LG

Super-Multi DVD Rewriter

SERVICE MANUAL

MODEL: GSA-H20A/
GSA-H20N/
GSA-H20L

P/NO : 3828HS1049E

may, 2006
Printed in Korea

MODEL : GSA-H20A/GSA-H20N/GSA-H20L

TABLE OF CONTENTS

INTRODUCTION **3**
FEATURES **4**
SPECIFICATIONS ..... **5~12**
LOCATION OF CUSTOMER CONTROLS ..... **13~14**
DISASSEMBLY ..... **15~16**
1. CABINET and CIRCUIT BOARD DISASSEMBLY 15
2. MECHANISM ASSY DISASSEMBLY 15
EXPLODED VIEW ..... **17~18**
MECHANICAL REPLACEMENT PARTS LIST ..... **19~20**
GLOSSARY **21**
THE DIFFERENCES OF CD-R/CD-RW DISCS AND GENERAL CD-ROM ..... **22~28**
1. Recording Layer 22
2. Disc Specification 22
3. Disc Materials 23
4. Reading Process of Optical Disc 24
5. Writing Process of CD-R Disc 25
6. Writing Process of CD-RW Disc 25
7. Organization of the PCA, PMA and Lead-in Area 26
8. Function of PCA and PMA area 27
9. OPC and ROPC 27
10. Writing Process of DISC 28
THE DIFFERENCES OF DVD-R/RW, DVD+R/RW DISCS AND DVD-ROM ..... **29~37**
1. Recording Layer 29
2. Disc Specification 30
3. Disc Materials 30
4. Writing Pulse Waveform of DVD+R 33
5. Writing Pulse Waveform DVD+RW 35
6. Organization of Inner Drive Area, Outer Drive Area, Lead-in Zone and Lead-out Zone 36
LightScribe MEDIA ..... **38~41**
1. LightScribe Media 38
2. Hardware Block Diagram of LightScribe Label Printing 39
3. MD Assy For LightScribe 40
4. Optical Encoder Assy 41
DVD & CD DATA PROCESSING ..... **42~45**
1. Data Processing Flow 42
2. Copy Protection and Regional Code Management Block 43
3. About Prevention the DVD-ROm from to be copy 44
4. About the DVD-ROM Regional Code 45
INTERNAL STRUCTURE OF THE PICK-UP ..... **46~48**
1. Block Diagram of the Pick-up 46
2. Pick up Pin Assignment 47
3. Signal detection of the P/U 48
DESCRIPTION OF CIRCUIT ..... **49~53**
1. ALPC Circuit 49
2. Focus/Tracking/Sled Servo Circuit 50
3. Spindle Circuit 52
MAJOR IC INTERNAL BLOCK DIAGRAM AND PIN DESCRIPTION ..... **54~71**
TROUBLESHOOTING GUIDE ..... **72~88**
How to use Test Tool ..... **72~88**
1. Dragon 84
2. Camus 88
BLOCK DIAGRAM ..... **89~90**
CIRCUIT DIAGRAM ..... **91~93**
PRINTED CIRCUIT BOARD DIAGRAM ..... **94~97**
ELECTRICAL REPLACEMENT PARTS LIST **98**

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 Super Multi DVD Rewriter and the electronic circuits in schematic form. This Super Multi DVD Rewriter was manufactured and assembled under our strict quality control standards and meets or exceeds industry specifications and standards.
This Super Multi DVD Rewriter is an internal drive unit designed for use with IBM PC, HP Vectra, 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 and DVD+RW disc.
This Super Multi DVD Rewriter can easily meet the upcoming MPC level 3 specification, and its Enhanced Intelligent Device Electronics (E-IDE) and ATAPI interface allows Plug and play integration in the majority of today's PCs without the need of an additional interface card.

Model name of GSA-H20#/GSA-H21# Series

		Optioanl Features		
Model Name	LS	VPCS	RAM	Product Name
GSA-H20N	X	X	O	Super-multi
GSA-H20L	O	X	O	
GSA-H20V	X	O	O	
GSA-H20A	O	O	O	
GSA-H21N	X	X	X	Dual
GSA-H21L	O	X	X	
GSA-H21V	X	O	X	
GSA-H21A	O	O	X	

FEATURES

1 General

1) Enhanced IDE (ATAPI) interface.
2) Internal Half-height Drive.
3) CD-R/RW, DVD-R/-R DL/-RW/+R/+R DL/+RW/RAM read and write compatible CD Family and DVD-ROM read compatible.
4) Buffer Under-run prevention function embedded.
5) 2MB buffer memory.
6) Power loading and power eject of a disc. Bare media loading.
7) MTBF : 125,000 POH
8) Vertical and Horizontal installable.
9) Support LightScribe Direct Label Printing Technology(GSA-H20L/GSA-H20A only)

2. Supported disc formats

1) Reads data in each DVD-ROM, DVD-R, DVD-R (Ver.1.0, Ver.2.0 for Authoring), and DVD-RAM (Ver. 2.0 & Higher)
2) Read and writes in each DVD-R (Ver.2.0 for General), -R DL, -RW, DVD-RAM(Ver.2.0 & Higher), DVD+R and +RL (Double layer), +RW
3) Reads data in each CD-ROM, CD-ROM XA, CD-I, Video CD, CD-Extra and CD-Text
4) Reads data in Photo CD (Single and Multi session).
5) Reads standard CD-DA
6) 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 DVD-RAM with CPRM and DVD-RW with CPRM
9) LightScribe DVD+R conforming to “LightScribe Media Specification”
10) LightScribe CD-R conforming to “LightScribe Media Specification”

3. Supported write method

1) DVD-R : Disc at Once and Incremental Recording.
2) DVD-R DL : Disc at Once and Incremental Recording
3) DVD-RW : Disc at Once, Incremental Recording and Restricted Overwrite.
4) DVD+R : Sequential Recording
5) DVD+R DL : Sequential Recording
6) DVD+RW : Random Write
7) CD-R/RW : Disc at Once, Session at Once, Track at Once and Packet Write
8) DVD-RAM : Random Write (Ver. 2.0 & Higher)
9) LightScribe Label Printing Functions complying with “LightScribe System Specification”

4. Audio

1) 16 bit digital data output through ATA interface.
2) Software Volume Control
3) Equipped with audio line output for audio CD playback.

SPECIFICATIONS

I. MODEL : GSA-H20N

1. SYSTEM REQUIREMENTS

-CPU: IBM Compatible Pentium4 1.6GHz (or faster)
(For High speed, 2GHz or faster recommended.)
-128MB Memory or greater

• SUPPORTING OPERATING SYSTEM

*** Operating System**

Window 98 Second Edition
(Not supported in LightScribe)
Windows Millennium Edition(Me)
(Not supported in LightScribe)
Window 2000 Professional
Window XP Home Edition, Professional

*** Recording tool**

(1) RecordNow (Sonic)
(2) DLA (sonic)
(3) Nero(Ahead)
(4) In CD(Ahead)
(5) Easy CD Creator (Roxio)
(6) Direct CD (Roxio)

2. GENERAL DESCRIPTION

2.1 Applicable disc formats

DVD	DVD-ROM:	4.7GB (Single Layer)
		8.5GB (Dual Layer)
	DVD-R:	3.95GB (Ver.1.0 : read only)
		4.7GB (Ver.2.0 for Authoring : read only)
		4.7GB (Ver.2.0 for General: read & write)
	DVD-RW:	4.7GB (Ver.1.1)
	DVD+R:	4.7GB
	DVD+R DL:	8.5GB
	DVD-R DL:	8.5GB
	DVD+RW:	4.7GB
	DVD-RAM:	4.7GB(Ver.2.0 & higher)
CD	CD-ROM Mode-1 data disc	
	CD-ROM Mode-2 data disc	
	CD-ROM XA, CD-I, Photo-CD Multi-Session, Video CD	
	CD-Audio Disc	
	Mixed mode CD-ROM disc (data and audio)	
	CD-Extra	
	CD-Text	
	CD-R (Conforming to “Orange Book Part2”: read & write)	
	CD-RW (Conforming to “Orange Book Part3”: read & write)	

2.2 Disc diameter 120mm
80mm (Horizontal only)

2.3 Data capacity

• User Data/Block DVD-ROM/R/RW/+R/+RW .....2,048 bytes/block
CD (Yellow Book) .....2,048 bytes/block(Mode 1 & Mode 2 Form 1)
2,336 bytes/block (Mode 2)
2,328 bytes/block (Mode 2 Form 2)
2,352 bytes/block (CD-DA)

3. DRIVE PERFORMANCE

3.1 Host interface X3T13 ATA/ATAPI5/1321D
INF-8090i Rev.5.3

3.2 Read/Write & Rotational speed

<Write>	DVD-R		2x, 4x (CLV), 8x (ZCLV), 12x (PCAV), 16x (CAV)
	DVD-RW		1x, 2x, 4x (CLV), 6x (ZCLV)
	DVD+R		2.4x, 4x (CLV), 8x (ZCLV), 12x (PCAV), 16x (CAV)
	DVD+RW		2.4x, 4x (CLV), 8x (ZCLV)
	DVD+R DL		2.4x, 4x (CLV), 6x, 8x (ZCLV)
	DVD-R DL		4x (CLV)
	DVD-RAM(Ver.2.0 & Higher)		2x, 3x (CLV), 5x (PCAV)
	CD-R		16x (CLV), 24x (ZCLV), 40x, 48x (CAV)
	CD-RW		4x, 10x, 16x (CLV), 24x, 32x (ZCLV)
			(High Speed : 8x, 10x, Ultra Speed>16x)
<Read>	DVD-ROM	Single layer	6.7x ~ 16x (CAV), Approx. 9,200 r/min
		Dual layer	5x ~ 12x (CAV), Approx. 7,600 r/min
	DVD-Video(CSS)		3.3x ~ 8x (CAV), Approx. 4,500 r/min
	DVD-R	3.95GB	6.7x ~ 16x (CAV), Approx. 9,200 r/min
		4.7GB	6.7x ~ 16x (CAV), Approx. 9,200 r/min
	DVD-RW	4.7GB	5x ~ 12x (CAV), Approx. 7,000 r/min
	DVD+R	4.7GB	6.7x ~ 16x (CAV), Approx. 9,200 r/min
	DVD+RW	4.7GB	5x ~ 12x (CAV), Approx. 7,000 r/min
	DVD+R DL	8.5GB	5x ~ 12x (CAV), Approx. 7,600 r/min
	DVD-R DL	8.5GB	5x ~ 12x (CAV), Approx. 7,600 r/min
	DVD-RAM (Ver. 2.0 & Higher)		3x ~ 5x (PCAV), Approx. 5,500 r/min
	CD-R/ROM, data/CD-I		20x ~ 48x (CAV), Approx. 9,800 r/min
	CD-RW		17x ~ 40x (CAV), Approx. 8,000 r/min
	CD-DA (DAE)		17x ~ 40x (CAV), Approx. 8,000 r/min
	CD-DA (Audio out)/VideoCD		6x ~ 15x (CAV), Approx. 3,130 r/min

3.3 Data transfer rate

3.3.1 Sustained transfer rate

<Write>	DVD-R	16x (CAV)		8.91 ~ 22.16 Mbytes/s (Max)
	DVD-RW	6x (ZCLV)		8.31 Mbytes/s (Max)
	DVD+R	16x (CAV)		8.91 ~ 22.16 Mbytes/s (Max)
	DVD+RW	8x (ZCLV)		11.08 Mbytes/s (Max)
	DVD+R DL	8x (ZCLV)		11.08 Mbytes/s (Max)
	DVD-R DL	4x (CLV)		5.54 Mbytes/s (Max)
	DVD-RAM	5x (PCAV)		4.15 ~ 6.925 Mbytes/s (Max)
		(w/o Verify)		(Ver.2.0 & higher)
	CD-R	48x (CAV)		2,400 ~ 7,200 kB/s (Mode-1) (Max)
	CD-RW	32x(ZCLV)		2,400 ~ 3,600 kB/s (Mode-1) (Max)
<Read>	DVD-ROM	Single layer		6.88 ~ 22.16 Mbytes/s (16x) Max.
		Dual layer		4.58 ~ 11.08 Mbytes/s (12x) Max.
	DVD+/-R			9.28 ~ 22.16 Mbytes/s (16x) Max.
	DVD+/-RW/DL			4.58 ~ 11.08 Mbytes/s (12x) Max.
	DVD-RAM			4.155 ~ 6.93 Mbytes/s (5x) Max
	CD-R/ROM			2,700 ~ 7,200 kbytes/s (48x) Max.
	CD-RW			2,550 ~ 6,000 kbytes/s (40x) Max.
	CD-DA(DAE)			2,550 ~ 6,000 kbytes/s (40x) Max.

3.3.2 Burst transfer rate

Ultra DMA Mode 2.....33.3 Mbytes/s Max.
Multiword DMA Mode 2.....16.6 Mbytes/s Max.
PIO Mode 4.....16.6 Mbytes/s Max.

3.4 Access time (Random)

* Typical value

DVD-ROM(SL) .....140 ms Typ. (Note 1)
DVD-ROM(DL) .....175 ms Typ. (Note 1)
CD-ROM .....120 ms Typ. (Note 1)
DVD-RAM .....200 ms Typ. (Note 1)

Note :

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

Test Disc : DVD : ALMEDIO TDV-520 / TDR-820

CD : ALMEDIO TCDR-701 / HITACH HCD-1

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

3.5 Data error rate (Measured with 5 retries maximum)

DVD-R/RW/ROM/RAM .....$<10^{-12}$
DVD+R/RW.....$<10^{-12}$
CD-ROM/R/RW.....$<10^{-12}$ (Mode-1)
.....$<10^{-9}$ (Mode-2)
Condition : It is assumed that the worst case raw error rate of the disc is 10^{-3}

3.6 Data buffer capacity 2Mbytes

4. Quality and Reliability

4.1 MTBF .....125,000 Power On Hours(Consecutive/Cumulative POH)
Assumption : .....Used in a normall office environment at room temperature.
-POH per year.....3,000
-ON/OFF cycles per year.....600
-Operating duty cycle.....20% of power on time (Seek: 5% of operating time)

4.2 Tray cycle test.....30,000 times
No degeneration in the mechanical part after test

4.3 Actuator mechanism.....1,000,000 full stroke seek

4.4 MTTR (Mean Time To Repair) .....0.5 h

4.5 Component life .....5 years or 2,000 h of Laser radiating time
Assumption : .....Used in a normall office environment.

5. POWER REQUIREMENTS

5.1 Source voltage

+5V ± 5% tolerance, less than 100 mVp-p Ripple voltage
+12V ± 10% tolerance, less than 100 mVp-p Ripple voltage

5.2 Current

Idle (Hold track state).....	+5V DC	0.6A Typ.	< 1.0 A Max.
	+12V DC	0.5A Typ.	< 1.0 A Max.
Write (Active)	+5V DC	1.3A Typ.	< 1.5 A Max.
	+12V DC	1.0A Typ.	< 1.3 A Max.
Read (Active).....	+5V DC	1.3A Typ.	< 1.5 A Max.
	+12V DC	1.0A Typ.	< 1.3 A Max.
Seek (Access).....	+5V DC	0.7A Typ.	< 1.2 A Max.
	+12V DC	0.7A Typ.	< 1.2 A Max.

3 Standby

Sleep mode (No disc)	1.1 W Typ.	<1.3 W Max.

6. AUDIO PERFORMANCE

Item		Typical	Test Signal	Test Condition	Note
AUDIO OUT	**Output Level**	0.7 Vrms	1KHz 0 dB	No Filter	at 47kΩ
	Frequency response	+/-3dB	20-20kHz 0dB		
	THD	0.1%	1KHz 0 dB	with IHF-A + 20KHz LPF	
Headphone output level(Optional)		-	-	-	None

7. Acoustic noise

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

Note : 1. Disc : Less than unbalance 0.3 $x10^{-4}$ Nm (0.3g-cm)

2. Installation : Horizontal

3. Ambient temperature : Normal temperature

4. Sequential read at max speed except loading, unloading and seek

8. Dimensions

External dimensions (W x H xD) 146 x 41.3 x 165mm

Front bezel (WxHxD) 148 x 42 x 5 mm

9. Mass .....max 800g

*** Please Contact the friendly staff of LG Service Care at: Website http: //www.LGEservice.com**

II. MODEL : GSA-H20A/GSA-H20L

1. SYSTEM REQUIREMENTS

-CPU: IBM Compatible Pentium4 1.6GHz (or faster)
(For High speed, 2GHz or faster recommended.)
-128MB Memory or greater

• SUPPORTING OPERATING SYSTEM

*** Operating System**

Window 98 Second Edition
(Not supported in LightScribe)
Windows Millennium Edition (Me)
(Not supported in LightScribe)
Window 2000 Professional
Window XP Home Edition, Professional

*** Recording tool**

(1) RecordNow (Sonic)
(2) DLA (sonic)
(3) Nero(Ahead)
(4) In CD(Ahead)
(5) Easy CD Creator (Roxio)
(6) Direct CD (Roxio)

2. GENERAL DESCRIPTION

2.1 Applicable disc formats

DVD	DVD-ROM:	4.7GB (Single Layer)
		8.5GB (Dual Layer)
	DVD-R:	3.95GB (Ver.1.0 : read only)
		4.7GB (Ver.2.0 for Authoring : read only)
		4.7GB (Ver.2.0 for General: read & write)
	DVD-RW:	4.7GB (Ver.1.1)
	DVD+R:	4.7GB
	DVD+R DL:	8.5GB
	DVD-R DL :	8.5GB
	DVD+RW:	4.7GB
	DVD-RAM:	4.7GB(Ver. 2.0 & higher)
CD	CD-ROM Mode-1 data disc	
	CD-ROM Mode-2 data disc	
	CD-ROM XA, CD-I, Photo-CD Multi-Session, Video CD	
	CD-Audio Disc	
	Mixed mode CD-ROM disc (data and audio)	
	CD-Extra	
	CD-Text	
	CD-R (Conforming to “Orange Book Part2”: read & write)	
	CD-RW (Conforming to “Orange Book Part3”: read & write)	

2.2 Disc diameter

120mm
80mm (Horizontal only)

2.3 Data capacity

• User Data/Block

DVD-ROM/R/RW/+R/+RW .....2,048 bytes/block
CD (Yellow Book) .....2,048 bytes/block(Mode 1 & Mode 2 Form 1)
2,336 bytes/block (Mode 2)
2,328 bytes/block (Mode 2 Form 2)
2,352 bytes/block (CD-DA)

3. DRIVE PERFORMANCE

3.1 Host interface X3T13 ATA/ATAPI5/1321D
INF-8090i Rev.5.3

3.2 Read/Write & Rotational speed

<Write>	DVD-R		2x, 4x (CLV), 8x (ZCLV), 12x (PCAV), 16x (CAV)
	DVD-RW		1x, 2x, 4x (CLV), 6x (ZCLV)
	DVD+R		2.4x, 4x (CLV), 8x (ZCLV), 12x (PCAV), 16x (CAV)
	DVD+RW		2.4x, 4x (CLV), 8x (ZCLV)
	DVD+R DL		2.4x, 4x (CLV), 6x, 8x (ZCLV)
	DVD-R DL		4x (CLV)
	DVD-RAM(Ver.2.0 & Higher)		2x, 3x (CLV), 5x (PCAV)
	CD-R		16x (CLV), 24x (ZCLV), 40x, 48x (CAV)
	CD-RW		4x, 10x, 16x (CLV), 24x, 32x (ZCLV)
			(High Speed : 8x, 10x, Ultra Speed>16x)
<Read>	DVD-ROM	Single layer	6.7x ~ 16x (CAV), Approx. 9,200 r/min
		Dual layer	5x ~ 12x (CAV), Approx. 7,600 r/min
	DVD-Video(CSS)		3.3x ~ 8x (CAV), Approx. 4,500 r/min
	DVD-R	3.95GB	6.7x ~ 16x (CAV), Approx. 9,200 r/min
		4.7GB	6.7x ~ 16x (CAV), Approx. 9,200 r/min
	DVD-RW	4.7GB	5x ~ 12x (CAV), Approx. 7,000 r/min
	DVD+R	4.7GB	6.7x ~ 16x (CAV), Approx. 9,200 r/min
	DVD+RW	4.7GB	5x ~ 12x (CAV), Approx. 7,000 r/min
	DVD+R DL	8.5GB	5x ~ 12x (CAV), Approx. 7,600 r/min
	DVD-R DL	8.5GB	5x ~ 12x (CAV), Approx. 4,500 r/min
	DVD-RAM (Ver. 2.0 & Higher)		3x ~ 5x (PCAV), Approx. 5,500 r/min
	CD-R/ROM, data/CD-I		20x ~ 48x (CAV), Approx. 9,800 r/min
	CD-RW		17x ~ 40x (CAV), Approx. 8,000 r/min
	CD-DA (DAE)		17x ~ 40x (CAV), Approx. 8,000 r/min
	CD-DA (Audio out)/VideoCD		6x ~ 15x (CAV), Approx. 3,130 r/min

3.3 Data transfer rate

3.3.1 Sustained transfer rate

<Write>	DVD-R	16x (CAV)	8.91 ~ 22.16 Mbytes/s (Max)
	DVD-RW	6x (ZCLV)	8.31 Mbytes/s (Max)
	DVD+R	16x (CAV)	8.91 ~ 22.16 Mbytes/s (Max)
	DVD+RW	8x (ZCLV)	11.08 Mbytes/s (Max)
	DVD+R DL	8x (ZCLV)	11.08 Mbytes/s (Max)
	DVD-R DL	4x (CLV)	5.54 Mbytes/s (Max)
	DVD-RAM	5x (PCAV)	4.15 ~ 6.925 Mbytes/s (Max)
	(Ver.2.0 & higher)	(w/o Verify)	
	CD-R	48x (CAV)	2,400 ~ 7,200 kB/s (Mode-1) (Max)
	CD-RW	32x(ZCLV)	2,400 ~ 3,600 kB/s (Mode-1) (Max)
<Read>	DVD-ROM	Single layer	6.88 ~ 22.16 Mbytes/s (16x) Max.
		Dual layer	4.58 ~ 11.08 Mbytes/s (12x) Max.
	DVD+/-R		9.28 ~ 22.16 Mbytes/s (16x) Max.
	DVD+/-RW/DL		4.58 ~ 11.08 Mbytes/s (12x) Max.
	DVD-RAM		4.155 ~ 6.93 Mbytes/s (5x) Max
	CD-R/ROM		2,700 ~ 7,200 kbytes/s (48x) Max.
	CD-RW		2,550 ~ 6,000 kbytes/s (40x) Max.
	CD-DA(DAE)		2,550 ~ 6,000 kbytes/s (40x) Max.

3.3.2 Burst transfer rate

Ultra DMA Mode 2.....33.3 Mbytes/s Max.
Multiword DMA Mode 2.....16.6 Mbytes/s Max.
PIO Mode 4.....16.6 Mbytes/s Max.

3.4 Access time (Random)

* Typical value

DVD-ROM(SL) .....140 ms Typ. (Note 1)
DVD-ROM(DL) .....175 ms Typ. (Note 1)
CD-ROM .....120 ms Typ. (Note 1)
DVD-RAM .....200 ms Typ. (Note 1) (Ver 2.0 & higher)

Note :

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

Test Disc : DVD : ALMEDIO TDV-520 / TDR-820

CD : ALMEDIO TCDR-701 / HITACH HCD-1

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

3.5 Data error rate (Measured with 5 retries maximum)

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

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

3.6 Data buffer capacity 2Mbytes

3.7 LightScribe Label Printing (** MKM LS-CD 2.0, ** Full Image Printing)

3.7.1 Printing Time

Best.....less than 29 minutes
Normal .....less than 24 minutes
Draft .....less than 18 minutes

3.7.2 Image Contrast complying to the colorimetry standard CIE L*a*b, defined as Delta L(ΔL)

Best.....higher than 28
Normal.....higher than 20
Draft .....higher than 12

* Note (1) DRF Parameters for this spec : Max LV=1400mm/sec, TrackShift=85 or 75,
Max. Laser Power=38mW
(2) T.B.D (High Speed LightScribe Label Printing)

4. Quality and Reliability

4.1 MTBF.....125,000 Power On Hours(Consecutive/Cumulative POH)
Assumption : .....Used in a normall office environment at room temperature.
-POH per year.....3,000
-ON/OFF cycles per year.....600
-Operating duty cycle.....20% of power on time (Seek: 5% of operating time)

4.2 Tray cycle test.....30,000 times
No degeneration in the mechanical part after test

4.3 Actuator mechanism .....1,000,000 full stroke seek

4.4 MTTR (Mean Time To Repair) .....0.5 h

4.5 Component life .....5 years or 2,000 h of Laser radiating time
Assumption : .....Used in a normall office environment.

5. POWER REQUIREMENTS

5.1 Source voltage

+5V ± 5% tolerance, less than 100 mVp-p Ripple voltage

+12V ± 10% tolerance, less than 100 mVp-p Ripple voltage

5.2 Current

Idle (Hold track state).....	+5V DC	0.6A Typ.	< 1.0 A Max.
	+12V DC	0.5A Typ.	< 1.0 A Max.
Write (Active)	+5V DC	1.3A Typ.	< 1.5 A Max.
	+12V DC	1.0A Typ.	< 1.3 A Max.
Read (Active).....	+5V DC	1.3A Typ.	< 1.5 A Max.
	+12V DC	1.0A Typ.	< 1.3 A Max.
Seek (Access).....	+5V DC	0.7A Typ.	< 1.2 A Max.
	+12V DC	0.7A Typ.	< 1.2 A Max.
Label Printing.....	+5V DC	0.7A typ.	< 1.0 A max.
	+12V DC	0.3 A typ.	< 1.0 A max.

5.3 Standby

Sleep mode (No disc) .....1.1 W Typ. <1.3 W Max.

6. AUDIO PERFORMANCE

Item		Typical	Test Signal	Test Condition	Note
AUDIO OUT	**Output Level**	0.7 Vrms	1KHz 0 dB	No Filter	at 47kΩ
	Frequency response	+/-3dB	20-20kHz 0dB		
	THD	0.1%	1KHz 0 dB	with IHF-A + 20KHz LPF	
Headphone output level(Optional)		-	-	-	None

7. Acoustic noise

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

Note : 1. Disc : Less than unbalance 0.3 x10^{-4} Nm (0.3g-cm)

2. Installation : Horizontal

3. Ambient temperature : Normal temperature

4. Sequential read at max speed except loading, unloading and seek

8. Dimensions

External dimensions (W x H xD) 146x41.3x165mm

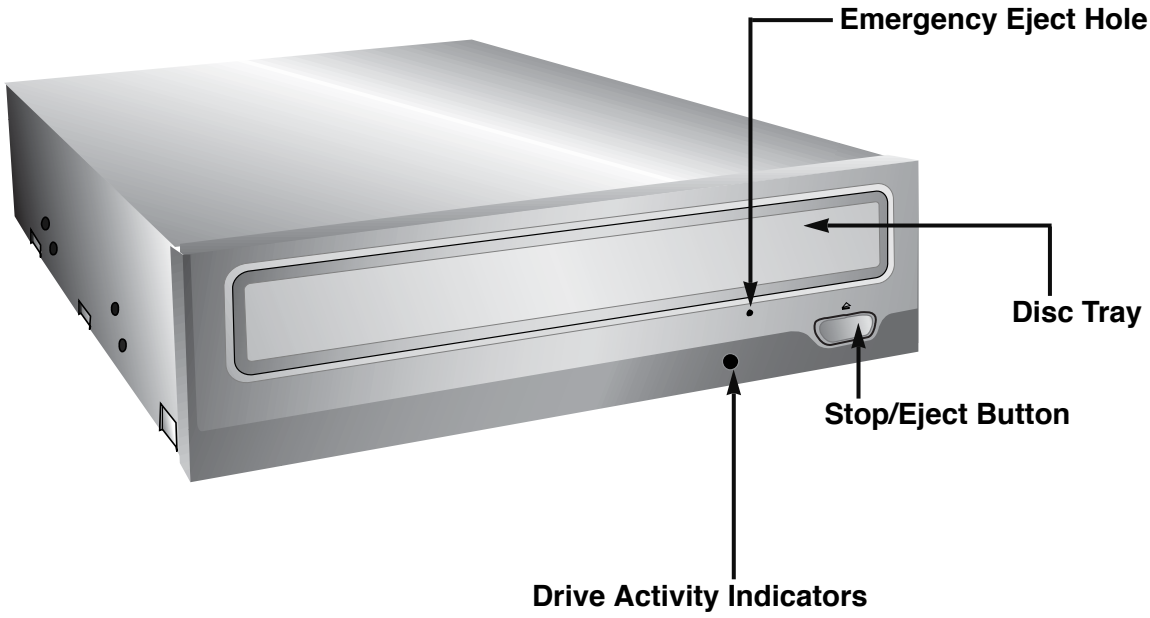
Front bezel (WxHxD) 148x42x5 mm

9. Mass .....Max. 800g

*** Please Contact the friendly staff of LG Service Care at: Website http: //www.LGEservice.com**

LOCATION OF CUSTOMER CONTROLS

Front Panel



1. **Disc tray**

   This is the tray for the disc. Place the disc on the ejected disc tray, then lightly push the tray (or push the eject button) and the Disc will be loaded.

   NOTE: Don't pull out or push in the disc tray forcibly. This might cause damage to the loading section of the drive.

2. **Stop/Eject button**

   This button is pressed to open the Disc tray.
   This button works only when power is supplied to the drive.

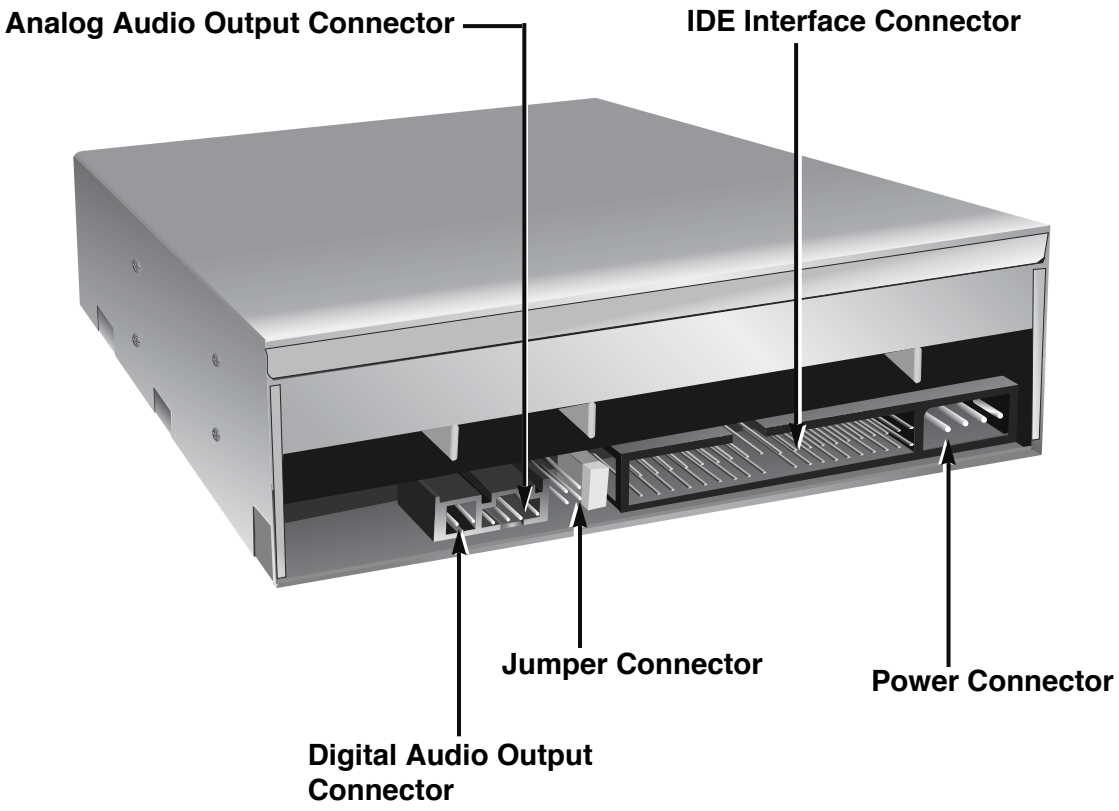
3. **Emergency Eject Hole**

   Insert a paper clip here to eject the Disc tray manually or when there is no power.

