm	
	Scratch		0.8mm	
DVD Readability	Black Dot	TDV-525	1.0mm	TDV-545
	Scratch	TDV-521	3.0mm	TDV-541
	Finger Print	TDV-525	75μm	TDV-545
	Eccentricity	TDV-512	150μm	
	Deviation	TDV-532	1.0mm	
Marginal Media MMCD Series Readability	MMCD-102	Ref: 45±3% Birf: 0±50nm Dev: 0.5±0.2deg	Support	MMCD #2 Media
	MMCD-103	Ref: 45±3% Birf: 150±30nm Dev: 0.0±0.2deg	Support	MMCD #3 Media
	MMCD-104	Ref: 45±3% Birf: 150±30nm Dev: 0.5±0.2deg	Support	MMCD #4 Media
	MMCD-106	Ref: 52±3% Birf: 0±50nm Dev: 0.5±0.2deg	Support	MMCD #6 Media
	MMCD-107	Ref: 52±3% Birf: 150±30nm Dev: 0.0±0.2deg	Support	MMCD #7 Media

Item	Condition		Specification	Remark
			Typ	
	MMCD-108	Ref: 52±3% Birf: 150±30nm Dev: 0.5±0.2deg	Support	MMCD #8 Media
	MMCD-110	Ref: 60±3% Birf: 0±50nm Dev: 0.5±0.2deg	Support	MMCD #10 Media
	MMCD-111	Ref: 60±3% Birf: 150±30nm Dev: 0.0±0.2deg	Support	MMCD #11 Media

A4. Compatibility

Item	Condition	Specification	Remark
Media Compatibility	**CD**	650 MB CD-ROM (Read Only) 80mm CD(Horizontal Mount Only) 800/700/650/ CD-Recordable (Read & Write) 700/650MB CD-Rewritable (Read & Write) 700/650MB High Speed CD-Rewritable (Read & Write) 700/650MB Ultra Speed CD-Rewritable (Read & Write)	
	DVD	5/9/10/18 G DVD-Single / Dual (PTP, OTP) (Read Only) 4.7G DVD±R/RW (Read & Write) DVD±R Dual (Read & Write) DVD-RAM (Read & Write) 80mm DVD	
	BD	BD-ROM, BDMV, BDAV	

Format Compatibility	**CD**	CD-DA (Red Book) - Standard Audio CD & CD-TEXT CD-ROM (Yellow Book Mode1 & 2) - Standard Data CD-ROM XA (Mode2 Form1 & 2) - Photo CD, Multi-Session CD-I (Green Book, Mode2 Form1 & 2, Ready, Bridge) CD-Extra/ CD-Plus (Blue Book) - Audio & Text/Video Video-CD (White Book) - MPEG1 Video CD-R (Orange Book Part □) CD-RW & HSRW (Orange Book Part□ Volume1 & Volume2) Super Audio CD (SACD) Hybrid type	
	DVD	DVD-ROM (Book 1.02), DVD-Dual DVD-Video (Book 1.1) DVD-R (Book 1.0, 3.9G) DVD-R (Book 2.0, 4.7G) - General & Authoring & CPRM DVD+R (Version 1.0) DVD+RW DVD-RW - Non CPRM & CPRM DVD+R Dual DVD-R Dual - Non CPRM & CPRM DVD-RAM (2.6G, 4.7G) - Non CPRM & CPRM	Play DVD-AUDIO except the case that required CPPM (Content protection for prerecorded Media) Non Support DVD-R DL format 4
	BD	25/50 GB BD-Single / Dual (Read Only) 25 GB BD-R Single/Single Low to High (Read & Write) 25 GB BD-RE Single (Read & Write) 50 GB BD-R/RE Dual (Read & Write) 100 GB BD-R/RE Triple (Read & Write, TBD) 128 GB BD-R Quadruple (Read & Write, TBD) 80mm BD	
Write Method		CD-R/RW : DAO, TAO, SAO, Fixed Packet Write (RW), Variable Packet Write (R)	

