LG

Slim Portable
Blu-ray Multi Drive
SERVICE MANUAL

MODEL: CP40NG10

P/NO : MFL67140030

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CAUTION - INVISIBLE LASER RADIATION WHEN OPEN AVOID EXPOSURE TO BEAM.

INTRODUCTION

This service manual provides a variety of service information.
It contains the mechanical structure of the Slim Tray BD Combo Drive and the electronic circuits in schematic form. This Slim BD Combo Drive was manufactured and assembled under our strict quality control standards and meets or exceeds industry specifications and standards.
This Slim BD Combo Drive is an internal drive unit designed for use with Apple notebook or compatible computer. It can write as much as 700 Mbytes of digital data into CD-R/RW disc, and can read as much as 700 Mbytes of digital data stored in a CD-ROM, CD-R and CD-RW disc.
It can write as much as 4.7Gbytes of digital data into DVD+R/RW disc, and can read as much as 4.7Gbytes of digital data stored in a DVD-ROM, DVD-R, DVD-RW, DVD+R, DVD+R DL DVD-R DL and DVD+RW disc.

FEATURES

1. General

(1) USB 2.0 Interface (480Mbits/s)
(2) Slim Portable Blu-ray Multi Drive
(3) CD-R/RW, DVD-R/-RW/-R DL / +R / +RW / +R DL/ RAM read and write compatible
CD Family, DVD-ROM, BD-ROM/R(SL/DL/LTH/TL)/RE(SL/DL/TL) read compatible
(4) Large buffer memory 2MB
(5) Buffer Under-run prevention function embedded
(6) Drawer Type manual loading / Electrical Release.
(7) Supports SATA Asynchronous Notification function
(8) Support Silent Play ; Noise reduction during movie playing
(9) Support Jamless Play
(10) Support BD 3D Movie Play
(11) Compliance with RoHS / Pb Free production
(12) AACS Bus Encryption supported

*LTH: BD-R Low to High disc

2. Supported Disc Formats

(1) Reads data in DVD-ROM, BD-ROM, BD-R(SL/DL/LTH/TL) and BD-RE(SL/DL/TL)
(2) Reads and writes in DVD-R(SL/DL), DVD-RW, DVD-RAM, DVD+R(SL/DL) and DVD+RW
(3) Reads data in 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) Reads and writes CD-R discs conforming to “Orange Book Part 2”
(7) Reads and writes CD-RW discs conforming to “Orange Book Part 3”
(8) Reads and writes DVD-R/-RW/-RAM with CPRM
(9) Support to read “CD layer” of Super Audio CD Hybrid type
(10) Support to read “AVCHD” format DVD disc
(11) Supports to read and write “AVCREC” format DVD disc
(12) Supports to read “DVD layer” of Hybrid Blu-ray disc

3. Performance (outline)

(1) Write speed:

DVD-R	2x CLV, 4x ZCLV, 8x CAV
DVD-R DL	2x CLV, 4x ZCLV, 6xZCLV
DVD-RW	1x CLV, 2x CLV, 4x ZCLV, 6x ZCLV
DVD-RAM	2x ZCLV, 3x ZCLV, 5x PCAV
	(Over 12x Media: Rea Only Support)
DVD+R	2.4x CLV, 4x ZCLV, 8x CAV
DVD+R DL	2.4x CLV, 4x ZCLV, 6x ZCLV
DVD+RW	2.4x CLV, 3.3x CLV, 4x ZCLV, 8x ZCLV
M-Disc	2.4x CLV, 4x ZCLV
CD-R	10x CLV, 16x ZCLV, 24x CAV
CD-RW	4x CLV, 10x CLV, 16x ZCLV, 24x ZCLV

(2) Read speed (basically finalized discs):

BD-ROM (SL/DL)	6x CAV / 6x CAV
BD-R (SL/DL/TL)	6x CAV / 4.8x CAV / 4.8X CAV
BD-R (LTH)	6x CAV
BD-RE (SL/DL/TL)	6x CAV / 4.8x CAV / 2X CLV
BDMV (AACS Compliant Disc)	4.8x CAV
DVD-ROM (SL/DL)	8x CAV / 8x CAV
DVD-R (SL/DL)	8x CAV / 6x CAV
DVD-RW	8x CAV
DVD+R (SL/DL)	8x CAV / 6x CAV
DVD+RW	8x CAV
DVD-RAM	2x, 3x ZCLV, 3x-5x PCAV
DVD-Video (CSS Compliant Disc)	4x CAV
M-Disc	8x CAV max
CD-R/RW/ROM	24x CAV
CD-DA (Ripping/Audio Play)	24x CAV / 10x CAV
Video CD	10x CAV

(3) Sustained Transfer rate:

BD-ROM	215.79 Mbits/s (6x) max.
DVD-ROM	11.08 MB/s (8x) max.
CD-ROM	3600 kB/s (24x) max.

(4) Burst Transfer rate: USB 2.0 480Mbps

(5) Support CD-Text read / write

(6) Multimedia MPC-3 compliant

(7) Audio 16 bit digital data output through ATA interface

*Definition

Transfer Rate:	1x (BD) = 35.965 Mbits/s,	Mbits/s = 10^6 bits/s
	1x (DVD) = 1.385 MB/s	MB/s = 10^6 bytes/s
	1x (CD) = 150 kB/s,	kB/s = 2^{10} bytes/s
Capacity:	MB = 2^{20} bytes,	kB = 2^{10} bytes

SPECIFICATIONS

1. Supporting Operating System & Application Software

1.1 Operating System (TBD)

Windows Vista: Home Basic, Home Premium, Ultimate Edition
Windows XP: Home, Professional, Media Center Edition
Windos7: Home Basic, Home Premium, Professional, Ultimate Edition

1.2 Application Software (Writing and Playback) TBD

(1) LG Burning Tool
(2) Power2Go (Cyberlink)
(3) PowerDVD (Cyberlink)

2. General Description

2.1 Applicable Disc Formats

BD	BD-ROM (SL/DL)	25GB / 50GB (Ver.1.3)
	BD-R (SL/DL/TL)	25GB / 50GB / 100GB (Ver.2.0)
	BD-RE (SL/DL/TL)	25GB / 50GB / 100GB (Ver.3.0)
DVD	DVD-ROM (SL/DL)	4.7GB / 8.5GB (Ver.1.1)
	DVD-R SL	4.7GB (Ver.2.1)
	DL	8.5GB (Ver.3.0)
	DVD-RW	4.7GB (Ver.1.2 / Rev 1.0, 2.0, 3.0)
	DVD-RAM	1.46GB/side, 4.7GB/side (Ver.2.0 Higher)
	DVD+R SL	4.7GB (Ver.1.3)
	DL	8.5GB (Ver.1.2)
	DVD+RW	4.7GB (Vol.1 Ver.1.3, Vol.2 Ver.1.0)
		M-Disc
CD	CD-ROM Mode-1data 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)	

-**Note**- DVD-R for Authoring (3.95GB), DVD-RAM (2.6GB) and DVD-RW DL are not supported.

2.2 Writing Method

(1) DVD-R SL: Disc at Once (DAO), Incremental Recording
(2) DVD-R DL: Disc at Once (DAO), Incremental Recording, Layer Jump Recording
(3) DVD-RW: Disc at Once (DAO), Incremental Recording, Restricted Overwrite
(4) DVD-RAM: Random Write
(5) DVD+R SL/DL: Sequential Recording
(6) DVD+RW: Random Write
(7) CD-R/RW: Disc at Once (DAO), Session at Once (SAO), Track at Once (TAO), Packet Write
(8) M-Disc Sequential Read

2.3 Disc diameter.....120 mm
80 mm

2.4 Data capacity

• User Data/Block BD-ROM / -R / -RE.....2,048 bytes/block
DVD-ROM / -R / -RW / -RAM / +R / +RW.....2,048 bytes/block
CD (Yellow Book).....2,048 bytes/block (Mode1 & Mode2 Form1)
2,336 bytes/block (Mode2)
2,328 bytes/block (Mode2 Form2)
2,352 bytes/block (CD-DA)

3. Drive performance

3.1 Host interface

External (Host) USB2.0 (480 Mbps)
Internal (Drive) X3T13 ATA/ATAPI-7 Revision 4b
INF-8090i Version 7 Rev 1.20
INCITS xxx T10/1675D Revision 4

3.2 Write Speed

<Write>

Media (Media Speed)	**Writing Speed**	**Transfer rate** (DVD:Mbytes/s, CD:kB/s)
DVD-R (1-2x)	2x CLV	2.77
-R (1-4x)	2x CLV, 2+4x ZCLV	2.77, 2.77+5.54
-R (1-8x)	3.3-4x PCLV, 3.3-8x CAV	4.58-5.54, 4.58-11.08
-R(1-16x)	3.3-4x PCLV, 3.3-8x CAV	4.58-5.54, 4.58-11.08
-R (8cm)	2x CLV	2.77
DVD-R DL (4x)	2x CLV, 2+4x ZCLV	2.77, 2.77+5.54
-R DL (8x)	2x CLV, 2+4x, 2+4+6x ZCLV	2.77, 2.77+5.54, 2.77+5.54+8.31
-R DL (12x)	2x CLV, 2+4x, 2+4+6x ZCLV	2.77, 2.77+5.54, 2.77+5.54+8.31
DVD-RW(1x)	1xCLV	1.39
-RW (1-2x)	2x CLV	2.77
-RW (2-4x)	2x CLV, 2+4x ZCLV	2.77, 2.77+5.54
-RW (2-6x)	2x CLV, 2+4x, 2+4+6x ZCLV	2.77, 2.77+5.54, 2.77+5.54+8.31
-RW (8cm)	2x CLV	2.77
DVD-RAM (2x)	2x ZCLV	2.77 (w/o Verify)
-RAM (2-3x)	3x ZCLV	4.16 (w/o Verify)
-RAM (2-5x)	3 - 5x PCAV	4.16 - 6.93 (w/o Verify)
-RAM (8cm)	2x ZCLV	2.77 (w/o Verify)
-RAM (over 12x)	Not supported	
DVD+R (1-2.4x)	2.4x CLV	3.32
+R (1-4x)	2.4x CLV, 2.4+4x ZCLV	3.32, 3.32+5.54
+R (1-8x)	3.3-4x PCAV, 3.3-8x CAV	4.58-5.54, 4.58-11.08
+R (1-16x)	3.3-4x PCAV, 3.3-8x CAV	4.58-5.54, 4.58-11.08
DVD+R DL (2.4x)	2.4x CLV	3.32
+R DL (8x)	2.4x CLV, 2.4+4x ZCLV	3.32, 3.32+5.54
2.4+4+6x ZCLV	3.31+5.54+8.31	
+R DL (16x)	2.4x CLV, 2.4+4x ZCLV	3.32, 3.32+5.54
	2.4+4+6x ZCLV	3.31+5.54+8.31
DVD+RW (1-2.4x)	2.4x CLV	3.32
+RW (1-4x)	2.4x CLV, 2.4+4x ZCLV	3.32, 3.32+5.54
+RW (3.3, 6-8x)	3.3x CLV, 3.3+6+8x ZCLV	4.58, 4.58+8.31+11.08
CD-R	10x CLV, 10+12+16x ZCLV	1500, 1500+1800+2400
10-24x CAV	1500-3600	
M-Disc	2.4x CLV, 4x ZCLV	3.32, 4.58-5.54
CD-RW (MS: 1-4x)	4x CLV	600
-RW (HS: 4-10x)	10x CLV	1500
-RW (US: 8-24x)	10 CLV, 10+16+24x ZCLV	1500, 1500+2400+3600
-RW (US+: 8-32x)	10 CLV, 10+16+24x ZCLV	1500, 1500+2400+3600
-RW (US+: 8-32x)	10 CLV, 10+16+24x ZCLV	1500, 1500+2400+3600

* “+”: change by step for ZCLV
* “-”: continuous change, for CAV, PCAV

3.3 Read Speed

<Read>

3.3.1 Data

Media	Read Speed	Transfer rate (DVD:Mbytes/s, CD:kB/s)
BD-ROM (SL)	2.5 - 6x CAV	89.91 - 215.79
(DL)	2.5 - 6x CAV	89.91 - 215.79
BD-R (SL)	2.5 - 6x CAV	89.91 - 215.79
(LTH)	2.5 - 6x CAV	89.91 - 215.79
(DL)	2 - 4.8x CAV	71.93 - 172.63
(TL)	2 - 4.8x CAV	71.93 - 172.63
BD-RE (SL)	2.5 - 6x CAV	89.91 - 215.79
(DL)	2 - 4.8x CAV	71.93 - 172.63
(TL)	2x CLV	71.93
DVD-ROM (SL)	3.3 - 8x CAV	4.58 - 11.08
(DL)	3.3 - 8x CAV	4.58 - 11.08
DVD-R	3.3 - 8x CAV	4.58 - 11.08
DVD-R DL	2.5 - 6x CAV	3.46 - 8.31
DVD+R	3.3 - 8x CAV	4.58 - 11.08
DVD+R DL	2.5 - 6x CAV	3.46 - 8.31
DVD-RW	3.3 - 8x CAV	4.58 - 11.08
DVD+RW	3.3 - 8x CAV	4.58 - 11.08
DVD-RAM	2x, 3x ZCLV, 3 - 5x PCAV	2.77, 4.16, 4.16 - 6.93
-RAM (8cm)	2x ZCLV	2.77
M-Disc	8x CAV	4.58 - 11.08
CD-R / RW / ROM	10 - 24x CAV	1500 - 3600

-Note- Read Speed: basically finalized discs specification.

3.3.2 Video and Audio

BDMV (SL/DL)	2 - 4.8X CAV	71.93 - 172.63
DVD-Video (SL/DL)	1.7 - 4x CAV	2.29 - 5.54
CD-DA (Ripping)	10 - 24x CAV	1500 - 3600
CD-DA (Audio Play)	4.3 - 10x CAV	630 - 1500
Video CD	4.3 - 10x CAV	630 - 1500

* Rotational speed (CLV, ZCLV)

BD-RE / R / ROM	1x: Approx. 1956 (Inside) - 810 r/min (Outside)
DVD-R / RW / ROM, +R / RW	1x: Approx. 1390 (Inside) - 580 r/min (Outside)
DVD-RAM	2x: Approx. 3250 (Inside) - 1380 r/min (Outside)
CD-R / RW / ROM	1x: Approx. 500 (Inside) - 210 r/min (Outside)

3.4 Burst Transfer Rate USB 2.0 480 Mbps

3.5 Access Time (1/3 stroke)

BD-XL	350ms typ
BD-ROM	200 ms typ
DVD-ROM	160 ms typ.
DVD-RAM	200 ms typ.
CD-ROM	160 ms typ.

Note 1 :

1) Average access time is the typical value of more than 50 times including latency and error correction time.

Test Disc: BD-ROM:.....SONY BLX-103
DVD-ROM:.....ALMEDIO TDR-820A
CD-ROM:.....ALMEDIO TCDR-701 / LG LGDS-01A

2) Typical value defines a measured value in normal temperature (20 ºC) and horizontal position.

3.6 Data Error Rate (Measured with 5 retries maximum)

BD-ROM/RE/R.....$<10^{-12}$
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 Time (Typical / without Multi-session)

Time to drive ready mode from sleep

CD-ROM.....4s
DVD-ROM.....4s
BD-ROM 4s

Time to drive ready mode from power on

BD-ROM (SL/DL) .....15s / 20s
BD-R (SL/DL/TL) .....26s / 28s / 40s
BD-RE (SL/DL/TL) .....26s / 30s / 40s
DVD-ROM (SL/DL) .....12s / 14s
DVD-R (SL/DL).....22s / 26s (Disc At Once)
DVD-RW.....22s (Disc At Once)
DVD+R (SL/DL) .....22s / 27s
DVD+RW.....22s
DVD-RAM.....45s
CD-ROM.....12s
CD-R.....24s
CD-RW 24s

3.8 Data Buffer Capacity 2MB

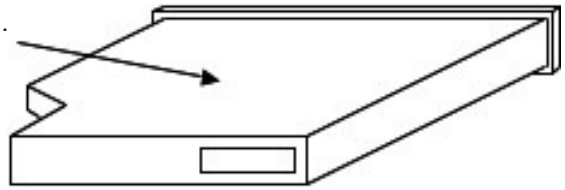
4. Environmental Conditions

4.1 Ambient Temperature

Operating Read .....5 to 50 °C
Write .....5 to 45 ºC
Storage/Transportation .....-30 to 60 ºC

4.2 Approval Temperature Rise

Center of Top Cover.....56 ºC max..



4.3 Temperature Gradient.....10 ºC/h

4.4 Relative Humidity

Operating Read .....15% to 85% (Non-Condensing)
Write.....15% to 80% (Depend on the Temperature)
Storage/Transportation .....10% to 90% (Non-Condensing)

4.5 Dew Point Temperature Restrictions ..... Less than 29 ºC

4.6 Altitude

Operating : 0 to 3,000 m
Non-Operating: 0 to 12,000 m

4.7 Vibration

(1) Operating
Read: 1.96 m/s^2 (0.2G) No unrecoverable error
(5 to 300) Hz sine wave sweep, 3oct./min at Each of 3 directions[1)],
Write: 0.98 m/s^2 (0.1G) No recording stop
(5 to 300) Hz sine wave sweep, 6oct./min at Each of 3 directions[1)]
(2) Non-Operating: 9.8 m/s^2 (1.0G) No physical and electrical damage. (No disc loaded)
(5 to 300) Hz sine wave sweep, 1 oct./min at Each of 3 directions[1)]
(3)Transportation: 8.04 m/s^2 (0.82G) No damage must results. (Packed unit)
(5 to 50) Hz random vibration for 20 min at Z-axis direction.

* [1)] 3direction : X(left and right), Y(back and front), Z(top and bottom) axis

4.8 Shock

(1) Operating :
Read: 49m/s^2 (5G) No unrecoverable error (“Retries” are allowed.)
11 ms Half sine wave at Each of 3 directions[1)]
(5 time shocks, 5 s between shocks.)
Write: 1.96m/s^2 (0.2G) No recording stop.
11 ms Half sine wave at Each of 3 directions[1)]
(5 time shocks, 5 s between shocks.)
(2) Non-Operating 980m/s^2 (100G) No damage after shock. (No disc loaded)
2ms Half sine wave at Each of 3 directions[1)]

* [1)] 3direction : X(left and right), Y(back and front), Z(top and bottom) axis

4.9 Drop Impact

Less than 60 cm
Note: Bulk package, 1 Corner, 3 Edges, 6 Faces.

5. Quality and Reliability

5.1 MTBF 60 000 Power On hours (POH)

Assumption : Used in a normal office environment at room temperature.

-POH per year 3,000

-ON/OFF cycles per year 480

-Operating duty cycle 10% of Power on time (Seek: 10% of operating time)

5.2 Tray Cycle Test 10,000 times tray open / close cycle test

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 2,000h of Laser radiating time

Assumption : Used in a normal office environment.

Note :Not Defined for LightScribe Label Printing

6. Electro Static Discharge Susceptibility (ESD)

Up to 6 kV (contact)	No user detectable data error
Up to 8 kV (contact)	No catastrophic failure or damage
Up to 10kV (air)	No user detectable data error
Up to 15kV (air)	No catastrophic failure or damage

* Test Conditions : C = 150pF, R = 330 ohms, 20 times discharge
except Optical Pick-up block and Connector

7. Power requirements

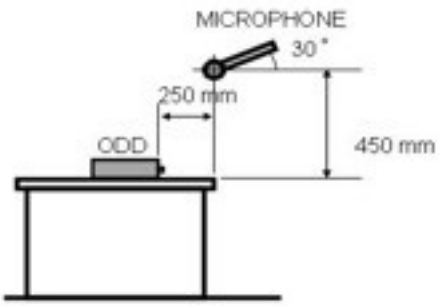
7.1 Source voltage +5V±5% Ripple Less than 100 mVp-p

7.2 Current

Standby	120 mA typ.	(Slumber)
Continuous Read	750 mA typ.	(CD-ROM 24x max. CAV)
	750 mA typ.	(DVD-ROM 8x max. CAV)
	750 mA typ.	(BD-ROM 6x max. CAV)
Continuous Write	800 mA typ.	(CD-R 24x ZCLV)
	850 mA typ.	(DVD+R 8x max. CAV)
	900 mA typ.	(DVD+/-R DL 6x ZCLV)
Seek	900 mA typ., 1.4 A max.	(CD-ROM 24x max. CAV)
Spin UP(Spindle motor start up)	1.1 A typ., 1.4 A max.	(CD-ROM 24x max. CAV)
Maximum Current	1.4 A	

-note- Inrush current within 2msec is ignored.

8. Acoustic noise



Less than 50 dBA at 0.25 m away from Bezel and 0.45 m height away (ISO7779 Seated Operator Position)

Note : 1. Disc: Less than Unbalance 0.3g·cm
2. Installation: Horizontal
3. Ambient Temperature: Normal Temperature
4. Except loading and unloading

9. Dimension

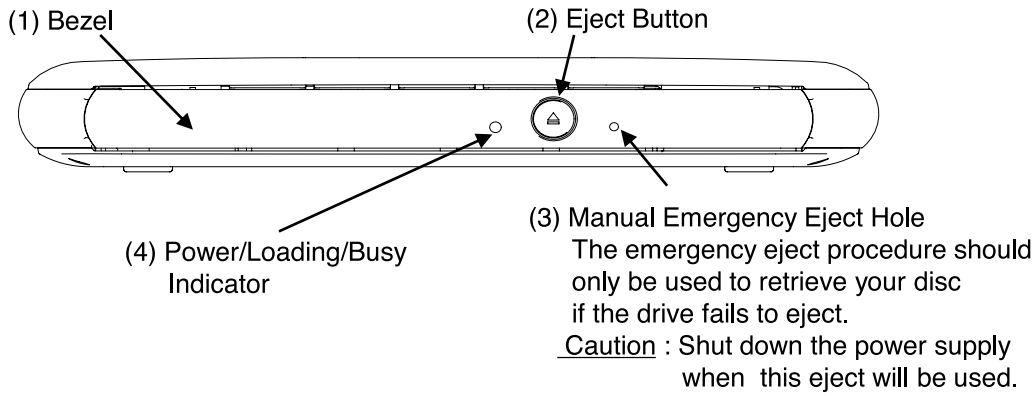
WxHxD 156 x 21.4 x 165.20 mm (Refer to Section 13.)