4. **Drive activity indicator**

   Green colored LED is used to indicate the operation of the Drive.

Rear Panel



1. **Power Connector**

   Connects to the power supply (5-and 12-V DC) of the host computer.

   NOTE : Be careful to connect with the proper polarity. Connecting the wrong way may damage the system (and is not guaranteed). Usually this connector can only be attached one-way.

2. **IDE Interface Connector**

   Connect to the IDE (Integrated Device Electronics) Interface using a 40-pin flat IDE cable.

   NOTE : Do not connect or disconnect the cable when the power is on, as this could cause a short circuit and damage the system. Always turn the power OFF when connecting or disconnecting the cable.

3. **Jumper Connector**

   This jumper determines whether the drive is configured as a master or slave. Changing the master-slave configuration takes effect after power-on reset.

4. **Analog Audio Output Connector**

   Provides output to a sound card (analog signal). Generally you need this to play a regular audio CD.

5. **Digital Audio Output Connector**

   This connector is not supported.

DISASSEMBLY

1. CABINET and CIRCUIT BOARD DISASSEMBLY

1-1. Bottom Chassis

A. Release 4 screws (A) and remove the Bottom Chassis in the direction of arrow (1). (See Fig.1-1)

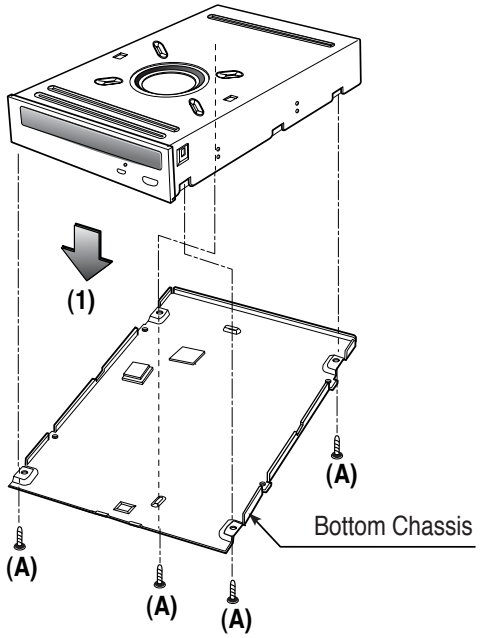


Fig. 1-1

1-2. Front Bezel Assy

A. Insert and press a rod in the Emergency Eject Hole and then the Disc Tray will open in the direction of arrow (2).
B. Remove the Tray Door in the direction of arrow (3) by pushing the stoppers forward.
C. Release 3 stoppers and remove the Front Bezel Assy.

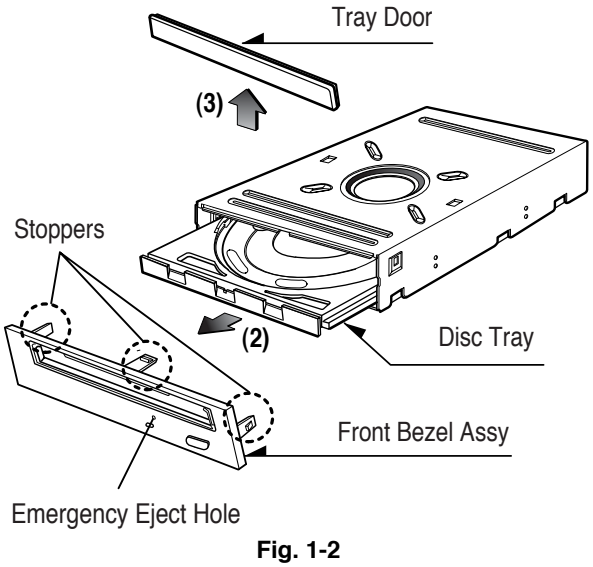


Fig. 1-2

1-3. Cabinet and Main Circuit Board

A. Remove the Cabinet in the direction of arrow (4). (See Fig. 1-3)
B. When the Disc tray has been opened completely, lift 2 points (a) and remove the Disc tray while drawing out simultaneously.
C. Remove the Soldering of the LD- and LD+ (b) for the Loading Motor, and then remove the Main Circuit Board.
D. At this time, be careful not to damage the 5 connectors of the Main Circuit Board.

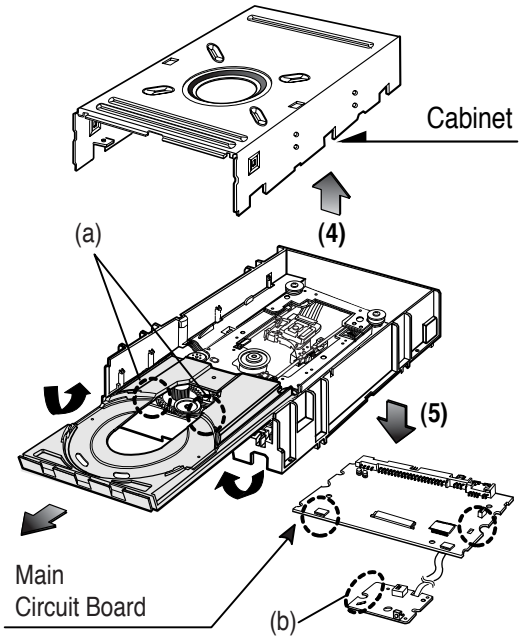


Fig. 1-3

2. MECHANISM ASSY DISASSEMBLY

2-1. Pick-up Unit

A. Release screws (B).
B. Separate the Pick-up Unit in the direction of arrow (6).

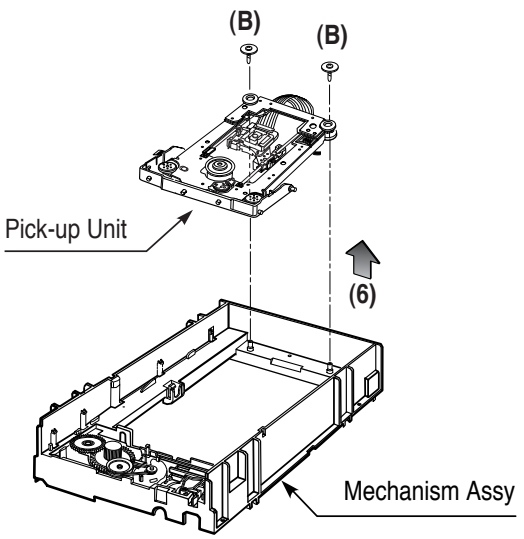


Fig. 2-1

2-2. Pick-up

A. Release 1 screw (C) and remove the Pick-up.

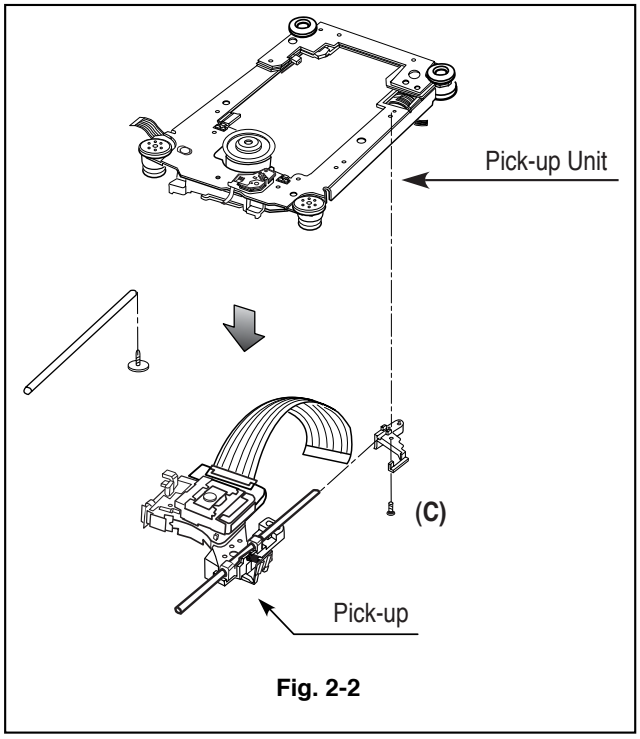
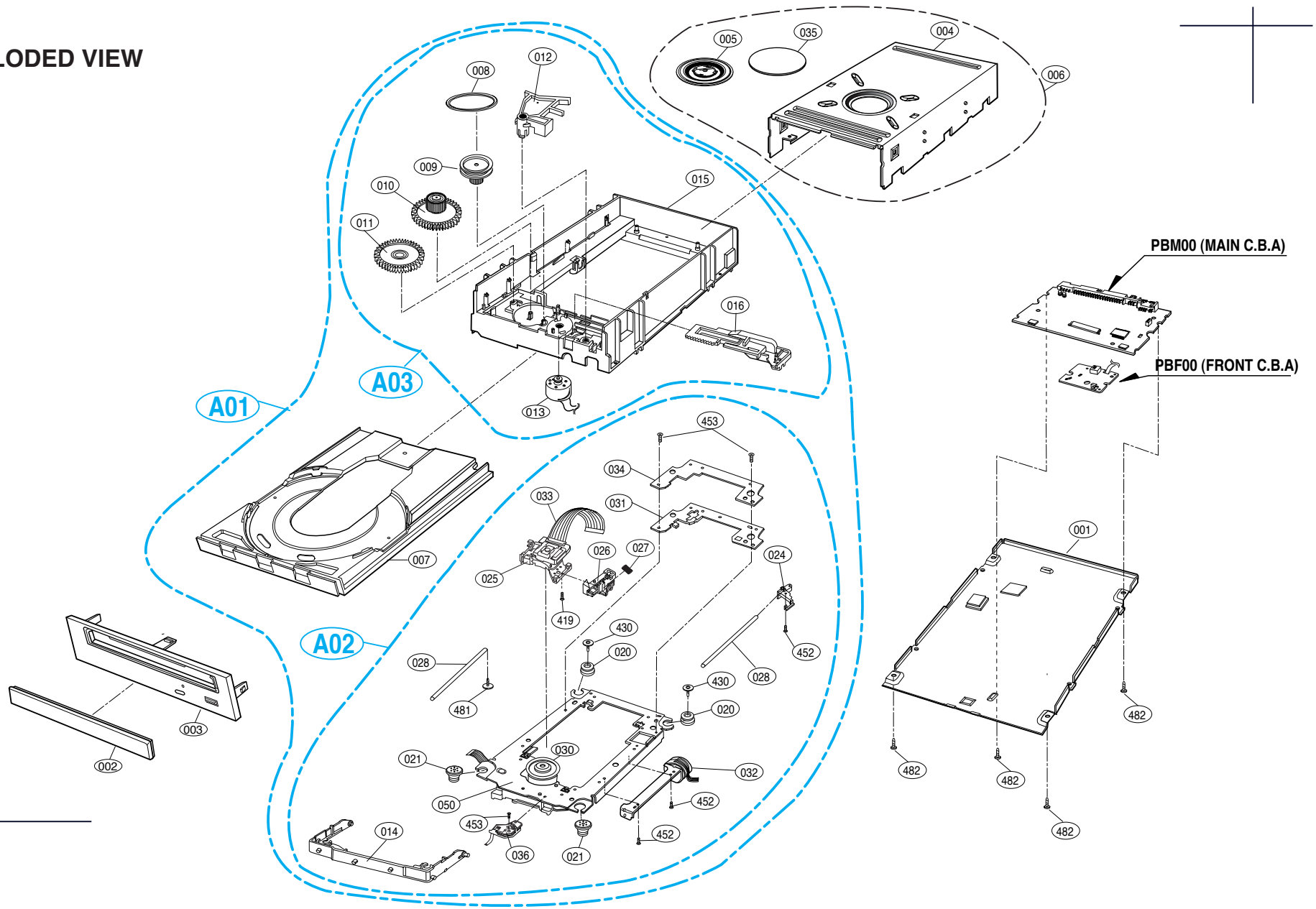


Fig. 2-2

EXPLODED VIEW



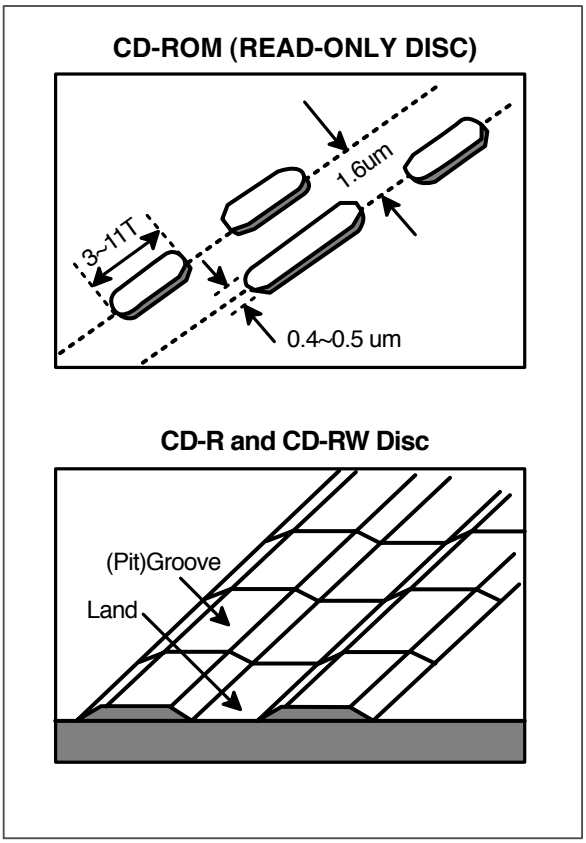
GLOSSARY

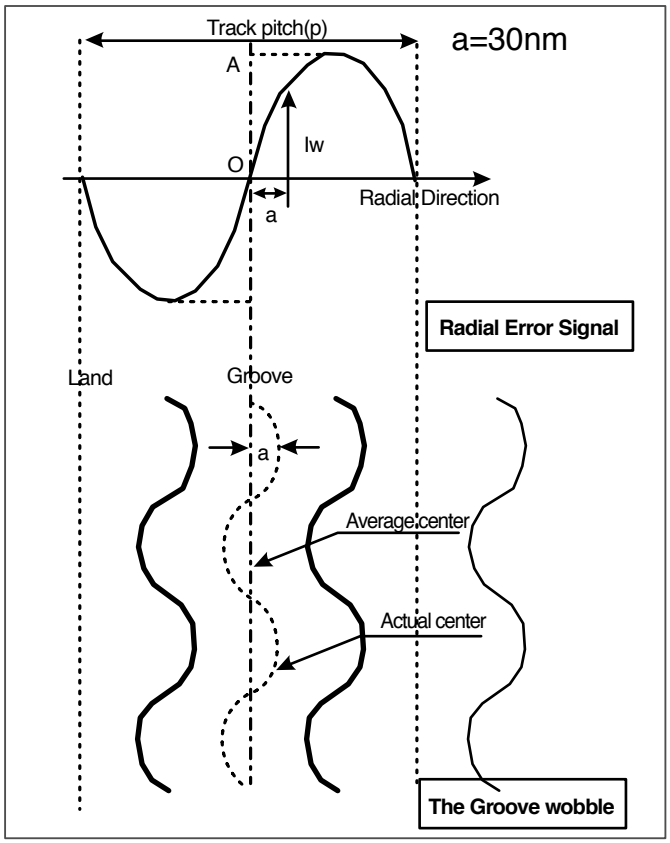
ATIP	Absolute Time in Pre-groove. With an additional modulation of the “Wobble”, the “Groove” contains a time code information.
Wobble	The pre-groove in the Disc is not a perfect spiral but is wobbled. With : – A typical amplitude of 30 nm – A spatial peried of 54~64 μm
CW	Continuous Wave. The laser 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.





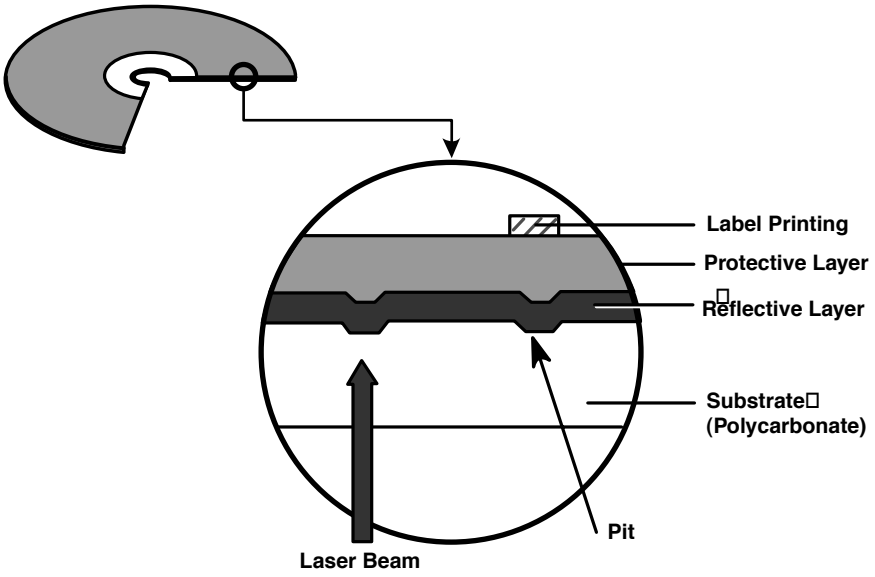
2. Disc Specification

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

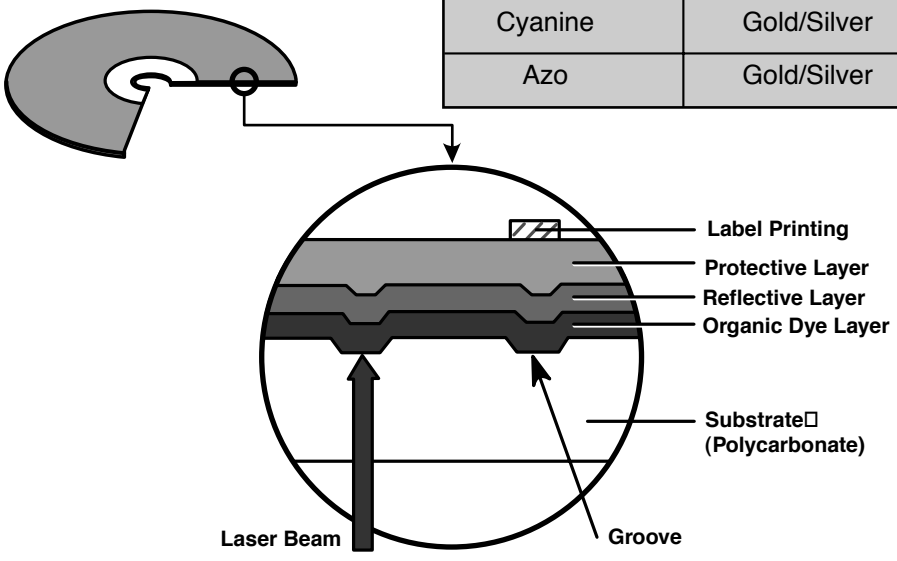
- It is composed of Silver _ colored aluminum plate and Reflective layer.
- Groove (Pit) of aluminum plate make a track.
- Laser wavelength : 780 nm, Laser Power (Read): 0.5mW
- Signal is detected by the difference of reflective beam intensity between “pit” and “Land” on the disc.



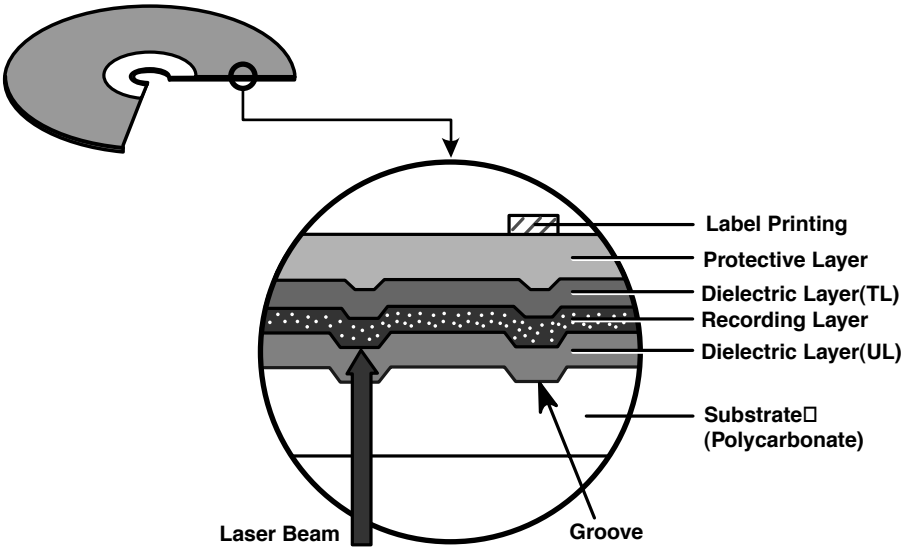
2) CD-R disc

- 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

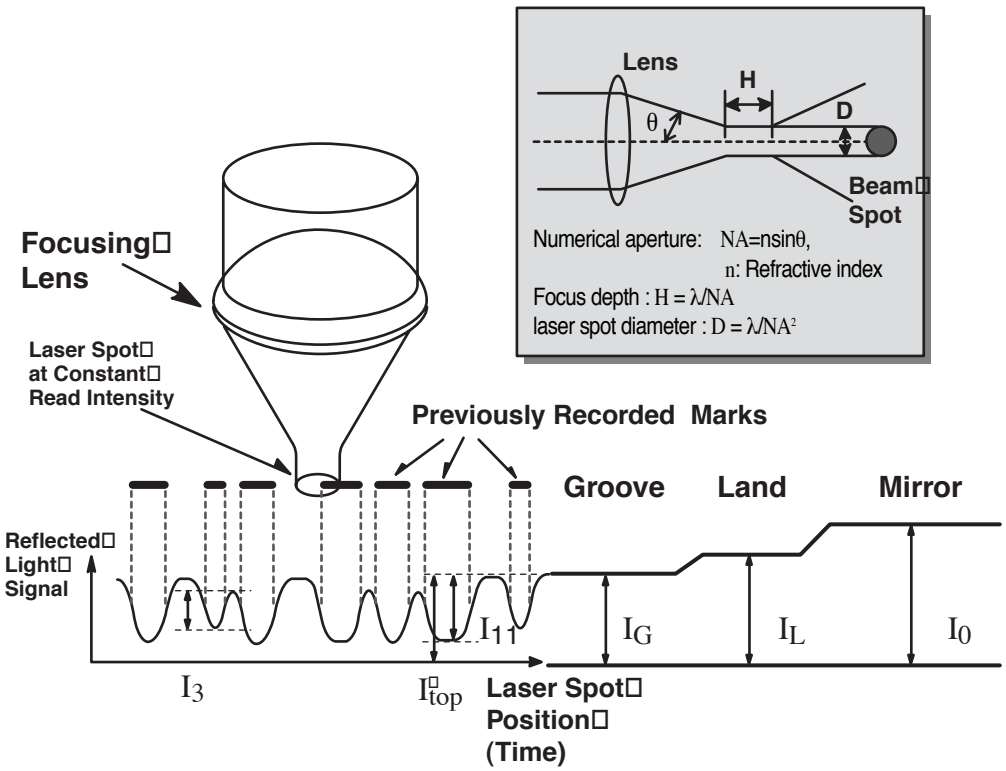


3) CD-RW Disc

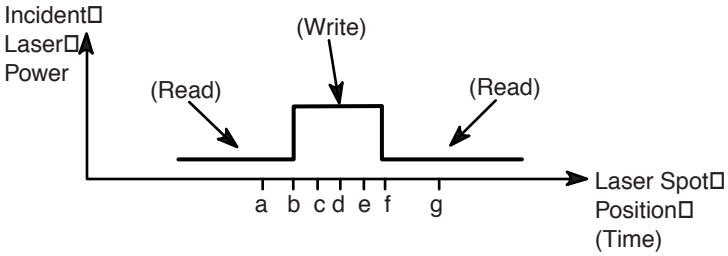


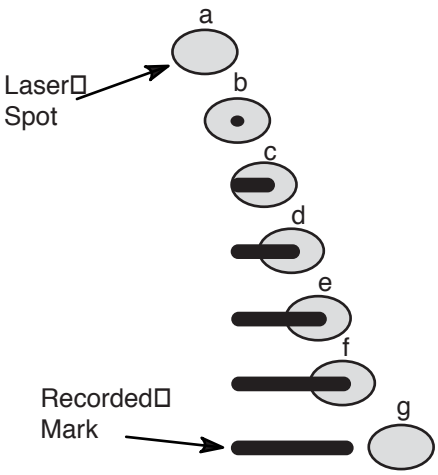
- It is composed of polycarbonate layer, alloy(silver, arsenic) layer, aluminum reflectivity layer, protective layer.
- An crystalized alloy layer is transformed into noncrystalized by the laser heat. Therefore, writing and reading is enabled by the difference of reflectivity.
- It is possible to overwrite 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.

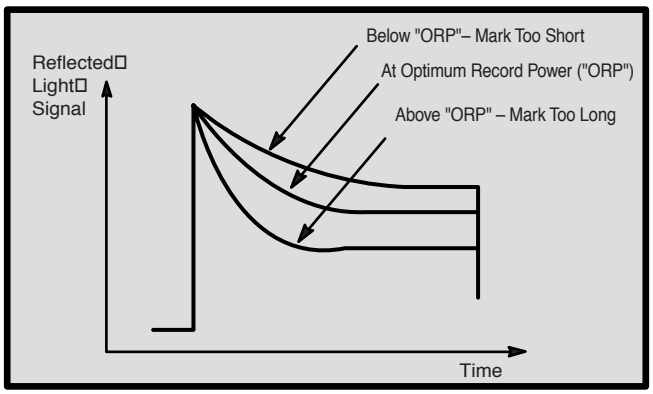
4. Reading process of Optical Disc

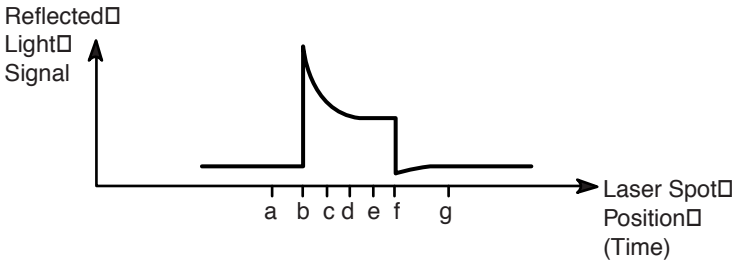


5. Writing Process of CD-R Disc

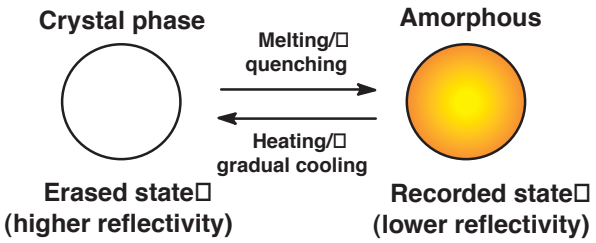


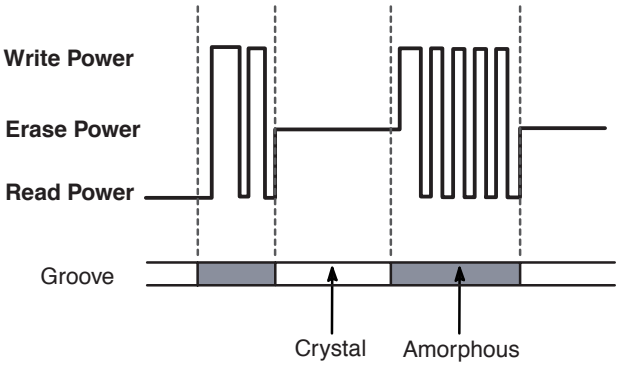






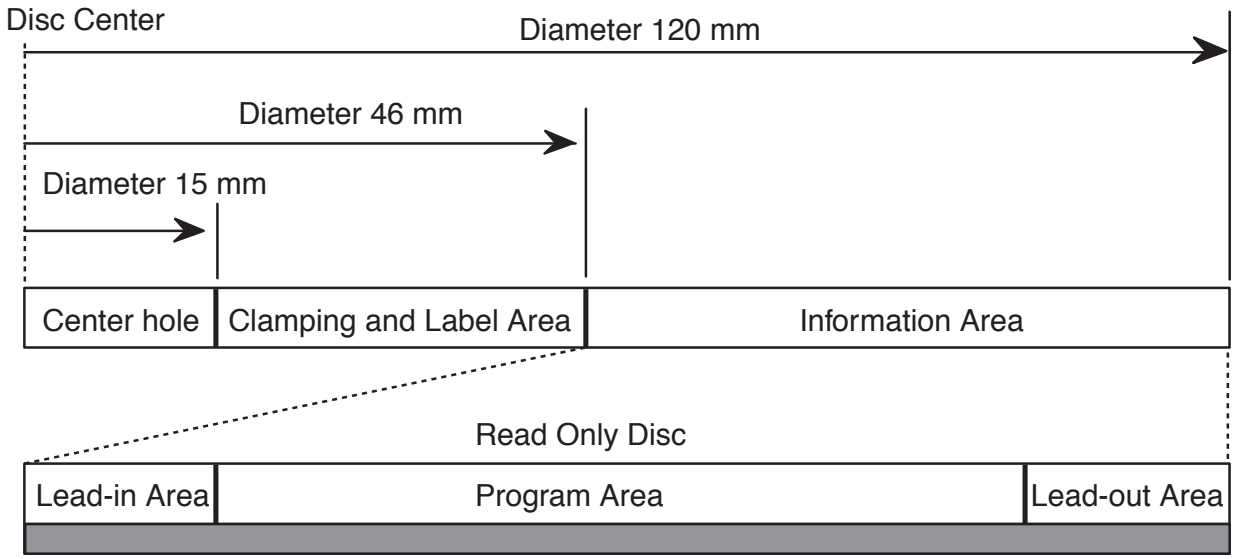
6. Writing process of CD-RW Disc



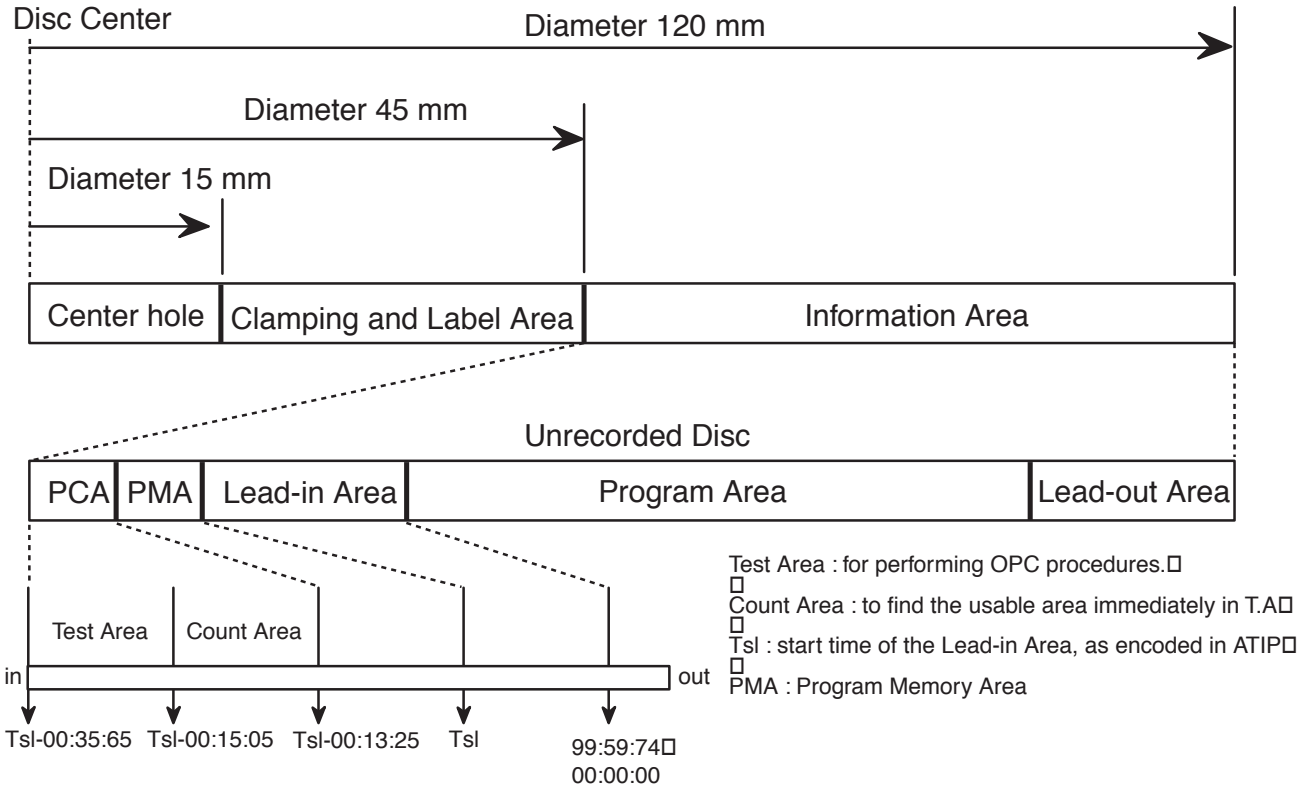


7. Organization of the PCA, PMA and Lead-in Area

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.