		DVD+R/RW: Sequential, Random (RW) DVD-R/RW: Incremental, DAO, Rigid Restricted Overwrite (RW) DVD-RAM: Random	
OS Compatibility		Windows95 OSR2 /98 SE, Windows NT, Windows ME Windows2000, Windows XP, Window Vista, Windows7	

A5. Power Consumption

Item	Condition	5VDC (Average)
Power Consumption	Sleep	40mA
	Standby (laser & motor off)	40mA
	Idle (laser on & motor turning)	550mA
	Sequential read at max speed	850mA
	Sequential write at max speed	900mA
	Continuous random read access at max speed	900mA
	Peak / Max current	1,300mA (Except inrush current less than 2ms)

A6. Mechanical

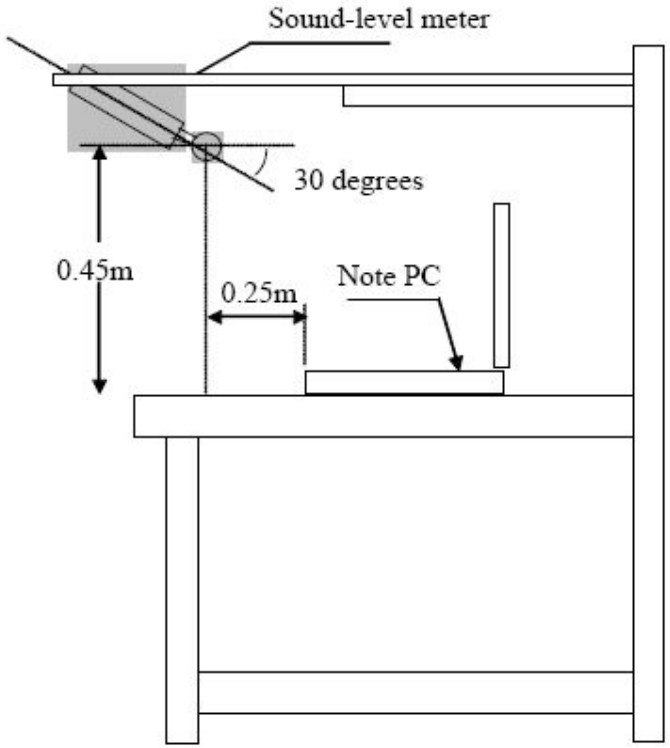
A6.1 General Specifications

Item	Condition	Specification	Remark
Acoustic Noise	**Sequential Read, Random/Full Access**	45 dB	Equipped in note-pc
Dimensions	**Drive**	128mm (W) x 127mm (D) x 12.7mm (H)	Without bezel, from front of drive chassis to rear of drive
Weight	**Unit Drive**	170g under (Net)	
Mounting Orientation		Horizontal & Vertical	
Front Area	**Loading Type**	Tray Type	
	Key	Tact SW (Open)	
	Emergency Release Hole	Drawer Open Hole	
	LED	Green	
	H/P Volume Knob	NA	
	H/P Jack	NA	
Rear Area		13Pin SATA Connector	Data 7 Pin, Power 6 Pin

* **Acoustic Noise Test Condition.**

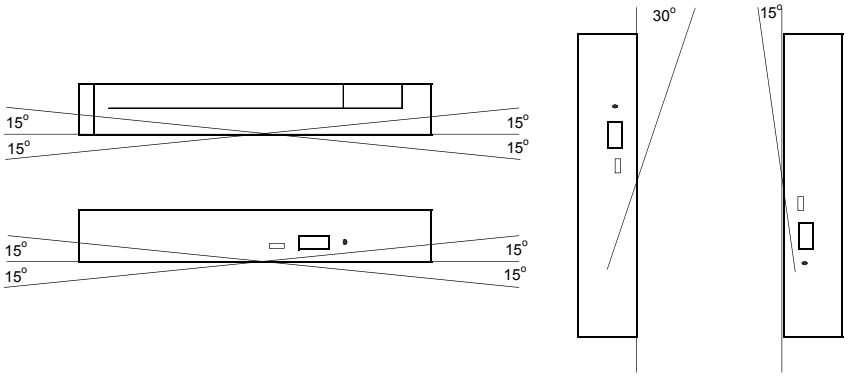
- In semi anechoic chamber.
- Measurement position will be 0.25m (Front) and 0.45m (Above) according to ISO9296 as shown below picture.
- Sound pressure shall measure while the drive (in Note PC) is seeking at its max speed, with 0.3gcm unbalance disc.
- Random, Full and Sequential access should be tested.