10.Mass

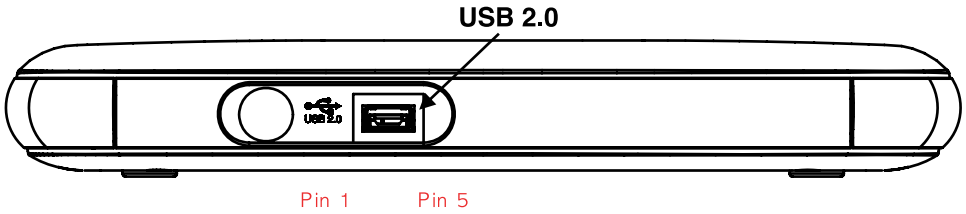
350 +/-7 g (BARE DRIVE170 g Max (Without Bezel)

11.Controls and Functions

11.1 Front View



11.2 Rear View



11.3 Connector Pin Assignment

Pin Assignment		
Pin No	**Function**	**Type**
1	VBUS	Power
2	D-	Signal
3	D+	Signal
4	GND	GND
5	GND	Shield GND

DISASSEMBLY

1. TOP COVER

A. Release 6 screws(A).
B. And then, remove Top Cover and 3 Decoration in the direction of arrow(1). (see Fig.1-1)
C. Remove a Top Shield.

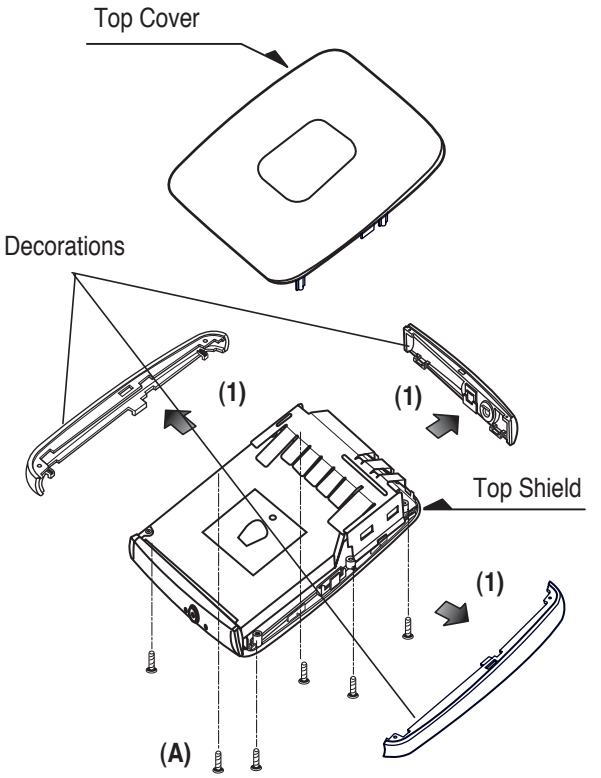


Fig. 1-1

2. INTETNAL DVD MULTI DRIVE

A. Release 1 screw (B)
B. And then, remove a Drive (2) and a Bottom Shield (3) in the direction of arrow. (see fig.1-2)

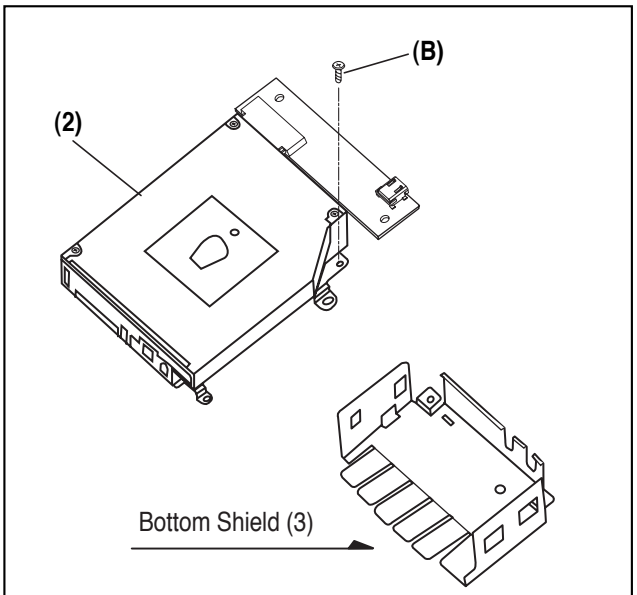


Fig. 1-2

3. USB BRIDGE BOARD

A. Remove the USB bridge board in the direction arrow(4). (See Fig. 1-3)
B. Release 2 screws (C), and then remove a Bracket.

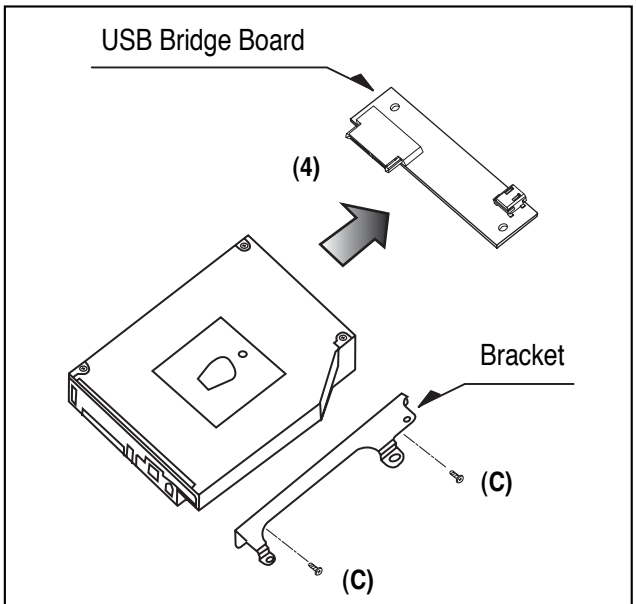
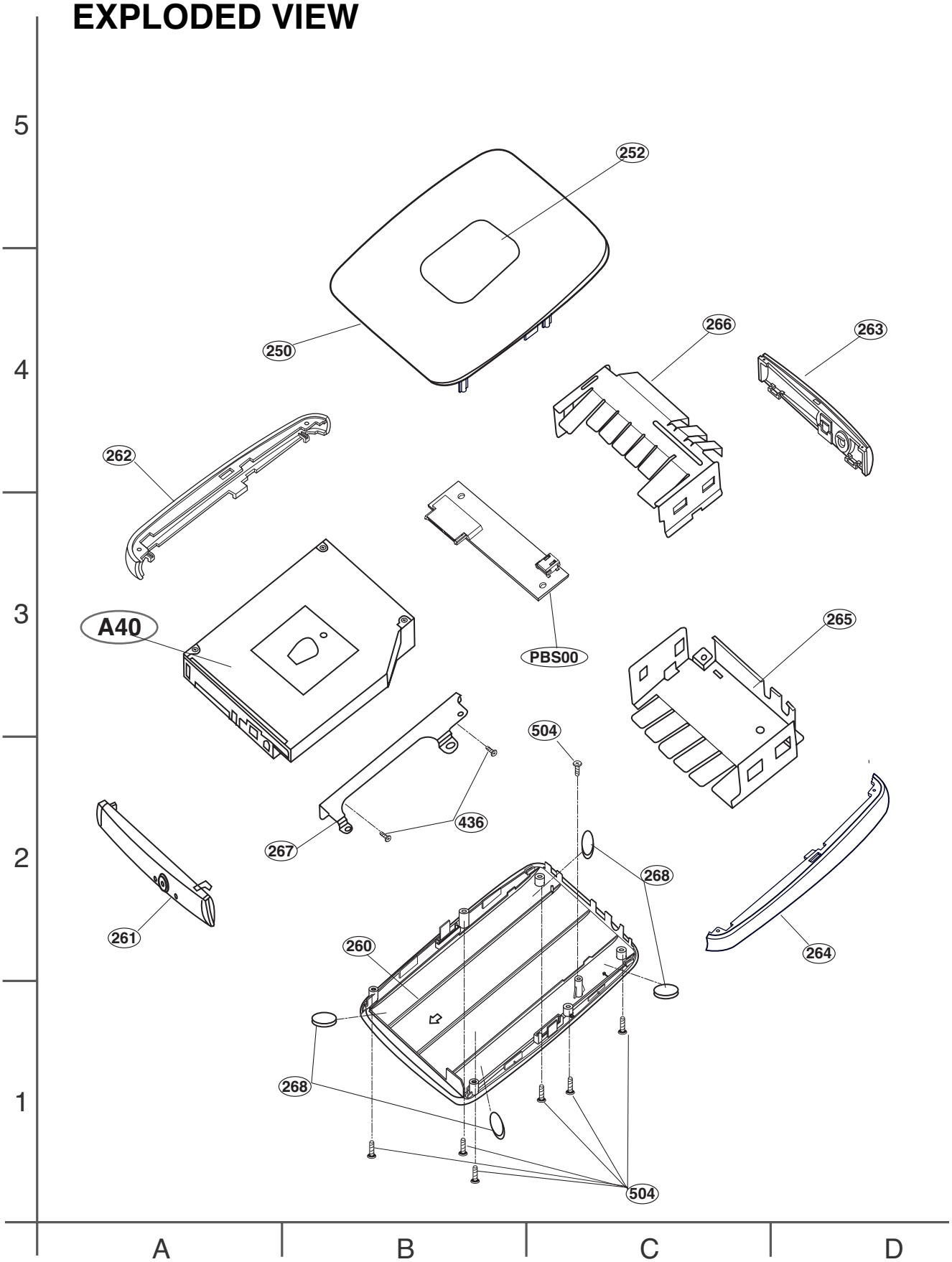


Fig. 1-3

EXPLODED VIEW



MECHANICAL REPLACEMENT PARTS LIST

• MODEL : CP40NG10

NSP: Not Service Part

LOCA.NO	PART NO(GS)	DESCRIPTION	SPECIFICATION	REMARKS
ASSEMBLE PARTS SECTION				
A01	AFP73525705	Mechanism Assembly	BCP1[BC5] MD Assy.Non-LS CT40N .	
PARTS SECTION				
250	MCK36801607	Cover	MOLD PC+ABS TOP BCP1 COVER GRAY TOP,Slim External	
252	MHK40633701	Sheet	COMPLEX - JRSP1 sheet -	
260	MCK36801703	Cover	MOLD PC+ABS BOTTOM RP5 BLACK SLIM External	
261	AAU33353802	Bezel Assembly	FRONT JRSP1 WHITE -	
262	MCK37719902	Cover	MOLD NA SIDE DECO(LEFT) JRSP1 SIDE DECO(LEFT)	
263	MCK37720004	Cover	MOLD PC+ABS REAR DECO_WHITE BCP1 NO DC JACK HOLE AND LOGO SLIM EXTERNAL ODD	
264	MCK37719802	Cover	MOLD NA SIDE DECO(RIGHT) JRSP1 SIDE DECO(RIGHT)	
265	MEK37720402	Housing	PRESS SUS 0.3 Shield Bottom	
266	MEK37720301	Housing	PRESS SUS301 0.3 PRESS SUS 301 0.3 Shield Top(JRSP1)	
267	MAZ37720501	Bracket	PRESS SECC 0.5t RIGHT GUIDE RP3/RP6/RP8/RP10/RP14/BP1/BCP1 STEEL -	
268	MDP61887003	Foot	COMPLEX BOTTOM foot BP1-1	
PBS00	EBR63687002	PCB Assembly,Main	BCP1 B/B MAIN PCB	
SCREW				
436	1SZZH-1009R	Customized Screw	D2.0 2.0MM SWRH4/BK 3.5MM 0.4MM MACHINE FLAT NO	
504	FAB30112501	Screw,Taptite	SEOUL MATERIAL CO.KR SPECIAL + S 4M 6M SWCH18A CZN SEOUL METAL CO., LTD.	
514	FAB30112504	Screw,Taptite	SEOUL MATERIAL SPECIAL + S 4mM 4mM SWCH18A BLACK SEOUL METAL CO., LTD.	

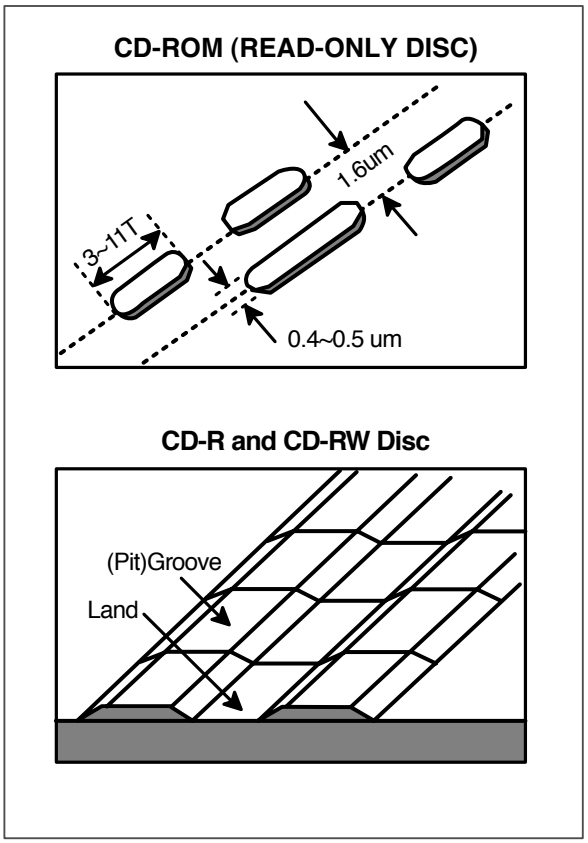
GLOSSARY

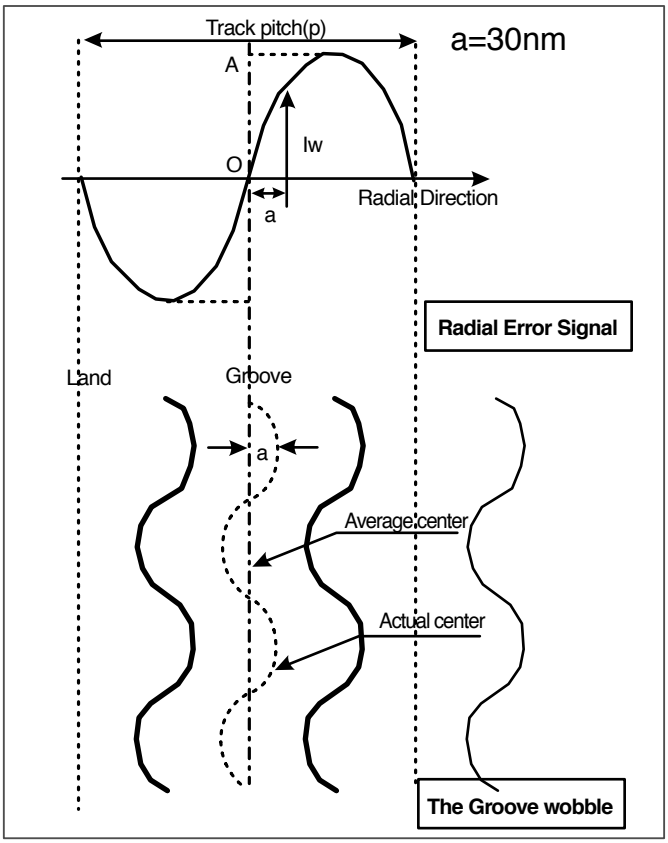
ATIP	Absolute Time in Pre-groove. With an additional modulation of the “Wobble”, the “Groove” contains a time code information.
Wobble	The pre-groove in the Disc is not a perfect spiral but is wobbled. With : – A typical amplitude of 30 nm – A spatial peried of 54~64 μm
CW	Continuous Wave. The laser light output is at a constant level.
DOW	Direct Over-Write. The action in which new information is recored over previously recorded information in CD-RW disc.
Overwrite	The action in which new information is recorded over previously recorded information.
(Pre-)Groove	The guidance track in which clocking and time code information is stored by means of an FM modulated wobble.
Land	Land is characterized in the following way: When radial signals are concerned,land is defined as the area between the grooves. When HF signal are concerned,land is defined as the area between the marks(pits) in tangential direction.
Hybrid Disc	A Multisession disc of which the first Session is mastered. On a hybrid disc, recorded and mastered information may co-exist.
Mastered Information	Information,stored as pits on the disc during the manufacturing process of the disc. (when making the master)
OPC	Optimum Power Control. Procedure is determined optimum recording power according to CD-R/RW Media in recording start step.
ROPC	Running OPC. The purpose is to continuously adjust the writing power to the optimum power that is required. When the optimum power may change because of changed conditions of disc and change in operating temperature.
Jitter	The 16 value of the time variation between leading and trailing edges of a specific (I3 … I11) pit or land as measured by Time Interval Analysis.
Deviation	The difference between a fixed value of Pit length and Land length.
TOC	Table Of Contents : in the Lead-in Area the subcode Q-channel contains information about the Tracks on the disc.
Packet Writing	A method of writing data on a CD in small increments. Two kinds of packets can be written : Fixed-length and Variable-length.
Write Strategy	The shape of the HF write signal used to modulate the power of the laser. The Write Strategy must be used for recordings necessary for disc measurements.
Information Area	Wobble, ATIP, Disc Identification, Write Power, Speed Range OPC Parameters, etc are recorded in the Information area of CD-RW Disc
Finalization	The action in which (partially) unrecorded or logically erased tracks are finished and the Lead-in and/or Lead-out areas are recorded or overwritten with the appropriate TOC subcode.
Logical Erase	A method to remove information from a disc area by overwriting it with an EFM signal containing mode 0 subcode A logically erased area is equivalent to an unrecorded
Physical Erase	The action in which previously recorded information is erased by overwriting with a CW laser output. After a Physical Erase action, the erased area on the CD-RW disc is in the unrecorded state again.
Session	An area on the disc consisting of a Lead-in area, a Program area, a lead-out area.
Multi session	A session that contains or can contain more than one session composed Lead-in and Lead-out

The differences of CD-R/CD-RW discs and General CD-ROM

1. Recording Layer

Recordable CD has a wobbled pre-groove on the surface of disc for laser beam to follow track.





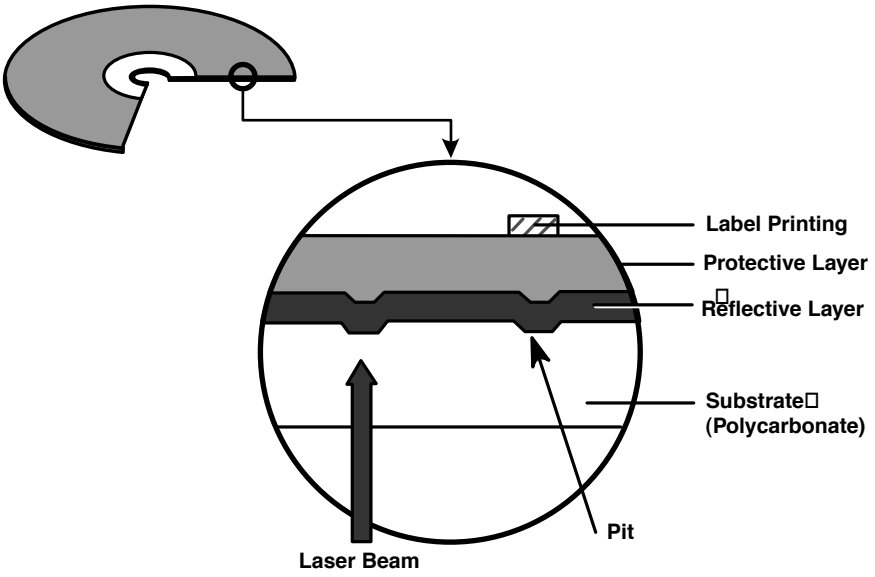
2. Disc Specification

ITEM	CD-ROM	CD-R	CD-RW
Standard	Yellow Book	Orange Book II	Orange Book III
Record	Not available	Write once	Re-Writeable
Tracking Signal I11/Itop (HF Modulation)	> 0.6	> 0.6	0.55 > M_{11}> 0.70
Read Laser Power(mW)	< 0.5 mW	< 0.7 mW	< 1.0 mW
Jitter	< 35 nsec	< 35 nsec	< 35 nsec
Reflectivity (R_{top})	70 %	65 %	15 % ~ 25 %
Remark) Write Laser Power(mW)		14-65 mW	6-45 mW

3. Disc Materials

1) CD-ROM disc

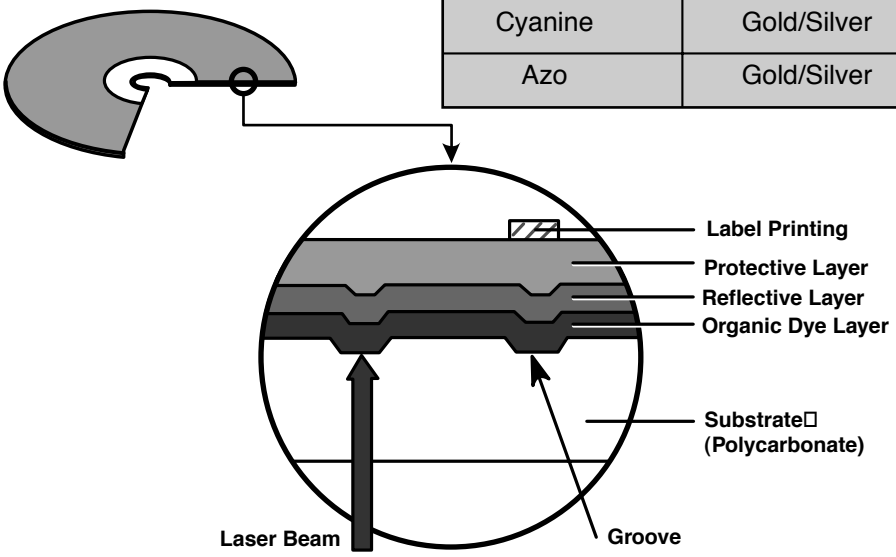
- It is composed of Silver _ colored aluminum plate and Reflective layer.
- Groove (Pit) of aluminum plate make a track.
- Laser wavelength : 780 nm, Laser Power (Read): 0.5mW
- Signal is detected by the difference of reflective beam intensity between “pit” and “Land” on the disc.