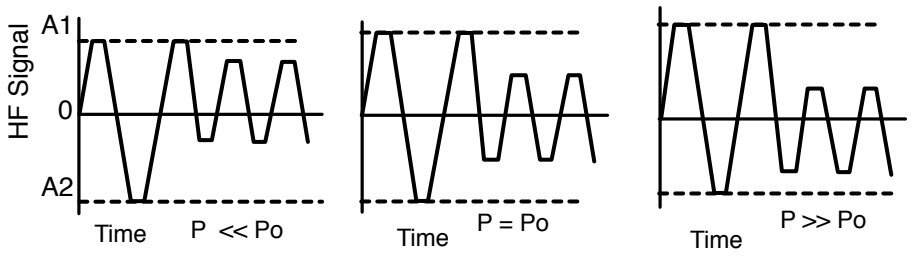
* When Disc is Finalized,
PMA information is transferred to the Lead_In area so that general Driver can read it.

* 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

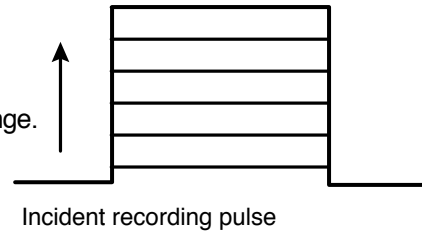
1) OPC (Optimum Power Control)

- 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)

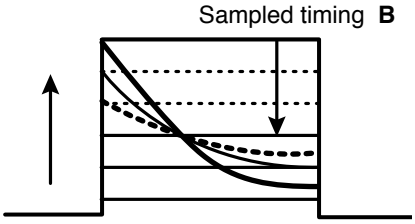


2) ROPC (Running Optimum Power Control)

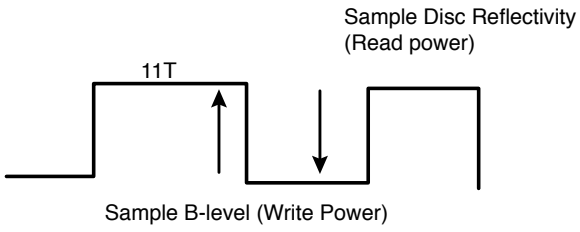
- Variable primary factor of Optimum Power
  - – Change of Power sensitivity on the Disc. (limited to 0.05 *Po)
  - – Wavelength shift of the laser diode due to the operating temperature change.
  - – Change of the Spot aberration due to the Disc skew, Substrate thickness, Defocus.
  - – Change of Disc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

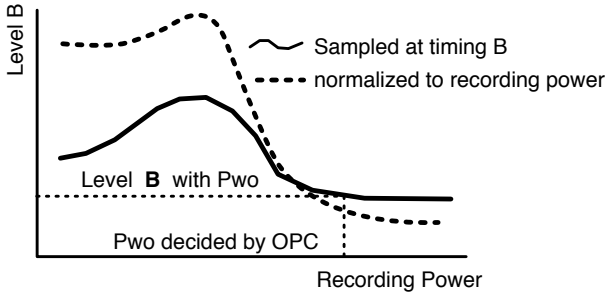

Incident recording pulse

- 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.

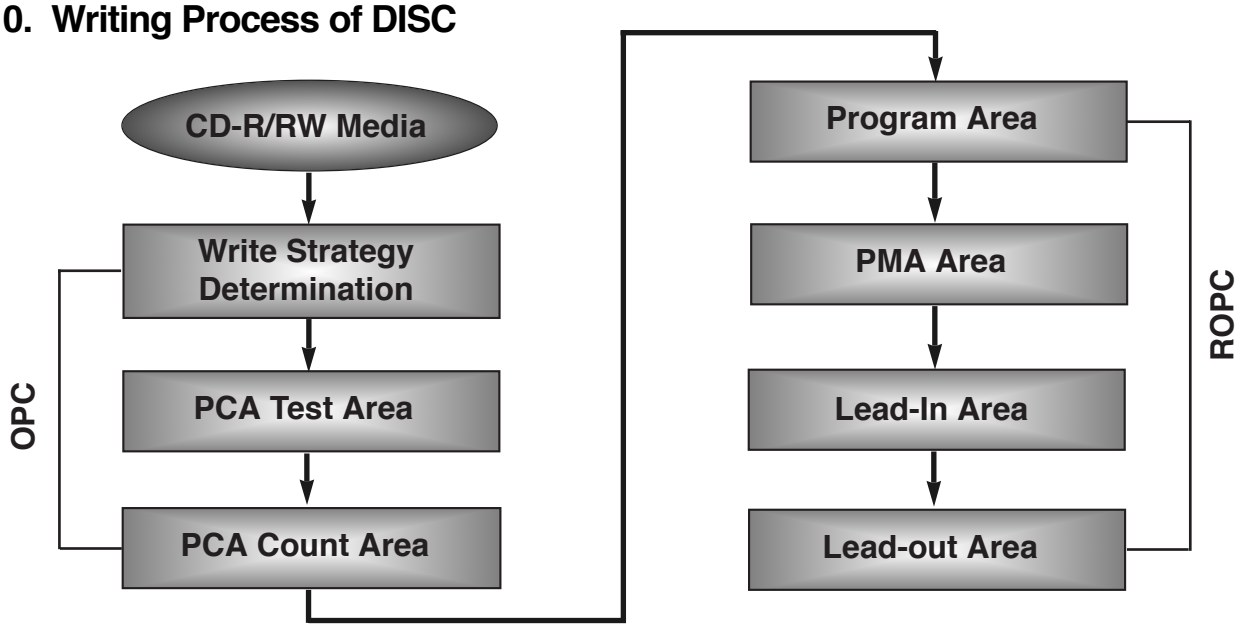


Reflected recording pulse





10. Writing Process of DISC



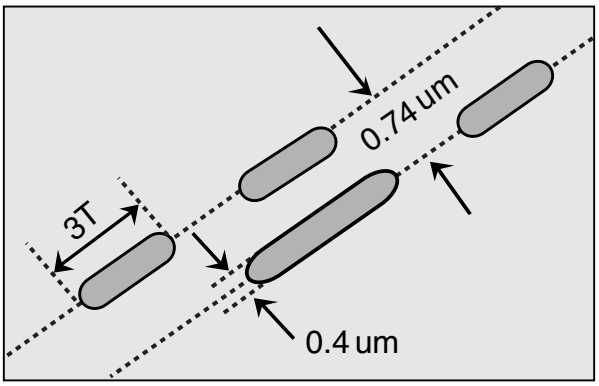
*** Recording Capacity of CD-R/RW (74Minute Recording media)**

- (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.)

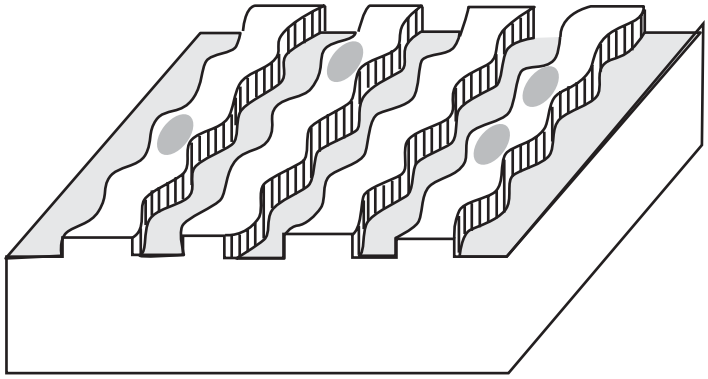
The differences of DVD-R/RW, DVD+R/RW discs and DVD-ROM

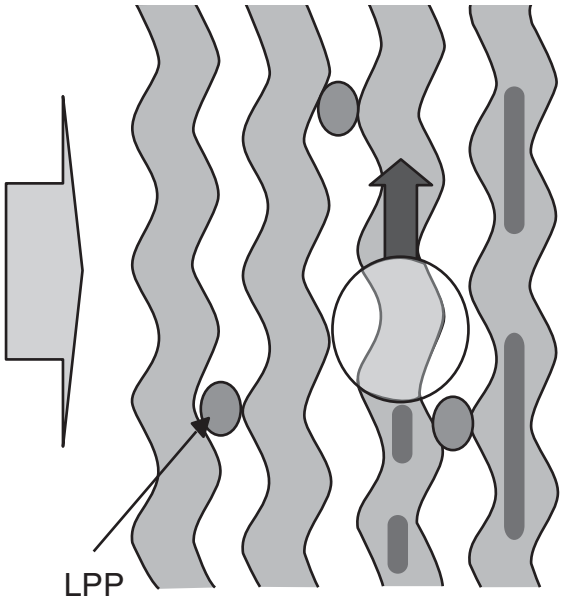
1. Recording Layer

DVD-ROM (Read Only Disc)

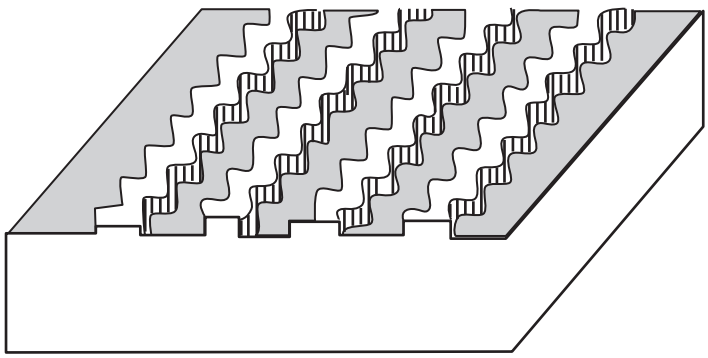


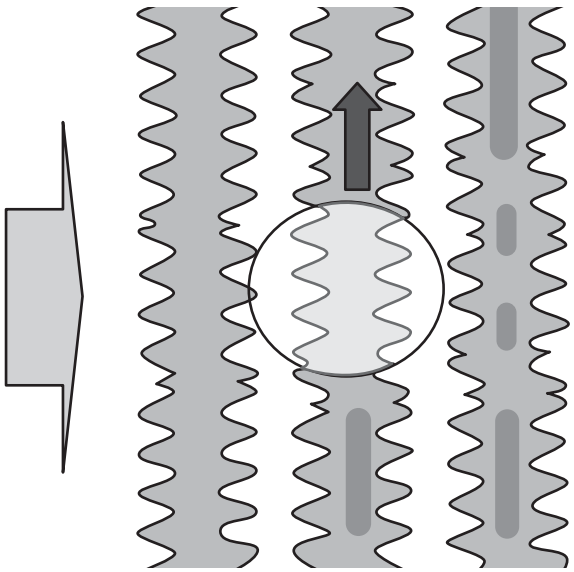
DVD-R/RW Disc





DVD+R/RW Disc





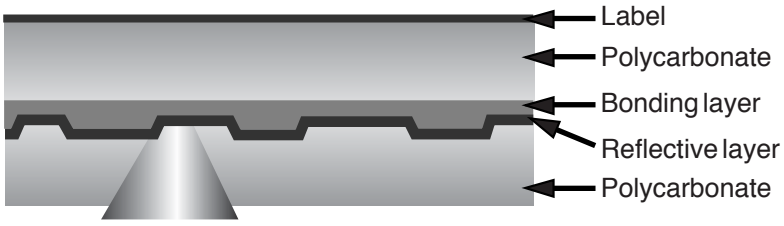
2. Disc Specification

	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%

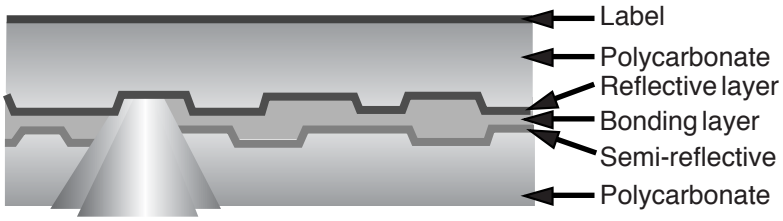
3. Disc Materials

1) DVD-ROM

<Single Layer >



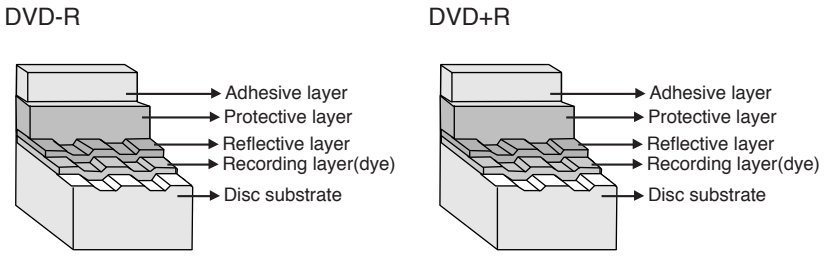
<Dual Layer >



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



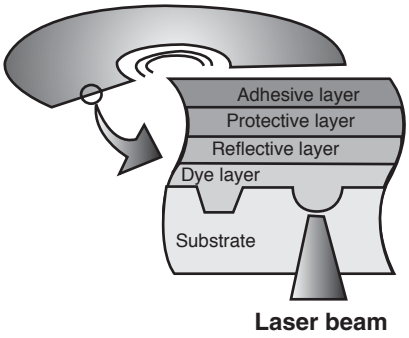
> Disc structure

[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.

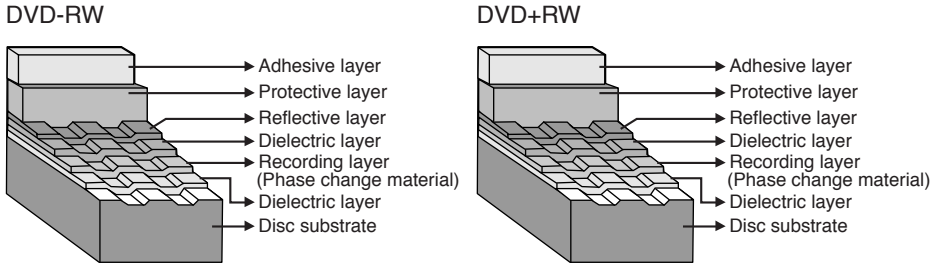


3) Recording format using phase-change recording material (DVD-RW/DVD+RW)

* 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



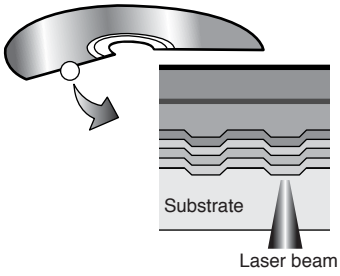
> Recording principles

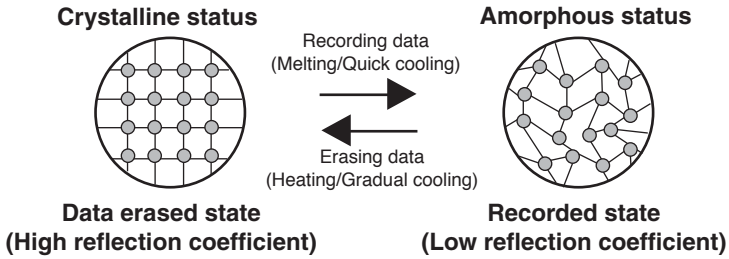
[Recording]

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.





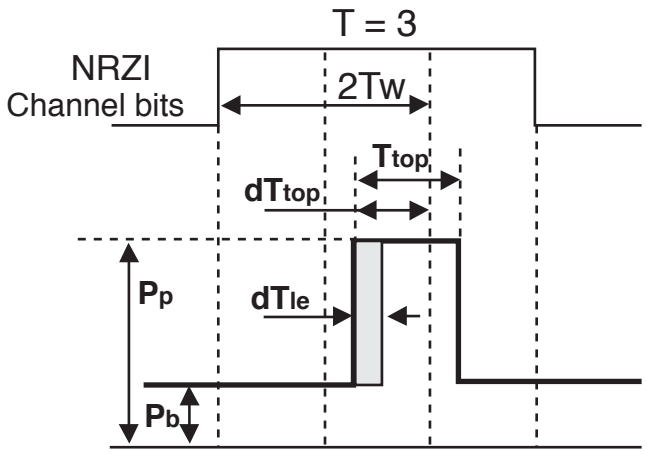
4. Writing Pulse Wave Form of DVD+R

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.

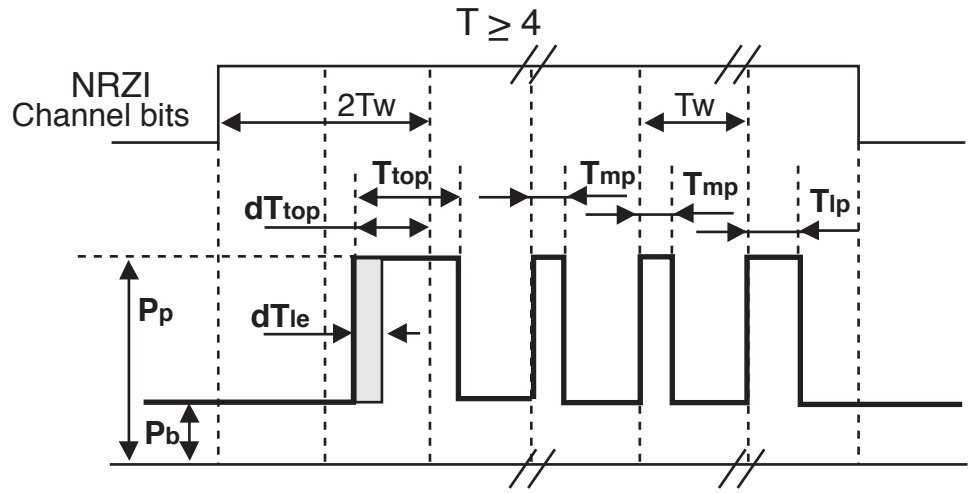
1) 1st Method : Using Pulsed Write Strategy

*** 3T :**



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

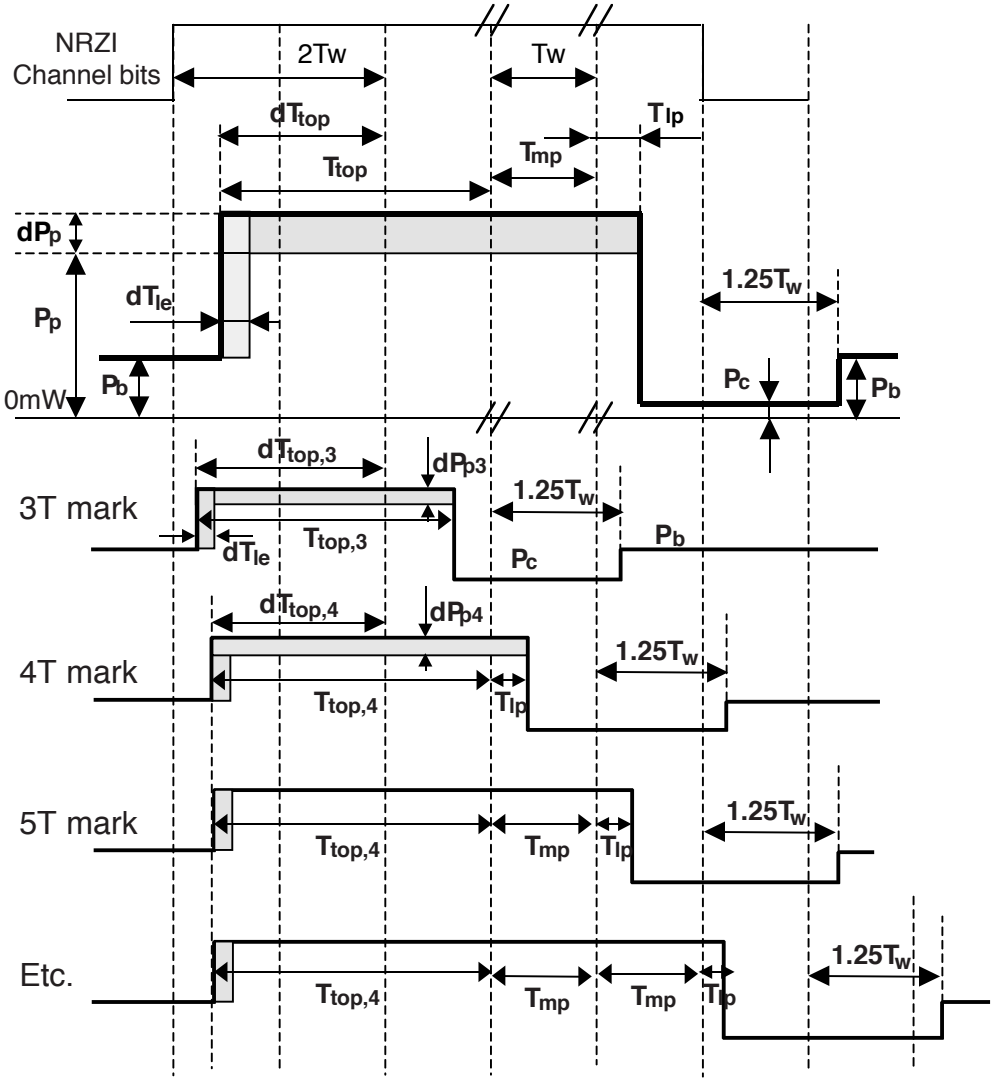
*** ≥ 4T :**



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

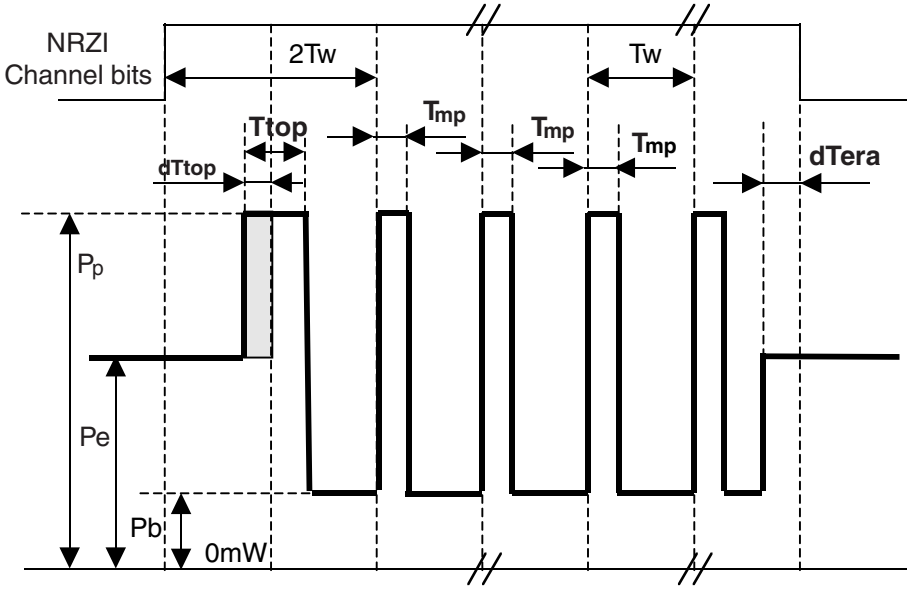
2) 2st Method : Using Blocked Write Strategy



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.)

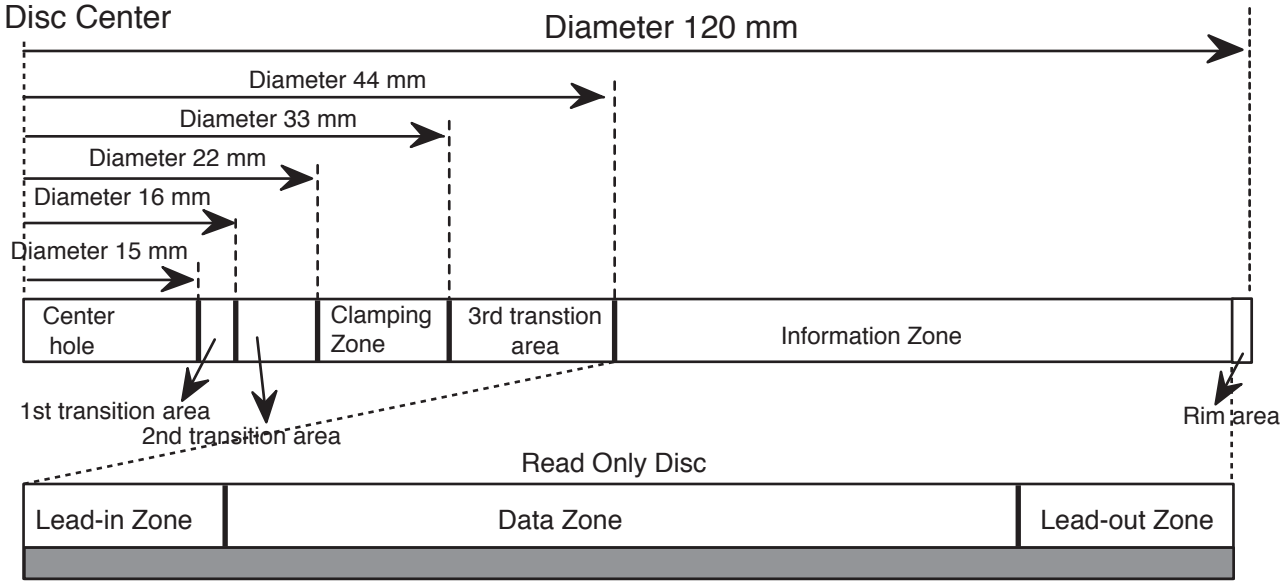
5. Writing Pulse Wave Form of DVD+RW



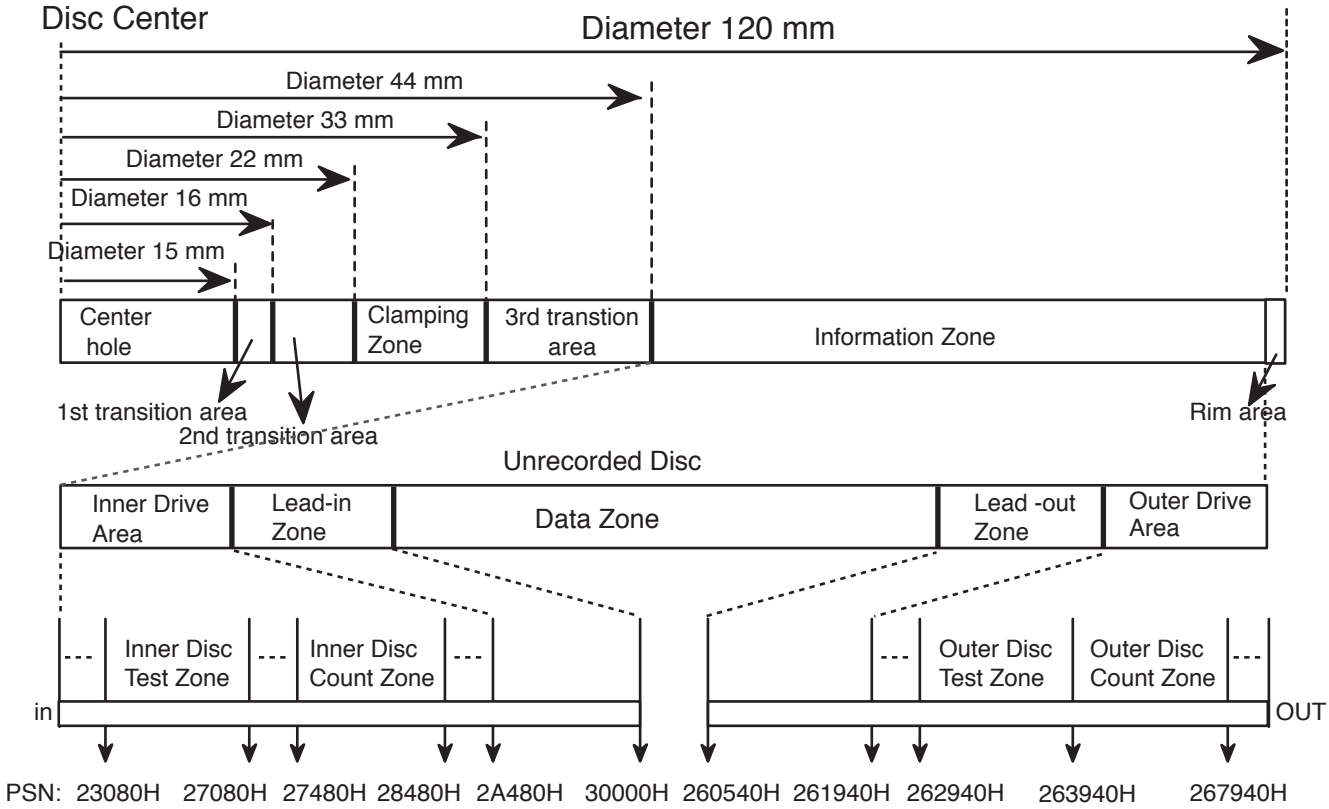
Pp : Actual write power
Pe : Erase Power
Pb : Bias Power

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

1) Layout of DVD-ROM disc

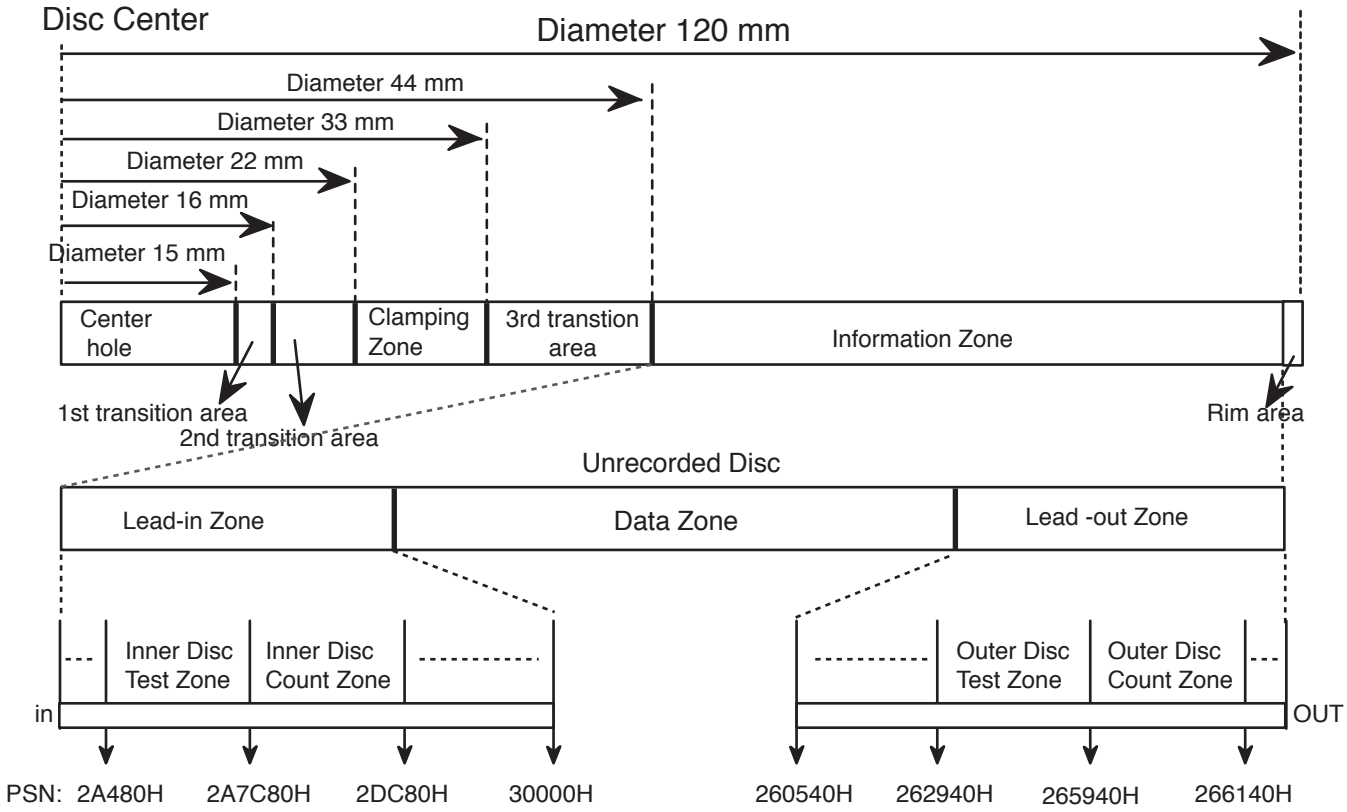


2) Layout of DVD+R disc



> 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.