Microphone orientation



A6.2 Installation Conditions

This drive can be installed horizontally within the angle of ±15 degrees, and vertically within the angle of 30/15 degrees. Refer to Figure 1 for details.



Horizontal Position Vertical Position

Figure 1 Mounting Angle

A7. Environmental

Item	Condition		Specification	Remark
Operating Environment	Temperature		5 to 50 (°C)	
	Humidity		10 to 90(%RH)	No Condensing
Storage Environment	Temperature		-40 to 65 (°C)	
	Humidity		5 to 95 (%RH)	No Condensing
Vibration	Operating	Random	Read : 1.0Grms Write : 0.5Grms	Direction :Bt,L,R Frequency: 5 -800Hz Appearance: No damage Loose Part nor crack
	Non-operating	Random	3.08Grms 15min	Direction : Bt,T,L,R,F,Bk Frequency: 7 -800Hz Appearance: No damage, loose part nor crack
Shock	Operating		Data : 6G, Audio : 3G	(11msec) (Half sine wave interval 6sec, 20 times) 3-direction(1 time each)
	Non-operating		240G	(2msec),Half sine wave, 6-direction(1 time each)
ESD	Contact Discharge		10 KV	+/- 2, 4, 6 KV : A +/- 8 KV, 10 KV : C
	Air Discharge		17 KV	+/- 2, 4, 6, 8, 10 KV : A +/- 12, 15 KV : B +/- 17 KV : C

Note: A - Normal Operating, No Degradation, No Failures

B - Some temporary performance degradation allowed, no data lost, self-recoverable, no hardware failures

C - Temporary performance degradation, recovery by operator is acceptable, no hardware failures

※ **ESD Test System : TSST Standard PC**

A8. ATAPI Interface and Commands

A8.1 ATA Command for ATAPI Device

Code	Command	Support
00h	NOP	OK
08h	DEVICE RESET	OK
20h	READ SECTOR - (Abort & return ATAPI signature)	OK
90h	EXECUTE DEVICE DIAGNOSTIC	OK
A0h	PACKET	OK
A1h	IDENTIFY PACKET DEVICE	OK
E0h	STANDBY IMMEDIATE	OK
E1h	IDLE IMMEDIATE	OK
E5h	CHECK POWER MODE	OK
E6h	SLEEP	OK
E7h	FLUSH CACHE - (Drives does nothing, and returns normal command completion)	OK
ECh	IDENTIFY DEVICE - (Abort & return ATAPI signature)	OK
EFh	SET FEATURES	OK

A8.2.ATAPI Packet Command

A1h	BLANK (types 000b, 001b, and 100b)	N/A
5Bh	CLOSE TRACK/SESSION	N/A
04h	FORMAT UNIT (all format types valid for device type)	N/A
46h	GET CONFIGURATION	OK
4Ah	GET EVENT STATUS NOTIFICATION	OK
ACh	GET PERFORMANCE (all format types valid for device type)	OK
12h	INQUIRY	OK
BDh	MECHANISM STATUS	OK
55h	MODE SELECT (10)	OK
5Ah	MODE SENSE (10)	OK
4Bh	PAUSE/RESUME	OK
45h	PLAY AUDIO (10)	OK
A5h	PLAY AUDIO (12) – Optional	OK
47h	PLAY AUDIO MSF	OK
1Eh	PREVENT/ALLOW MEDIUM REMOVAL	OK
28h	READ (10)	OK
A8h	READ (12)	OK
3Ch	READ BUFFER - Optional	OK
5Ch	READ BUFFER CAPACITY	OK
25h	READ CAPACITY	OK
BEh	READ CD with DAP bit support	OK
B9h	READ CD MSF with DAP bit support	OK
51h	READ DISC INFORMATION	OK
ADh	READ DISC STRUCTURE (all format types valid for device type)	OK
23h	READ FORMAT CAPACITIES	N/A