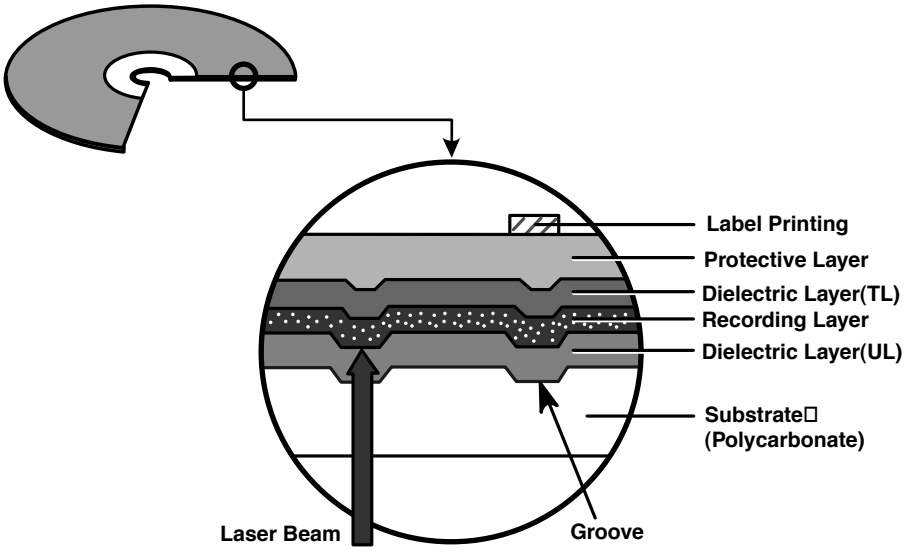
2) CD-R disc

- It is so-called WORM (Write Once Read Many) CD.
- It is composed of polycarbonate layer, Organic dye layer, Reflective layer, and Protective layer.Gold/Silver Reflective layer is used to enhance the reflectivity
- According to the kinds of Organic dye layer, it is divided by Green CD, Gold CD, Blue CD.
- Laser Wavelength : 780 nm, Laser Power (read) : 0.7 mW
- Recording Power : 8x(14~20mW), 16x(25~35mW)
- When some part of dye layer is exposed to laser heat, it’s color changs black.Therefore, writing and reading is enabled by the difference of reflectivity between changed part and unchanged part.
- Polycarbonate layer has Pre_Groove which make a Track.

Pigment	Reflective Layer	Color
Phtalocyanine	Gold/Silver	Yellow/White
Cyanine	Gold/Silver	Dark Green/Bright Green
Azo	Gold/Silver	Dark Blue

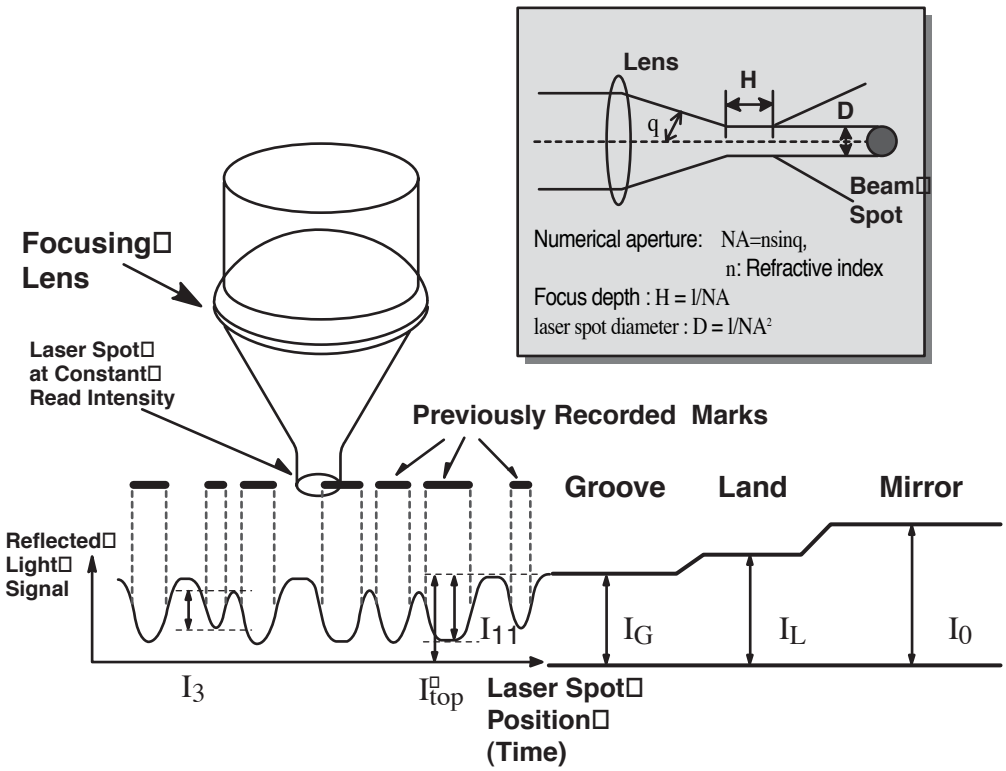


3) CD-RW Disc

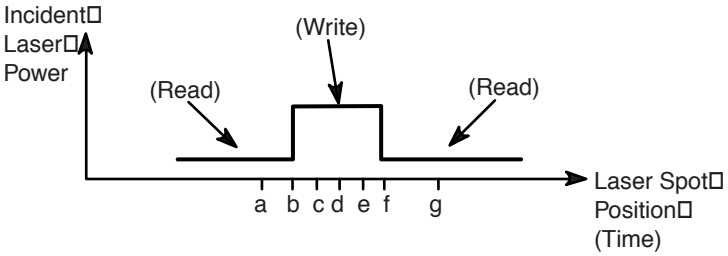


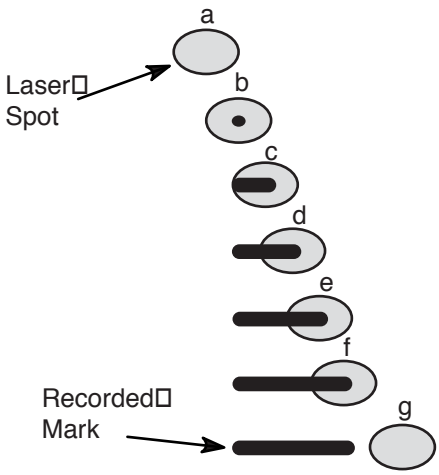
- It is composed of polycarbonate layer, alloy(silver, arsenic) layer, aluminum reflectivity layer, protective layer.
- An crystalized alloy layer is transformed into noncrystalized by the laser heat. Therefore, writing and reading is enabled by the difference of reflectivity.
- It is possible to overwrite about 1000 times.
- Laser Wavelength : 780 nm, Laser Power (Read) : 1.0mW
- Recording Power : Erase (4~18mW), Write (6~45mW)
- When disc rewriting, new data is overwritten previously recorded data.
- Polycarbonate layer has a Pre-Groove which make a track.

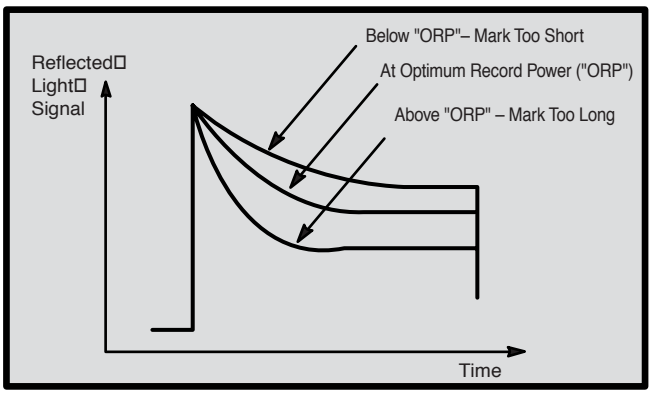
4. Reading process of Optical Disc

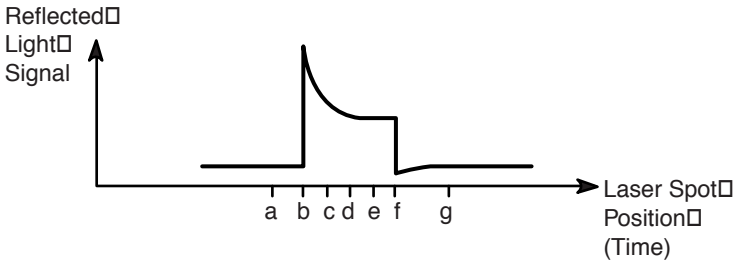


5. Writing Process of CD-R Disc

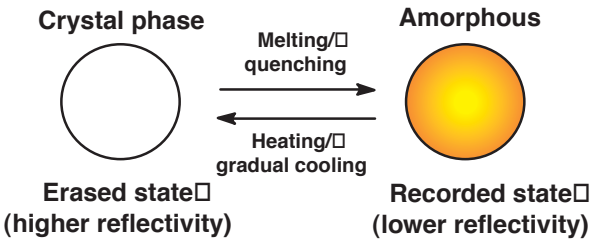


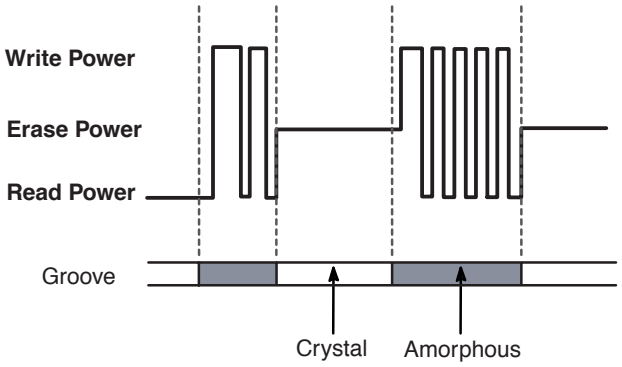






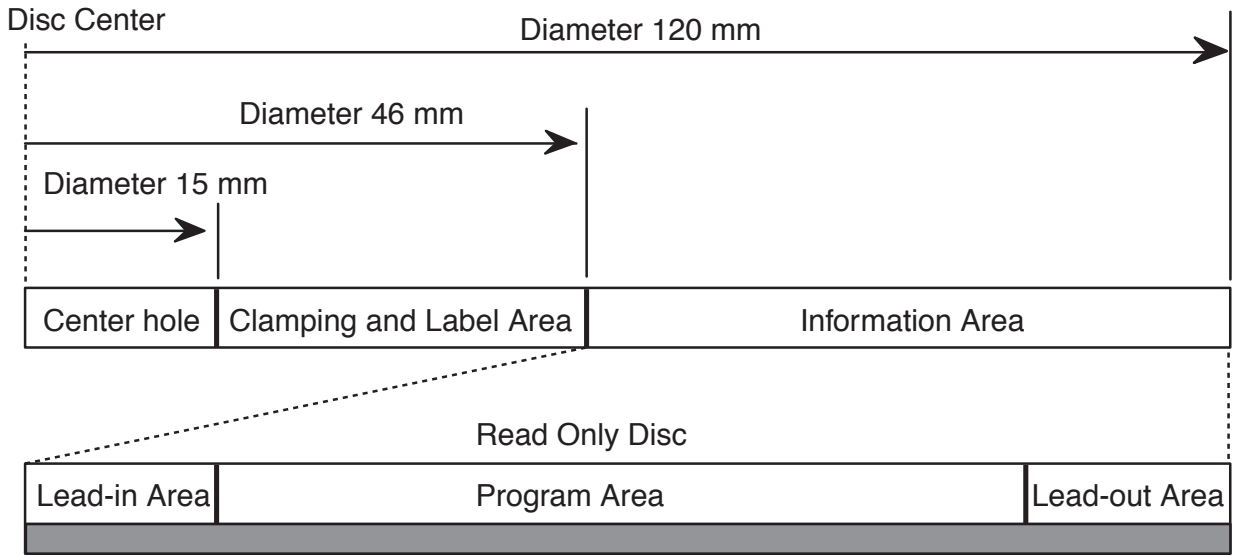
6. Writing process of CD-RW Disc



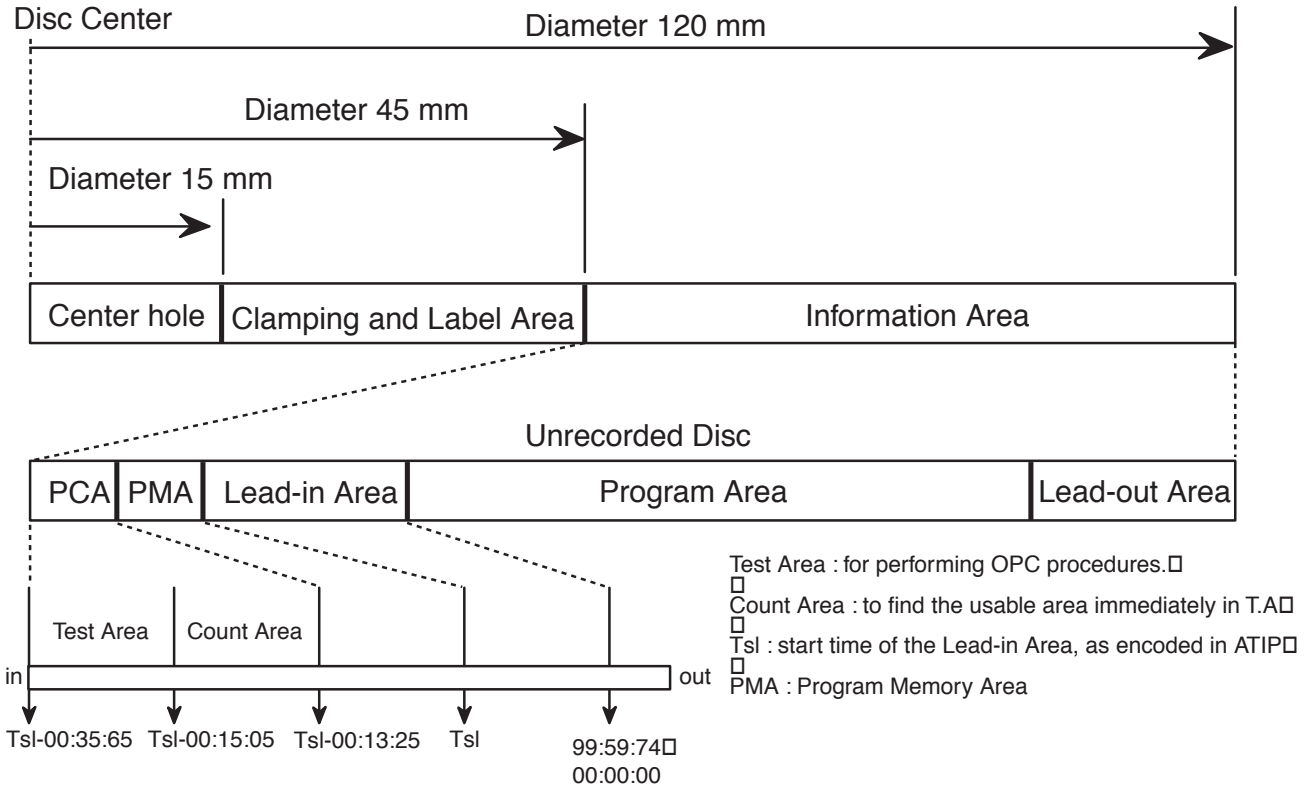


7. Organization of the PCA, PMA and Lead-in Area

1) Layout of CD-ROM disc



2) Layout of CD-R/RW disc



8. Function of PCA and PMA area

1) PCA (Power Calibration Area)

- PCA area is used to determine the correct Laser Power for a disc.
  - – Method 1 : PCA area is divided by a track.
  - – Method 2 : The previous Calibration value is referred.
  - – Method 3 : ROPC is used to determine Laser Power value automatically in data writing.
- CD-R Disc can write maximum 99 Tracks but CD-RW Disc can write unlimited tracks because it has a rewritable function.

2) PMA (Program Memory Area)

- It has a track information (track No, track Start/End time) of every track before writing completed.
  - – PMA area has the last written point and the next writable point of a disc.
  - – In case of CD to CD copy, some writer may not write PMA area.

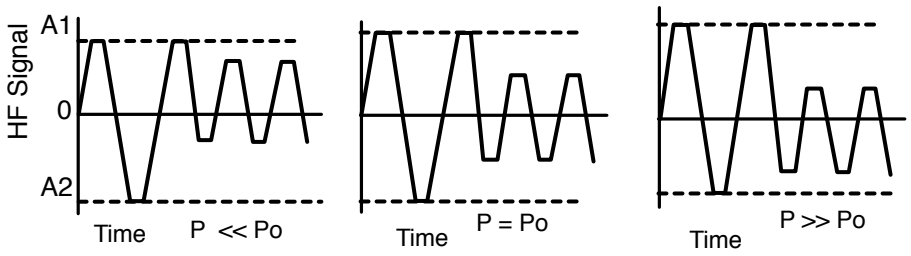
* When Disc is Finalized,
PMA information is transferred to the Lead_In area so that general Driver can read it.

* Because PCA and PMA area exist before Lead-In area, General CD Player or CD-ROM Drive can't read these areas.

9. OPC and ROPC

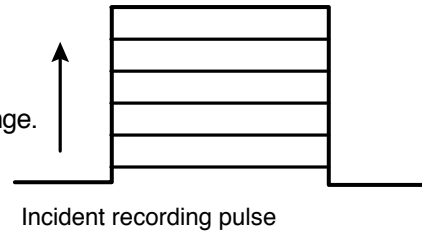
1) OPC (Optimum Power Control)

- This is the first step of writing process, because CD writer has its own laser power value and media have different writing characteristics,
  - – This is determined by the Writing characteristic, speed, temperature, and humidity.
  - – Laser wavelength is determined by the environmental temperature (775~795nm) and Optical Laser Power is determined by the test and retry.
- Asymmetry and optimum writing Power
  - – EFM signal Asymmetry is determined by the writing power.
    Therefore, Optical Power which has the same value to the preset power value can be estimated by measuring HF signal Asymmetry on the PCA area.
- Measurement of Asymmetry
  - * Parameter setting (Beta) : Using AC coupled HF signal before equalization
    Beta = (A1+A2)/(A1-A2)

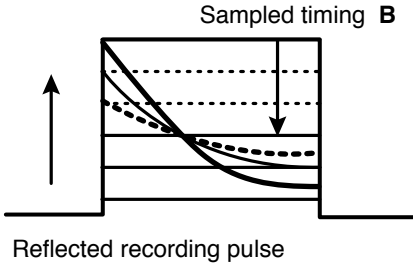


2) ROPC (Running Optimum Power Control)

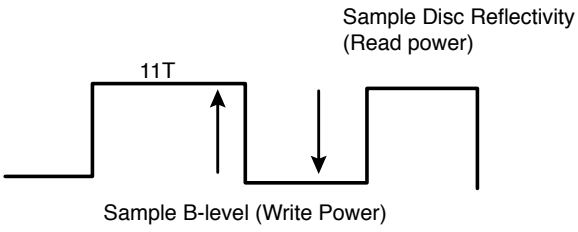
- Variable primary factor of Optimum Power
  - – Change of Power sensitivity on the Disc. (limited to 0.05 *Po)
  - – Wavelength shift of the laser diode due to the operating temperature change.
  - – Change of the Spot aberration due to the Disc skew, Substrate thickness, Defocus.
  - – Change of Disc or Optics conditions due to the long term OPC
    ==> It is necessary to adjust continuously to obtain the Optimum Power.

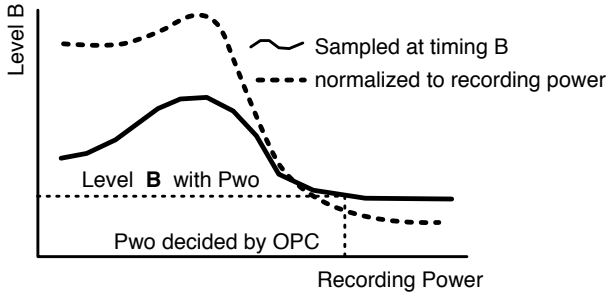

Incident recording pulse

- Principle of Running OPC
  - – To meet the factors mentioned above, a horizontal _ direction movement of a curve is uesd.
  - – Beta = f(B-level) = constant on the Recorded Disc
  - – Procedure of ROPC
    - a. Reference B-level is determined during OPC Procedure.
    - b. During Recording, B-level value is controlled to have a close Reference B-level value.
    - c. Normalization of B-level is used to eliminate the effect of reflectivity fluctuation.
      ==> The reflected B-level value is normalized by the disc reflectivity itself.