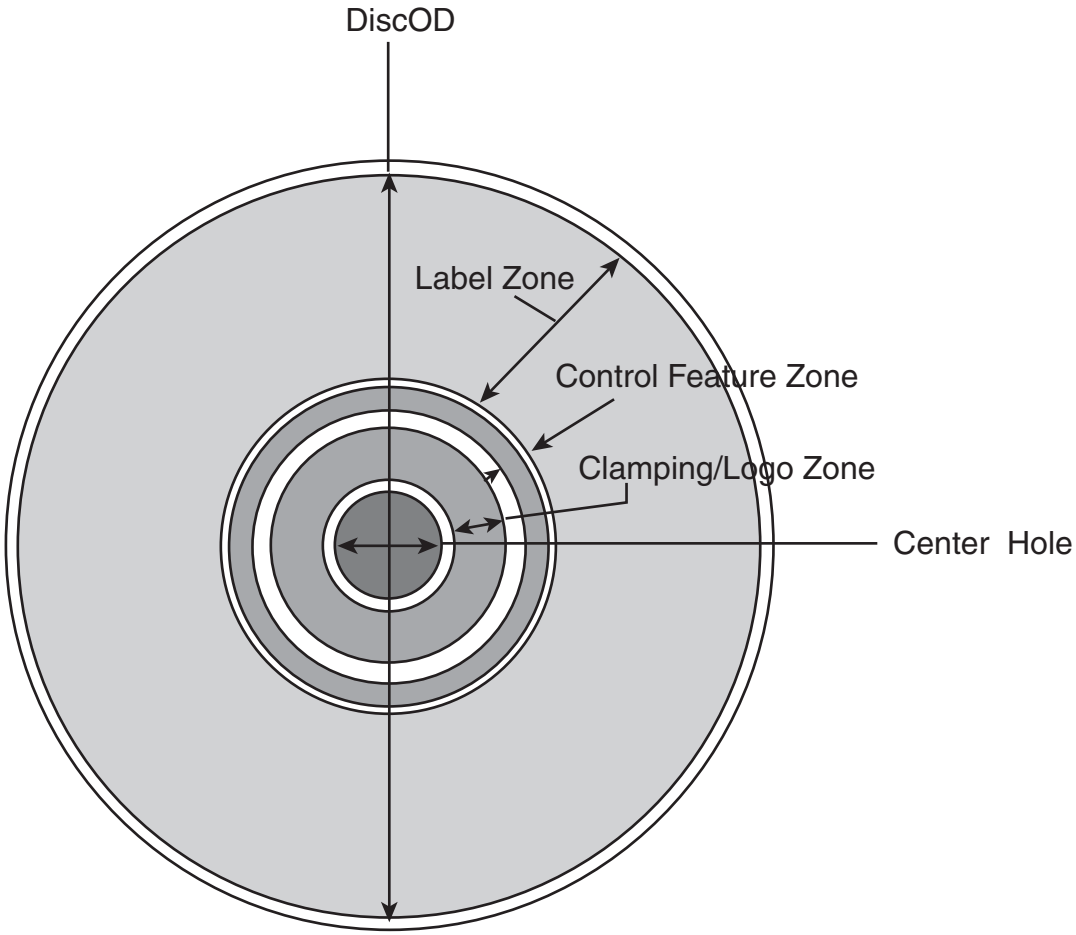
3) Layout of DVD+RW disc

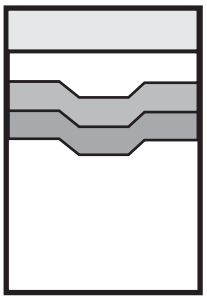


> Inner Disc Test Zone : for performing OPC procedures.
> Inner Disc Count Zone : for counting the number of OPC algorithm performed in IDT Zone.
> Outer Disc Test Zone : for performing OPC procedures.
> Outer Disc Count Zone : for counting the number of OPC algorithm performed in IDT Zone.

LightScribe Media

1. LightScribe Media

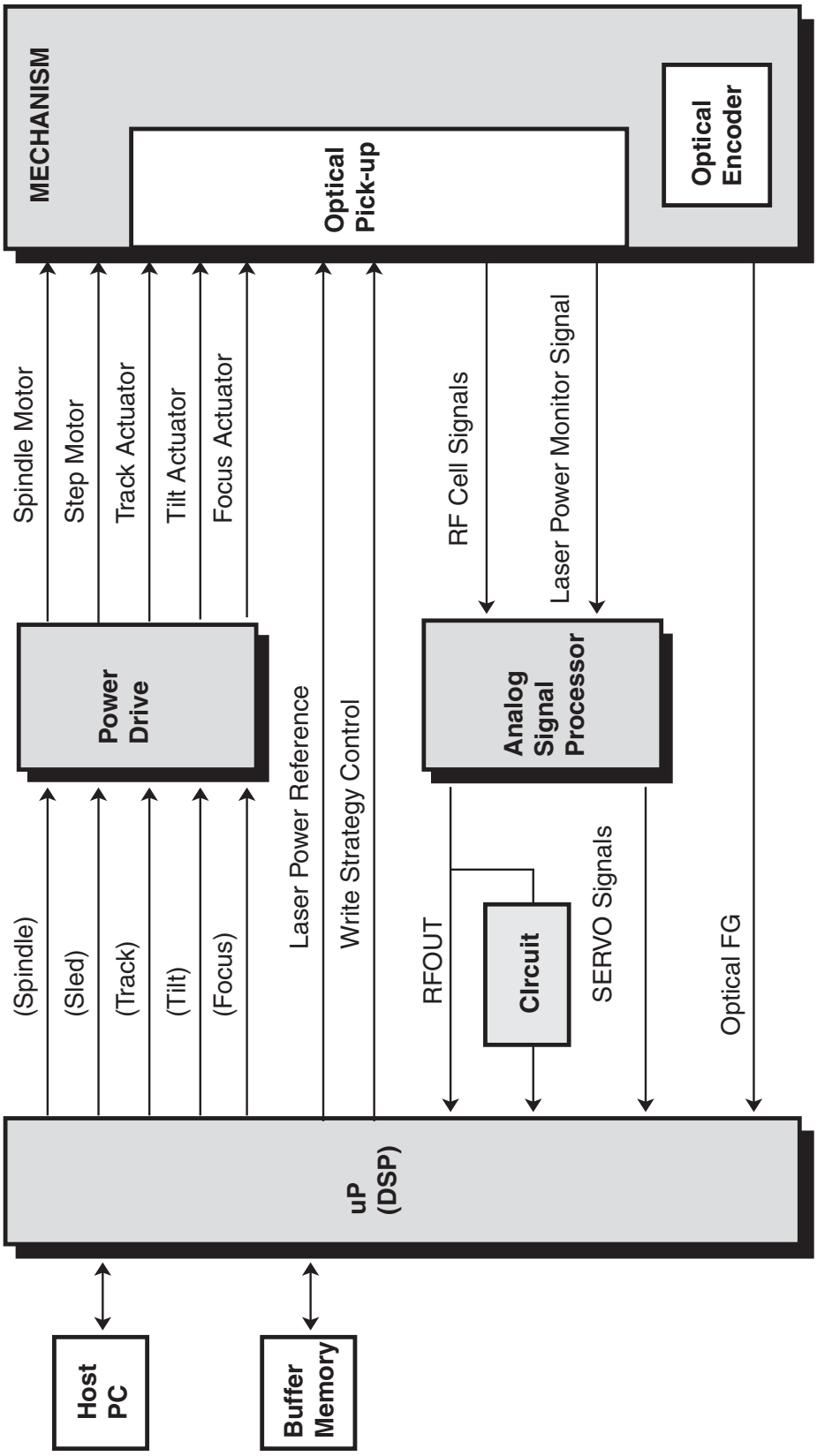




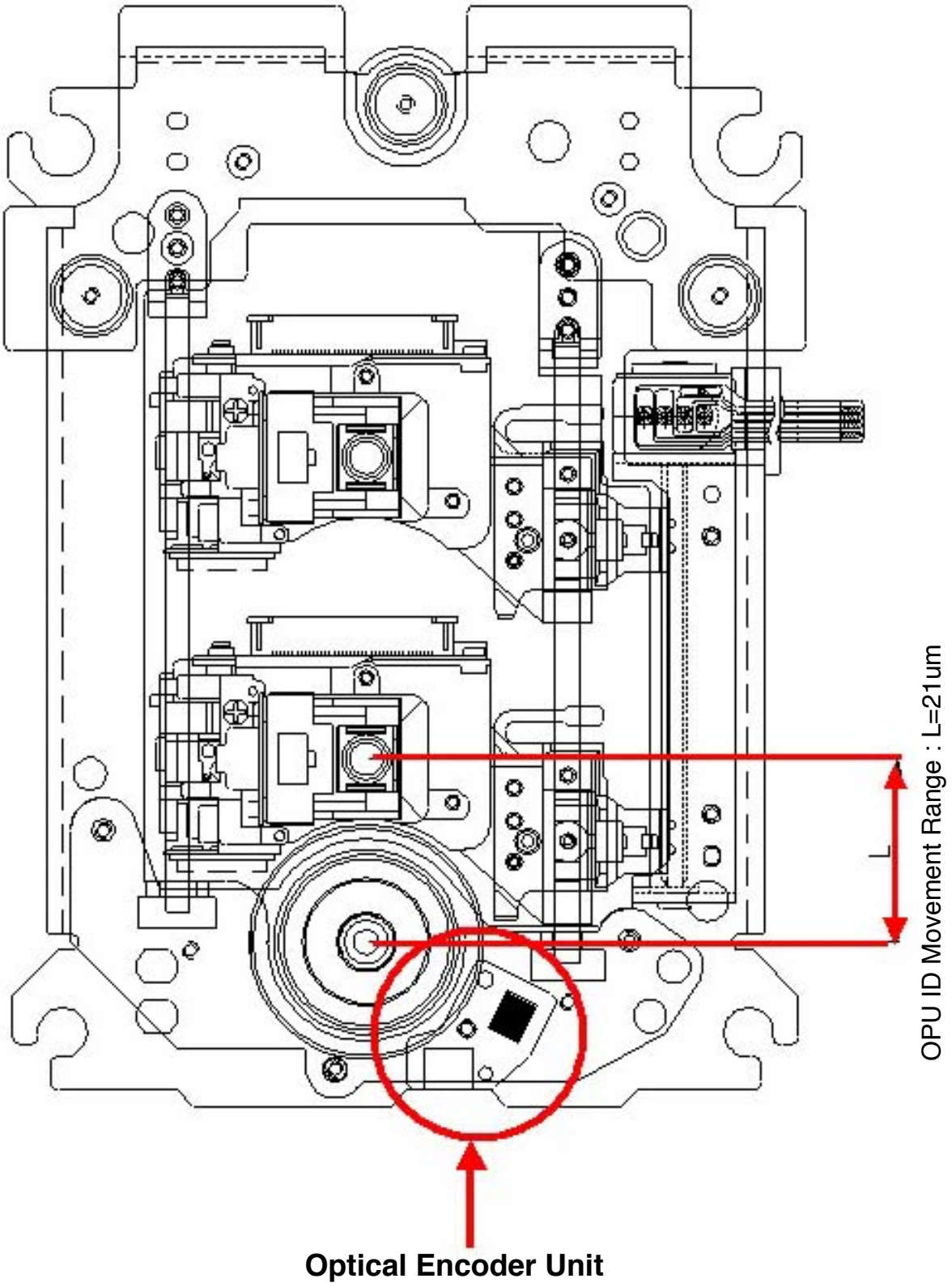
Screen Printed Imaging Layer
Clear Protective Coating
Reflective/Thermal Layer
Dye Data Layer

Polycarbonate
Substrate

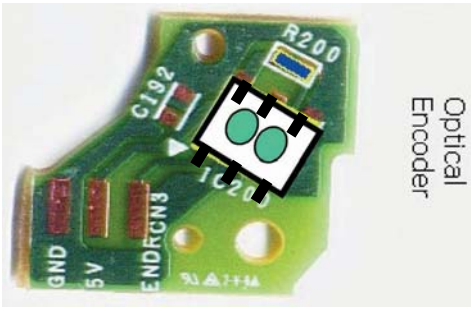
2. Hardware Block Diagram of LightScribe Label Printing



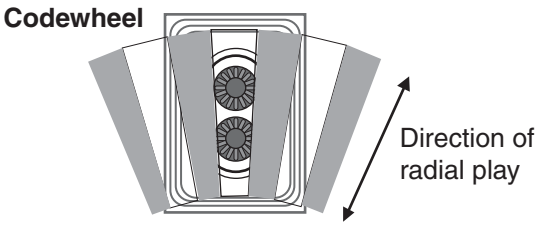
3. MD Assy For LightScribe



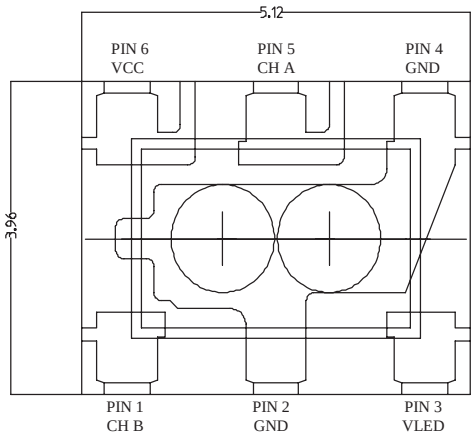
4. Optical Encoder Assy

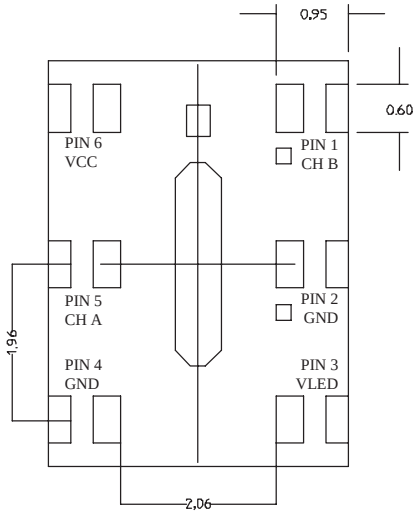


Encoder PCB

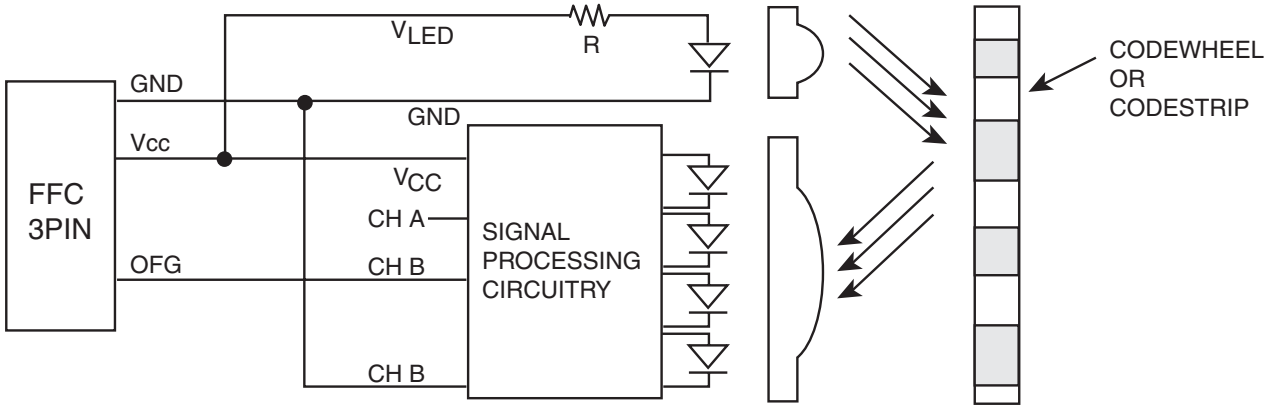


Optical Encoder IC



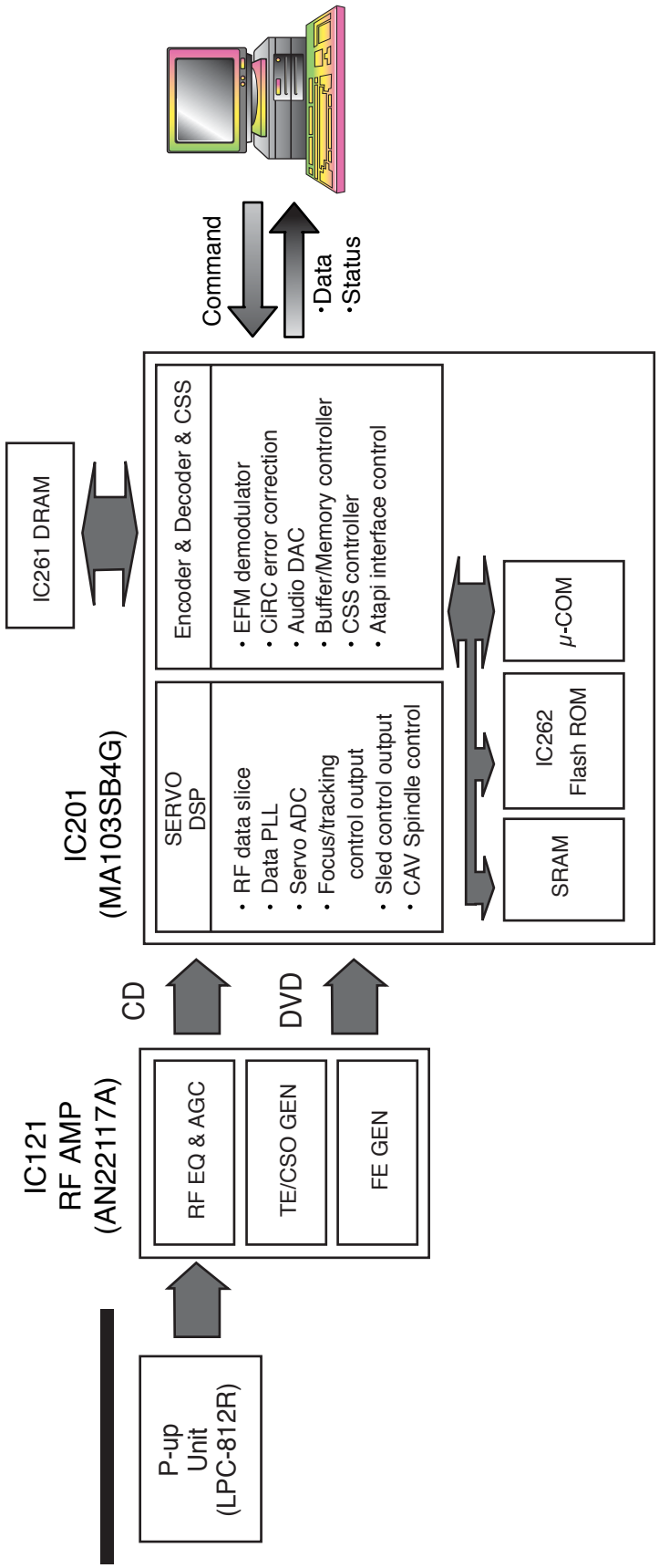


Schematic of Enc PCB



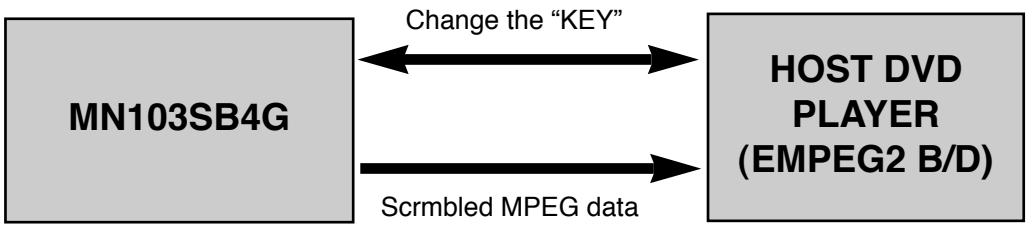
DVD & CD DATA PROCESSING

1. Data Processing Flow



2. Copy Protection and Regional Code Management Block

Block Diagram



KEY Magagement 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.

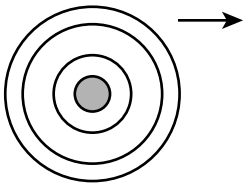
(2) Encoded “Disc Key” and “Title Key” host is transfer with the bus Key.

(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 Prevention the DVD-ROM from to be copy

A data is able to encode and record in the disc, if a copyright holder wants to prevent the disc from copying.



In case of a disc enhanced movie of 3 titles.....

DISC KEY (2048 Bytes) is used to encode the whole contents in the disc and TITLE KEY (5 Bytes) is used to encode the title respectively.

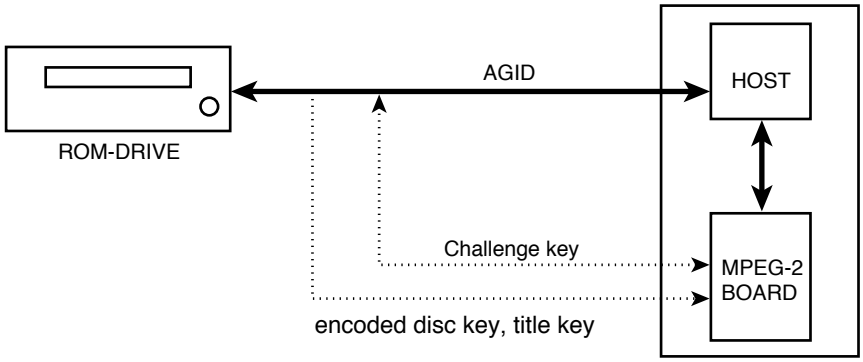
So, the data is encoded and stored in a disc through the unknown algorithms with a disc key and title key. (At this time, the disc key and title key are stored in a disc.)

... As above, the disc is able to copy when the disc key and title key are opened.

Then, ROM-DRIVE encodes the disc key and title key and transfers to MPEG-2 board.

If you want to play the disc prevented from the copy.....

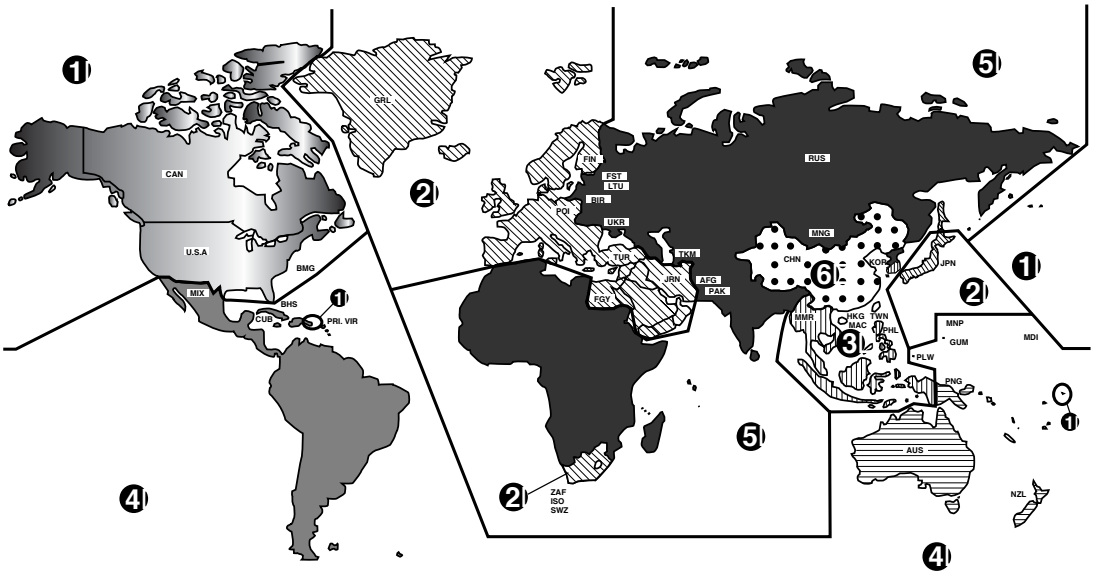
First of all, ROM-DRIVE and MPEG-2 board identify with each other through the procedure as described below.

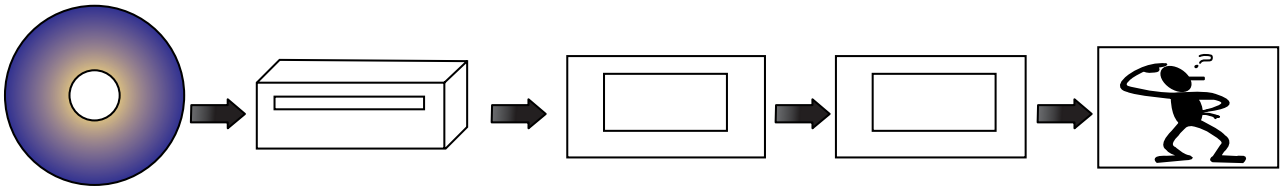


1. Drive and host gives and takes the ID of 2bit. This ID is AGID (Authentication Grant ID).
   The various decoder boards are attached to the host, in these, AGID sets the MPEG-2 board and drive.
2. After the AGID is set, MPEG-2 board generates the challenge key (10 Byte) and transfers to drive. The board and drive generate key 1 (5Byte) with the challenge key respectively. (Of course, the Algorithm generating the key 1 is not known.)
3. Compare with the generated key 1, if it corresponds each other, the first step of authentication is completed. This is a course to identify the MPEG-2 board with a drive.
4. The second step of authentication is a course to identify a drive with the MPEG-2 board.
   The dirve generates a challenge key and transfers it to the MPEG-2 board. The dirve and MPEG-2 board generate the key 2 (5Byte) with the challenge key, compare with each other, and if it corresponds and the secondary step of authentication is completed.
5. As above, the identification is completed.
6. The dirve and MPEG-2 board generate the Bus key with the key 1 and key 2 and own it.
7. Dirve encodes the disc key and title key with this Bus key and transfers to the MPEG-2 board.
8. The MPEG-2 board reads the encoded disc key and title key with the Bus key only.
9. MPEG-2 board lets data read from the drive to decode with the read disc key and title key and makes into the video signal by decoding.

4. 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.

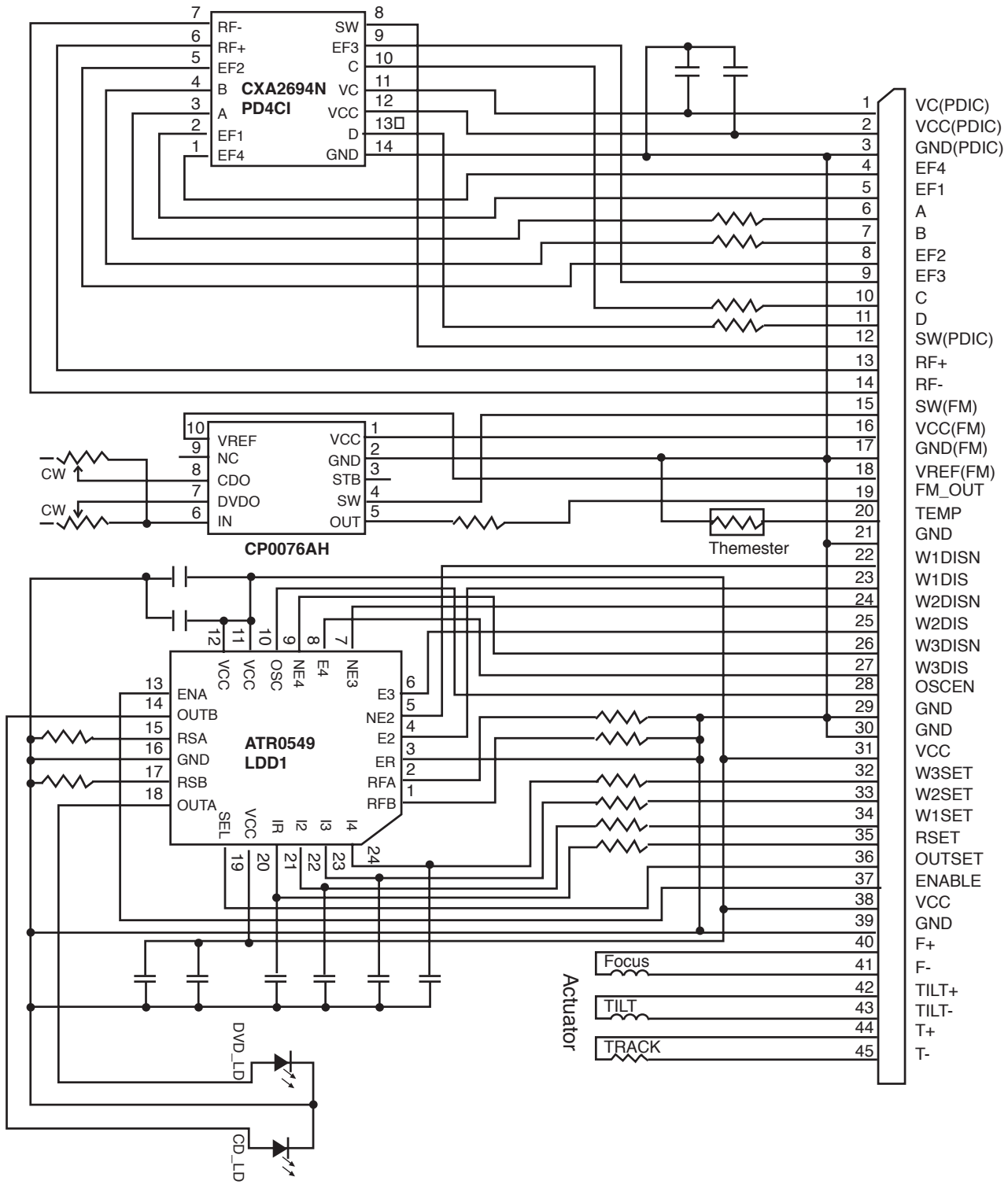
Transfer to MPEG-2 board reading the regional code.