ABh	READ MEDIA SERIAL NUMBER	N/A
42h	READ SUB-CHANNEL	OK
43h	READ TOC/PMA/ATIP (all format values valid for device type)	OK
52h	READ TRACK INFORMATION	OK
58h	REPAIR TRACK - Optional	N/A
A4h	REPORT KEY	OK
03h	REQUEST SENSE	OK
53h	RESERVE TRACK	N/A
2Bh	SEEK	OK
5Dh	SEND CUE SHEET	N/A
BFh	SEND DISC STRUCTURE (formats 04h, 05h, C0h)	OK
A3h	SEND KEY	OK
54h	SEND OPC INFORMATION	N/A
BBh	SET CD SPEED	N/A
A7h	SET READ AHEAD	OK
B6h	SET STREAMING	OK
1Bh	START/STOP UNIT	OK
4Eh	STOP PLAY/SCAN	OK
35h	SYNCHRONIZE CACHE (support Immediate bit)	N/A
00h	TEST UNIT READY	OK
2Fh	VERIFY (10)	N/A
2Ah	WRITE (10)	N/A
AAh	WRITE (12)	N/A
2Eh	WRITE AND VERIFY (10)	N/A
3Bh	WRITE BUFFER -Optional	N/A

A8.3.DAP Bit Implementation

Code	Command	Support
-	Drive supports implementation of DAP	OK

A8.4.Time to Assertion of Busy

Code	Command	Support
-	Drives conforms to the Power-on and Hardware Reset protocol of the ATA/ATAPI specification by setting the ATA Status Register BSY bit to one within 400 ns of the negation of RESET-.	OK

A8.5 ATA, SFF-8090 & MMC-4 Revision Level

Items	Last Version	Level
SFF-8090	Version 7	Supported
MMC	Version 6	Supported
SATA	Version 3.1	Supported