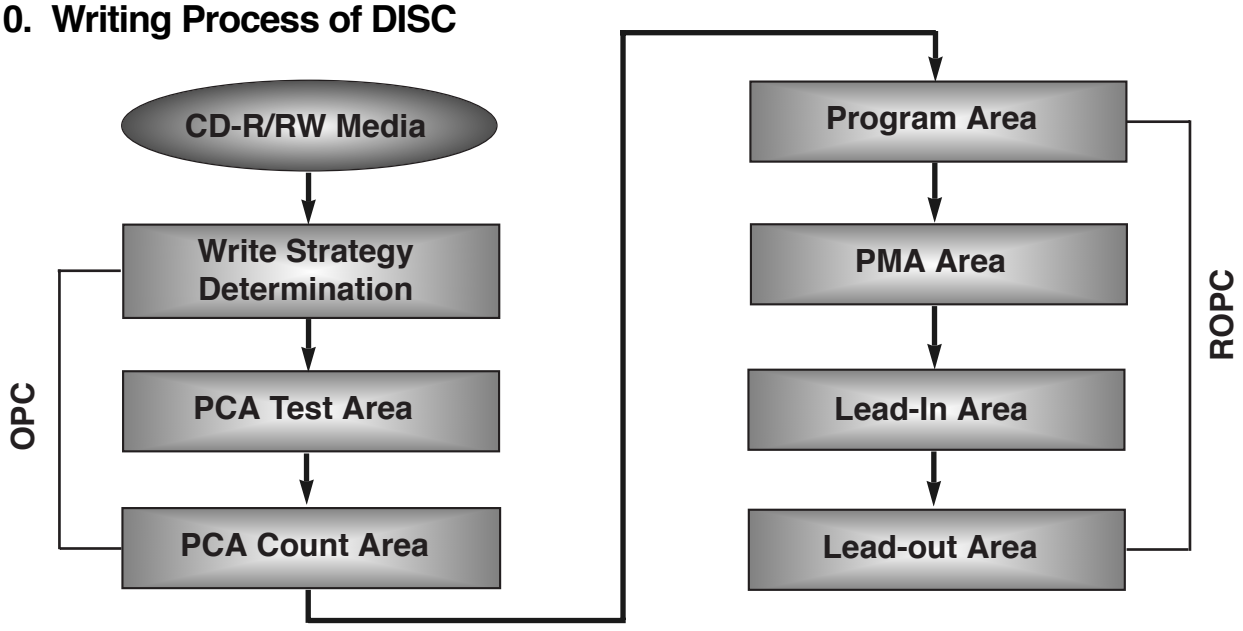


Reflected recording pulse





10. Writing Process of DISC



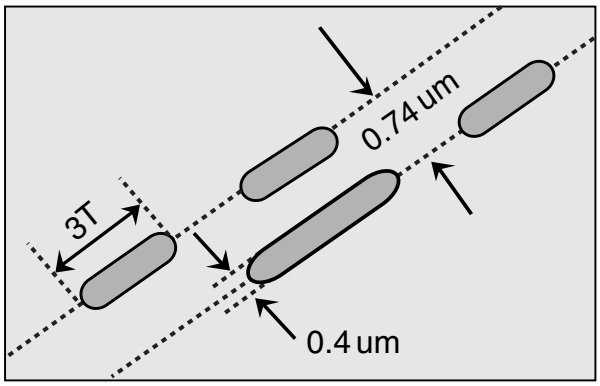
*** Recording Capacity of CD-R/RW (74Minute Recording media)**

- (2048 Byte/Sector) X (75 Sector/Second) X (60 Second/Minute) X 74 Minute
  = 681,984,000 Bytes = 682 Mbytes
- But the actual recording capacity is about 650 Mbytes. (according to the ISO 9660 standard, approximately 30 Mbytes are used to make directory structure and volume names.)

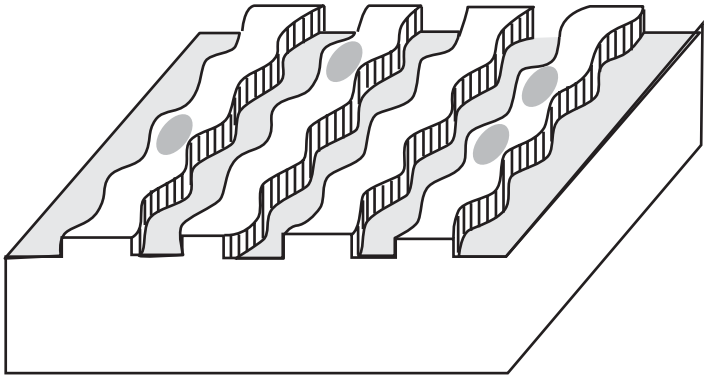
The differences of DVD-R/RW, DVD+R/RW discs and DVD-ROM

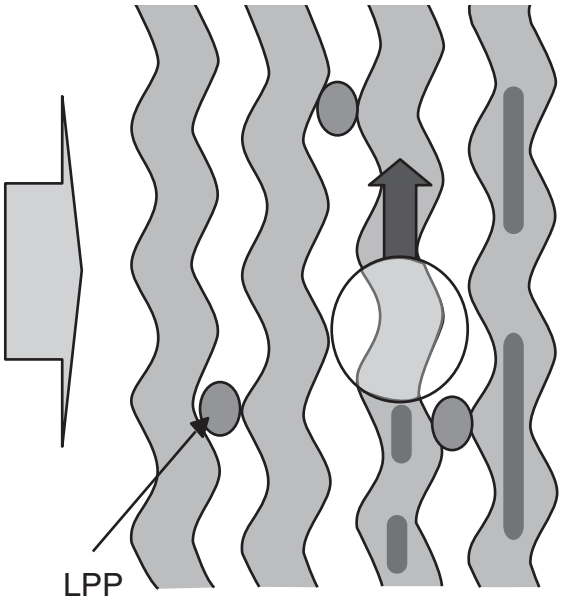
1. Recording Layer

DVD-ROM (Read Only Disc)

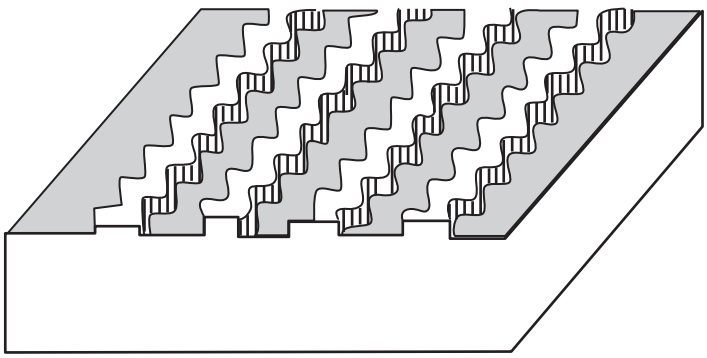


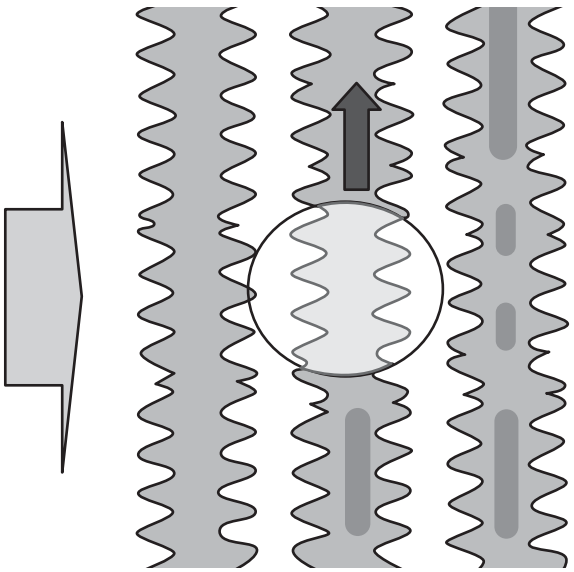
DVD-R/RW Disc





DVD+R/RW Disc





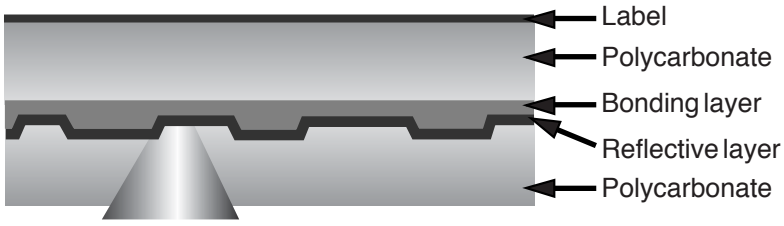
2. Disc Specification

	DVD-ROM		DVD-R	DVD-RW	DVD+R	DVD+RW
	Single-Layer	Dual-Layer				
Media Type	Read Only	Read Only	Dye	Phase change	Dye	Phase change
User data capacity	4.7GB	8.54GB	4.7GB	4.7GB	4.7GB	4.7GB
Wavelength	650nm	650nm	650nm	650nm	650nm	650nm
Reflectivity	45~85%	18~30nm	45~85%	18~30%	45~85%	18~30nm
Track pitch	0.74 μm	0.74 μm	0.74 μm	0.74 μm	0.74 μm	0.74 μm
Minimum pit length	0.4 μm	0.44 μm	0.4 μm	0.4 μm	0.4 μm	0.4 μm
Modulation	>0.6	>0.6	>0.6	>0.6	>0.6	>0.6
Channel bit- rate	26.16MHz	26.16MHz	26.16MHz	26.16MHz	26.16MHz	26.16MHz
Wobble Frequency	-	-	140KHz	140KHz	817.4KHz	817.4KHz
Addressing	26.16MHz	26.16MHz	Wobble & LPP	Wobble & LPP	Wobble(ADIP)	Wobble(ADIP)
Read Power (mW)					0.7 ± 0.1	0.7 ± 0.1
Write Power (mW)	-	-				
JItter	<8%	<8%	<8%	<8%	<9%	<9%

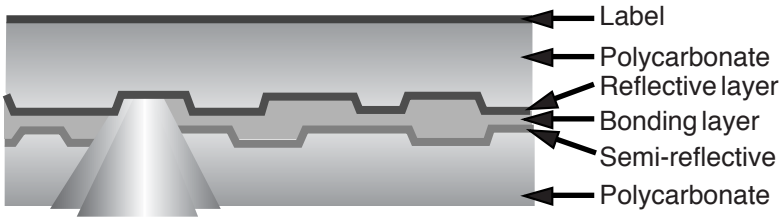
3. Disc Materials

1) DVD-ROM

<Single Layer >



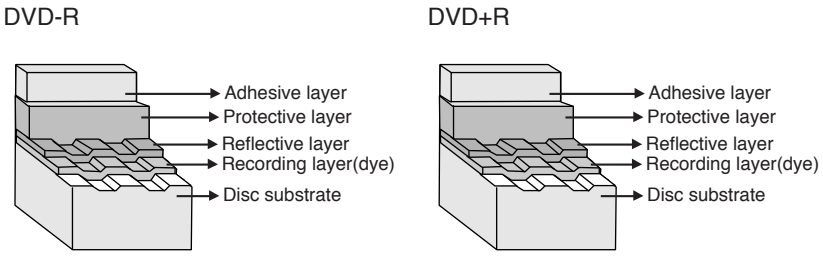
<Dual Layer >



2) Recording format using organic dye material (DVD-R/DVD+R)

* The format that records data through the creation of recorded marks by changing the organic dye material with a laser beam.

> Disc structure



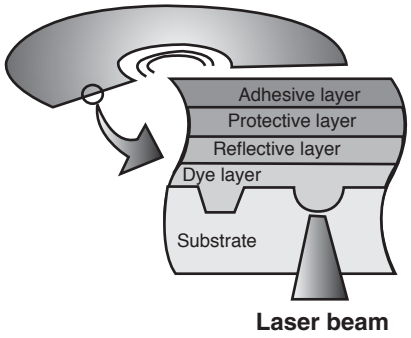
> Disc structure

[Recording]

Recording is done by changing the organic dye layer and the substrate with a laser when a strong is applied to a disc, the temperature of the ortanic dye material goes up, the dye is decomposed and the substrate changes at the same time. At this time, a durable bit is created as is the case with a CD-ROM.

[Playback]

Signals are read with the differences of the reflection of a laser from pits.

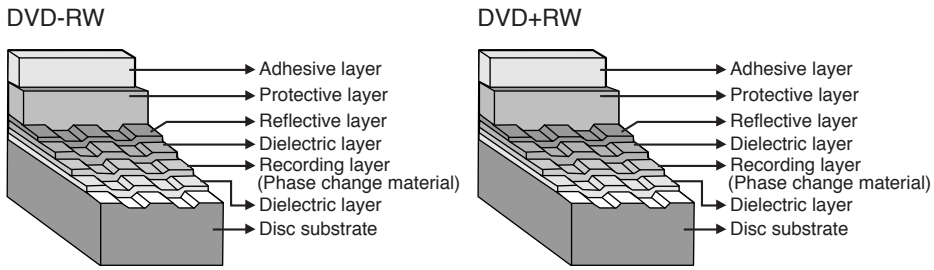


3) Recording format using phase-change recording material (DVD-RW/DVD+RW)

* Data is recorded by changing the recording layer from the amorphous status to the crystalline status, and played back by reading the difference of the reflection coefficient.

[Amorphous : Non-crystalline]

> Disc structure



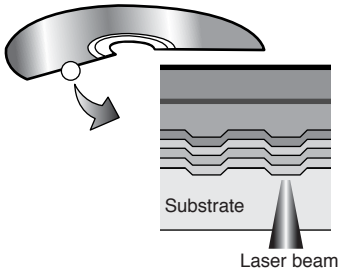
> Recording principles

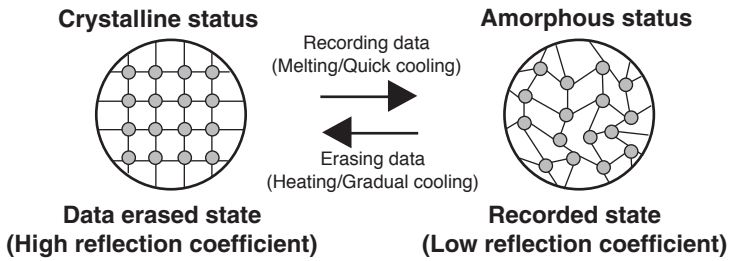
[Recording]

When a high-power laser is applied to the recording material, it melts and then becomes amorphous with a low reflection coefficient when it quickly cools off. When a mid-power laser is applied to heat gradually the recording material and then gradually cools it off, it becomes crystal with a high reflection coefficient.

[Playback]

A low-power laser is used for playback. The amount of reflected light depends on the status (amorphous or crystalline) of the recording material. This is detected by an optical sensor.





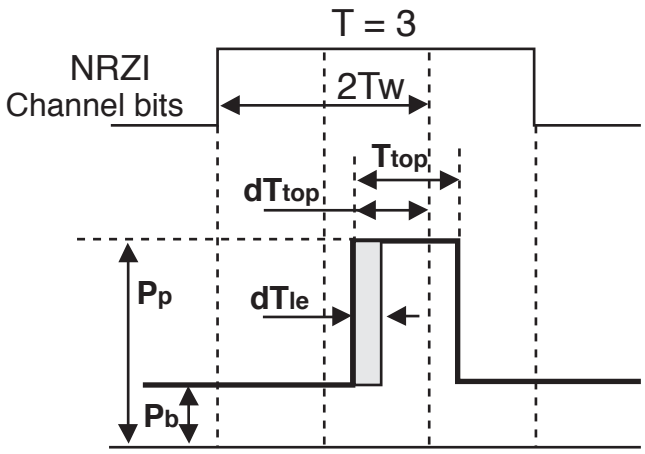
4. Writing Pulse Wave Form of DVD+R

For different speed ranges, different write strategies can be used. This document specifies 2 options:

- a pulsed write strategy, where each single mark is created by a number of subsequent separated short pulses.
- a blocked write strategy, where each single mark is created by one continuous pulse.

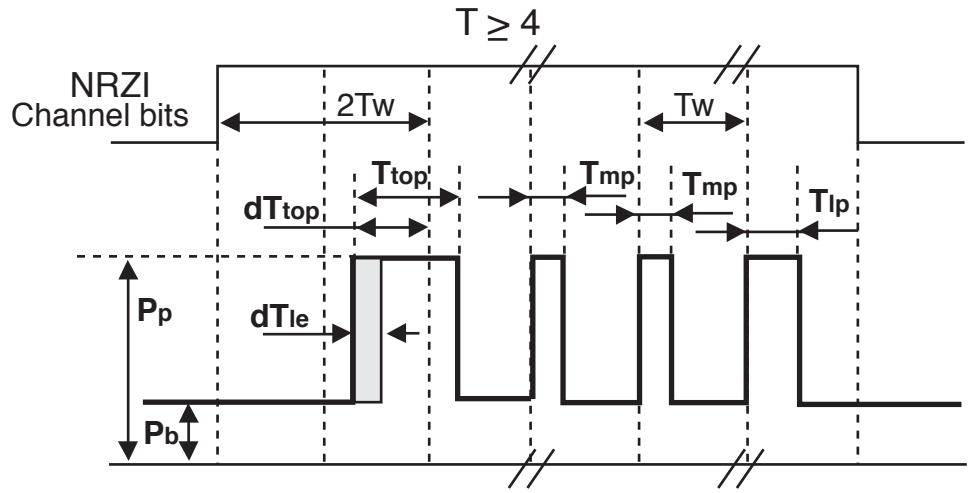
1) 1st Method : Using Pulsed Write Strategy

*** 3T :**



N = 3 : only the top pulse(T_{top}), first pulse lead-time dT_{top} , dT_{le}

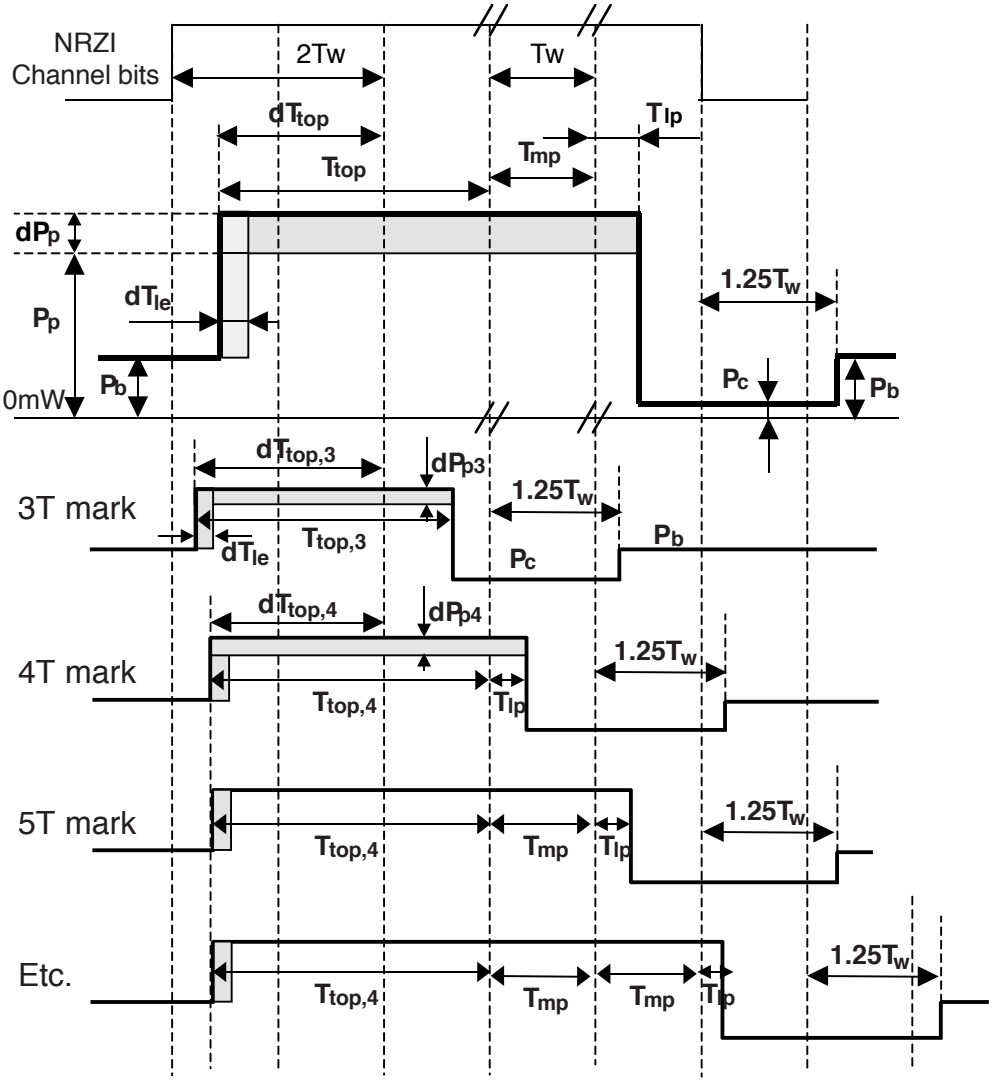
*** ≥ 4T :**



N ≥ 4 : the top pulse (T_{top}), multi-pulse (T_{mp}) and last pulse (T_{lp}), first pulse lead-time dT_{top}, dT_{le}

Pp : Actual write power
Pb : Bias Power

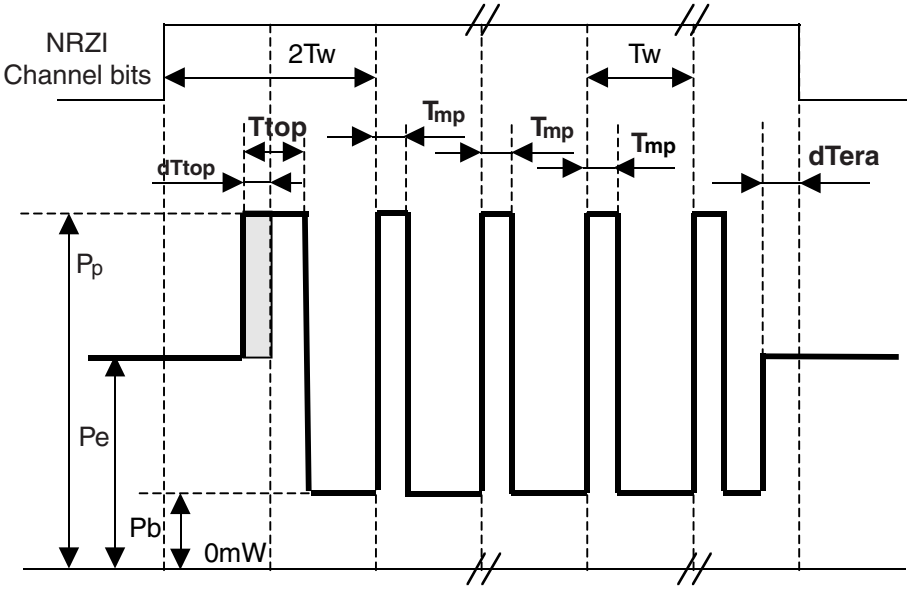
2) 2st Method : Using Blocked Write Strategy



⇨ **N = 3 : T_{top} (cm = 3) can be optimized individually.**
N ≥ 4 : T_{top} (cm ≥ 4) + (N-3) x T_w + T_{lp} , T_w = T_{mp}
P_c shall be < 0.1mW

Pp : Actual write power
Pb : Bias Power
dPp : Additional power (Only be applied for the 3T and 4T marks)
Pc : Cooling power (Especially at higher recording speeds, optimum cooling down of the recording layer after writing a mark may be needed.)