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

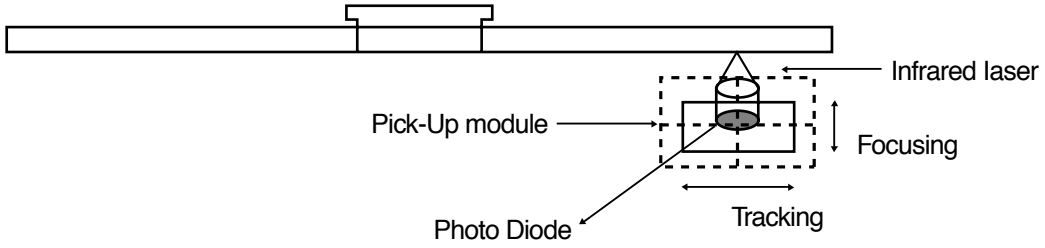
1. Block Diagram of the PICK-UP(LPC-812R)



2. Pick up Pin Assignment

No.	Pin Name	Signal Description
45	T-	Tracking Actuator drive signal-
44	T+	Tracking Actuator drive signal+
43	Tilt-	Tilting Actuator drive signal-
42	Tilt+	Tilting Actuator drive signal+
41	F-	Focusing Actuator drive signal-
40	F+	Focusing Actuator drive signal+
39	GND(LDD)	Ground connection for LDD
38	VCC(LDD)	Power supply for LDD
37	ENABLE	Disables output current regardless of OUTEN(ENABLE Low:No lout)
36	OUTSEL	High:selects DVD LD, Low:CD LD
35	RSET	Input voltage for current amplifier
34	W1SET	Input voltage for current amplifier
33	W2SET	Input voltage for current amplifier
32	W3SET	Input voltage for current amplifier
31	VCC(LDD)	Power supply for LDD
30	GND(LDD)	Ground connection for LDD
29	GND(LDD)	Ground connection for LDD
28	OSCEN	TTL control for Oscillator Enable (High Enable)
27	W3DIS	LVDS control for output current (High Enable)
26	W3DISN	LVDS control for output current (Low Enable)
25	W2DIS	LVDS control for output current (High Enable)
24	W2DISN	LVDS control for output current (Low Enable)
23	W1DIS	LVDS control for output current (High Enable)
22	W1DISN	LVDS control for output current (Low Enable)
21	GND(FPD)	Ground connection for PDIC, FPD, TEMP
20	TEMP	Output voltage for controlling temperature
19	FPD-OUT	APC amplifier output
18	VREF(FPD)	APC amplifier reference voltage output
17	GND(TEMP)	Ground connection for PDIC, FPD, TEMP
16	VCC(FPD)	Power supply for FPD
15	SW2(FPD)	FPD output gain Select (High : CD, Low:DVD)
14	RF-	Signal PDIC RF negative differential output
13	RF+	Signal PDIC RF positive differential output
12	SW1(PDIC)	PDIC output gain Select (L/M/H)
11	D	Signal PDIC output D
10	C	Signal PDIC output C
9	EF3	Signal PDIC output EF3
8	EF2	Signal PDIC output EF2
7	B	Signal PDIC output B
6	A	Signal PDIC output A
5	EF1	Signal PDIC output EF1
4	EF4	Signal PDIC output EF4
3	GND(PDIC)	Ground connection for PDIC, FPD, TEMP, LDD
2	VCC(PDIC)	Power supply for PDIC(+5V)
1	VC(PDIC)	Reference voltage input for PDIC)

3. Signal detection of the P/U



1) Focus Error Signal ==> (A+C)-(B+D)

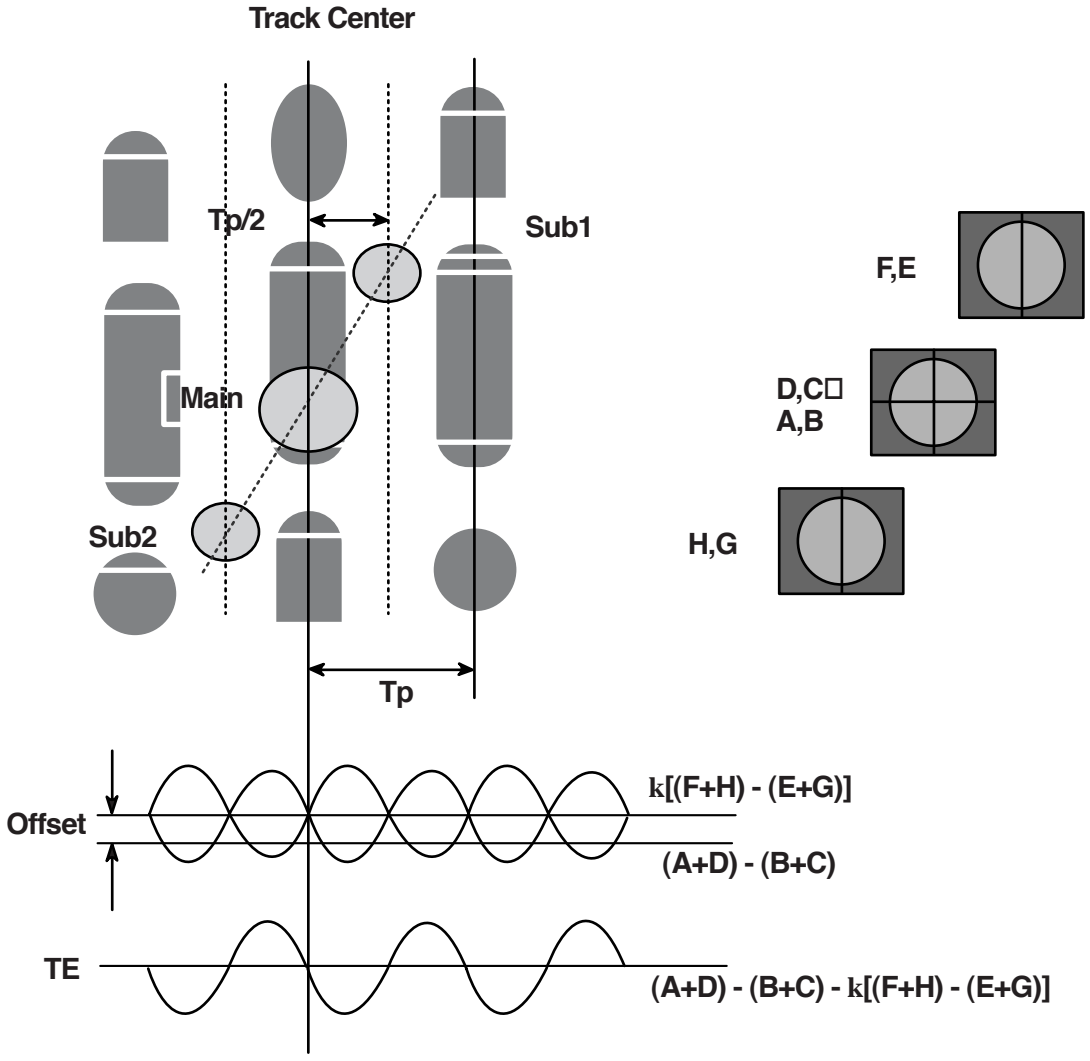
This signal is generated in SODC Servo Block (IC201, MN103SB4G) through (IC121, AN22117A) and controls the pick-up's up and down to focus on Disc.

2) Tracking Error Signal (DPP Method) ==> {(A+D)-(B+C)}- k x {(EF_1+EF_4)-(EF_2+EF_3)}

This signal is generated in SODC Servo Block (IC201, MN103SB4G) through (IC121, AN22117A) and controls the pick-up's left and right shift to find to track on Disc.

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

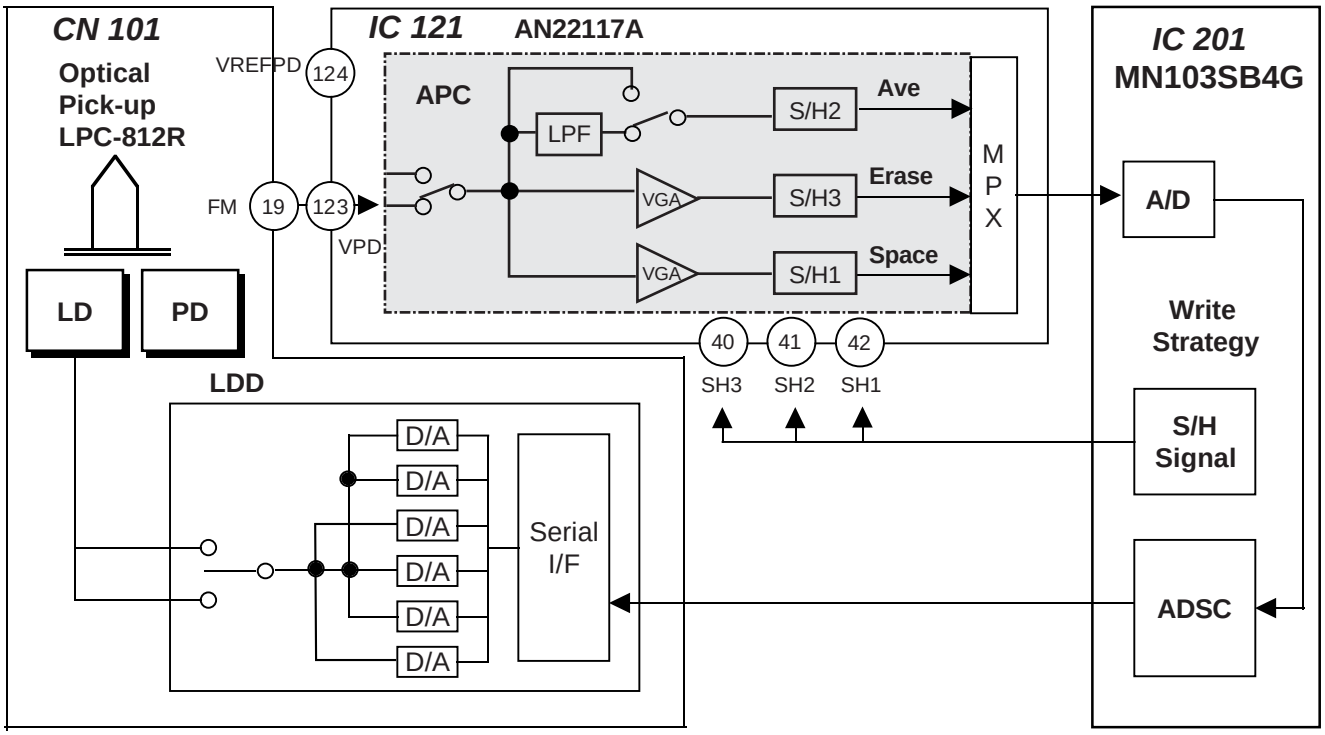
This signal is converted to DATA signal in DSP IC (IC201 : MN103SB4G).



DESCRIPTION OF CIRCUIT

1. ALPC (Automatic Laser Power Control) Circuit

1-1. Block Diagram

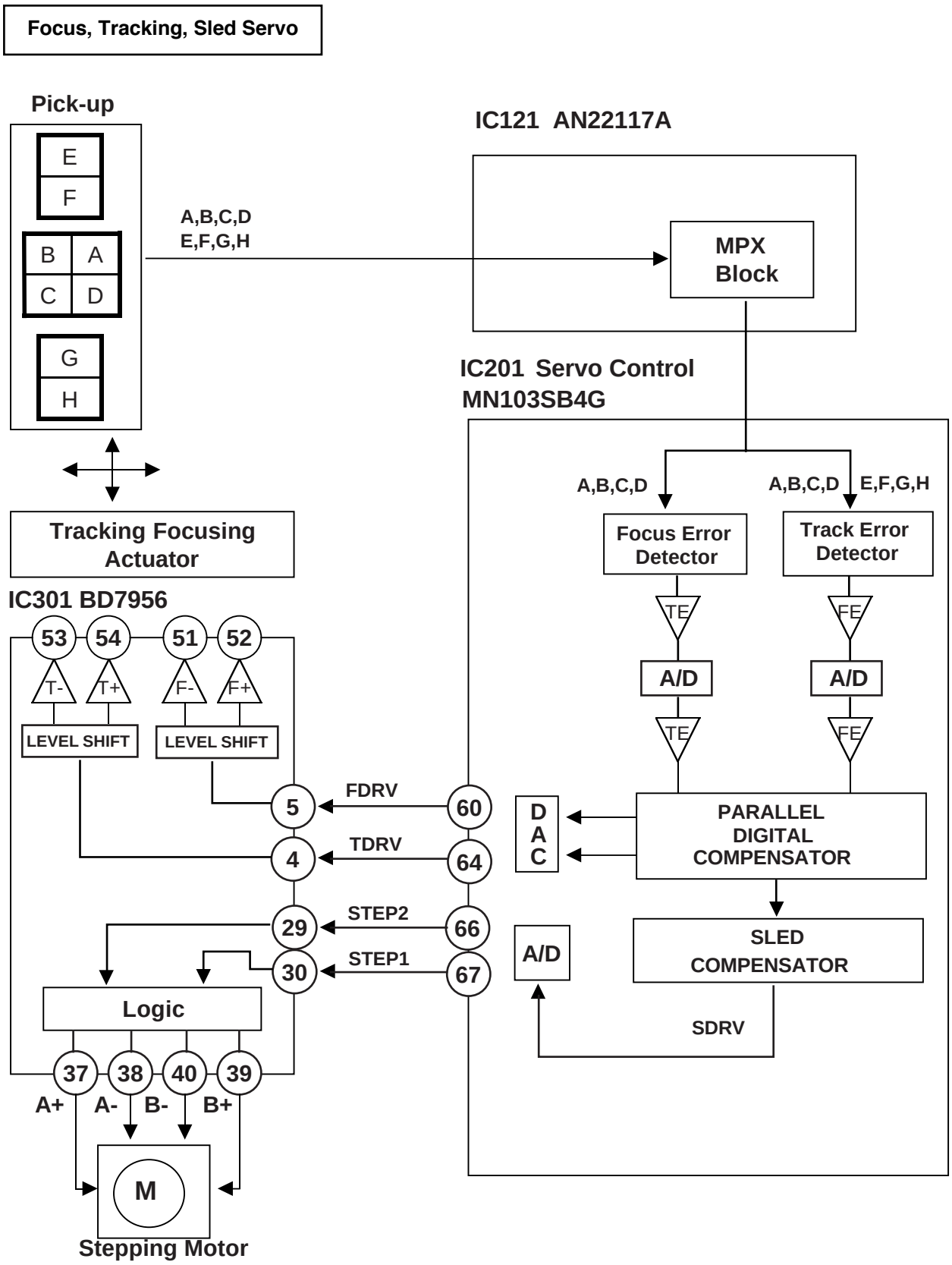


1-2. ALPC (Automatic Laser Power Control) Circuit Operation

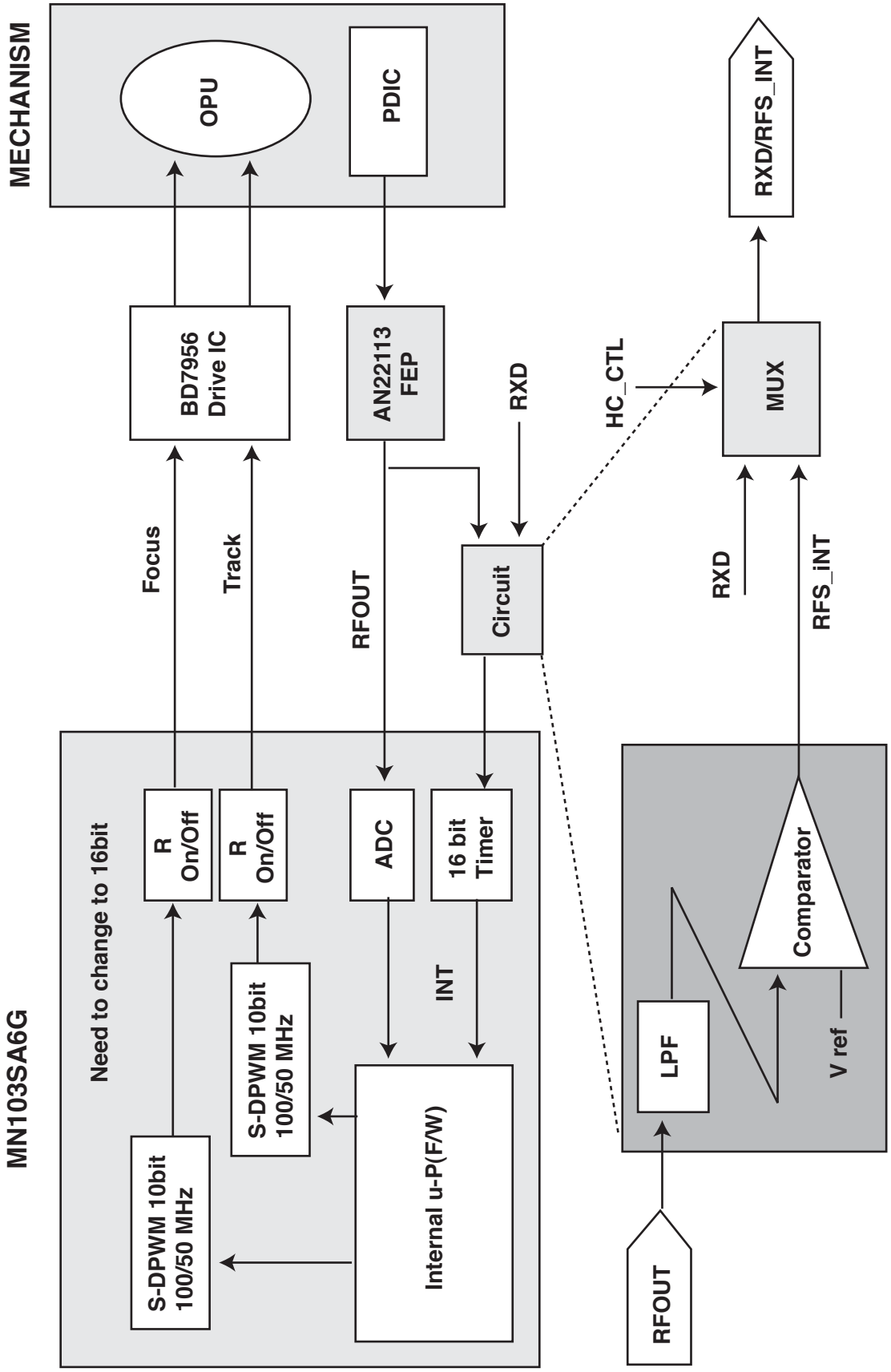
The ALPC block detects the laser output power of the front monitor. The power signal detected with the PD for front monitor detection is input the voltage from the VPD pin(123Pin), the reference signal of the input signal is input from the VREFPD pin(124Pin). The ALPC block generates the singals from 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

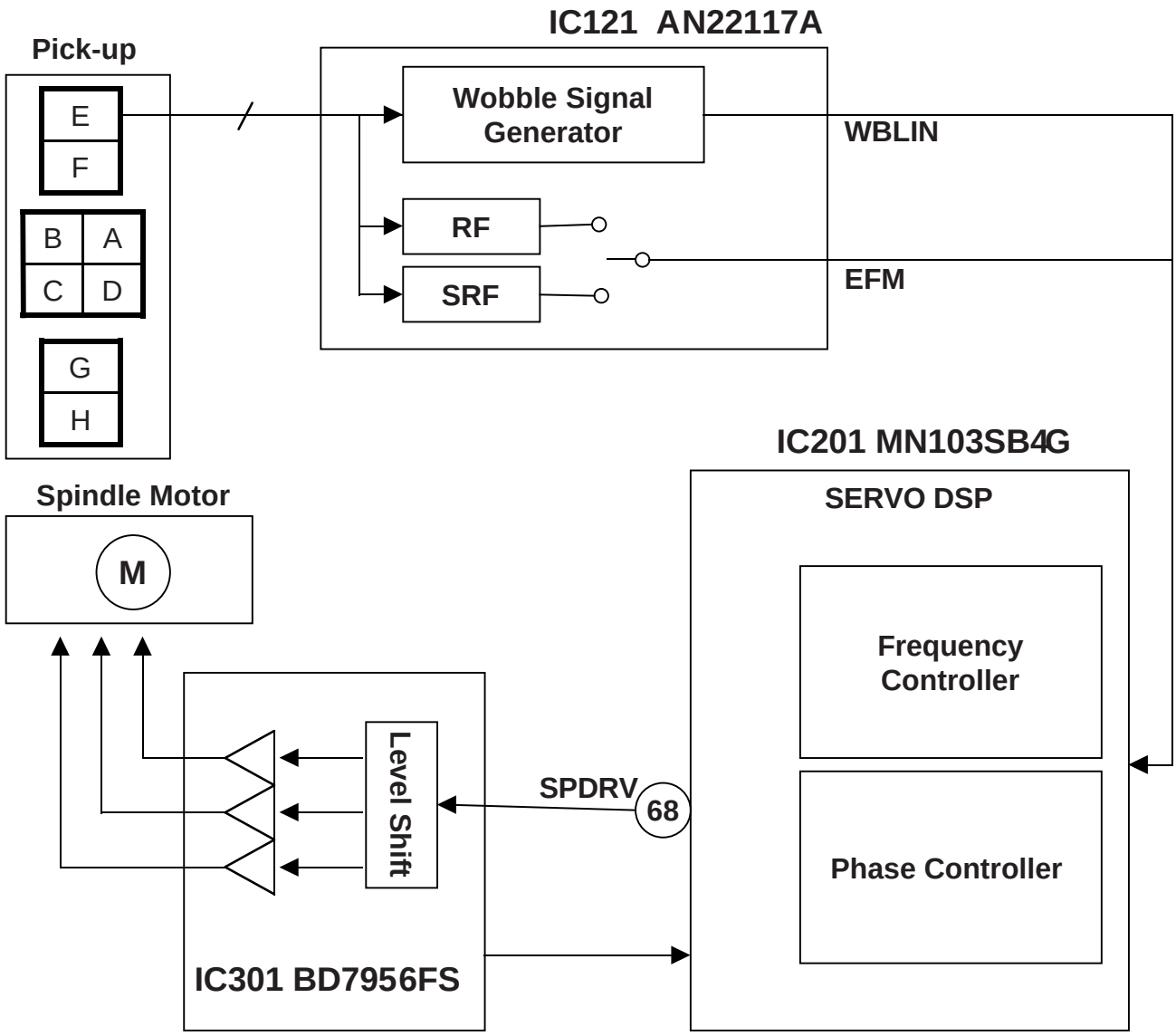


2-2. Focus & Tracking Servo Process(using the LightScribe)



3. Spindle Servo Circuit

3-1. Spindle Servo Process



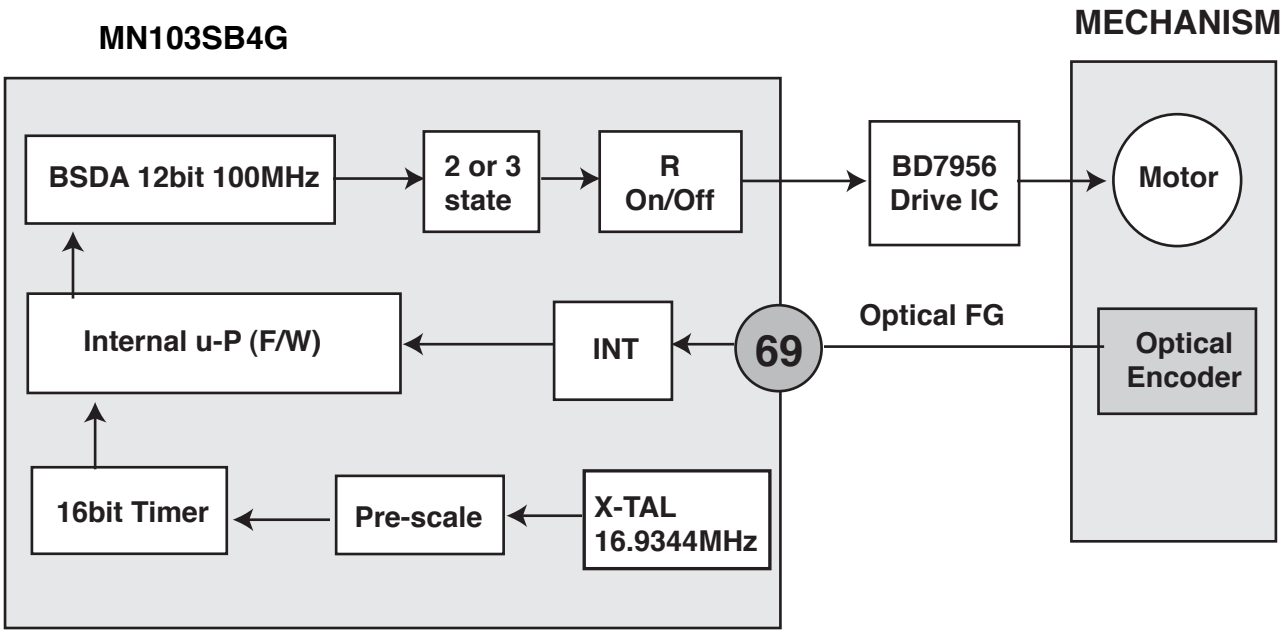
3-2. Spindle Servo

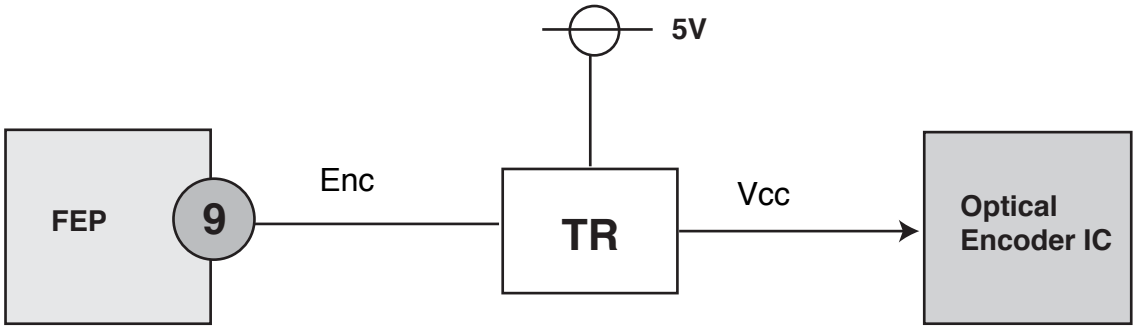
Spindle servo is as following ;

1) Wobble CLV 4x, 10x, 16x, 24x, 32x, 40x : Blank area in CD-R, CD-RW
2) Wobble CLV 1x, 2x, 2.4x, 4x, 8x : Blank area in DVD+/-R/RW
3) CD 15x CAV : Video CD, CD-DA(Audio out)
4) CD 32x CAV : CD-RW, CD-DA(DAE)
5) CD 40x, 48x CAV : CD-ROM/R
6) DVD 12x CAV : Single Layer DVD-ROM(Movie), Dual Layer DVD-ROM, DVD+RW, DVD-RW, DVD+R Double Layer
7) DVD 12x CAV : DVD+R, DVD-R
6) DVD 16x CAV : Single layer DVD-ROM(Data)

-Spindle Servo is controlled by IC201(MN103SB4G) and servo signal is output via SP-DRV(Pin68).