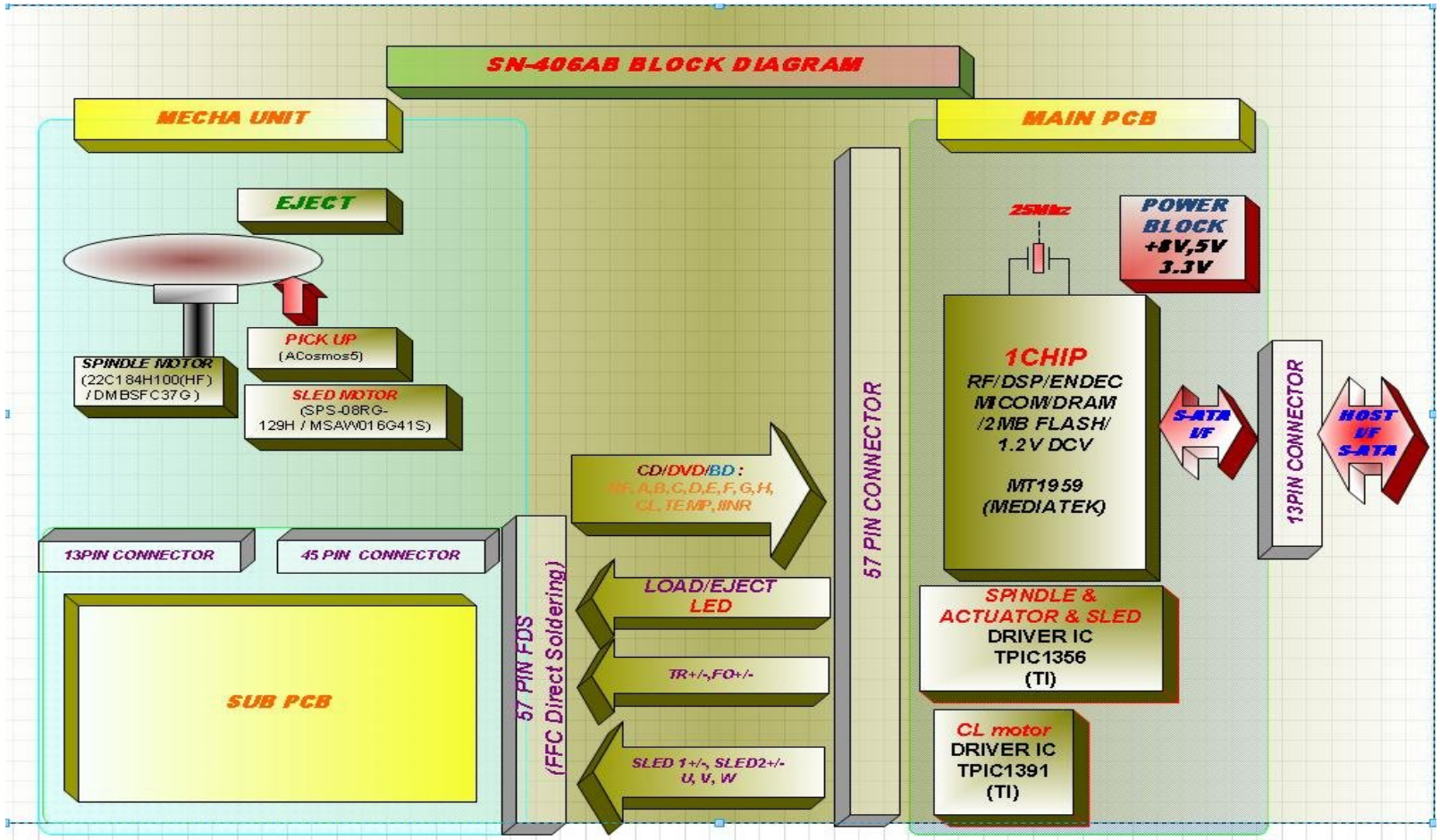
A9. SATA Feature Support

Code	Feature	Support
	SSP (Software Setting Preservation)	be enabled by default : OK
	ASR (Asynchronous signal recovery)	Not Support
	ASN (Asynchronous Notification)	Support (Default as On)
	HIPM (Host Initiating Interface Power Management)	be reported as “supported” : OK
	DIPM (Device Initiating Interface Power Management)	be reported as “supported” : OK (Partial : 10ms / Slumber : 500ms)
	SSC(Spread Spectrum Clocking)	Support (Default as On, But follow Host PC SSC Spec)
	GEN 1(1.5 Gbps)	Support
	Audio Play	Although SN-406AB does not have provision for analog audio outputs, for compatibility Reasons, support the following features and commands: CD Audio External Play (0103h) feature Pause/Resume (4Bh) command Play Audio (10) (45h) command Play Audio MSF (47h) command Stop Play/Scan (4Eh) command