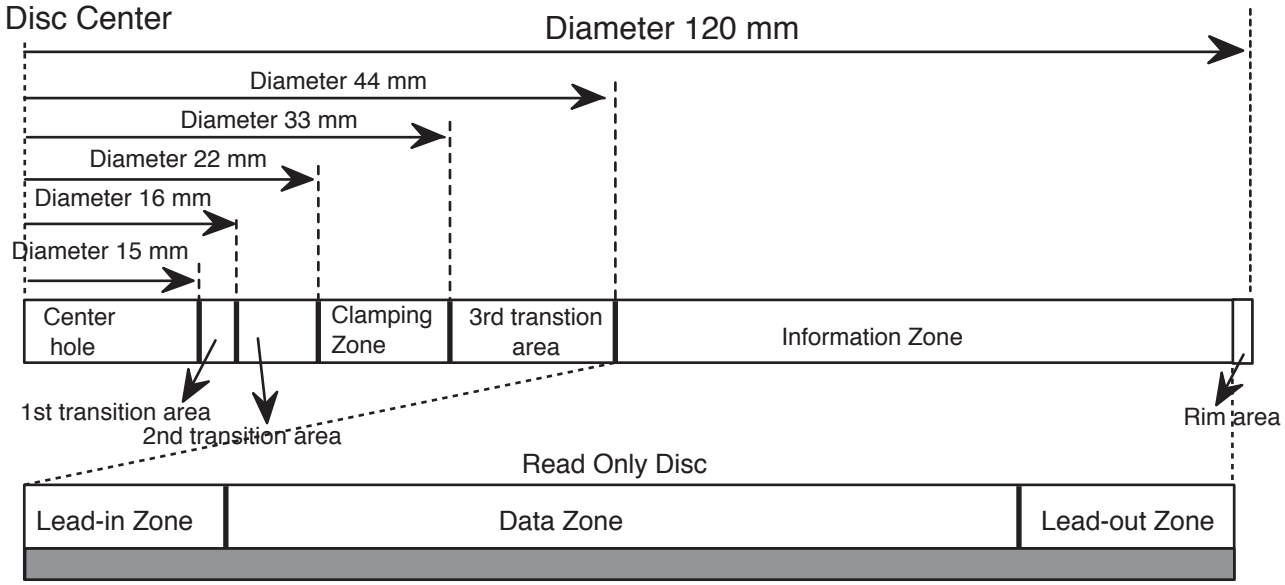
5. Writing Pulse Wave Form of DVD+RW



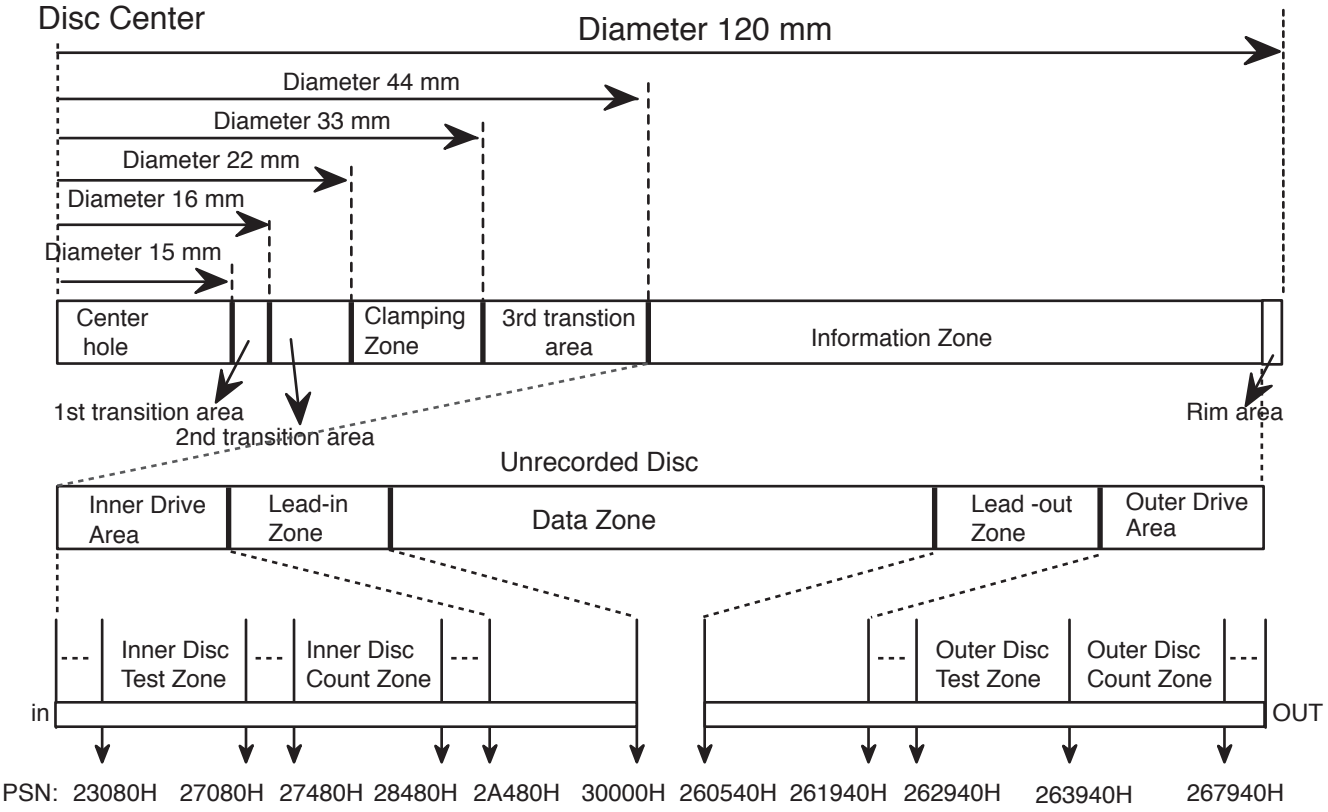
Pp : Actual write power
Pe : Erase Power
Pb : Bias Power

6. Organization of the Inner Drive Area, Outer Drive Area, Lead-in Zone and Lead-out Zone

1) Layout of DVD-ROM disc

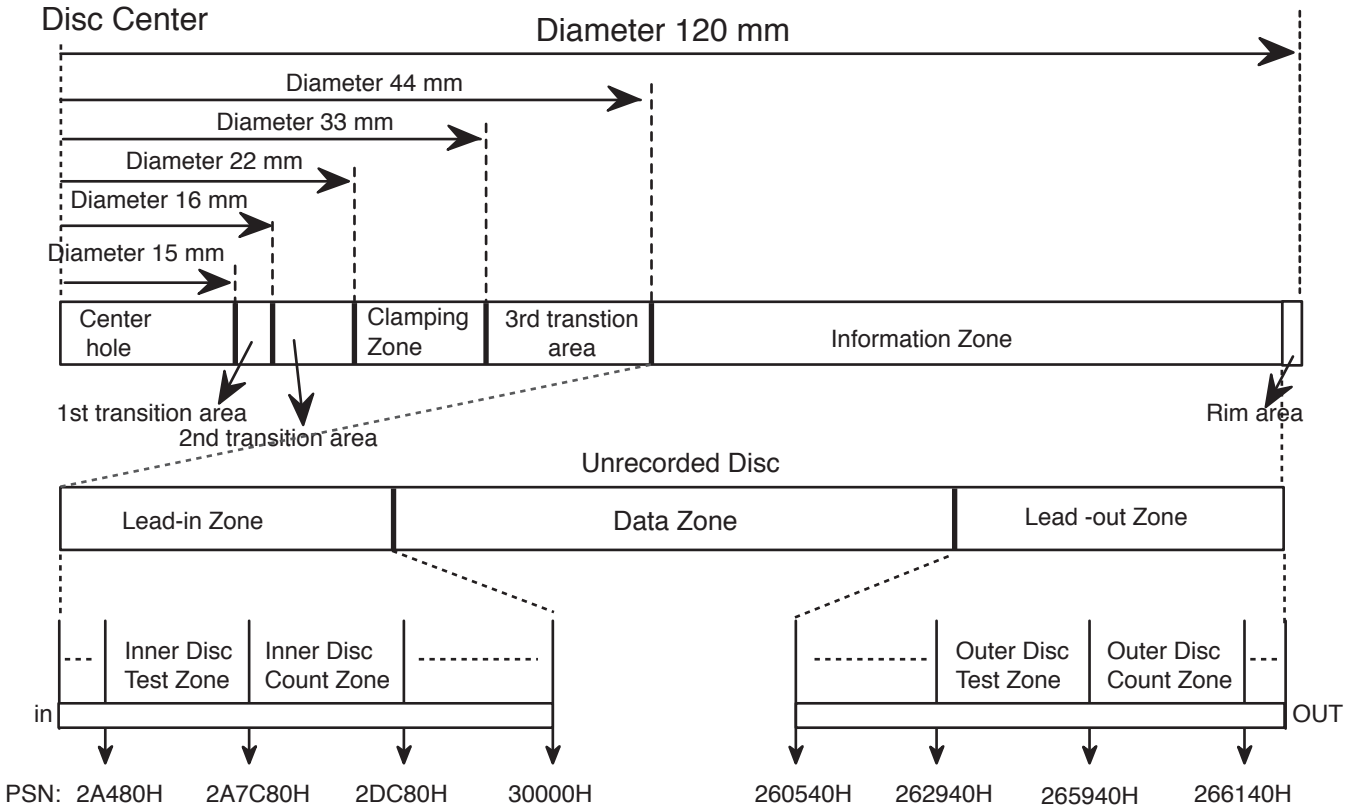


2) Layout of DVD+R disc



> Inner Disc Test Zone : for performing OPC procedures.
> Inner Disc Count Zone : for counting the number of OPC algorithm performed in IDT Zone.
> Outer Disc Test Zone : for performing OPC procedures.
> Outer Disc Count Zone : for counting the mumger of OPC algorithm performed in IDT Zone.

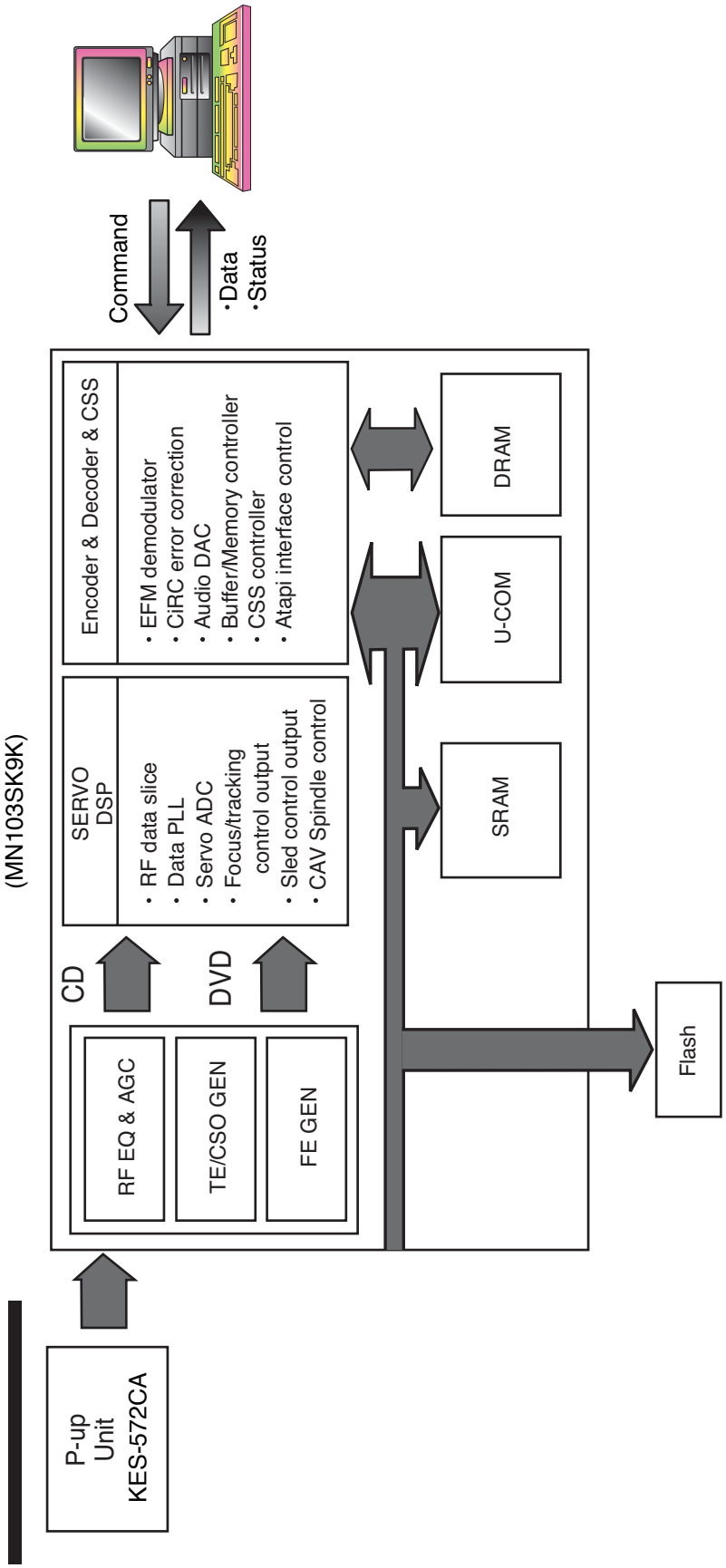
3) Layout of DVD+RW disc



> Inner Disc Test Zone : for performing OPC procedures.
> Inner Disc Count Zone : for counting the number of OPC algorithm performed in IDT Zone.
> Outer Disc Test Zone : for performing OPC procedures.
> Outer Disc Count Zone : for counting the number of OPC algorithm performed in IDT Zone.

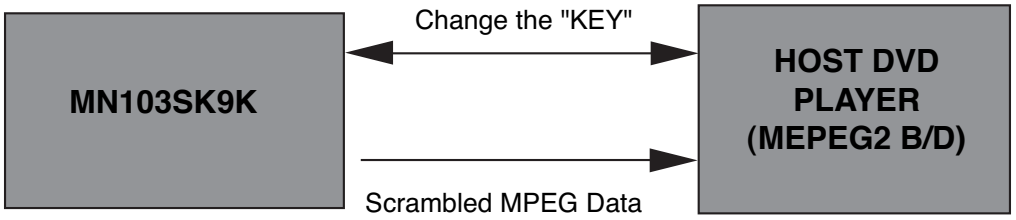
DVD & CD DATA PROCESSING

1. Data Processing Flow



2. Copy Protection and Regional Code Management Block

Block Diagram



KEY Management Control

Brief Process

1. Regional Code for DVD Disc

– DVD-ROM drive transfers the regional code of the control data to host by the command of host, the DVD player of host reads the regional code, and plays title in the case of allowed regional code only.

2. Management of DVD Disc for the scrambled of data

(1) DVD-ROM and DVD player of host generate the “KEY 1” respectively, transfer to opposite part, the “KEY 2” is received, recognizes the data transfer or not with this value, and generates the bus key encoded the data.

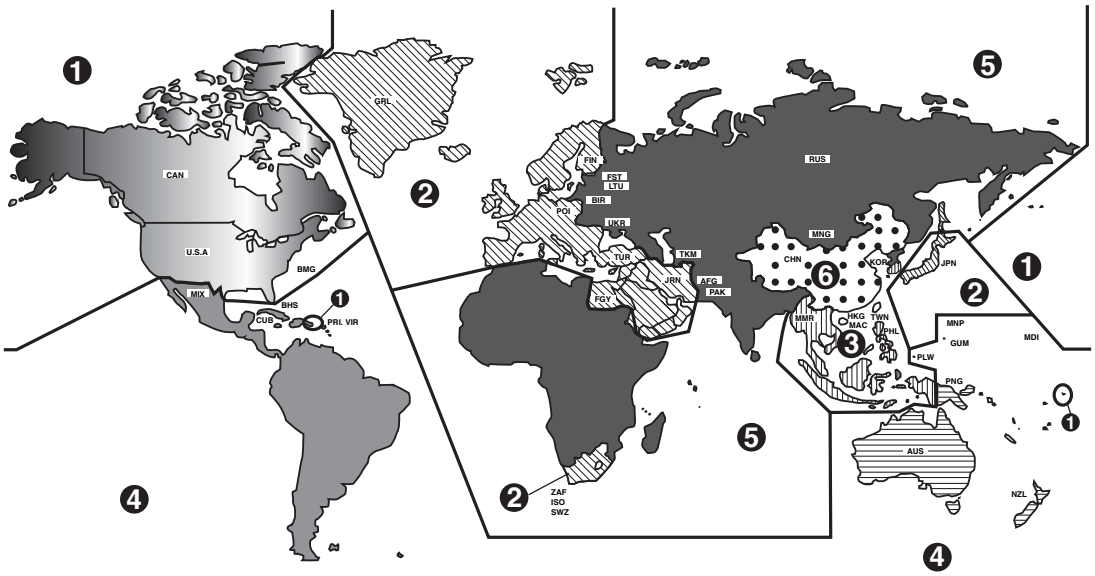
(2) Encoded “Disc Key” and “Title Key” host is transfer with the bus Key.

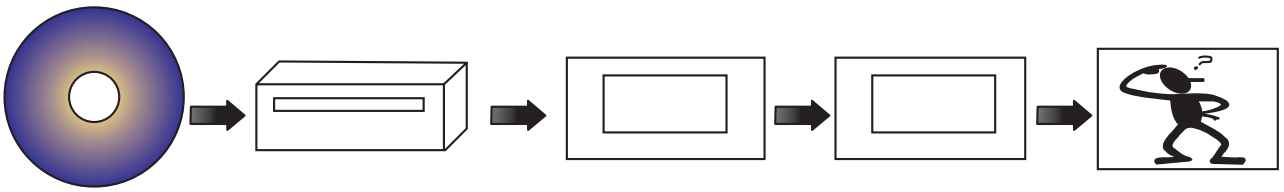
(3) DVD player of host reads the key value, and uses the value to restore the scrambled data.

* Refer to the next page for the details.

3. About the DVD-ROM Regional Code

Regional code





DISC ROM-DRIVE MPEG-2 BOARD VGA CARD MONITOR

The disc has the regional code of 8 bit.

Example)
The disc manufactured in the U.S.A, has the number one.

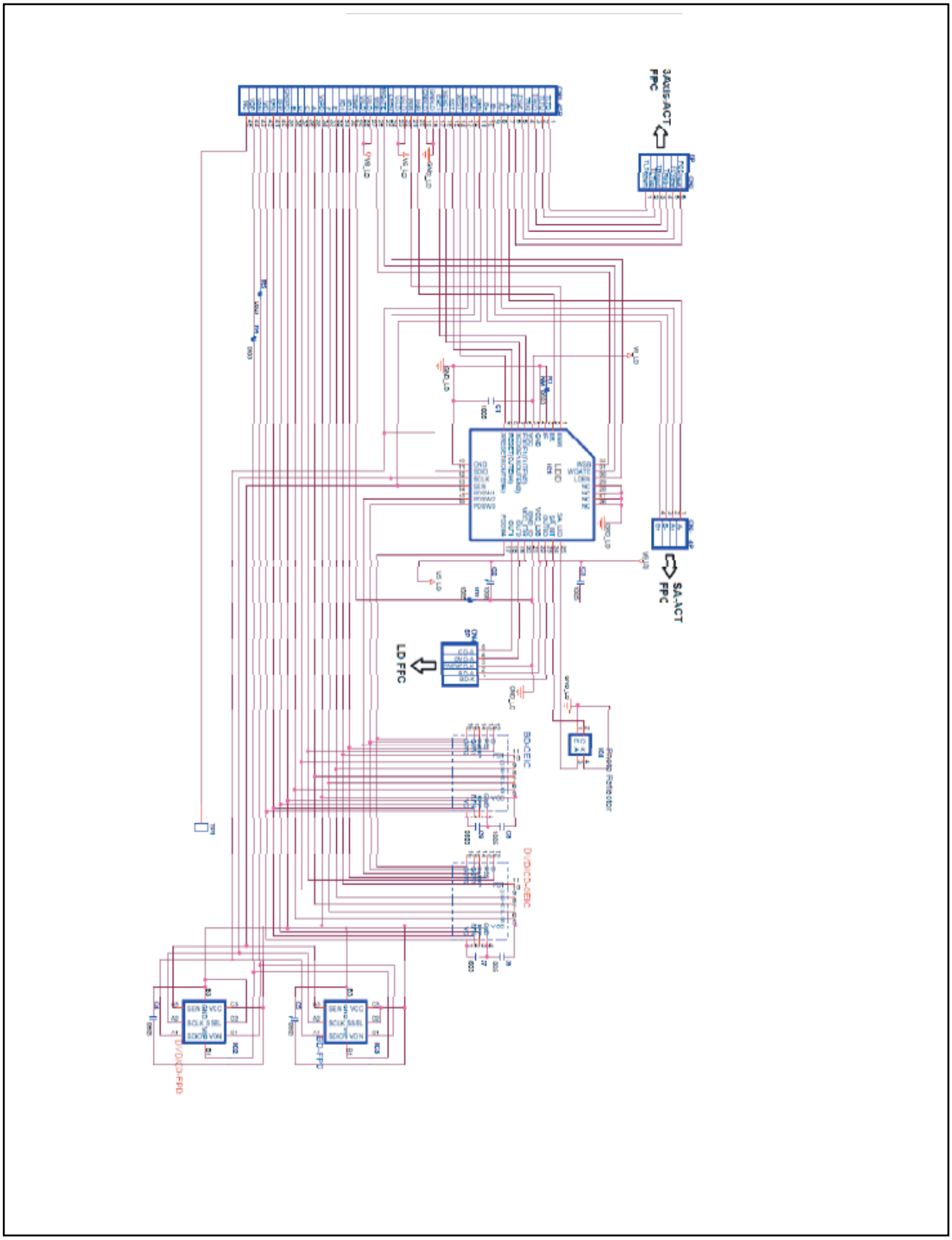
Transfer to MPEG-2 board reading the regional code.

If the board is setting to the regional code 1 for the U.S.A. ...
Check the received regional code to number 1, all or not, transfer the data to VGA card in accordance with only a case among the three case.