3-3. Spindle Servo Process(using the LightScribe)

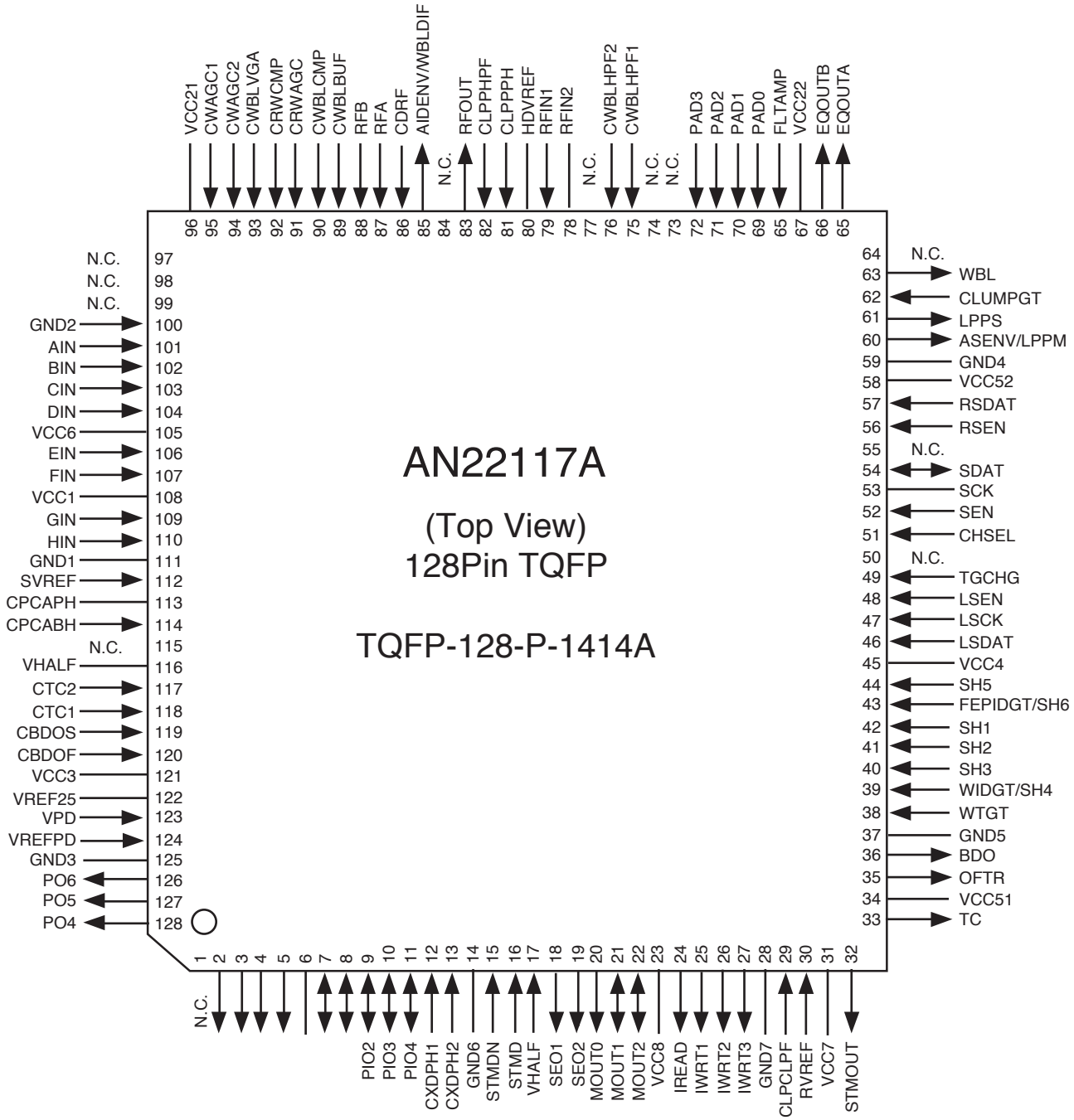




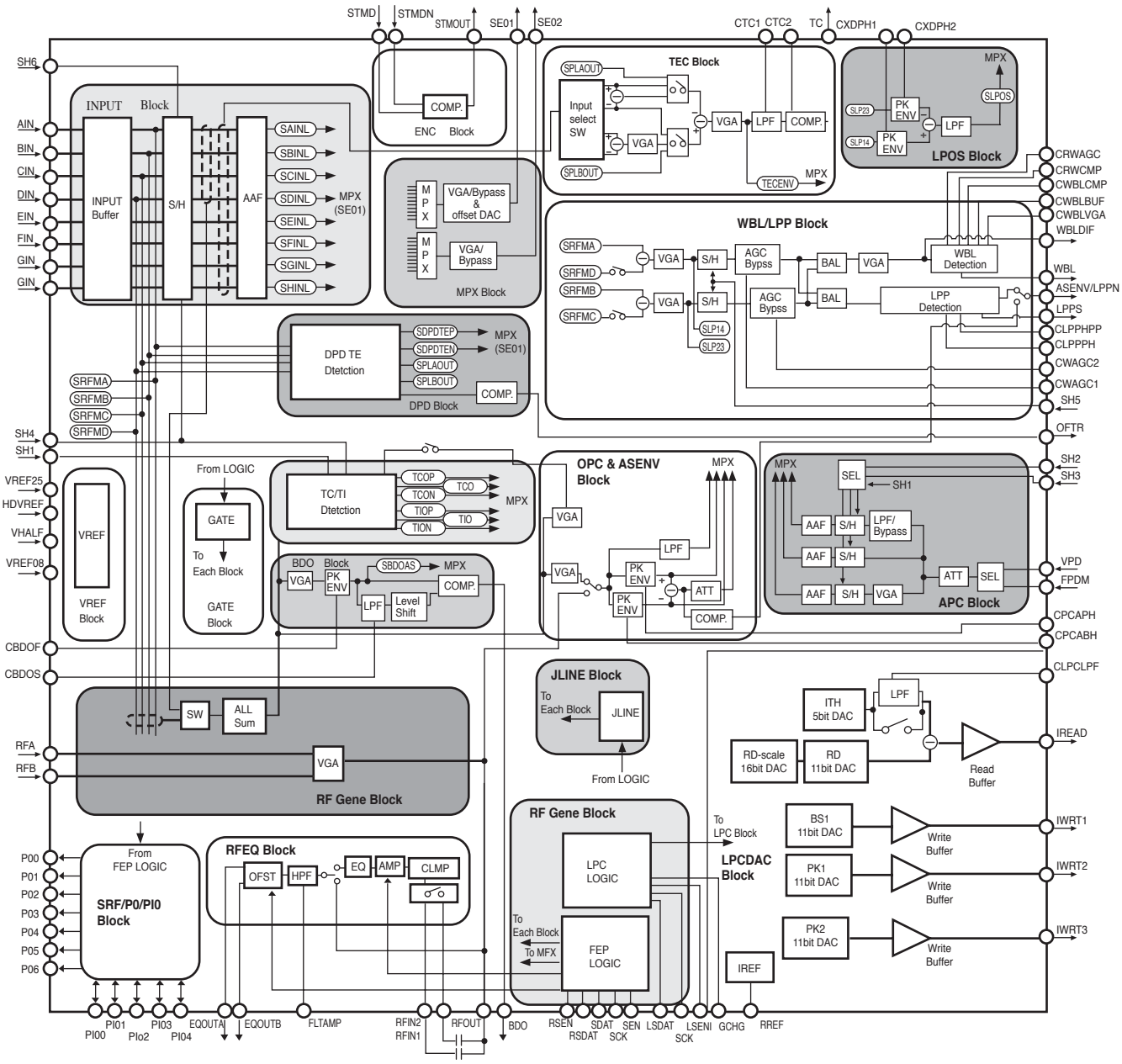
MAJOR IC INTERNAL BLOCK DIAGRAM AND PIN DESCRIPTION

IC121 (AN22117A) : FEP(RF) Analog Signal Processor

- **Pin Assignment**



Block Diagram



• Pin Assignment

Pin no.	Pin Name	Type	Function
1	NC	-	-
2	PO3	O	General CMOS output pin
3	PO2	O	Head Amp/OEIC gain change signal output pin 3.
4	PO1	O	Head Amp/OEIC gain change signal output pin 2.
5	PO0	O	Head Amp/OEIC gain change signal output pin 1.
6	VCC53	PS	Power supply pin for CMOS I/F & LOGIC.
7	PIO0	I/O	General CMOS Input/Output pin 0.
8	PIO1	I/O	General CMOS Input/Output pin 1.
9	PIO2	I/O	General CMOS Input/Output pin 2.
10	PIO3	I/O	General CMOS Input/Output pin 3.
11	PIO4	I/O	General CMOS Input/Output pin 4.
12	CXDPH1	I	PH capacitor commection pin 1 for LPOS.
13	CXDPH2	I	PH capacitor commection pin 2 for LPOS
14	GND6	PS	GND pin for BG.
15	STMDN	I	PD input pin for STM.
16	STMD	I	PD input pin for STM.
17	VREF08	O	0.8V reference voltage output pin (APC).
18	SEO1	O	Output pin 1 after selection of each error signal.
19	SEO2	O	Output pin 2 after selection of each error signal.
20	MOUT0	O	Analog monitor 0.
21	MOUT1	I/O	Analog monitor 1.
22	MOUT2	I/O	Analog monitor 2.
23	VCC8	PS	Power supply pin for LPC (5.0V)
24	IREAD	O	DAC electric current output pin for READ.
25	IWRT1	O	DAC electric current output pin 1 for WRITE.
26	IWRT2	O	DAC electric current output pin 2 for WRITE.
27	IWRT3	O	DAC electric current output pin 3 for WRITE.
28	GND7	PS	GND pin for LPC.
29	CLPCLPF	I	Capacitor connection pin for LPC/DAC LPF.
30	RVREF	I	Capacitor connection pin for reference voltage setting.
31	VCC7	PS	Power supply pin for LPC (3.3V).
32	STMOUT	O	Encoder circuit comparator output.
33	TC	O	Track cross signal output.
34	VCC51	PS	Power supply pin for CMOS I/F & LOGIC(3.3V)
35	OFTR	O	OFTR signal output.
36	BDO	O	BDO output.
37	GND5	PS	Ground pin for CMOS I/F.
38	WTGT	I	Write gate signal input pin (pull-down)
39	WIDGT/SH4	I	VFO through signal input pin. ROPC mark detection sampling signal innput pin (pull-down)
40	SH3	I	PCA average detection, APC space detection/Playback power detection/ Erase detection sample timing signal input pin(pulldown).

Pin no.	Pin Name	Type	Function
41	SH2	I	PCA peak/bottom detection, APC space detection/ Playback power detection/ Erase detection sample timing signal input pin (pulldown)
42	SH1	I	ROPC space detection, APC space detection/ Playback power detection sample timing signal input pin(pulldown).
43	FEPIDGT/SH6	I	CAPA through signal input pin/servo sampling signal input pin (pull-down)
44	SH5	I	Sample-and-hold timing signal input pin of wobble S/H at recording (pull-down)
45	VCC4	PS	Power supply pin for internal LOGIC (5.0V)
46	LSDAT	I/O	Serial data input for LPC.
47	LSCK	I	Serial clock enable input LPC.
48	LSEN	I	Serial enable input for LPC.
49	TGCHG	I	LPC DAC bank change control signal input pin.
50	NC	-	-
51	CHSEL	I	Serial MPX channel change data input pin.
52	SEN	I	Serial enable input pin for FEP (pull-down)
53	SCK	I	Serial clock input pin for FEP (pull-up).
54	SDAT	I/O	Serial data input pin for FEP.
55	NC	-	-
56	RSEN	I	Serial enable input for RF (pull-down).
57	RSDAT	I	Serial signal data input for RF
58	VCC52	PS	Power supply pin for CMOS I/F & internal current source power supply pin2 (3.3V)
59	GND4	PS	Ground pin for internal LOGIC
60	ASENV/LPPM	O	ASENV output/LPP mark output pin
61	LPPS	O	LPP space output pin
62	CLUMPGT	I	RFAGC input bias circuit clamp setting input pin (pulldown)
63	WBL	O	WBL binary output
64	NC	-	-
65	EQOUTA	O	Equalizer filter output pin 1.
66	EQOUTB	O	Equalizer filter output pin 2.
67	VCC22	PS	Power supply pin for RFEQ/LPP (5.0V)
68	FLTAMP	I	Filter final stage AMP reference voltage stabilization pin.
69	PAD0	I	A/D input pin 0
70	PAD1	I	A/D input pin 1
71	PAD2	I	A/D input pin 2
72	PAD3	I	A/D input pin 3
73	NC	-	-
74	NC-	-	-
75	CWBLHPF1	I	HPF capacitor connection pin for WBLAGC 1.
76	CWBLHPF2	I	HPF capacitor connection pin for WBLAGC 2.
77	NC	-	-

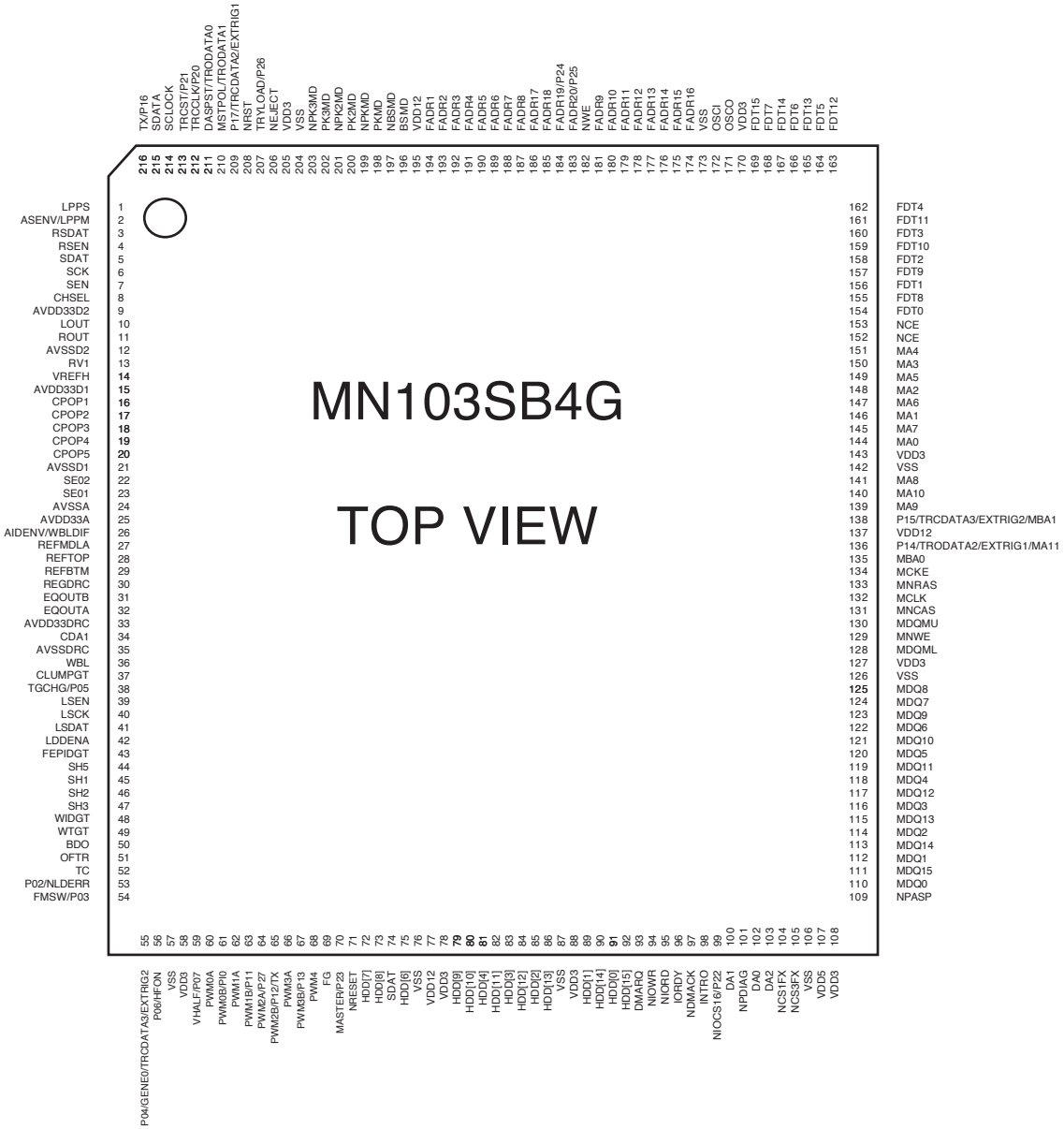
Pin no.	Pin Name	Type	Function
78	RFIN2	I	RFAGC signal input pin 2.
79	RFIN1	I	RFAGC signal input pin 1.
80	HDVREF	O	2.2V reference voltage output pin.
81	CLPPPH	I	Capacitor connection pin for LPP peak hold
82	CLPPHPF	I	Capacitor connection pin for LPPHPF
83	RFOUT	O	RF signal output pin.
84	NC	-	-
85	AIDENV/WBLDIF	O	ASENV binary output/Differential signal output pin for ADIP detection
86	CDRF	I	CD RF signal input pin.
87	RFA	I	DVD RF differential input pin 1.
88	RFB	I	DVD RF differential input pin 2.
89	CWBLBUF	I	Capacitor connection pin for WBLDIF.
90	CWBLCMP	I	Floating Capacitor connection pin for VGA before WBL binary.
91	CRWAGC	I	AGC adjustment capacitor connection pin for +RW.
92	CRWCMP	I	Floating Capacitor connection pin for VGA before WBLDIF AGC.
93	CWBLVGA2	I	Floating Capacitor connection pin for VGA before SRL.
94	CWAGC2	I	AGC adjustment capacitor connection pin 2 for WBL extraction.
95	CWAGC1	I	AGC adjustment capacitor connection pin 1 for WBL extraction.
96	VCC21	PS	-
97	NC	-	-
98	NC	-	-
99	NC	-	-
100	GND2	PS	Power supply pin for RF gene/WBL (5.0V)
101	AIN	I	DVD Tracking input pin 1.
102	BIN	I	DVD Tracking input pin 2.
103	CIN	I	DVD Tracking input pin 3.
104	DIN	I	DVD Tracking input pin 4.
105	VCC6	PS	Power supply pin for DPD (3.3V)
106	EIN	I	CD main signal input pin 1.
107	FIN	I	CD main signal input pin 2.
108	VCC1	PS	Power supply pin for INPUT MATRIX/SERVO (5.0V)
109	GIN	I	CD servo signal input pin 1.
110	HIN	I	CD servo signal input pin 2.
111	GND1	PS	Ground pin for INPUT MATRIX/SERVO/DPD.
112	SVREF	I	OEIC signal reference level input pin.
113	CPCAPH	I	PCA pick hold capacitor connection pin.
114	CPCABH	I	PCA bottom bold capactior connection pin.
115	NC	I	-
116	VHALF	O	Reference voltage output pin 1/2 VCC (3.3V).
117	CTC2	I	Floating capacitor connection pin for tracking error binary.

Pin no.	Pin Name	Type	Function
118	CTC1	I	Capacitor connection pin for TC HPF.
119	CBDOS	I	Capacitor connection pin for BDO detecting circuit LPF.
120	CBDOF	I	Capacitor connection pin for BDO detecting circuit Pick detection.
121	VCC3	PS	Power supply pin for APC/OPC/ASENV (5.0V).
122	VREF25	O	2.5V reference voltage output pin.
123	VPD	I	DVD front monitor signal input pin.
124	VREFPD	I	Front light system reference level input pin.
125	GND3	PS	Ground pin for APC/OPC/ASENV.
126	PO6	O	Ground CMOS output pin 6.
127	PO5	O	Ground CMOS output pin 5.
128	PO4	O	Ground CMOS output pin 4.

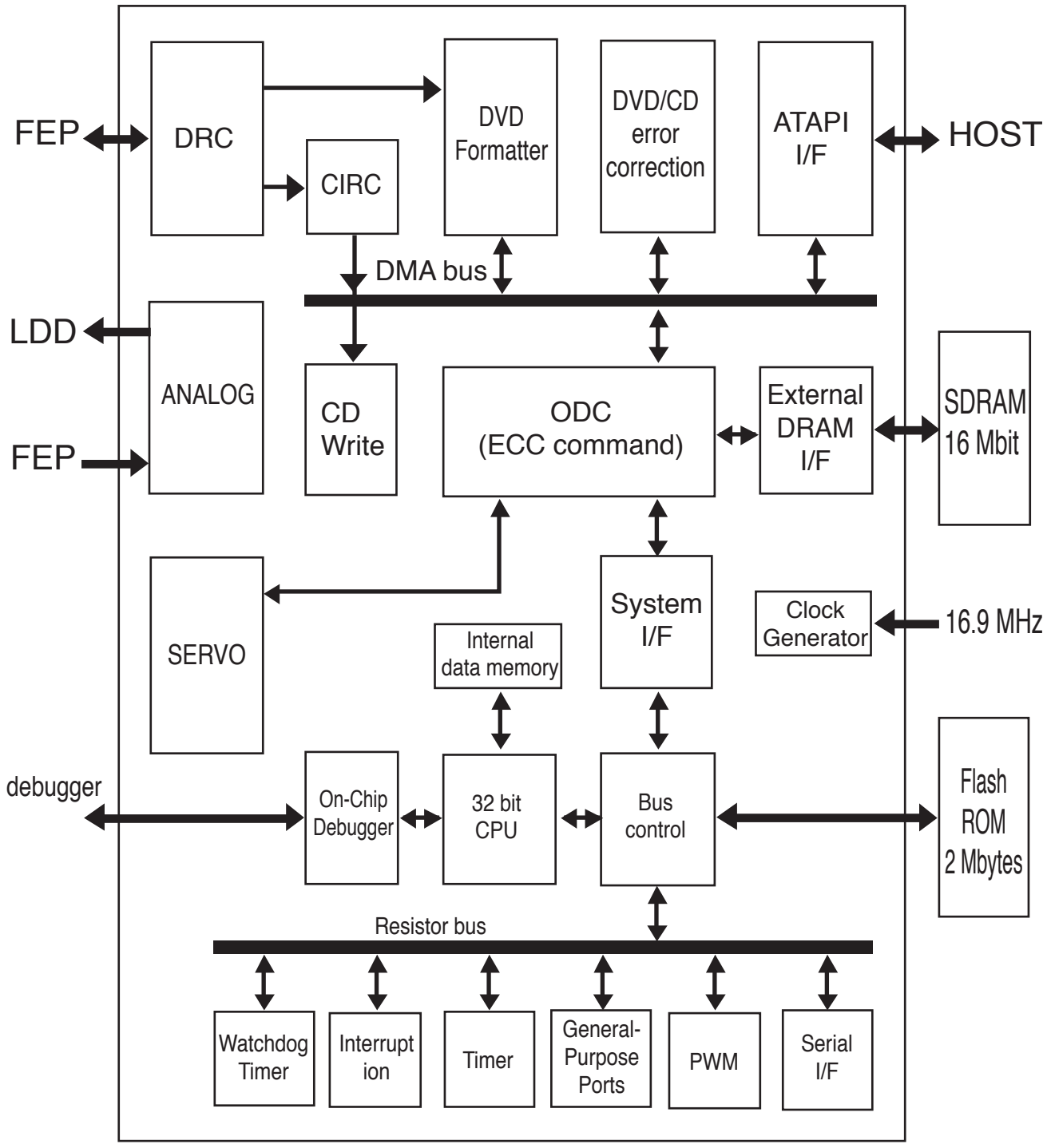
I : Input pin O: Output pin I/O : I/O pin PS : Power supply/Ground pin N.C: Non Connection

IC201 (MN103SB4G) : Encoder, Decoder & DSP Singal Processor

- **Pin Assigment**



- **Block Diagram (SODC:MN103SB4G)**



• Pin Table

Pin Number	Pin Name	I/O	Connection Target	Description
1	LPPS	I	FEP	LPP space input
2	ASENV	I	FEP	ASENV input
	LPPM			LPP mark input
3	RSDAT	O	FEP	FEP serial interface data 2(RF)
4	RSEN	O	FEP	FEP serial interface enable 2 (RF)
5	SDAT	I/O	FEP	FEP serial interface data
6	SCK	O	FEP	FEP serial interface clock
7	SEN	O	FEP	FEP serial interface enable
8	CHSEL	O	FEP	CAPA polarity switch signal. sub beam sampling signal
9	AVDD33D2	Power supply	Power supply	Analog Vpp (3.3V) for audio
10	LOUT	O	Audio AMP	Analog audio output (Lch)
11	ROUT	O	Audio AMP	Analog audio output (Rch)
12	AVSSD2	GND	GND	Analog Vss for audio
13	RV1	I/O	Res	Fixed current source for LVDS, WBL and analog blocks.
14	VREFH	I	FEP	2.2V reference voltage input
15	AVDD33D1	Power supply	Power supply	WOBBLE analog V_{DD} (3.3V)
16	CPOP1	I/O	Cap. Res	Filter connection pin for wobble PLL
17	CPOP2	I/O	Cap. Res	Filter connection pin for wobble PLL
18	CPOP3	I/O	Cap. Res	Filter connection pin for wobble PLL
19	CPOP4	I/O	Cap. Res	Filter connection pin for wobble PLL
20	CPOP5	I/O	Cap. Res	Filter connection pin for wobble PLL
21	AVSSD1	GND	GND	WOBBLE analog Vss
22	SEO2	I	FEP	Error signal output after selection, analog input
23	SEO1	I	FEP	Error signal output after selection, analog input
24	AVSSA	GND	GND	Servo analog-to-digital converter analog Vss
25	AVDD33A	Power supply	Power supply	Servo analog-to-digital converter analog V_{DD} (3.3V)
26	AIDENV	I	FEP	TE signal for DVD-RAM
	WBLDIF			ADIP detector signal input
27	REFMDLA	O	Cap.	Analog-to-digital converter reference voltage for ADIP
28	REFTOP	O	Cap.	Analog-to-digital converter reference voltage for DRC (TOP)
29	REFBTM	O	Cap.	Analog-to-digital converter reference voltage for DRC(BOTTOM)
30	REGDRC	O	Cap.	DRC analog-to-digital converter analog Vdd (12V)
				Internal regurator output
31	EQOUTB	I	FEP	RF differential signal (NEG)
32	EQOUTA	I	FEP	RF differential signal (POS)
33	AVDD33DRC	Power supply	Power supply	DRC analog-to-digital converter analog V_{DD} (3.3V)
34	CDA1	O	Cap.	Smothing capacitance for DRC-VCC
35	AVSSDRC	GND	GND	DRC analog Vss

Pin Number	Pin Name	I/O	Connection Target	Description
36	WBL	I	FEP	Wobble binary signal
37	CLUMPGT	O	FEP	RF AGC blas circuit clamp signal
38	TGCHG	I/O	OEIC	Write power switch signal
	P05			General-purpose I/O. TxD, PWM
39	LSEN	O	PU	LDD serial interface enable
40	LSCK	O	PU	LDD serial interface clock
41	LSDAT	I/O	PU	LDD serial interface data
42	LDDENA	O	PU	LDD enable signal
43	FEPIDGT	O	FEP	CAPA punch out signal, main beam sampling signal
44	SH6	O	FEP	Write WOBBLE sample and hold dampling signal
45	SH1	O	FEP	Sample timing signal for ROPC space detection, APC space detection, and read power detection
46	SH2	O	FEP	Sample timing signal for PCA peak, bottom detection, APC peak detection, and mean value detection.
47	SH3	O	FEP	Sample timing signal for PCA mean value detection. APC space detection, read power detection, and erase detection.
48	WIDGT	O	FEP	VFO punch out signal, ROPC mark detection sampling signal
49	WTGT	O	FEP	Write gate
50	BDO	I	FEP	Dropout signal input
51	OFTR	I	FEP	Off track signal input
52	TC	I	FEP	Track crossing signal input
53	PO2	I/O	-	CPU external interrupt. RxD, PWM, general-purpose I/O, laser fault detect signal.
54	FMSW	I/O	PU	Power monitor detector multiplier conversion signal
				General-purpose I/O
55	PO4	I/O	-	CPU external interrupt, TxD, PWM general-purpose I/O.
	GENE0			Inner limit switch input
	TRCDATA3			Trace data 3
	EXTRIG2			Trigger 2
56	PO6	I/O	-	CPU external interrupt (5V input,), RxD, PWM, general-purpose I/O
	HFON			External high frequncy module (HFM) ON/OFF
57	VSS	GND	GND	Digital Vss
58	VDD3	Power supply	Power supply	I/O pad Vdd (3.3V)
59	VHALF	I/O	FEP	Drive pin central reference voltage input
	PO7		I/O	General-purpose I/O, CPU external interrupt.
60	PWM0A	O	DRIVER	Focus drive differential PWM+ output, focus drive BSDA output
61	PWMOB	I/O	DRIVER	Focus drive differential PWM- output
	P10		I/O	General-purpose I/O, TxD, Serial CLK, PWM
62	PWM1A	O	DRIVER	Focus 2 (tilt) drive differential PWM+ output, focus 2 drive BSDA output

Pin Number	Pin Name	I/O	Connection Target	Description
62	PWM1A	O	DRIVER	Focus 2(tilt) drive differential PWM+ output, focus 2 drive BSDA output.
63	PWM1B	I/O	DRIVER	Focus 2(tilt) drive differential PWM-output
	P11			General-purpose I/O, RxD, PWM
64	PWM2A	I/O	DRIVER	Tracking drive differential PWM+ output, tracking drive BSDA output
	P27			General-purpose I/O, PWM
65	PWM2B	I/O	DRIVER	Tracking drive differential PWM-output
	P12			General-purpose I/O, TxD
	TX			ICE60958-compliant digital output
66	PWM3A	O	DRIVER	Traverse drive differential PWM+ output, stepper 1 drive output
67	PWM3B	I/O	DRIVER	Traverse drive differential PWM- output, stepper 2 drive output
	P13			General-purpose I/O, RxD
68	PWM4	O	DRIVER	Spindle drive output
69	FG	I	DRIVER	Spindle FG input(5V input)
70	MASTER	I/O	HOST	ATAPI master/slave signal
	P23			General-purpose I/O
71	NRESET	I	HOST	ATAPI reset signal
72	HDD7	I/O	HOST	ATAPI data I/O
73	HDD8	I/O	HOST	ATAPI data I/O
74	HDD6	I/O	HOST	ATAPI data I/O
75	VSS	GND	GND	Digital Vss
76	VDD12	Power supply	Power supply	Internal logic Vpp(1.2V)
77	VDD3	Power supply	Power supply	I/O pad V_{DD}(3.3V)
78	HDD9	I/O	HOST	ATAPI data I/O
79	HDD5	I/O	HOST	ATAPI data I/O
80	HDD10	I/O	HOST	ATAPI data I/O
81	HDD4	I/O	HOST	ATAPI data I/O
82	HDD11	I/O	HOST	ATAPI data I/O
83	HDD3	I/O	HOST	ATAPI data I/O
84	HDD12	I/O	HOST	ATAPI data I/O
85	HDD2	I/O	HOST	ATAPI data I/O
86	HDD13	I/O	HOST	ATAPI data I/O
87	VSS	GND	GND	Digital Vss
88	VDD3	Power supply	Power supply	I/O pad V_{DD}(3.3)
89	HDD1	I/O	HOST	ATAPI data I/O
90	HDD14	I/O	HOST	ATAPI data I/O
91	HDD0	I/O	HOST	ATAPI data I/O
92	HDD15	I/O	HOST	ATAPI data I/O
93	DMARQ	O	HOST	DMA request to ATAPI host

Pin Number	Pin Name	I/O	Connection Target	Description
94	NIOWR	I/O	HOST	ATAPI host write signal
95	NIORD	I/O	HOST	ATAPI host read signal
96	IORDY	O	HOST	Ready signal to ATAPI host
97	NDMACK	I	HOST	ATAPI host DMA acknowledge signal
98	INTRQ	O	HOST	Interrupt request to ATAPI host
99	NIOCS16	I/O	HOST	ATAPI data bus width select signal
	P22			General-purpose I/O
100	DA1	I/O	HOST	ATAPI host address signal input
101	NPDIAG	I/O	HOST	Diagnostic signal from ATAPI slave to master
102	DA0	I/O	HOST	ATAPI host address signal
103	DA2	I/O	HOST	ATAPI host address signal
104	NCS1FX	I	HOST	ATAPI host chip select signal
105	NCS3FX	I	HOST	ATAPI host chip select signal
106	VSS	GND	GND	Digital Vss
107	VDD5	Power supply	Power supply	5V reference power supply
108	VDD3	Power supply	Power supply	I/O pad V_{DD}(3.3V)
109	NDASP	I/O	HOST	ATAPI drive active slave signal
110	MDQ0	I/O	SDRAM	SDRAM data
111	MDQ15	I/O	SDRAM	SDRAM data
112	MDQ1	I/O	SDRAM	SDRAM data
113	MDQ14	I/O	SDRAM	SDRAM data
114	MDQ2	I/O	SDRAM	SDRAM data
115	MDQ13	I/O	SDRAM	SDRAM data
116	MDQ3	I/O	SDRAM	SDRAM data
117	MDQ12	I/O	SDRAM	SDRAM data
118	MDQ4	I/O	SDRAM	SDRAM data
119	MDQ11	I/O	SDRAM	SDRAM data
120	MDQ5	I/O	SDRAM	SDRAM data
121	MDQ10	I/O	SDRAM	SDRAM data
122	MDQ6	I/O	SDRAM	SDRAM data
123	MDQ9	I/O	SDRAM	SDRAM data
124	MDQ7	I/O	SDRAM	SDRAM data
125	MDQ8	I/O	SDRAM	SDRAM data
126	VSS	GND	GND	Digital Vss
127	VDD3	Power supply	Power supply	I/O pad V_{DD}(3.3V)
128	MDQML	O	SDRAM	SDRAM DQML signal
129	MNWE	O	SDRAM	SDRAM write enable signal
130	MDQMU	O	SDRAM	SDRAM DQMU signal