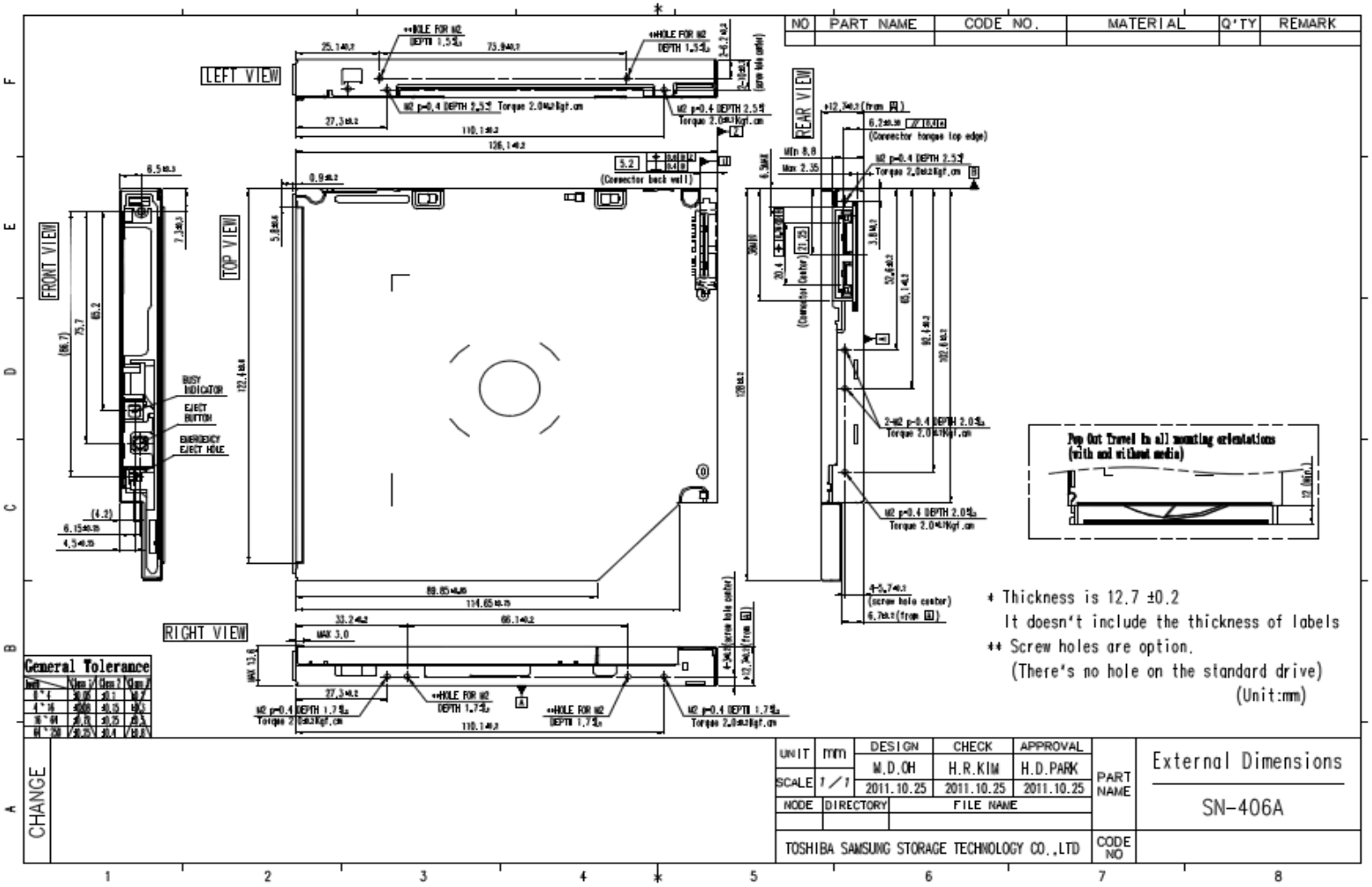
A10. Critical component

Item	Component	Description	Supplier	Remarks
Mechanical Part	Pick-Up	A-COSMOS 5	OPTIS	
	DECK	S8A	TSST	
	Spindle Motor	DMBSFC37G	SEMCO	
		22C184H100(HF)	NIDEC	
	Stepping Motor	MSAW016G41S	SANKYO	
		SPS-08RG-129H	MOATECH	
Electrical Part	ENDEC	MT1959	MEDIATEK	
	SERVO / DSP			
	DRAM			
	MICOM			
	RF			
	FLASH			
	DRIVER (2Chip)	TPIC1356	TI	
		TPIC1391	TI	