Receiving data from the MPEG-2 board and output through the monitor

INTERNAL STRUCTURE OF THE PICK-UP

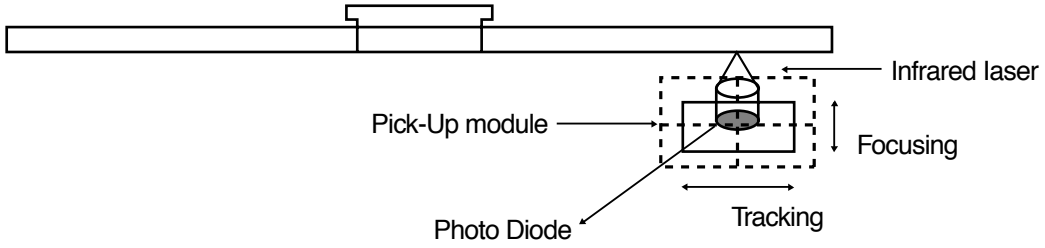
1. Block Diagram of the PICK-UP(KES-572CA)



2. Connector Pin Arrangement

Pin#	Pin Name	I/O	Signal Type	Block	Detail	Explanation
1	TLTD	I	DRIVE	ACT	Tilt	Input + voltage -> OBL Tilt inside Up
2	TLTU	I				Input + voltage -> OBL Tilt outside Up
3	TRKO	I			Tracking	Input + voltage -> OBL shift outer
4	TRKI	I				Input + voltage -> OBL shift inner
5	FCSF	I			Focus	Input + voltage -> Disc far
6	FCSN	I				Input + voltage -> Disc near
7	A-	I	DRIVE	SA	Stepping Motor Input	Terminal A (-)
8	A+	I				Terminal A (+)
9	B-	I				Terminal B (-)
10	B+	I				Terminal B (+)
11	SEN	I	CMOS	SIF	Serial Interface	Serial Interface Enable Signal Input (LDD, FPD)
12	SCLK	I				Serial Interface Clock Signal Input (LDD, FPD)
13	SDIO	I/O				Serial Interface Data Signal Input/Output (LDD, FPD)
14	XRST	I	LVDS	LDD	LVDS Signal	RESET
15	RST	I				
16	XEGE1	I				EDGE1
17	EGE1	I				
18	GNDLD	I	POWER		LDD GND	LDD GND
19						
20	IINR	I	ANALOG		LD setting current	IINR setting current control signal input
21	IINW	I				IINR setting current control signal input
22	V5LD	I	POWER		LDD 5V Power Supply	LDD 5V Power Supply
23						
24	LDEN	I	CMOS		LDD Enable	L : Disable , Power Save (All of LD Output) (The value of Register is maintained)
25	WGATE	I			Read/Write timing Signal	L : Read Enable, H : Write Enable
26	WSB	I			Bank Select Signal	
27	V8LD	I	POWER		LD 8V Power Supply	8V Power Supply for BD Laser Drive
28						
29	TEMP	O	ANALOG	THERM	Temperature detection Output	Temperature detection Output (Thermistor side) (Other side connect with GND in OP) In use, resistance connection is necessary
30	PD2	O	ANALOG	OEIC & FPD	OEIC Servo Signal	Servo Signal Output Reference Voltage = VC
31	PD1	O				
32	E	O				
33	F	O				
34	V5PD	I	POWER		OEIC/FPD 5V Power Supply	OEIC/FPD Common 5V Power Supply
35	A	O	ANALOG		OEIC Servo Signal	Servo Signal Output Reference Voltage = VC
36	C	O				
37	D	O				
38	B	O				
39	GNDPD	I	POWER		OEIC/FPD GND	OEIC/FPD Common GND
40	RFP	O	ANALOG		OEIC RF Output	RF Output Differential Output(P) Vc : 1.6V
41	RFN	O				RF Output Differential Output(N) Vc : 2.9V
42	VC	I			OEIC Vc	OEIC Vc 1.9V or 2.2V
43	VON	O			Front Monitor Output	Front Monitor Output Differential Output(N) Vc : 2V
44	VOP	O				Front Monitor Output Differential Output(P) Vc : 2V
45	NC	-				

3. Signal detection of the P/U



1) Focus Error Signal ==> E-F

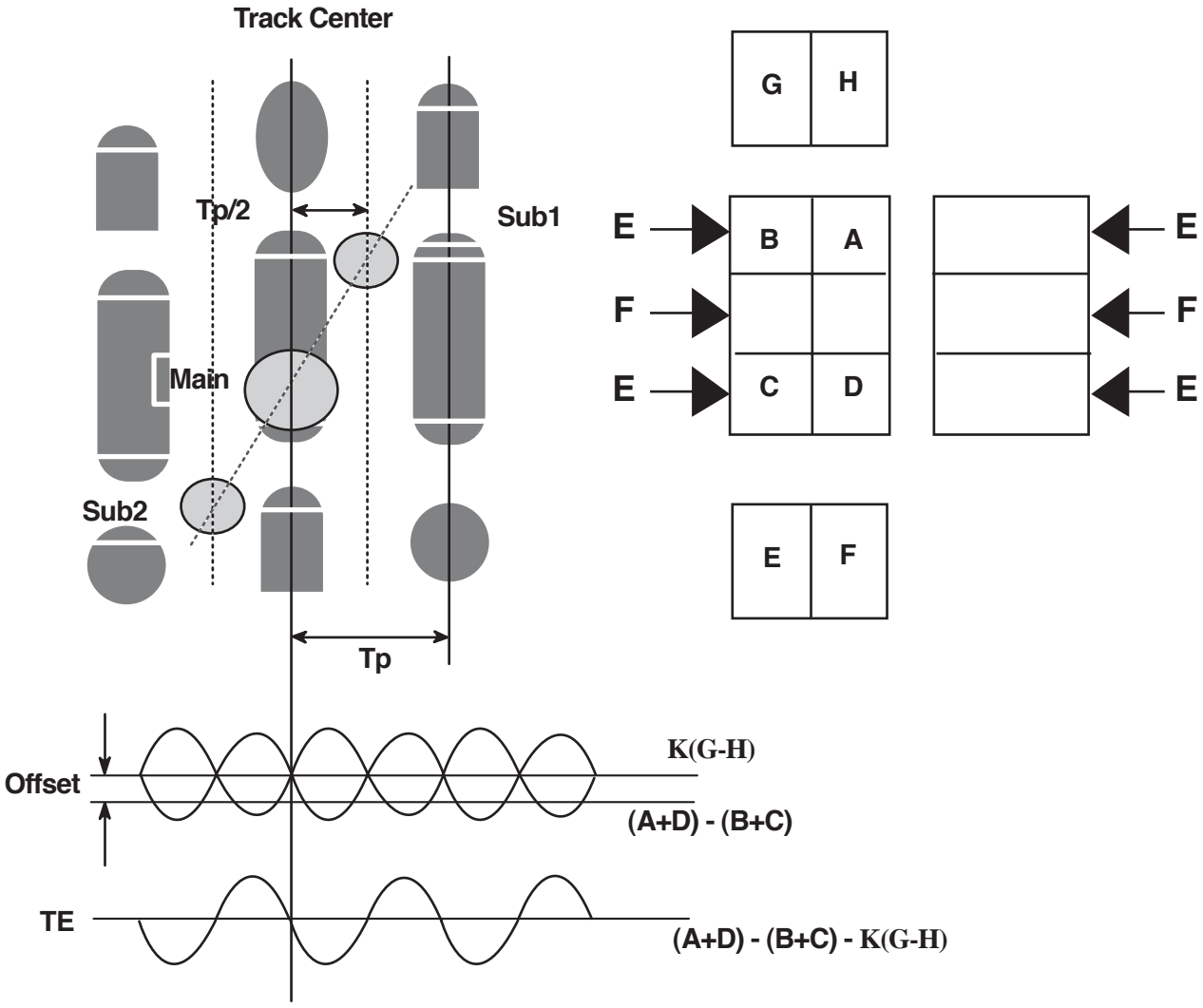
This signal is generated in RF IC (IC101 : MN103SK9K) and controls the pick-up's up and down to focus on Disc.

2) Tracking Error Signal (DPP Method) ==> {(A+D)-(B+C)}- k x (G-H)

This signal is generated in RF IC (IC101 : MN103SK9K) and controls the pick-up's left and right shift to find to track on Disc.

3) RF Signal ==> (A+B+C+D)

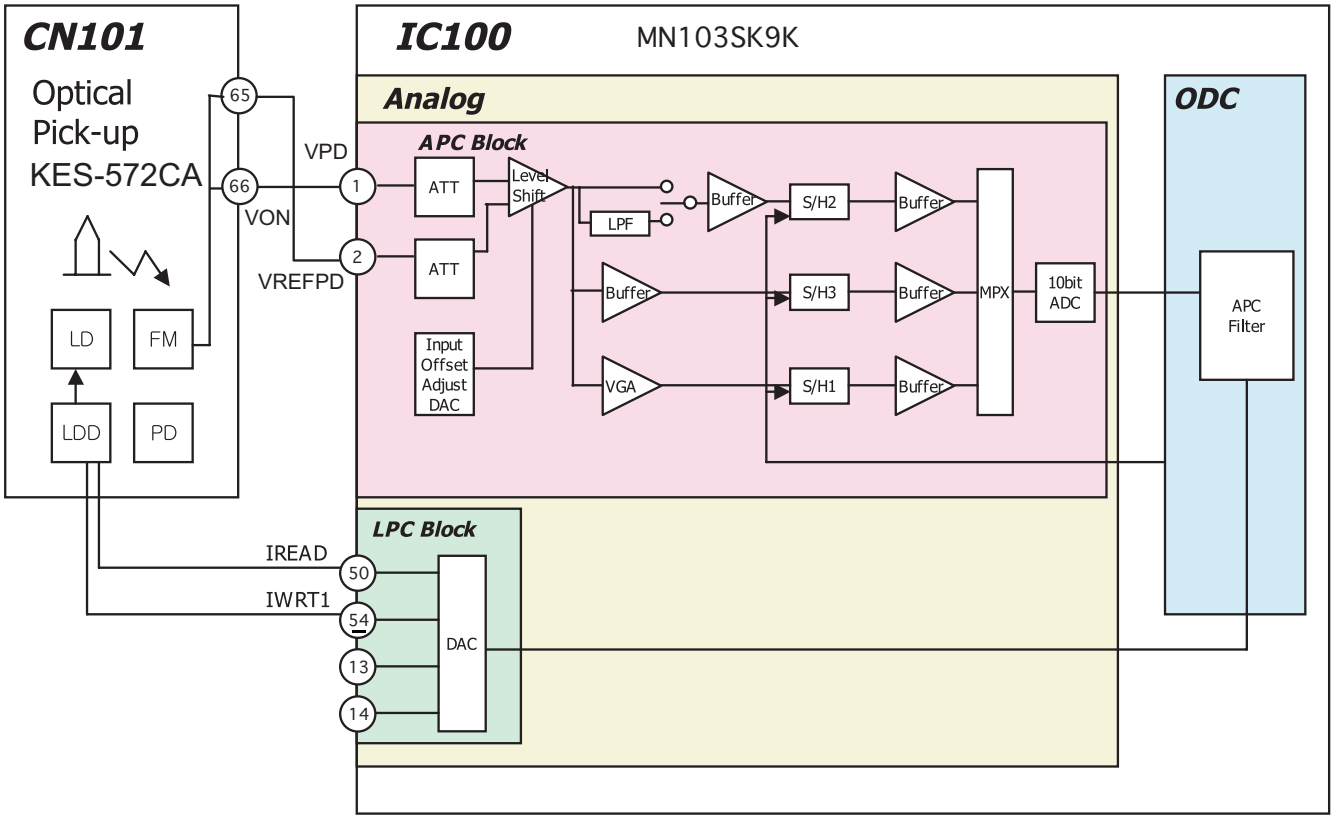
This signal is converted to DATA signal in DSP IC (IC101 : MN103SK9K).



DESCRIPTION OF CIRCUIT

1. ALPC (Automatic Laser Power Control) Circuit

1-1. Block Diagram

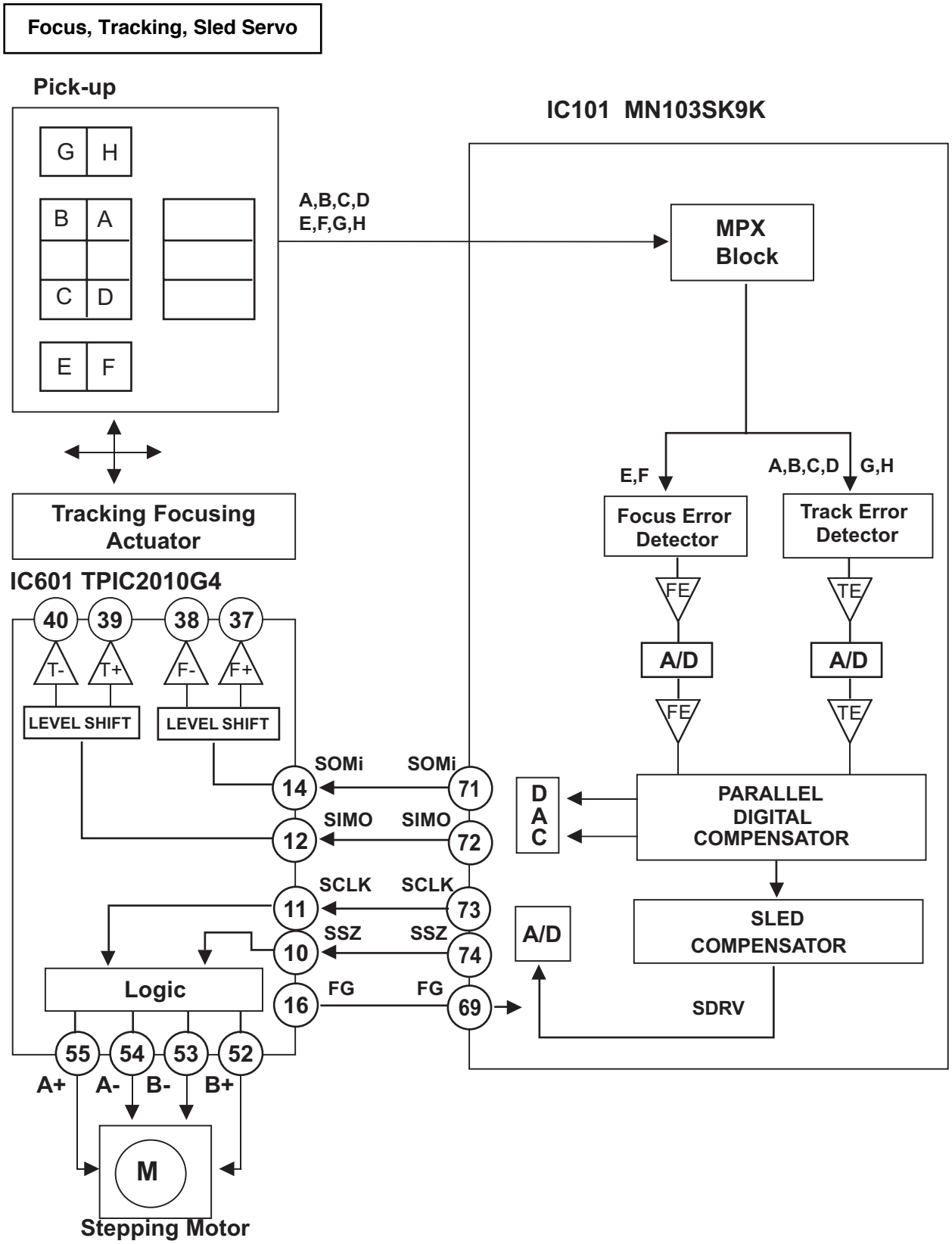


1-2. ALPC (Automatic Laser Power Control) Circuit Operation

The ALPC block detects the laser output power of the front monitor. The power signal detected with the PD for front monitor detection is input the voltage from the VPD pin(1Pin), and VREFPD pin(2pin). These two signals are differential. The ALPC block generates the singals from the input laser power signals in the following detection systems. This block has four detection paths:All average value path, multi pulse average/peak value detection path, erase/bottom value detection path, space/playback power value detection path.