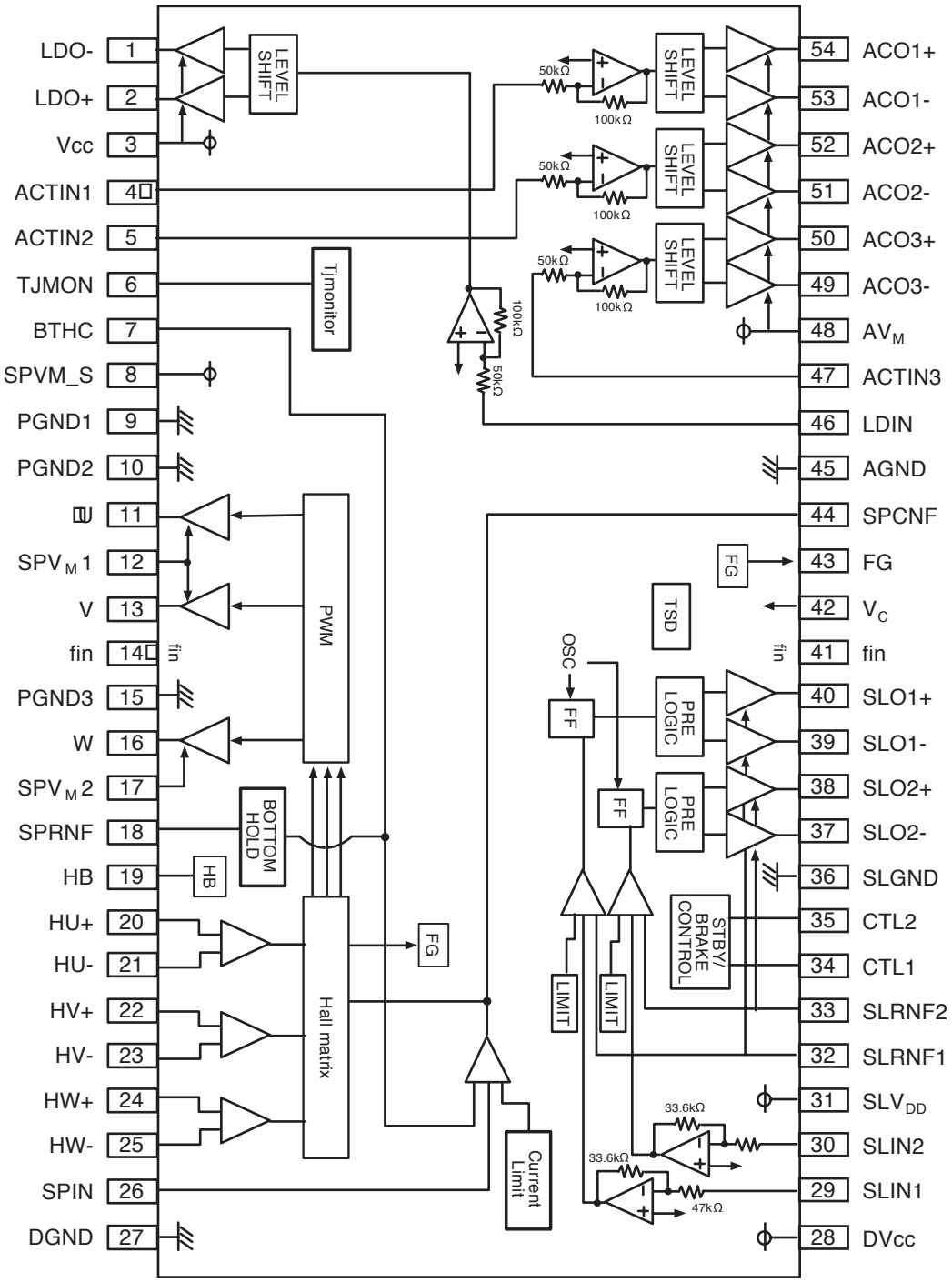
Pin Number	Pin Name	I/O	Connection Target	Description
131	MNCAS	O	SDRAM	SDRAM CAS signal
132	MCLK	I/O	SDRAM	SDRAM clock
133	MNRAS	O	SDRAM	SDRAM RAS signal
134	MCKE	O	SDRAM	SDRAM clock enable signal
135	MBA0	O	SDRAM	SDRAM bank switch 0
136	P14	I/O	SDRAM	General-purpose I/O, Serial CLK, PWM
	TRCDATA2			Debugging trace data
	EXTRIG1			Trigger
	MA11			SDRAM address
137	VDD12	Power supply	Power supply	Internal logic Vpp (1.2V)
138	P15	I/O	SDRAM	General-purpose I/O, PWM
	TRCDATA3			Debugging trace data
	EXTRIG2			Trigger
	MBA1			SDRAM bank switch 1
139	MA9	O	SDRAM	SDRAM address
140	MA10	O	SDRAM	SDRAM address
141	MA8	O	SDRAm	SDRAM address
142	VSS	GND	GND	Digital Vss
143	VDD3	Power supply	Power supply	I/O pad VDD(3.3V)
144	MA0	O	SDRAM	SDRAM address
145	MA7	O	SDRAM	SDRAM address
146	MA1	O	SDRAM	SDRAM address
147	MA6	O	SDRAM	SDRAM address
148	MA2	O	SDRAM	SDRAM address
149	MA5	O	SDRAM	SDRAM address
150	MA3	O	SDRAM	SDRAM address
151	MA4	O	SDRAM	SDRAM address
152	NCE	O	FLASH	Flash ROM chip enable signal
153	NOE	O	FLASH	Flash ROM output enable signal
154	FDT0	I/O	FLASH	Flash ROM data
155	FDT8	I/O	FLASH	Flash ROM data
156	FDT1	I/O	FLASH	Flash ROM data
157	FDT9	I/O	FLASH	Flash ROM data
158	FDT2	I/O	FLASH	Flash ROM data
159	FDT10	I/O	FLASH	Flash ROM data
160	FDT3	I/O	FLASH	Flash ROM data
161	FDT11	I/O	FLASH	Flash ROM data
162	FDT4	I/O	FLASH	Flash ROM data

Pin Number	Pin Name	I/O	Connection Target	Description
163	FDT12	I/O	FLASH	Flash ROM data
164	FDT5	I/O	FLASH	Flash ROM data
165	FDT13	I/O	FLASH	Flash ROM data
166	FDT6	I/O	FLASH	Flash ROM data
167	FDT14	I/O	FLASH	Flash ROM data
168	FDT7	I/O	FLASH	Flash ROM data
169	FDT15	I/O	FLASH	Flash ROM data
170	VDD3	Power supply	Power supply	I/O pad V_{DD}(3.3V)
171	OSCO	O	Xtal	Oscilator output
172	OSCI	I	Xtal	Oscilator input (16.9344MHz)
173	VSS	GND	GND	Digital Vss
174	FADR16	I/O	FLASH	Flash ROM address
175	FADR15	I/O	FLASH	Flash ROM address
176	FADR14	I/O	FLASH	Flash ROM address
177	FADR13	I/O	FLASH	Flash ROM address
178	FADR12	I/O	FLASH	Flash ROM address
179	FADR11	I/O	FLASH	Flash ROM address
180	FADR10	I/O	FLASH	Flash ROM address
181	FADR9	I/O	FLASH	Flash ROM address
182	NWE	O	FLASH	Flash ROM write enable signal
183	FADR20	I/O	FLASH	Flash ROM address
	P25			General-purpose I/O
184	FADR19	I/O	FLASH	Flash ROM address
	P24			General-purpose I/O
185	FADR18	I/O	FLASH	Flash ROM address
186	FADR17	I/O	FLASH	Flash ROM address
187	FADR8	I/O	FLASH	Flash ROM address
188	FADR7	I/O	FLASH	Flash ROM address
189	FADR6	I/O	FLASH	Flash ROM address
190	FADR5	I/O	FLASH	Flash ROM address
191	FADR4	I/O	FLASH	Flash ROM address
192	FADR3	I/O	FLASH	Flash ROM address
193	FADR2	I/O	FLASH	Flash ROM address
194	FADR1	I/O	FLASH	Flash ROM address
195	VDD12	Power supply	Power supply	Internal logic V_{DD}(1.2V)
196	BSMD	O	PU	BIAS modulation singl differential current output
197	MBSMD	O	PU	MBIAS modulation signal differential current output
198	PKMD	O	PU	PEAK1 modulation signal differential current ouput

Pin Number	Pin Name	I/O	Connection Target	Description
199	NPKMD	O	PU	NPEAK1 modulation signal differential current output
200	PK2MD	O	PU	PEAKk2 modulation signal differential current output
201	NPK2MD	O	PU	NPEAK2 modulation signal differential current output
202	PK3MD	O	PU	PEAK3 modulation signal differential current output
203	NPK3MD	O	PU	NPEAK3 modulation signal differential current output
204	VSS	GND	GND	Digital Vpp
205	VDD3	Power supply	Power supply	I/O pad V_{DD}(3.3V)
206	NEJECT	I/O	Mecha	Tray eject signal (SODC external interrupt)
207	TRYLOAD	I/O	Mecha	Tray eject signal (SODC external interrupt)
	P26			General-purpose I/O
208	NRST	I	Reset IC	Reset input (power on reset)
209	P17	I/O	-	General-purpose I/O
	TRCDATA2			Trace data 2
	EXTRIG1			External interrupt
210	MSTPOL	I/O	-	MASTER pin polarity switch
	TRCDATA1			Trace data 1
211	DASPST	I/O	-	DASP setting
	TRCDATA0			Trace data 0
212	TRCCLK	I/O	-	Trace clock
	P20			General-purpose I/O
213	TRCST	I/O	-	Trace status
	P21			General-purpose I/O
214	SCLOCK	I/O	-	Debugger clock, DRC monitor 1
215	SDATA	I/O	-	Debugger data, DRC monitor 0
216	TX	I/O	-	IEC958-compliant digital output, debugging serial TX
	P16			General-purpose I/O

IC301 (BD7956FS) : CD-ROM/DVD-ROM 7CH POWER DRIVER

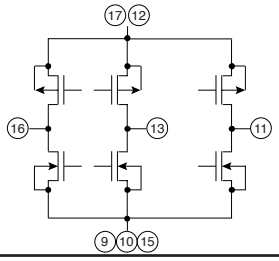
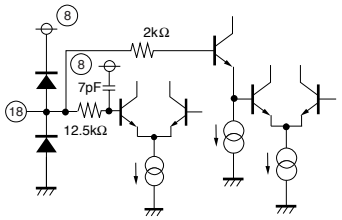
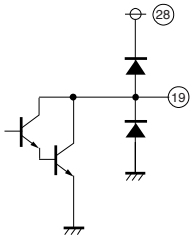
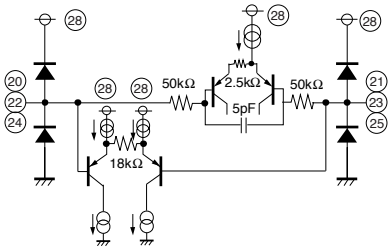
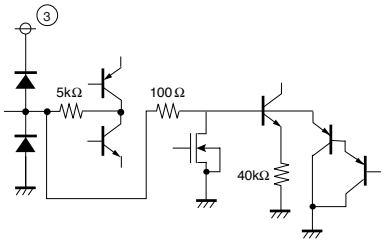
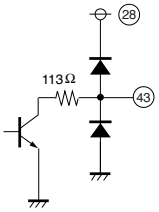
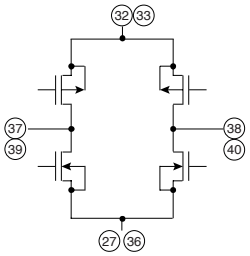
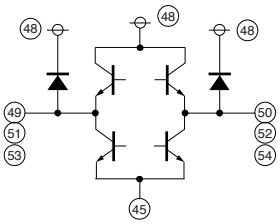
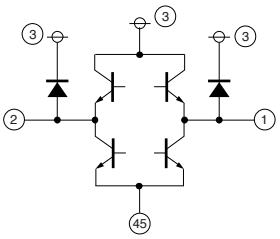
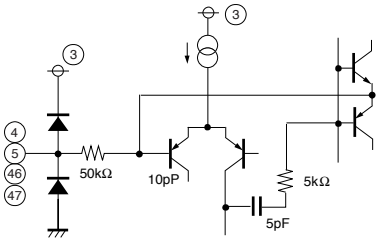
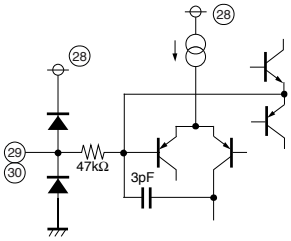
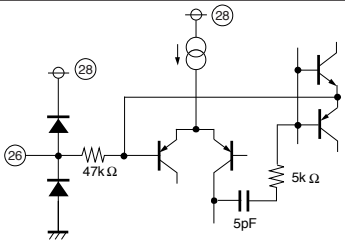
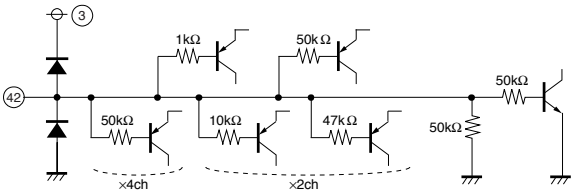
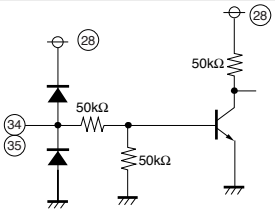
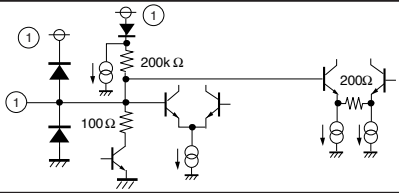
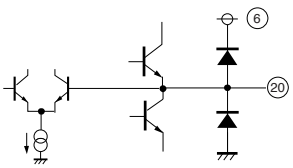
• Block Diagram



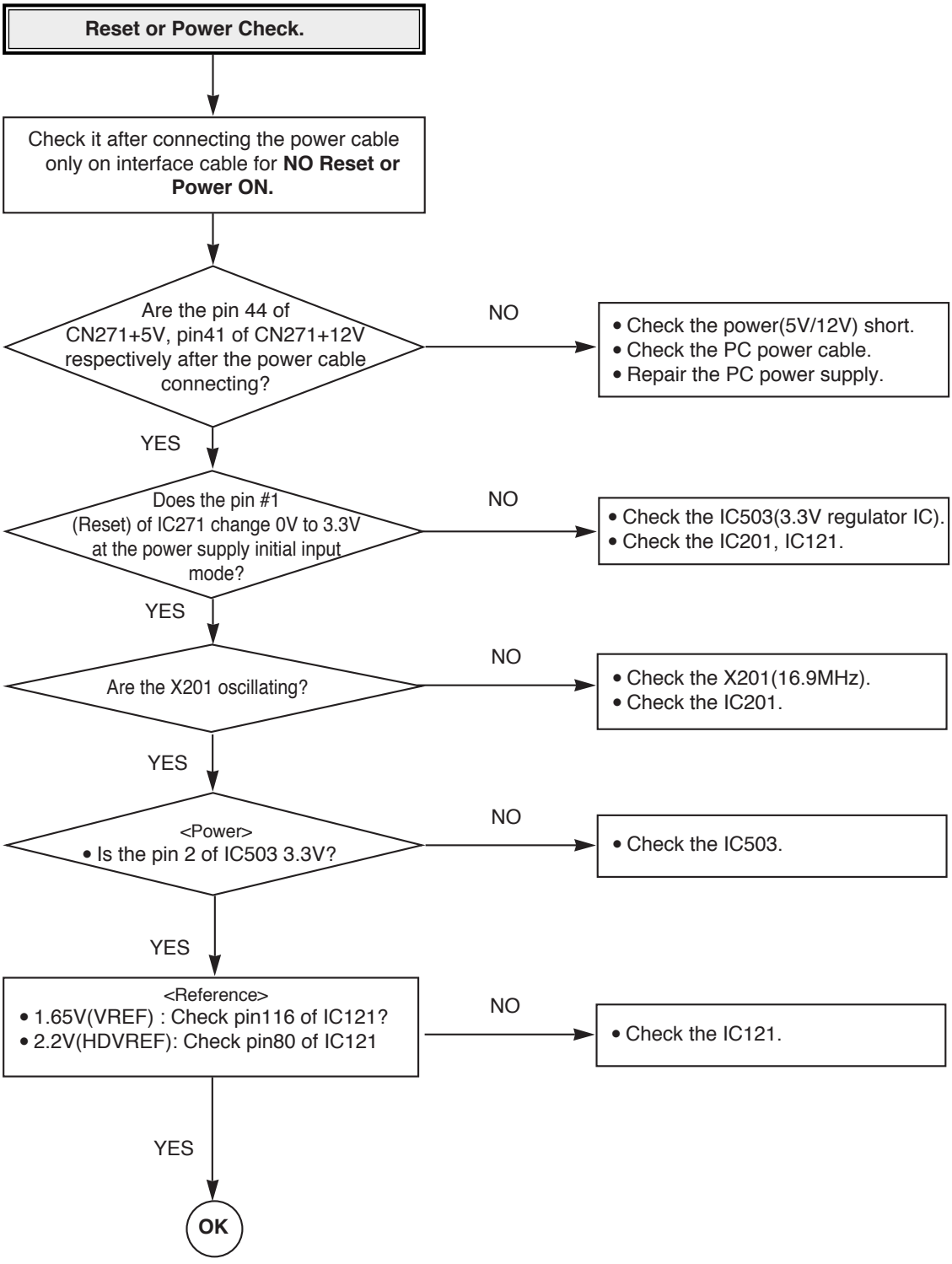
• Pin Function

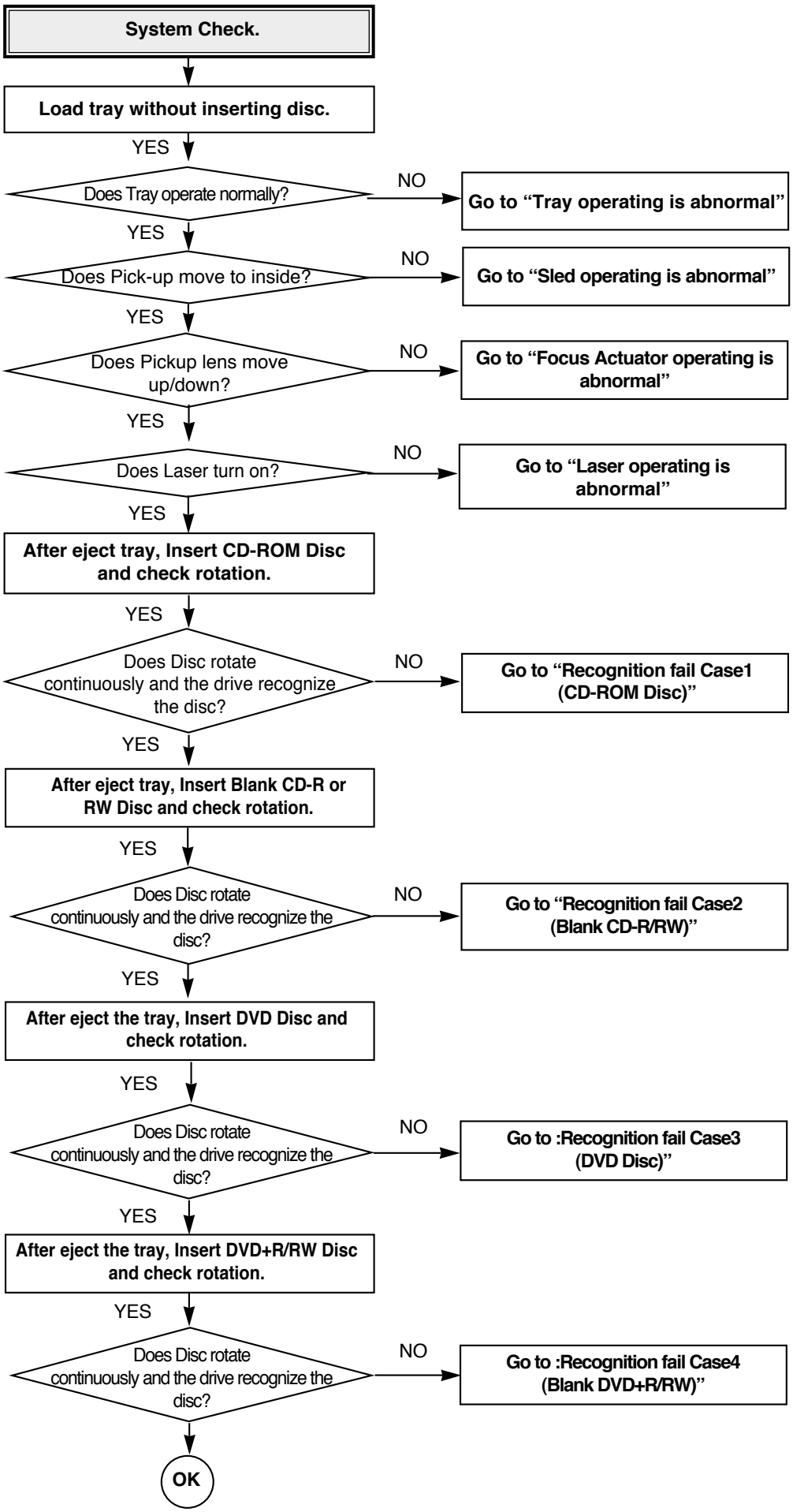
No	Symbol	Description	No	Symbol	Description
1	LDO-	Loading driver negative output	54	ACO1+	Actuator driver 1 positive output
2	LDO+	Loading driver positive output	53	ACO1-	Actuator driver 1 negative output
3	Vcc	BTL pre and Loading power supply	52	ACO2+	Actuator driver 2 positive output
4	ACTIN1	Actuator driver 1 input	51	ACO2-	Actuator driver 2 negative output
5	ACTIN2	Actuator driver 2 input	50	ACO3+	Actuator driver 3 positive output
6	TJMON	monitor of chip temperature	49	ACO3-	Actuator driver 3 negative output
7	BTHC	Capacitor connection terminal for spindle current bottom holding	48	AVM	Actuator driver block power supply
8	SPVM-S	Spindle driver sense power supply	47	ACTIN3	Actuator driver input 3
9	PGND1	Spindle driver power ground 1	46	LDIN	Loading driver input
10	PGND2	Spindle driver power ground 2	45	AGND	BTL driver block power ground
11	U	Spindle driver output U	44	SPCNF	Spindle driver feedback filter
12	SPVM1	Spindle driver power supply 1	43	FG	Frequency generator output
13	V	Spindle driver output V	42	Vc	Reference voltage input
14	fin	fin	41	fin	fin
15	PGND3	Spindle driver power ground 3	40	SLO1+	Sled driver 1 positive output
16	W	Spindle driver output W	39	SLO1-	Sled driver 1 negative output
17	SPVM2	Spindle driver power supply 2	38	SLO2+	Sled driver 2 positive output
18	SPRNF	Spindle driver current sense	37	SLO2-	Sled driver 2 negative output
19	HB	Hall bias	36	SLGND	Sled driver power ground
20	HU+	Hall amp.U positive input	35	CTL2	Driver logic control 2 input
21	HU-	Hall amp.U negative input	34	CTL1	Driver logic control 1 input
22	HV+	Hall amp.V positive input	33	SLRNF2	Sled driver 2 current sense
23	HV-	Hall amp.V negative input	32	SLRNF1	Sled driver 1 current sense
24	HW+	Hall amp.W positive input	31	SLVDD	Sled driver PowerMOS pre-supply
25	HW-	Hall amp.W negative input	30	SLIN2	Sled driver 2 input
26	SPIN	Spindle driver input	29	SLIN1	Sled driver 1 input
27	DGND	PWM block pre-ground	28	DVcc	PWM block control power supply

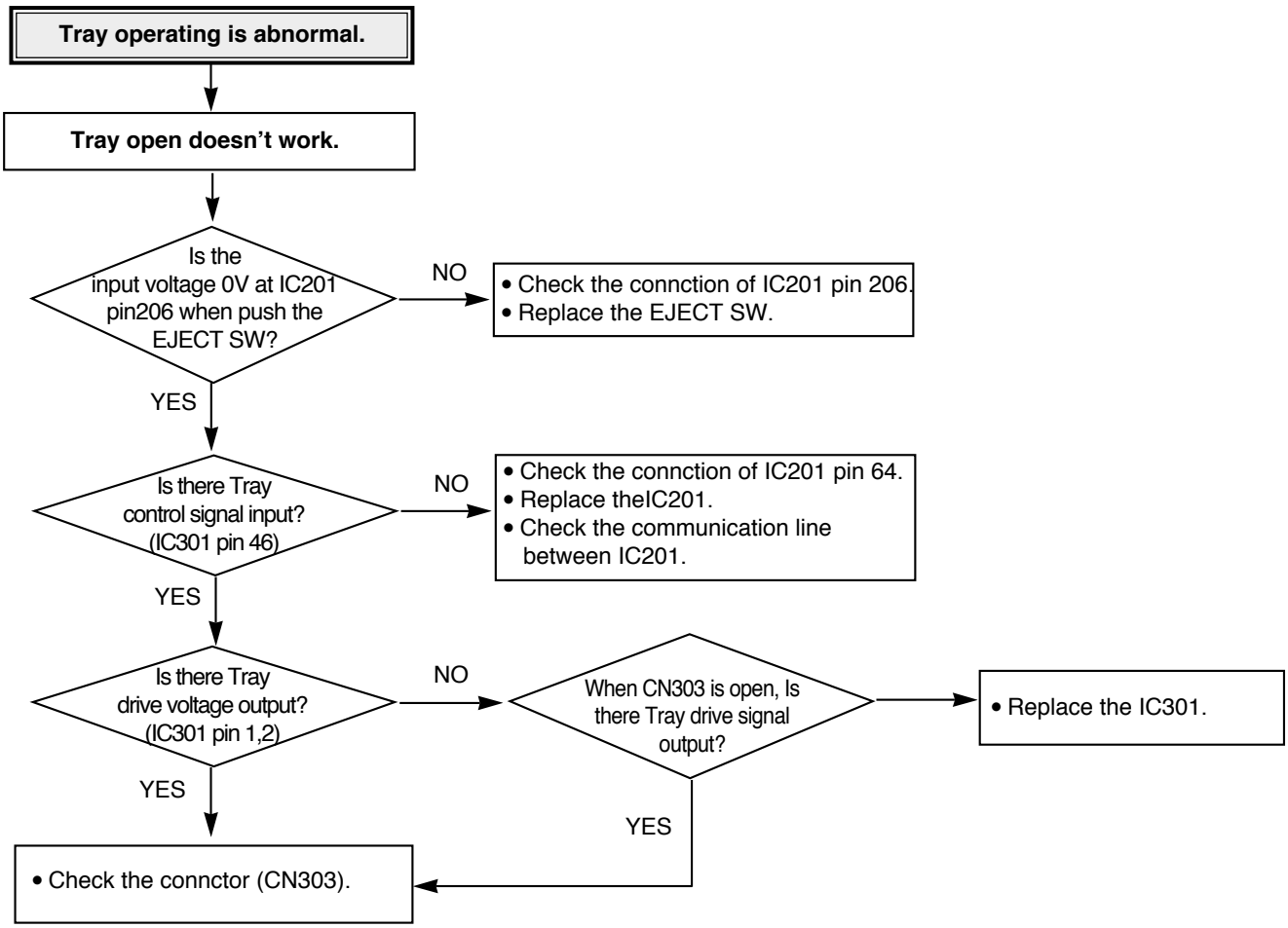
Input/Output circuit diagram

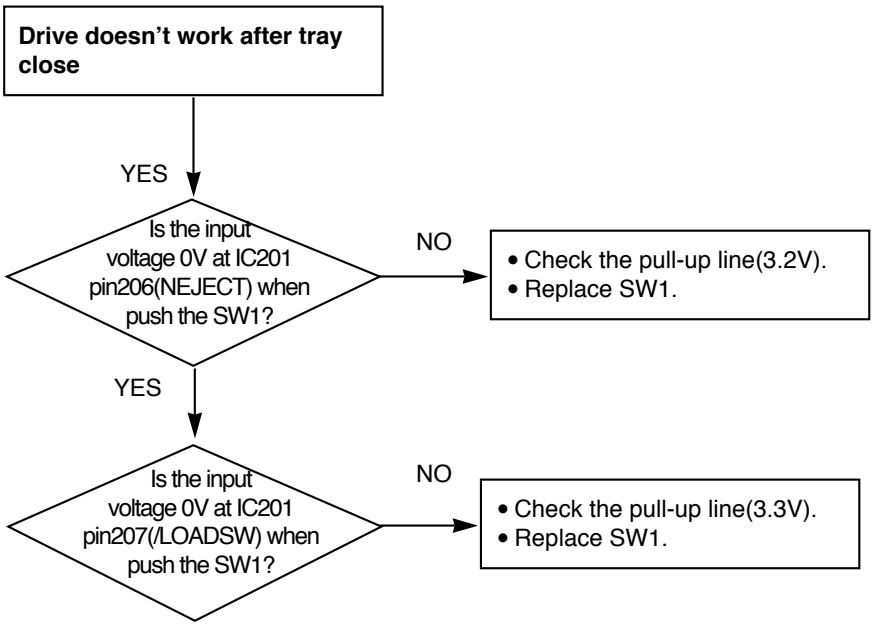
Three-phase motor driver output	Spindle driver current detection input	Hall bias
		
Hall signal input	**Splindle driver feedback filter pin**	**FG signal output**
		
PWM driver output SLED1, 2	**BTL driver output FO, TK**	**BTL driver output LD**
		
BTL driver input ACT1,2,3,LD	**PWM driver input SLED1, 2**	**PWM driver input Spindle**
		