A11. Block diagram



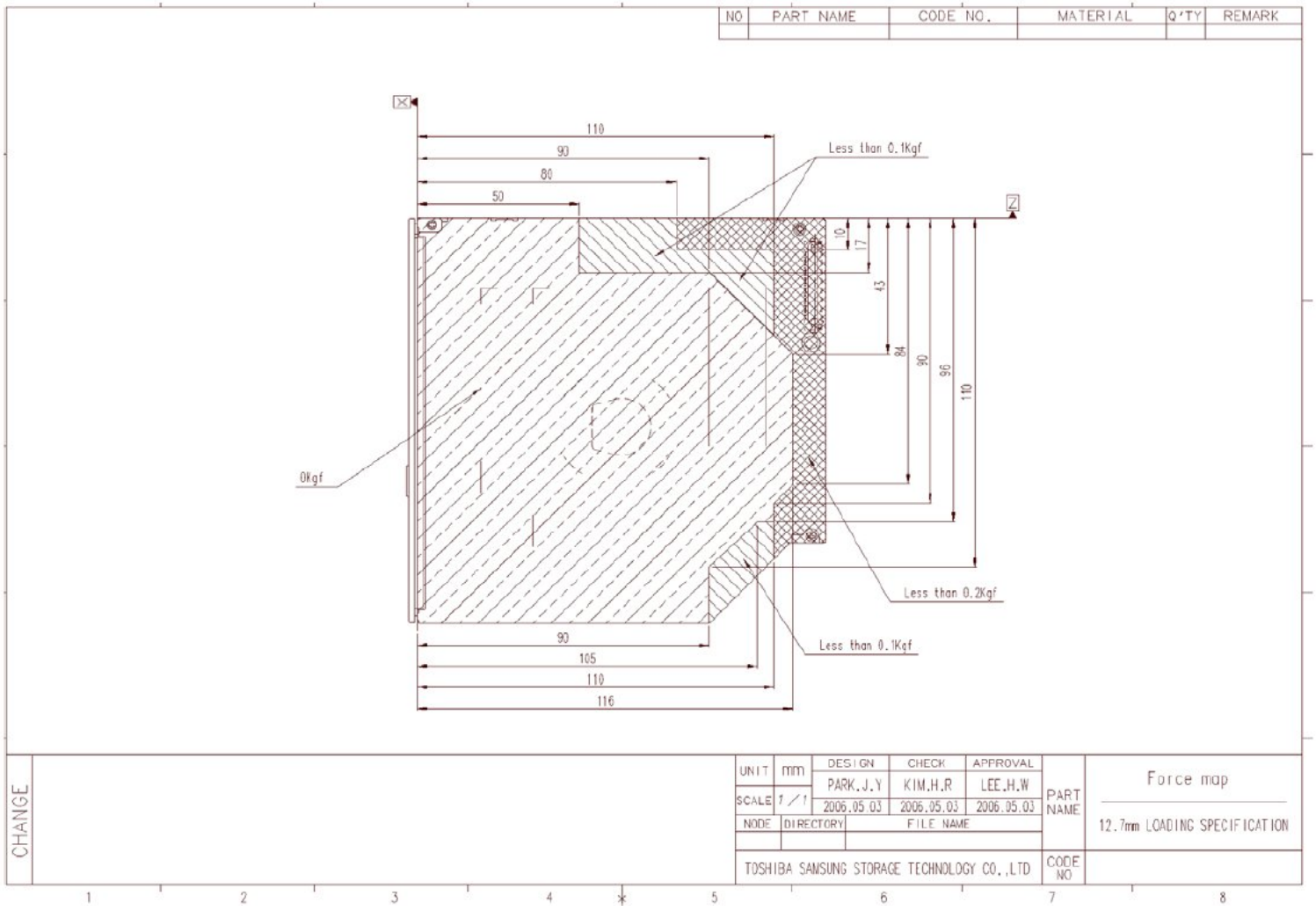
A12. External Dimension



A13. Product Label Drawing

Product Label Drawing will be updated by 6/10 (Monday)

A14. Force Map



A15. MTBF

1] MTBF target : 125,000 POH

2] Total Usage time: ODD 400 Hours/Year (20% Duty of 2,000 Hour)
(Computer: 2,000 POH/Year)

MTBF : 127,945 POH