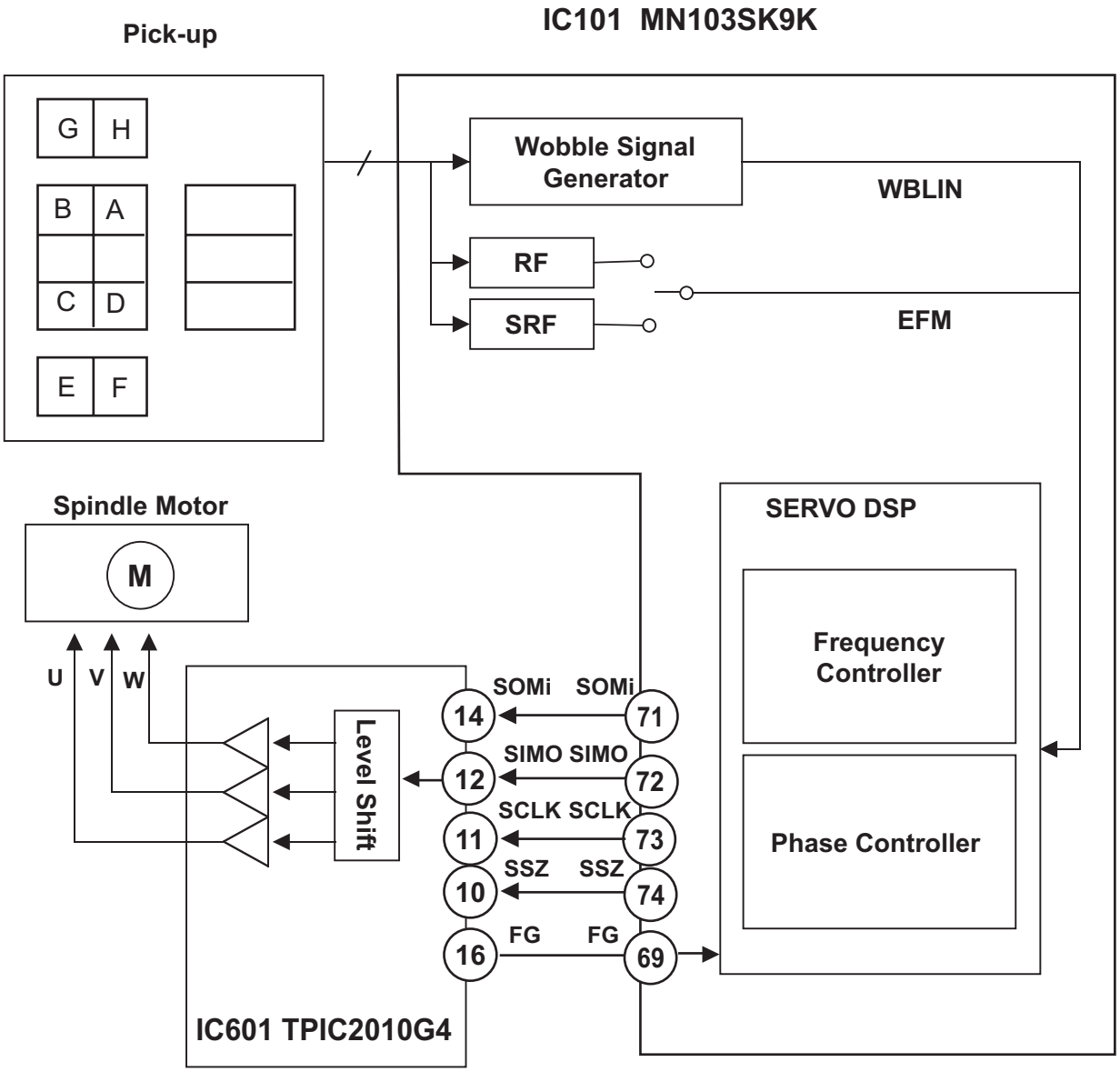
2. Focus/Tracking/Sled Servo Circuit

2-1. Focus, Tracking & Sled Servo Process



3. Spindle Servo Circuit

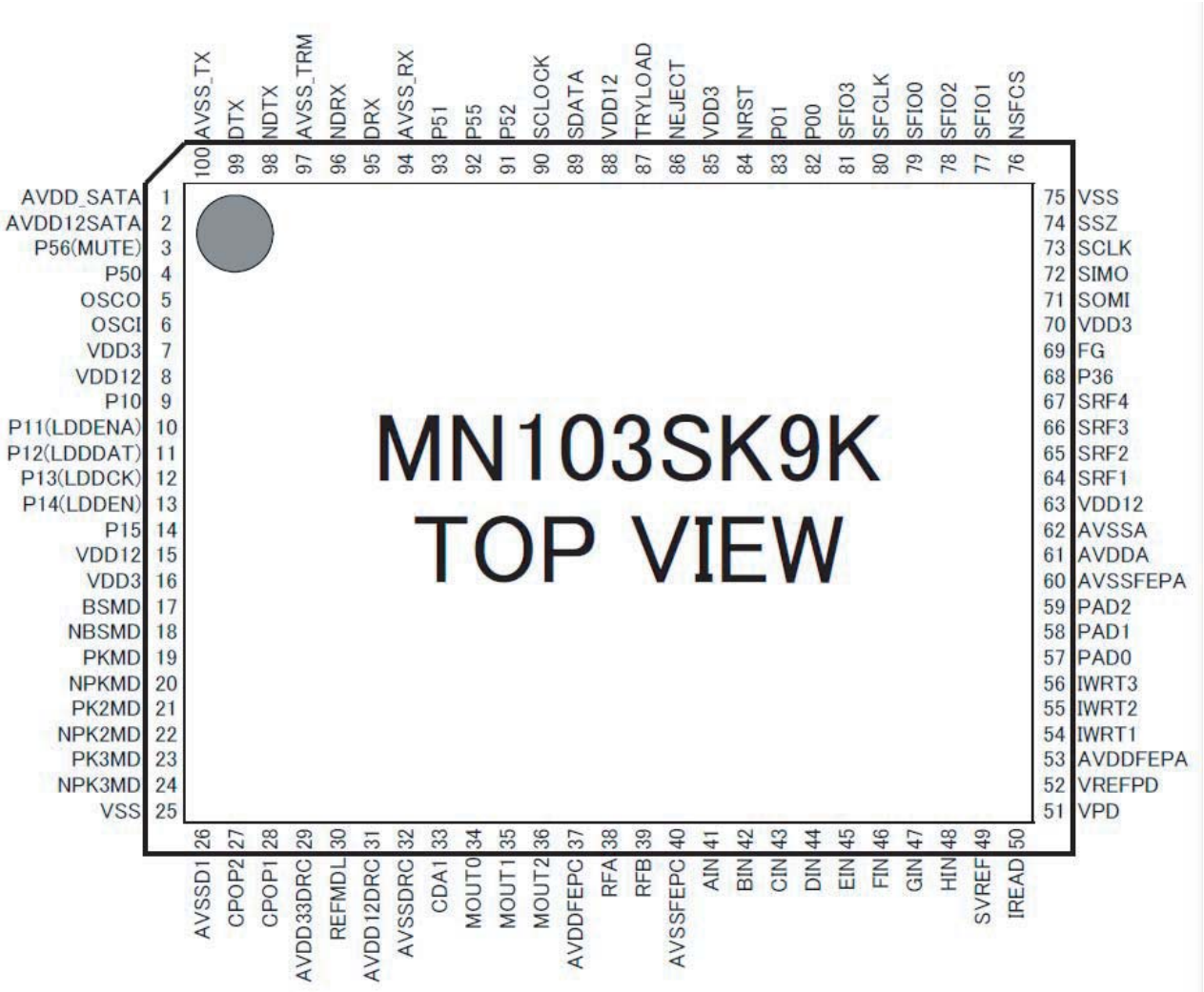
3-1. Spindle Servo Process



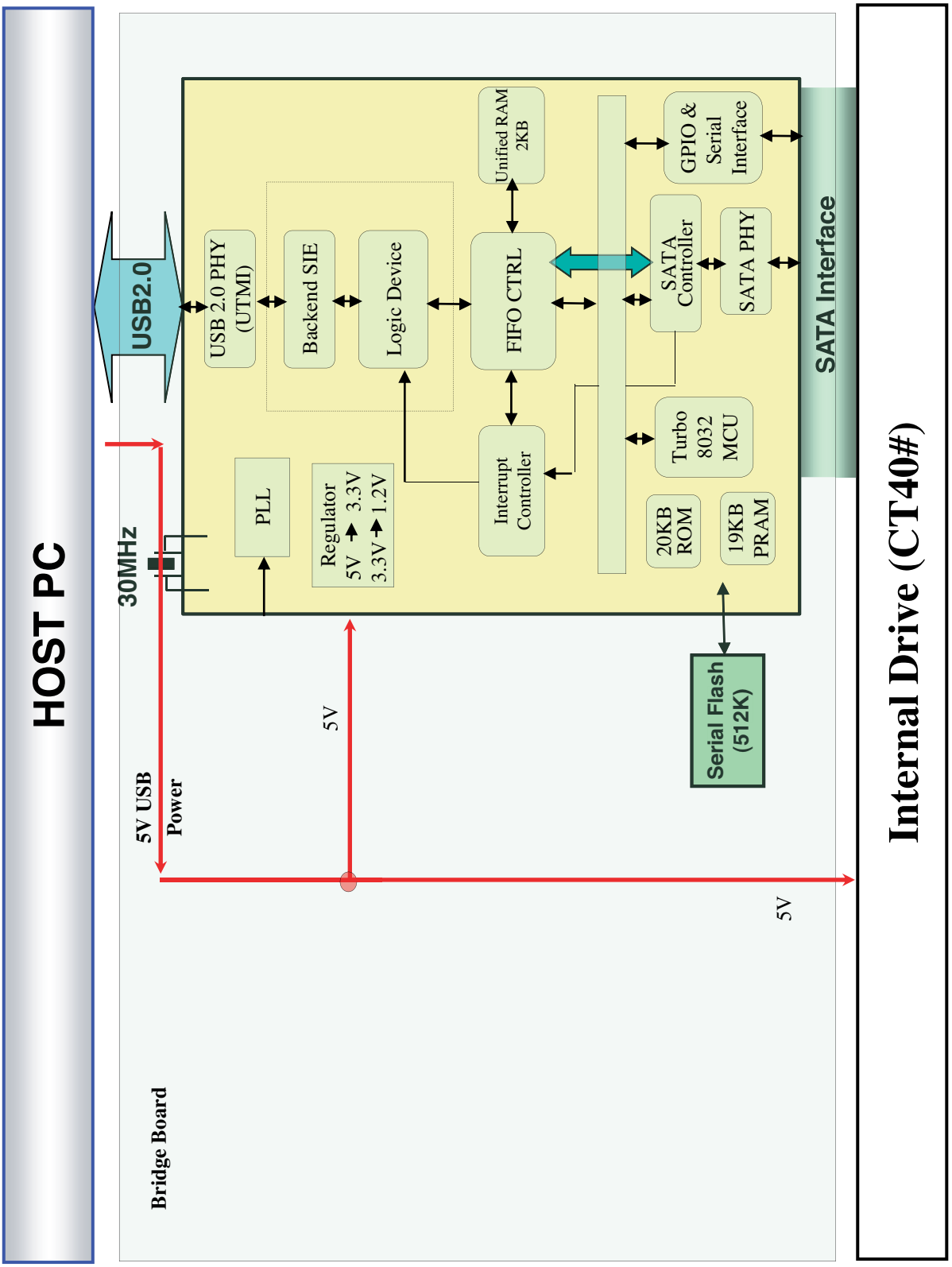
MAJOR IC INTERNAL BLOCK DIAGRAM AND PIN DESCRIPTION

IC101 (MN103SK9K) : Optical Disc controller for DVD-RAM/R/RW, BD-R/RE

- **Pin Assignment**



Block Diagram (MN103SK9K)



List of Pins

Pin No	Pin Name	I/O	Connection Target	General-Purpose port	Description
1	AVDD_SATA	Power supply	Power supply	-	S-ATA analog power supply (3.3 V)
2	AVDD12SATA	Power supply	Power supply	-	S-ATA analog power supply (1.2 V)
3	P56(MUTE)	I/O	-	P56	General-purpose port P56/MONI
4	P50	I/O	-	P50	General-purpose port P50/MONI/DRCMONI3/SGIO0
5	OSCO	O	Oscillator	-	Oscillation output
6	OSCI	I	Oscillator	-	Oscillation input (33.8688MHz)
7	VDD3	Power supply	Power supply	-	I/O pin V_{DD} (3.3 V)
8	VDD12	Power supply	Power supply	-	Internal logic V_{DD} (1.2 V)
9	P10	I/O	-	P10	General-purpose port P10/MONI/HFON/SH5/External interrupt
10	P11 (LDDENA)	I/O	-	P11	General-purpose port P11/MONI/LDDENA
11	P12 (LDDDAT)	I/O	-	P12	General-purpose port P12/LDDDAT/I2C-SDA
12	P13 (LDDCK)	I/O	-	P13	General-purpose port P13/LDDCK/I2C-SCL
13	P14 (LDDEN)	I/O	-	P14	General-purpose port P14/LDDEN
14	P15	I/O	-	P15	General-purpose port P15/PWM2
15	VDD12	Power supply	Power supply	-	Internal logic V_{DD} (1.2 V)
16	VDD3	Power supply	Power supply	-	I/O pin V_{DD} (3.3 V)
17	BSMD	I/O	OPU	P60	BSDM modulation signal differential current output/General-purpose port P60
18	NBSMD	I/O	OPU	P61	NBSDM modulation signal differential current output/General-purpose port P61
19	PKMD	I/O	OPU	P62	PEAK modulation signal differential current output/General-purpose port P62
20	NPKMD	I/O	OPU	P63	NPEAK modulation signal differential current output/General-purpose port P63
21	PK2MD	I/O	OPU	P64	PEAK2 modulation signal differential current output/General-purpose port P64
22	NPK2MD	I/O	OPU	P65	NPEAK2 modulation signal differential current output/General-purpose port P65
23	PK3MD	I/O	OPU	P26	PEAK3 modulation signal differential current output/General-purpose port P26/MONI/TGCHG
24	NPK3MD	I/O	OPU	P27	NPEAK3 modulation signal differential current output/General-purpose port P27/MONI/SGIO0
25	VSS	GND	GND	-	Digital V_{SS}
26	AVSSD1	GND	GND	-	Wobble analog V_{SS}
27	CPOP2	I/O	Cap,Res	-	Filter connection for wobble PLL
28	CPOP1	I/O	Cap,Res	-	Filter connection for wobble PLL
29	AVDD33DRC	Power supply	Power supply	-	DRC analog-to-digital converter analog V_{DD} (3.3 V)
30	REFMDL	O	Cap	-	DRC analog-to-digital converter reference voltage
31	AVDD12DRC	Power supply	Power supply	-	DRC analog-to digital converter analog V_{DD} (1.2 V)
32	AVSSDRC	GND	GND	-	Analog V_{SS}
33	CDA1	O	Cap	-	Smoothing capacitor connection for DRC-VCO
34	MOUT0	O	-	-	Analog monitor 0
35	MOUT1	O	-	-	Analog monitor 1
36	MOUT2	O	-	-	Analog monitor 2
37	AVDDFEPC	Power supply	Power supply	-	FEP analog V_{DD} (3.3 V)
38	RFA	I	OPU,Cap	-	RF differential input 1
39	RFB	I	OPU,Cap	-	RF differential input 2
40	AVSSFEPC	GND	GND	-	FEP analog V_{SS}
41	AIN	I	OPU	-	Main input
42	BIN	I	OPU	-	Main input
43	CIN	I	OPU	-	Main input
44	DIN	I	OPU	-	Main input

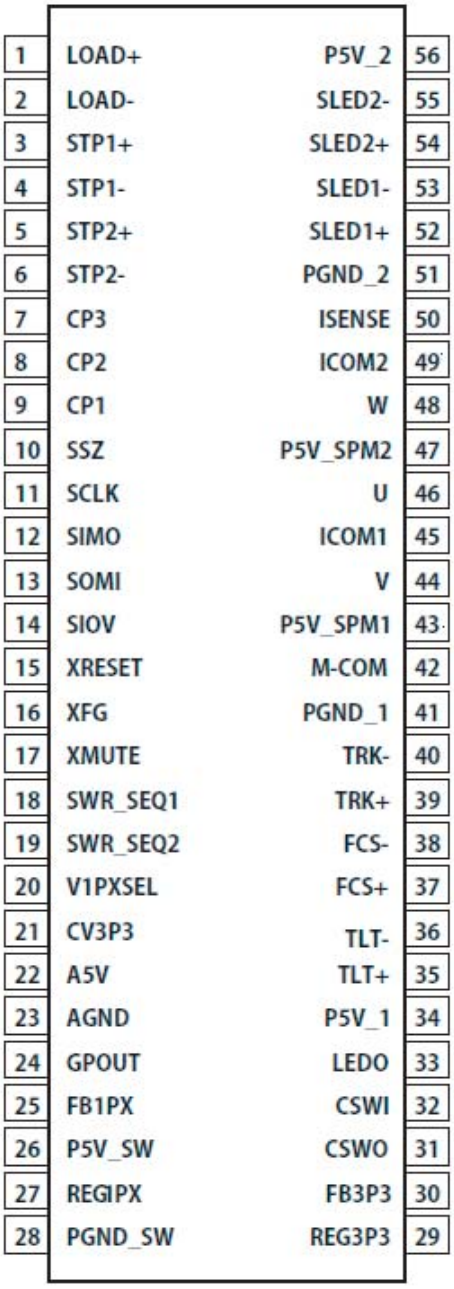
Pin No	Pin Name	I/O	Connection Target	General-Purpose port	Description
45	EIN	I	OPU	-	Sub input
46	FIN	I	OPU	-	Sub input
47	GIN	I	OPU	-	Sub input
48	HIN	I	OPU	-	Sub input
49	SVREF	O	-	-	Reference voltage output (1.65 V / 1.9 V / 2.2 V)
50	IREAD	O	OPU	-	READ DAC current output

Pin No	Pin Name	I/O	Connection Target	General-Purpose port	Description
51	VPD	I/O	OPU	-	Front monitor signal input (Neg)/ Reference voltage output 2.5 V (Single)
52	VREFPD	I	OPU	-	Front monitor reference voltage input (Pos)/Front monitor signal input
53	AVDDFEPA	Power supply	Power supply	-	FEP analog V_{DD} (3.3 V)
54	IWRT1	I/O	OPU	P20	WRITE DAC current output 1/General-purpose port P20/PWM0
55	IWRT2	I/O	OPU	P21	WRITE DAC current output 2/General-purpose port P21/LSEN2 (spherical aberration correction stepping motor default position detection signal)/PWM1
56	IWRT3	I/O	OPU	P22	WRITE DAC current output 3/General-purpose port P22/PWM2
57	PAD0	I/O	-	P23	General-purpose analog-to-digital input 0/General-purpose port P23/PWM3
58	PAD1	I/O	-	P24	General-purpose analog-to-digital input 1/General-purpose port P24
59	PAD2	I/O	-	P25	General-purpose analog-to-digital input 2/General-purpose port P25/ External interrupt
60	AVSSFEPA	GND	GND	-	FEP analog V_{SS}
61	AVDDA	Power supply	Power supply	-	Servo analog-to-digital converter analog V_{DD} (3.3 V)
62	AVSSA	GND	GND	-	Servo analog-to-digital converter analog V_{SS}
63	VDD12	Power supply	Power supply	-	Internal logic V_{DD} (1.2 V)
64	SRF1	I/O	OPU	P32	OEIC control signal 1/General-purpose port P32
65	SRF2	I/O	OPU	P33	OEIC control signal 2/General-purpose port P33
66	SRF3	I/O	OPU	P34	OEIC control signal 3/General-purpose port P34
67	SRF4	I/O	OPU	P35	OEIC control signal 4/General-purpose port P35
68	P36	I/O	-	P36	General-purpose port P36/MONI/SGIO1
69	FG	I/O	DRIVER	P40	Spindle FG input/MONI/General-purpose port P40
70	VDD3	Power supply	Power supply	-	I/O pin V_{DD} (3.3 V)
71	SOMI	I	DRIVER	-	Serial Driver to SODC Data
72	SIMO	O	DRIVER	-	Serial Driver from SODC Data
73	SCLK	O	DRIVER	-	Serial Driver Clock
74	SSZ	O	DRIVER	-	Serial Driver Enable
75	VSS	GND	GND	-	Digital V_{SS}
76	NSFCS	O	FlashROM	-	Serial Flash Memory Chip Select
77	SFIO1	I/O	FlashROM	-	Serial Flash Memory Serial Data1 Input/Output
78	SFIO2	I/O	FlashROM	-	Serial Flash Memory Serial Data2 Input/Output
79	SFIO0	I/O	FlashROM	-	Serial Flash Memory Serial Data0 Input/Output
80	SFCLK	O	FlashROM	-	Serial Flash Memory Serial Clock
81	SFIO3	I/O	FlashROM	-	Serial Flash Memory Serial Data3 Input/Output
82	P00	I/O	-	P00	General-purpose port P00/MONI/DRCMONI2/EXTRG0/PWM0/RxD0
83	P01	I/O	-	P01	General-purpose port P01/MONI/DRCMONI1/PWM1/TxD0
84	NRST	I	Reset IC	-	Reset input (Power-on reset)
85	VDD3	Power supply	Power supply	-	I/O pin V_{DD} (3.3 V)
86	NEJECT	I/O	Mecha	P16	Neject signal (SODC external interrupt)/General-purpose port P16/MONI/DRCMONI6/External interrupt
87	TRYLOAD	I/O	Mecha	P17	Tray load signal (SODC external interrupt)/General-purpose port P17/MONI/DRCMONI5/External interrupt
88	VDD12	Power supply	Power supply	-	Internal logic V_{DD} (1.2 V)
89	SDATA	I/O	-	P03	Debugger data/General-purpose port P03/MONI/DRCMONI0/TxD1
90	SCLOCK	I/O	-	P02	Debugger clock/General-purpose port P02/MONI/DRCMONICLK/RxD1
91	P52	I/O	-	P52	General-purpose port P52/MONI/DRCMONI7/LSEN2 (spherical aberration correction stepping motor default position detection signal)/EXTRG1/CLK1/PWM3/External interrupt
92	P55	I/O	-	P55	General-purpose port P55/MONI/External interrupt
93	P51	I/O	-	P51	General-purpose port P51/MONI/DRCMONI4/OUTR (Traverse inner rim SW)/CLK0/External interrupt
94	AVSS_RX	GND	GND	-	S-ATA analog ground
95	RRX	I	SATA		Receive signal (normal)
96	NRRX	I	SATA		Receive signal (inverted)

Pin No	Pin Name	I/O	Connection Target	General-Purpose port	Description
97	AVSS_TRM	GND	GND	-	S-ATA analog ground
98	NDTX	O	SATA	-	Device transmit signal (inverted)
99	DTX	O	SATA	-	Device transmit signal (normal)
100	AVSS_TX	GND	GND	-	S-ATA analog ground

IC601 (TPIC2010G4) : System Motor Driver IC

1.1. Block Diagram

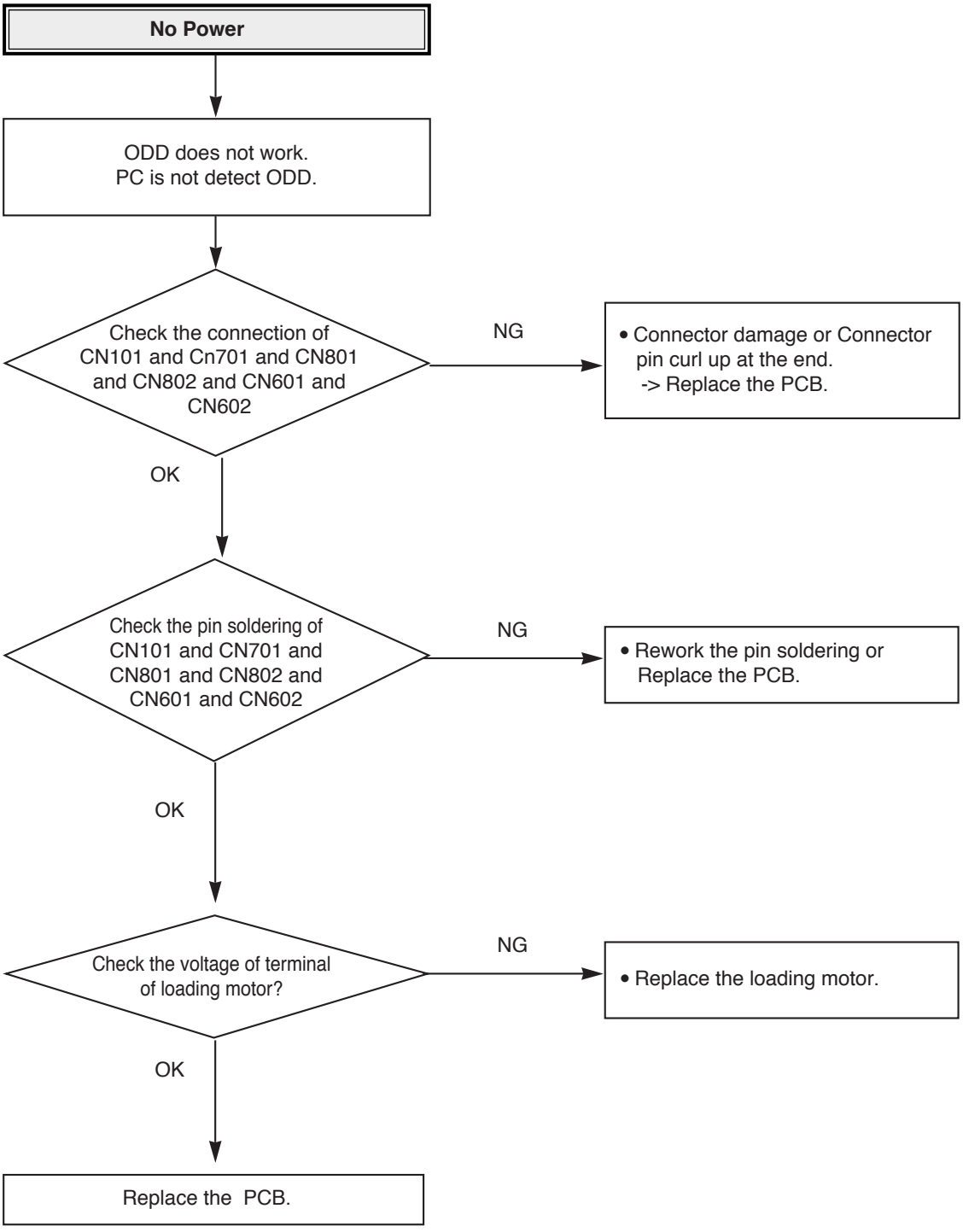


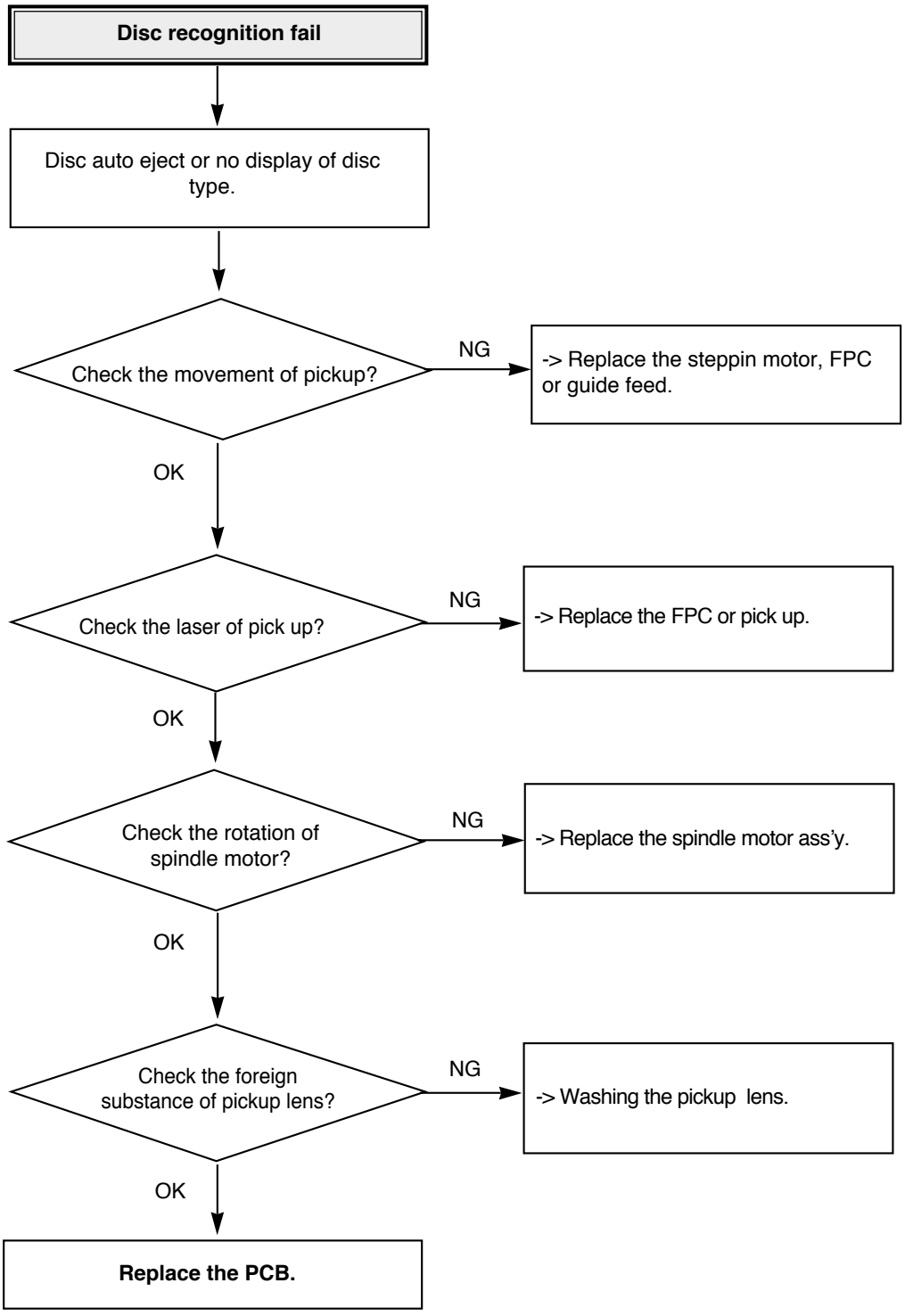
1.2 Pin Function

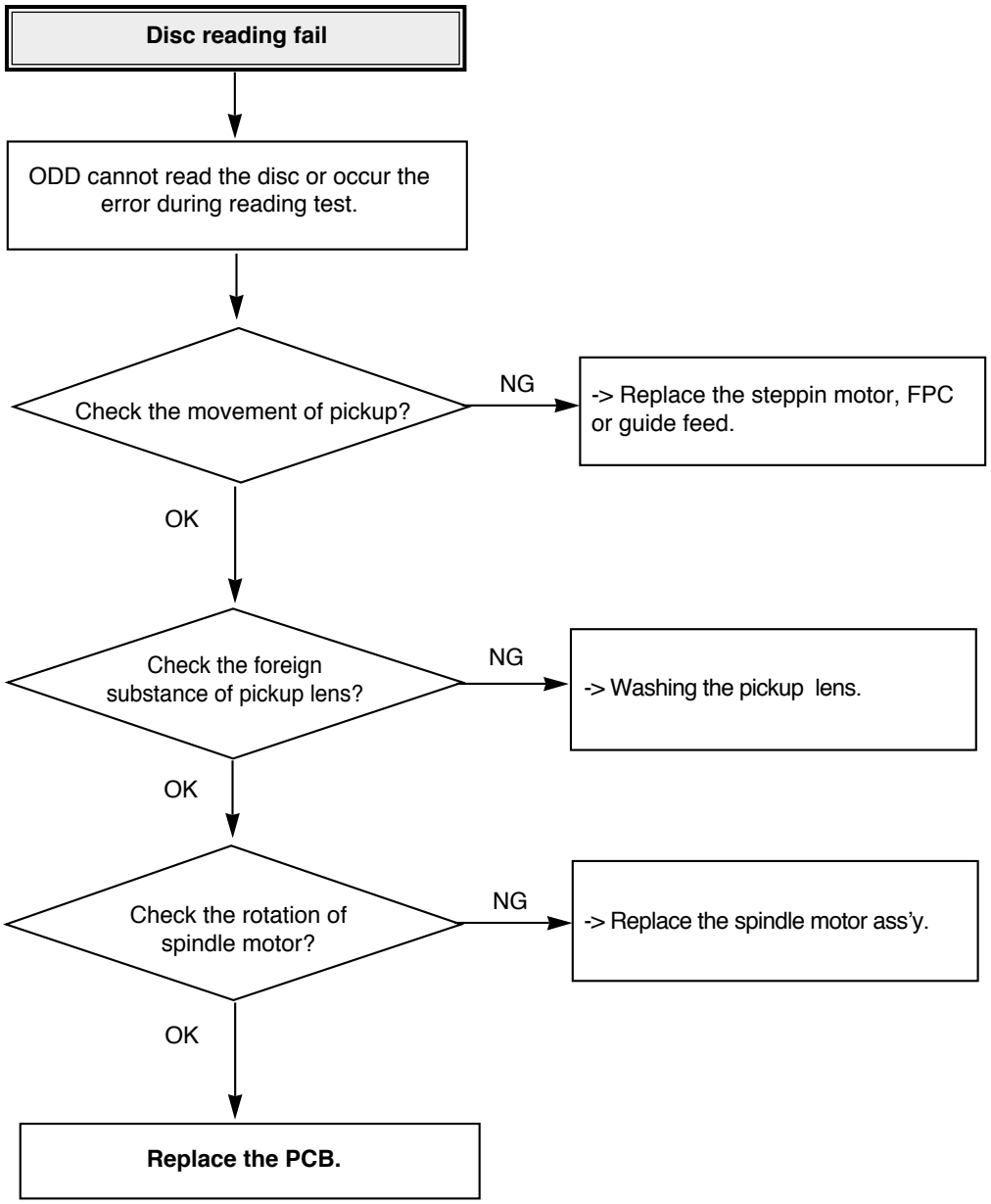
No	Name	I/O	description
1	LOAD+	OUT	Load positive output terminal
2	LOAD-	OUT	Load negative output terminal
3	STP1+	OUT	STP1 positive output terminal for collimator
4	STP1-	OUT	STP1 negative output terminal for collimator
5	STP2+	OUT	STP2 positive output terminal for collimator
6	STP2-	OUT	STP2 negative output terminal for collimator
7	CP3	MISC	Capacitance connection for Charge Pump
8	CP2	MISC	Capacitance connection for Charge Pump
9	CP1	MISC	Capacitance connection for Charge Pump
10	SSZ	IN	SIO Slave Select Low active input terminal
11	SCLK	IN	SIO Serial clock input terminal
12	SIMO	IN	SIO Slave Input Master Output terminal
13	SOMI	OUT	SIO Slave Output Master Input terminal
14	SIOV	PS	Power supply terminal for Serial Port 3.3V typical
15	XRESET	OUT	Power on reset output Internally pulled up to SIOV
16	XFG	OUT	Motor speed signal output, internally pulled up to SIOV
17	XMUTE	IN	XMUTE input terminal to reset the driver IC (optional)
18	SWR_SEQ1	IN	Internal DC/DC converter startup up sequence setting
19	SWR_SEQ2	IN	Internal DC/DC converter startup up sequence setting
20	V1PXSEL	IN	V1Px output voltage setting
21	CV3P3	MISC	Capacitance terminal for internal 3.3V core
22	A5V	PS	Power supply terminal for internal logic 5V
23	AGND	PS	Ground terminal for internal logic
24	GPOUT	OUT	General Purpose Output (Test monitor)
25	FB1PX	IN	Feed back input terminal for 1PX converter
26	P5V_SW	PS	Power supply terminal for DCDC converters
27	REG1PX	OUT	REG1PX DCDC converter switching output (GPOUT1)
28	PGND_SW	PS	GND terminal for DCDC converters
29	REG3P3	OUT	REG3P3 DCDC converter switching output terminal (GPOUT2)
30	FB3P3	IN	Feed Back input terminal for 3.3V DCDC converter
31	CSWO	OUT	Power switch output for 5V OEIC in OPU
32	CSWI	PS	Power supply terminal for 5V OEIC power switch
33	LEDO	OUT	LED output terminal
34	P5V_1	PS	Power supply terminal for TI/F/T drivers
35	TLT+	OUT	Tilt positive output terminal
36	TLT-	OUT	Tilt negative output terminal
37	FCS+	OUT	Focus positive output terminal
38	FCS-	OUT	Focus negative output terminal
39	TRK+	OUT	Tracking positive output terminal
40	TRK-	OUT	Tracking negative output terminal
41	PGND_1	PS	GND terminal for Ti/F/T channel drivers
42	M-COM	IN	Motor center tap connection
43	P5V_SPM1	PS	Power supply terminal for Spindle driver
44	V	OUT	V phase output terminal for spindle motor
45	ICOM1	MISC	Current sense resister terminal for spindle driver
46	U	OUT	U phase output terminal for spindle motor
47	P5V_SPM2	PS	Power supply input for Spindle driver
48	W	OUT	W phase output terminal for spindle motor
49	ICOM2	MISC	Current sense resister terminal for spindle driver
50	ISENS	IN	Current sense input terminal for spindle drivers
51	PGND_2	PS	GND terminal for SLED channel drivers
52	SLED1+	OUT	Sled1 positive output terminal
53	SLED1-	OUT	Sled1 negative output terminal
54	SLED2+	OUT	Sled2 positive output terminal

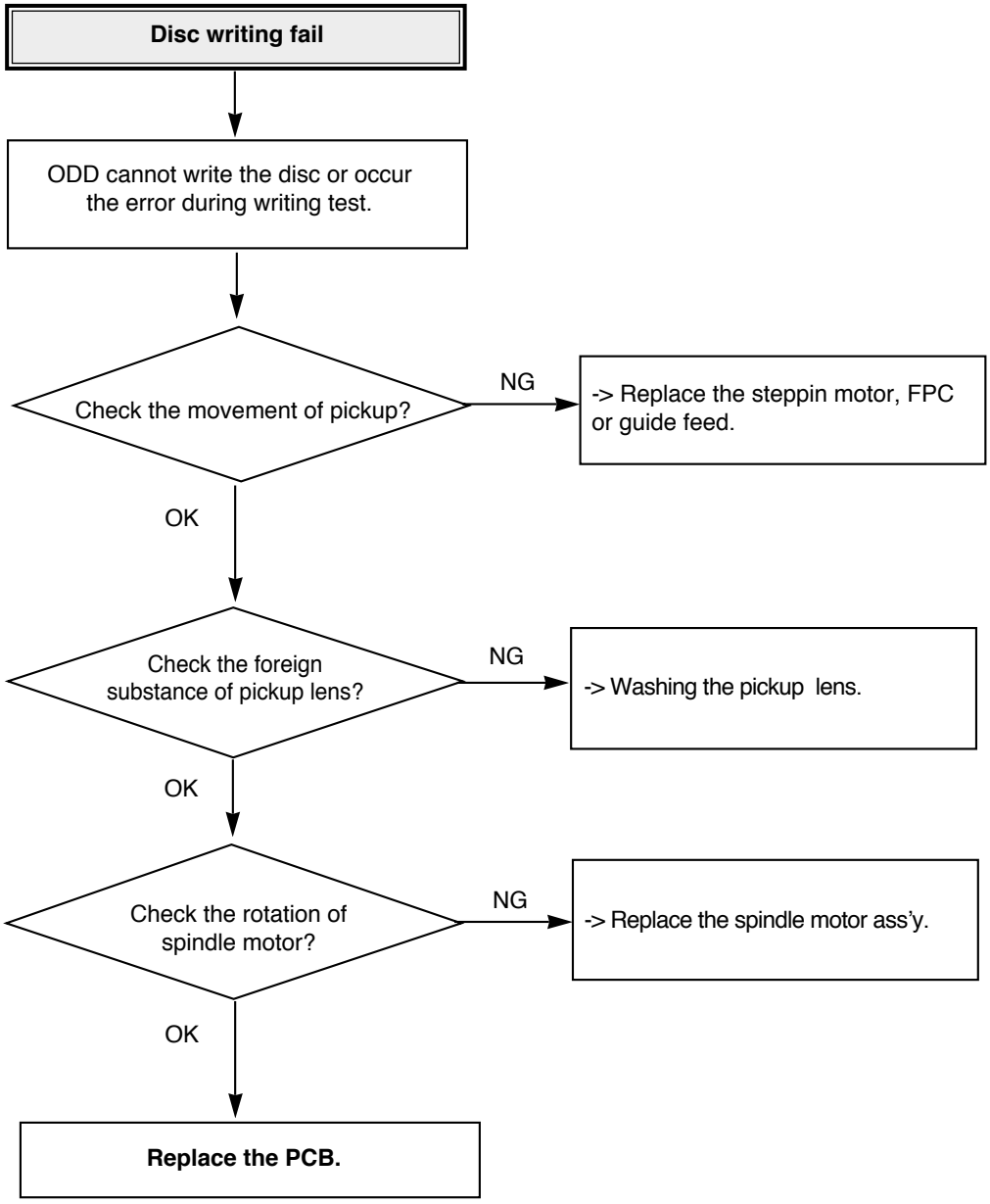
55	SLED2-	OUT	Sled2 negative output terminal
56	P5V_2	PS	Power supply terminal for SLED channel drivers

TROUBLESHOOTING GUIDE

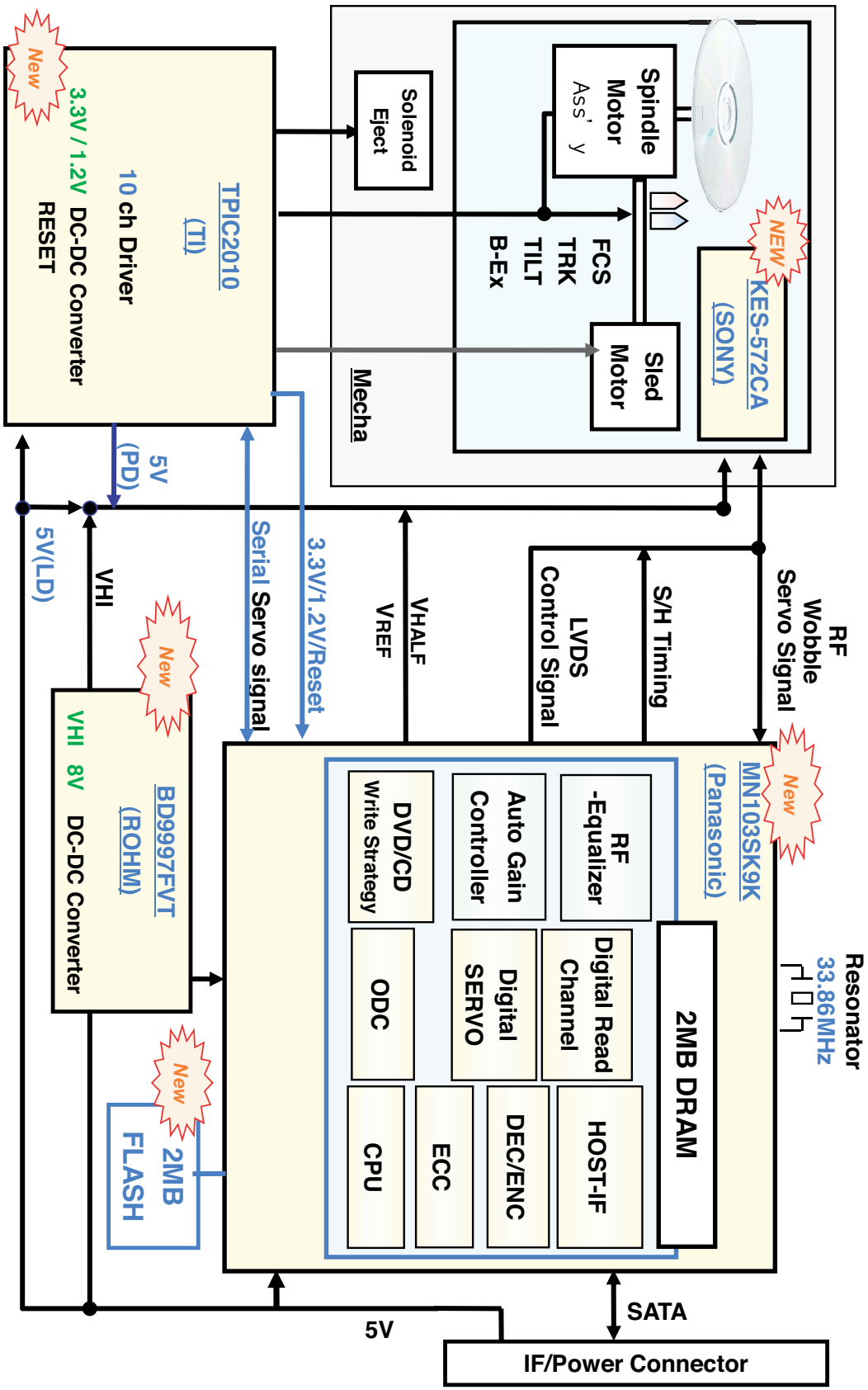



Disc recognition fail
Disc auto eject or no display of disc type.
Check the movement of pickup?
NG
-> Replace the steppin motor, FPC or guide feed.
OK
Check the laser of pick up?
NG
-> Replace the FPC or pick up.
OK
Check the rotation of spindle motor?
NG
-> Replace the spindle motor ass'y.
OK
Check the foreign substance of pickup lens?
NG
-> Washing the pickup lens.
OK
Replace the PCB.

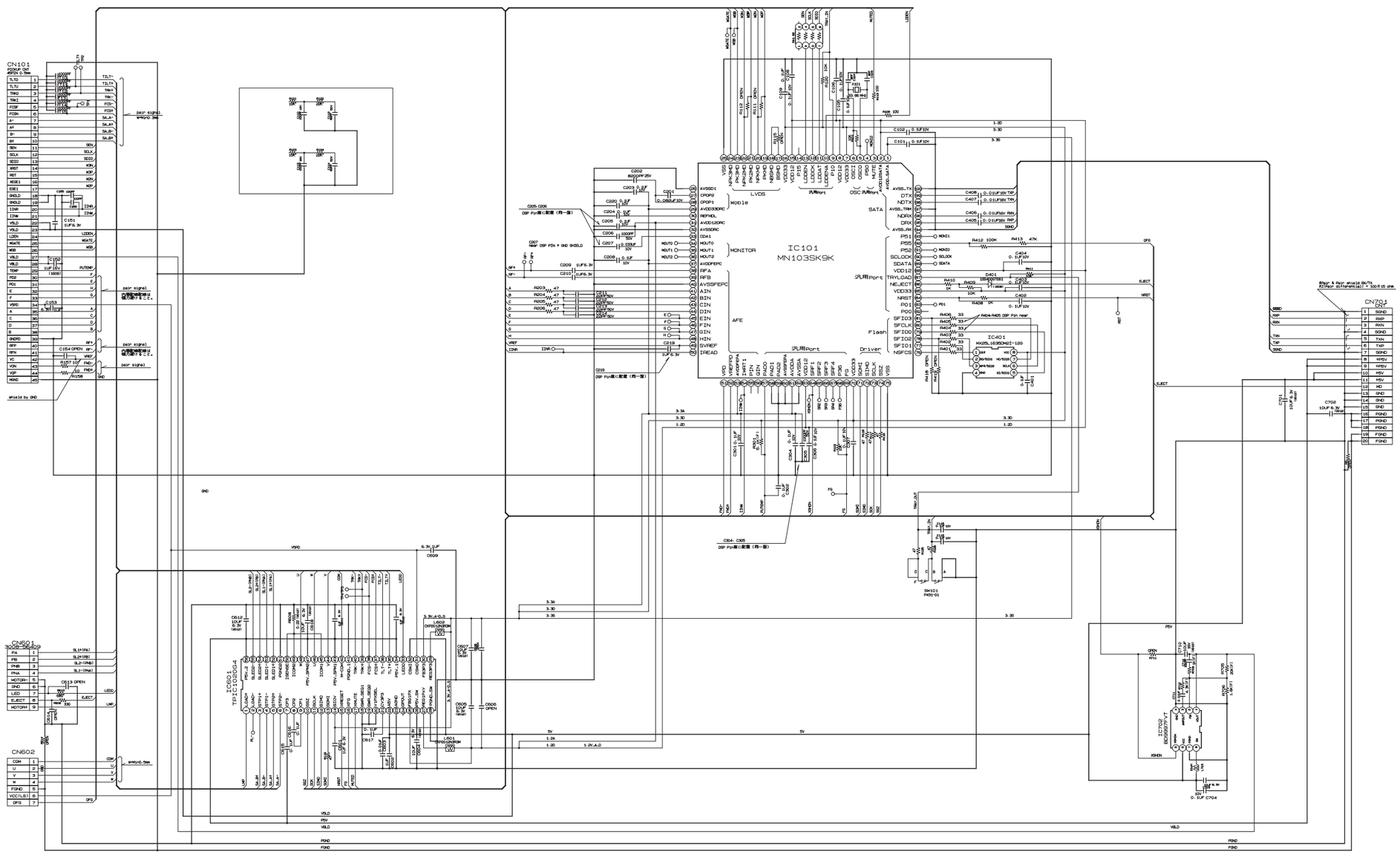

Disc reading fail
ODD cannot read the disc or occur the error during reading test.
Check the movement of pickup?
NG
-> Replace the steppin motor, FPC or guide feed.
OK
Check the foreign substance of pickup lens?
NG
-> Washing the pickup lens.
OK
Check the rotation of spindle motor?
NG
-> Replace the spindle motor ass'y.
OK
Replace the PCB.


Disc writing fail
ODD cannot write the disc or occur the error during writing test.
Check the movement of pickup?
NG
-> Replace the steppin motor, FPC or guide feed.
OK
Check the foreign substance of pickup lens?
NG
-> Washing the pickup lens.
OK
Check the rotation of spindle motor?
NG
-> Replace the spindle motor ass'y.
OK
Replace the PCB.

BLOCK DIAGRAM



CIRCUIT DIAGRAM



Bridge Board Circuit Diagram