Reference voltage input		**Control signal input**
		
BTHC terminal	**TJ output**	
		

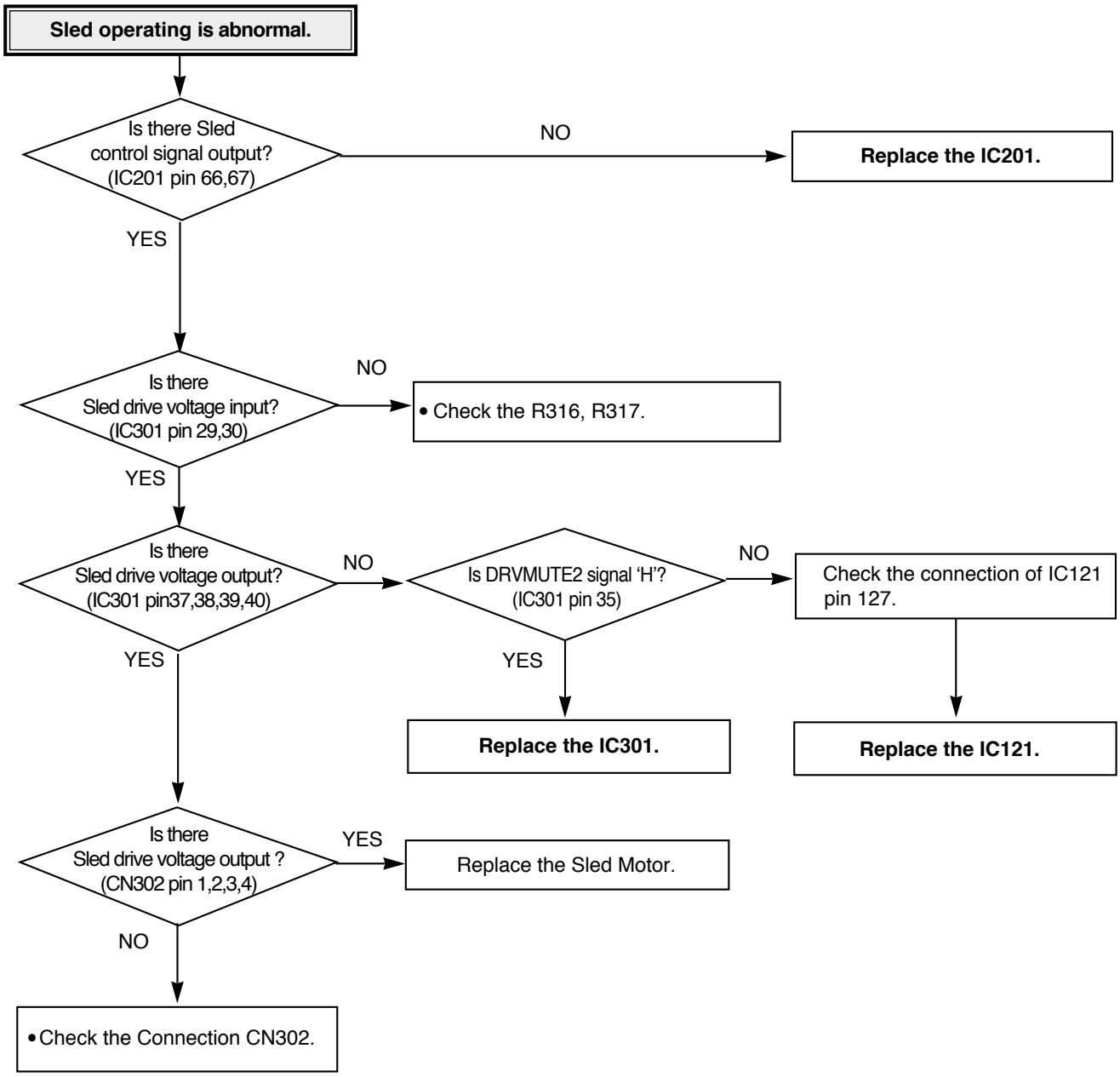
TROUBLESHOOTING GUIDE

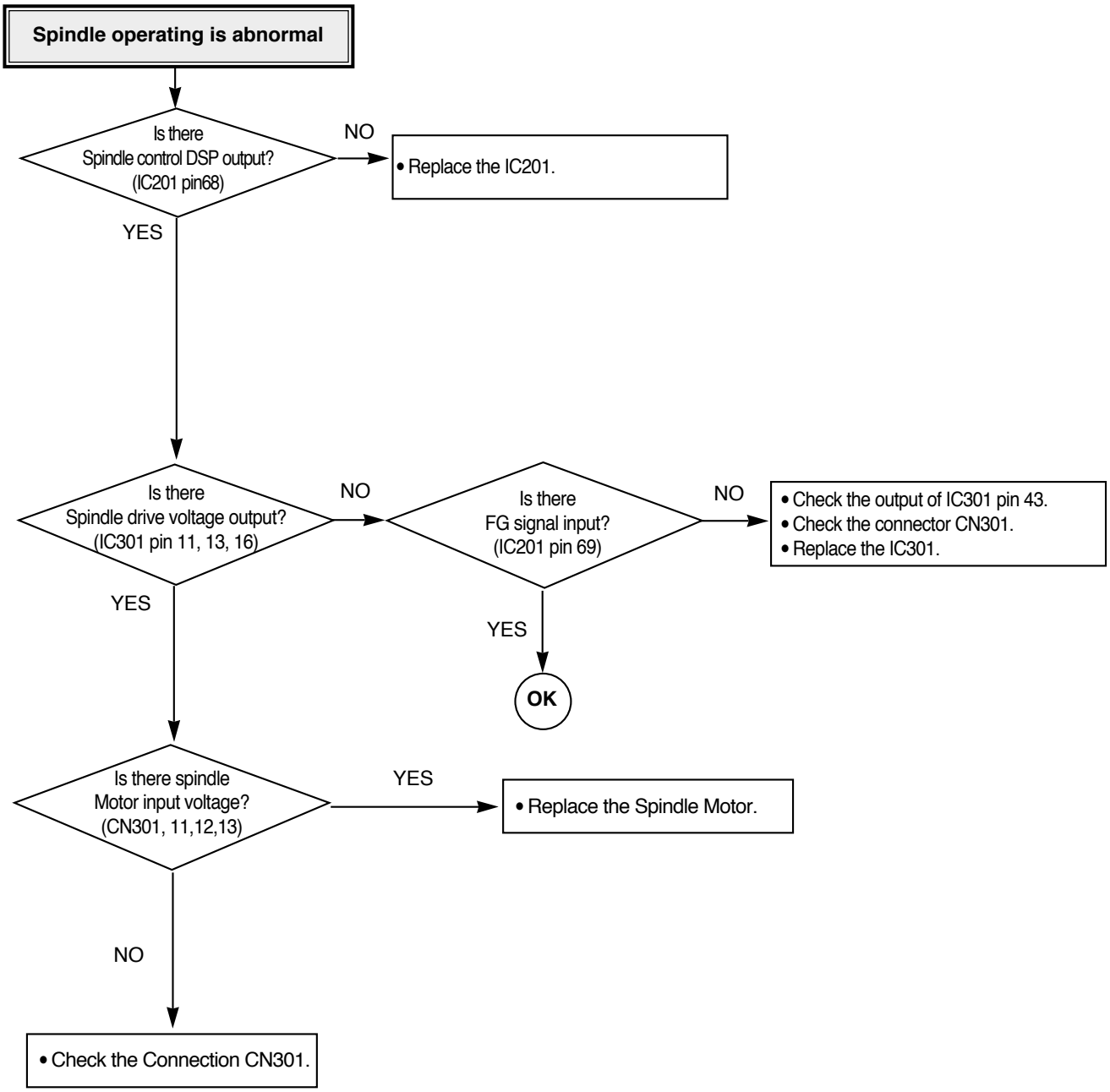


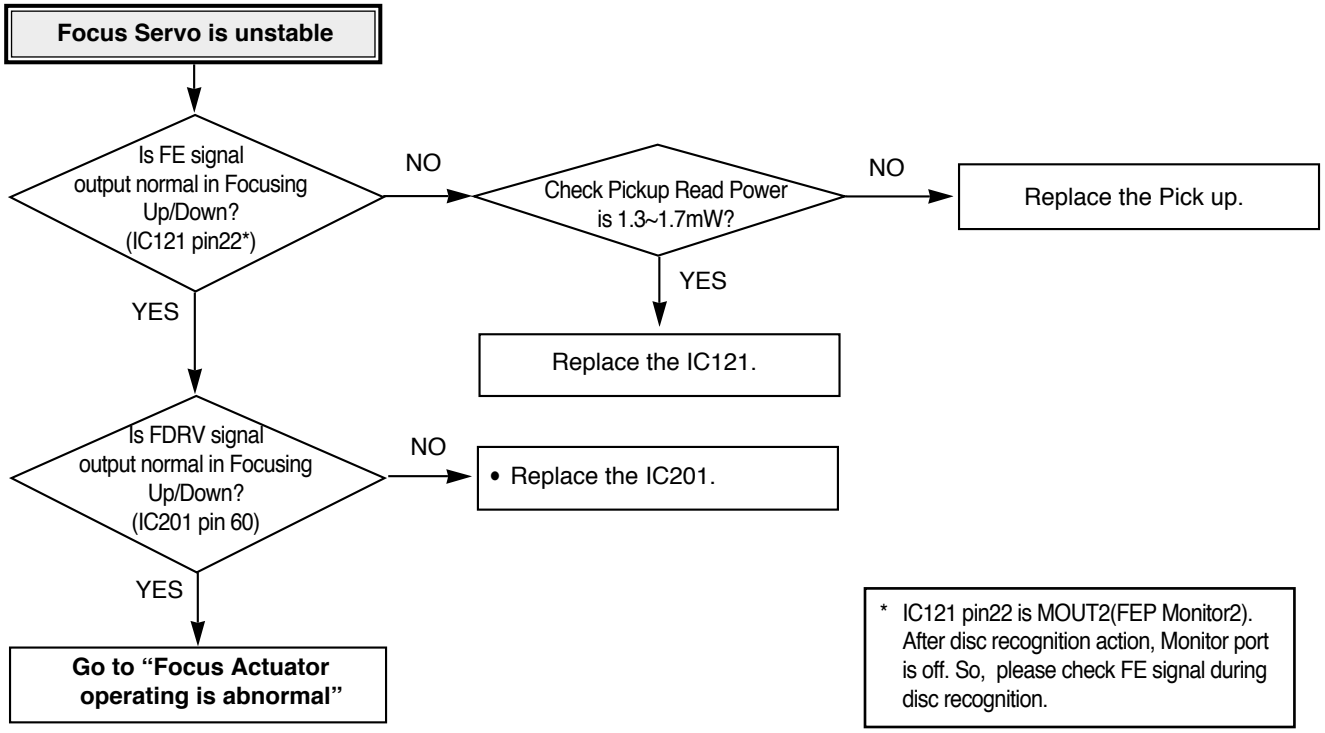

System Check.
Load tray without inserting disc.
YES
Does Tray operate normally?
NO
Go to "Tray operating is abnormal"
YES
Does Pick-up move to inside?
NO
Go to "Sled operating is abnormal"
YES
Does Pickup lens move up/down?
NO
Go to "Focus Actuator operating is abnormal"
YES
Does Laser turn on?
NO
Go to "Laser operating is abnormal"
YES
After eject tray, Insert CD-ROM Disc and check rotation.
YES
Does Disc rotate continuously and the drive recognize the disc?
NO
Go to "Recognition fail Case1 (CD-ROM Disc)"
YES
After eject tray, Insert Blank CD-R or RW Disc and check rotation.
YES
Does Disc rotate continuously and the drive recognize the disc?
NO
Go to "Recognition fail Case2 (Blank CD-R/RW)"
YES
After eject the tray, Insert DVD Disc and check rotation.
YES
Does Disc rotate continuously and the drive recognize the disc?
NO
Go to :Recognition fail Case3 (DVD Disc)"
YES
After eject the tray, Insert DVD+R/RW Disc and check rotation.
YES
Does Disc rotate continuously and the drive recognize the disc?
NO
Go to :Recognition fail Case4 (Blank DVD+R/RW)"
OK

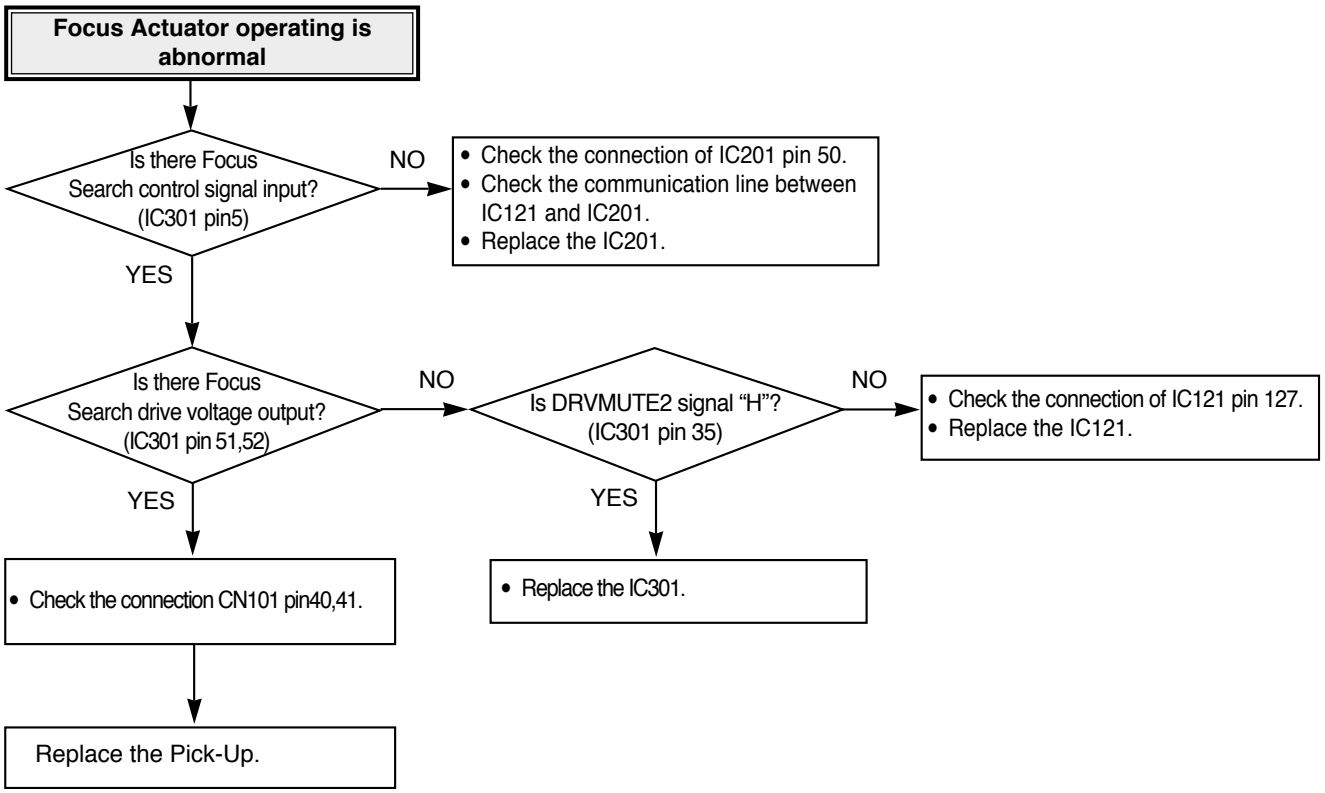

Tray operating is abnormal.
Tray open doesn't work.
Is the input voltage 0V at IC201 pin206 when push the EJECT SW?
NO
• Check the connction of IC201 pin 206.
• Replace the EJECT SW.
YES
Is there Tray control signal input? (IC301 pin 46)
NO
• Check the connction of IC201 pin 64.
• Replace theIC201.
• Check the communication line between IC201.
YES
Is there Tray drive voltage output? (IC301 pin 1,2)
NO
When CN303 is open, Is there Tray drive signal output?
• Replace the IC301.
YES
YES
• Check the connctor (CN303).

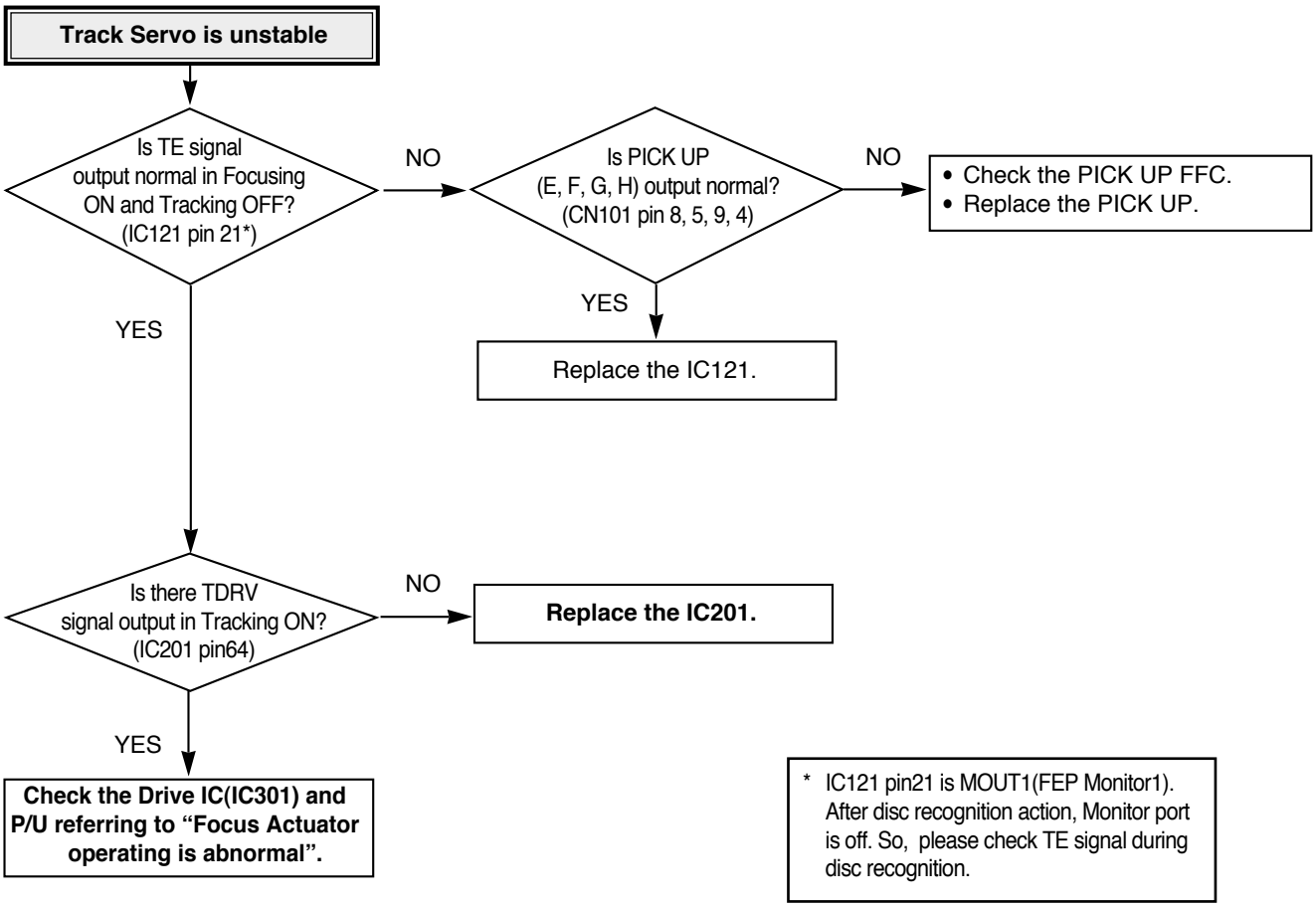

Drive doesn't work after tray close
YES
Is the input voltage 0V at IC201 pin206(NEJECT) when push the SW1?
NO
• Check the pull-up line(3.2V).
• Replace SW1.
YES
Is the input voltage 0V at IC201 pin207(/LOADSW) when push the SW1?
NO
• Check the pull-up line(3.3V).
• Replace SW1.

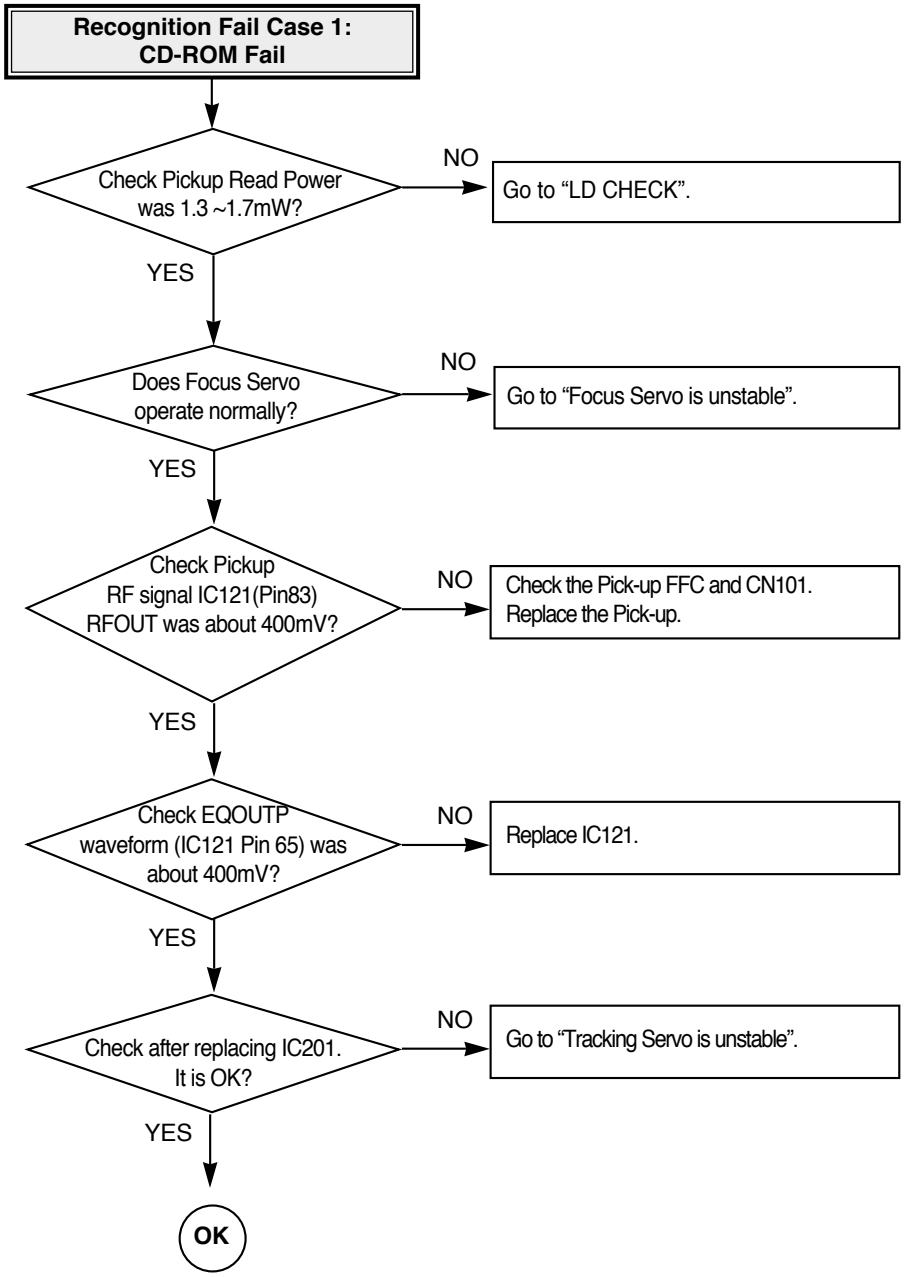

Sled operating is abnormal.
Is there Sled control signal output? (IC201 pin 66,67)
NO
Replace the IC201.
YES
Is there Sled drive voltage input? (IC301 pin 29,30)
NO
• Check the R316, R317.
YES
Is there Sled drive voltage output? (IC301 pin37,38,39,40)
NO
Is DRVMUTE2 signal 'H'? (IC301 pin 35)
NO
Check the connection of IC121 pin 127.
YES
YES
Replace the IC301.
Replace the IC121.
Is there Sled drive voltage output ? (CN302 pin 1,2,3,4)
YES
Replace the Sled Motor.
NO
• Check the Connection CN302.

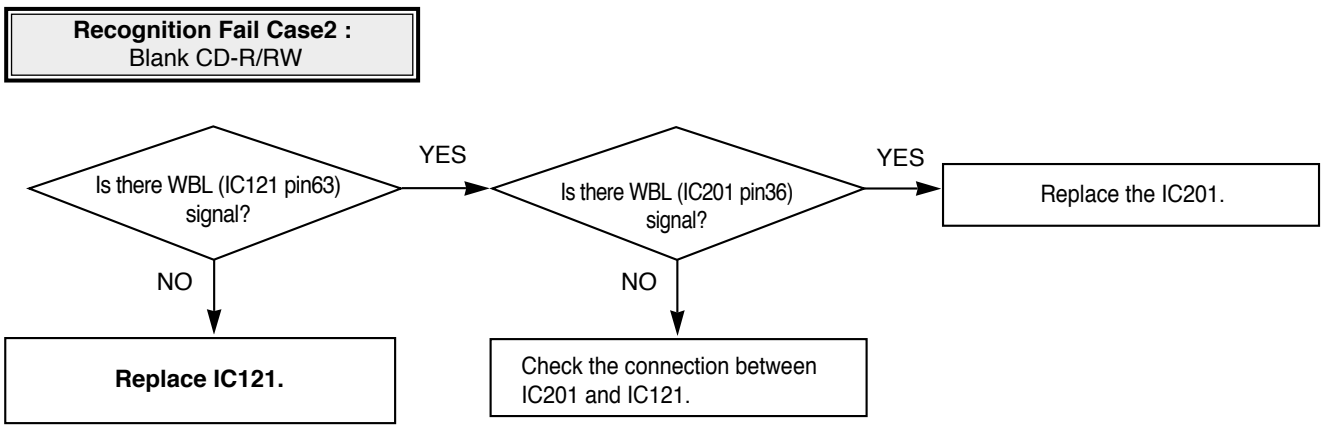

Spindle operating is abnormal
Is there
Spindle control DSP output?
(IC201 pin68)
NO
• Replace the IC201.
YES
Is there
Spindle drive voltage output?
(IC301 pin 11, 13, 16)
NO
Is there
FG signal input?
(IC201 pin 69)
NO
• Check the output of IC301 pin 43.
• Check the connector CN301.
• Replace the IC301.
YES
YES
OK
Is there spindle
Motor input voltage?
(CN301, 11,12,13)
YES
• Replace the Spindle Motor.
NO
• Check the Connection CN301.

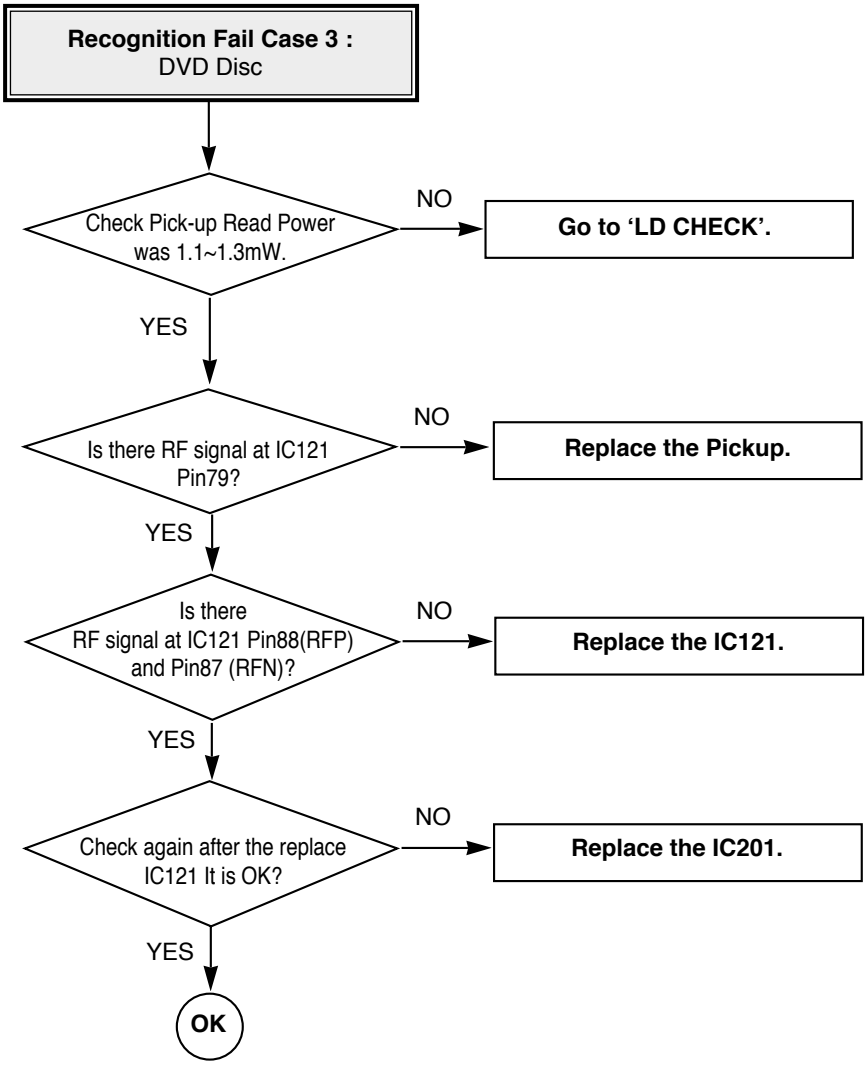

Focus Servo is unstable
Is FE signal output normal in Focusing Up/Down? (IC121 pin22*)
NO
Check Pickup Read Power is 1.3~1.7mW?
NO
Replace the Pick up.
YES
Replace the IC121.
YES
Is FDRV signal output normal in Focusing Up/Down? (IC201 pin 60)
NO
• Replace the IC201.
YES
Go to "Focus Actuator operating is abnormal"
* IC121 pin22 is MOUT2(FEP Monitor2). After disc recognition action, Monitor port is off. So, please check FE signal during disc recognition.

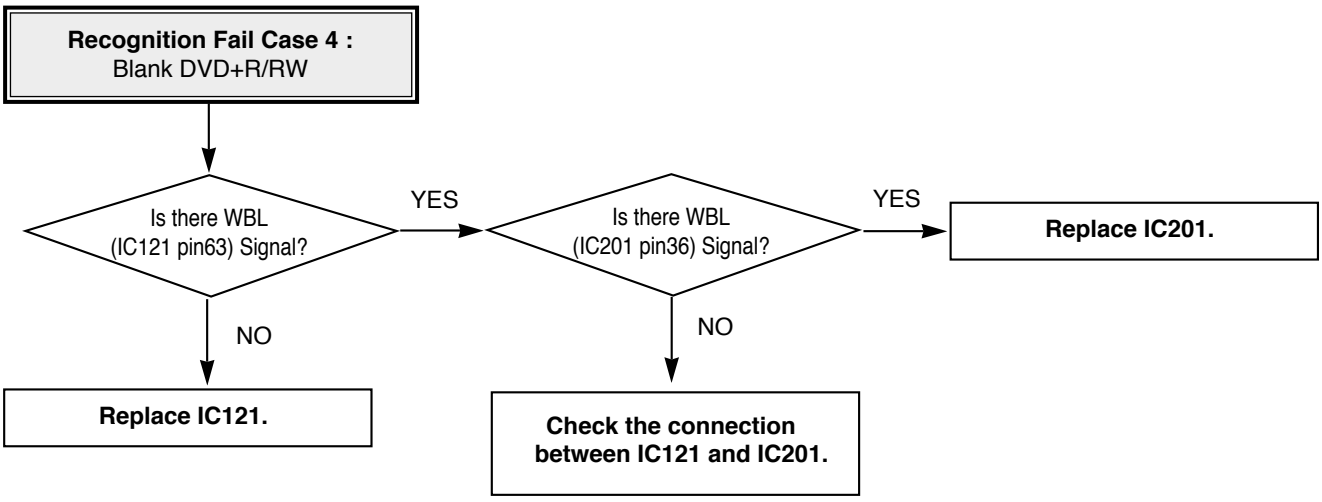

Focus Actuator operating is abnormal
Is there Focus Search control signal input? (IC301 pin5)
NO
• Check the connection of IC201 pin 50.
• Check the communication line between IC121 and IC201.
• Replace the IC201.
YES
Is there Focus Search drive voltage output? (IC301 pin 51,52)
NO
Is DRVMUTE2 signal "H"? (IC301 pin 35)
NO
• Check the connection of IC121 pin 127.
• Replace the IC121.
YES
YES
• Check the connection CN101 pin40,41.
• Replace the IC301.
Replace the Pick-Up.


Track Servo is unstable
Is TE signal output normal in Focusing ON and Tracking OFF? (IC121 pin 21*)
NO
Is PICK UP (E, F, G, H) output normal? (CN101 pin 8, 5, 9, 4)
NO
• Check the PICK UP FFC.
• Replace the PICK UP.
YES
Replace the IC121.
YES
Is there TDRV signal output in Tracking ON? (IC201 pin64)
NO
Replace the IC201.
YES
Check the Drive IC(IC301) and P/U referring to "Focus Actuator operating is abnormal".
* IC121 pin21 is MOUT1(FEP Monitor1). After disc recognition action, Monitor port is off. So, please check TE signal during disc recognition.

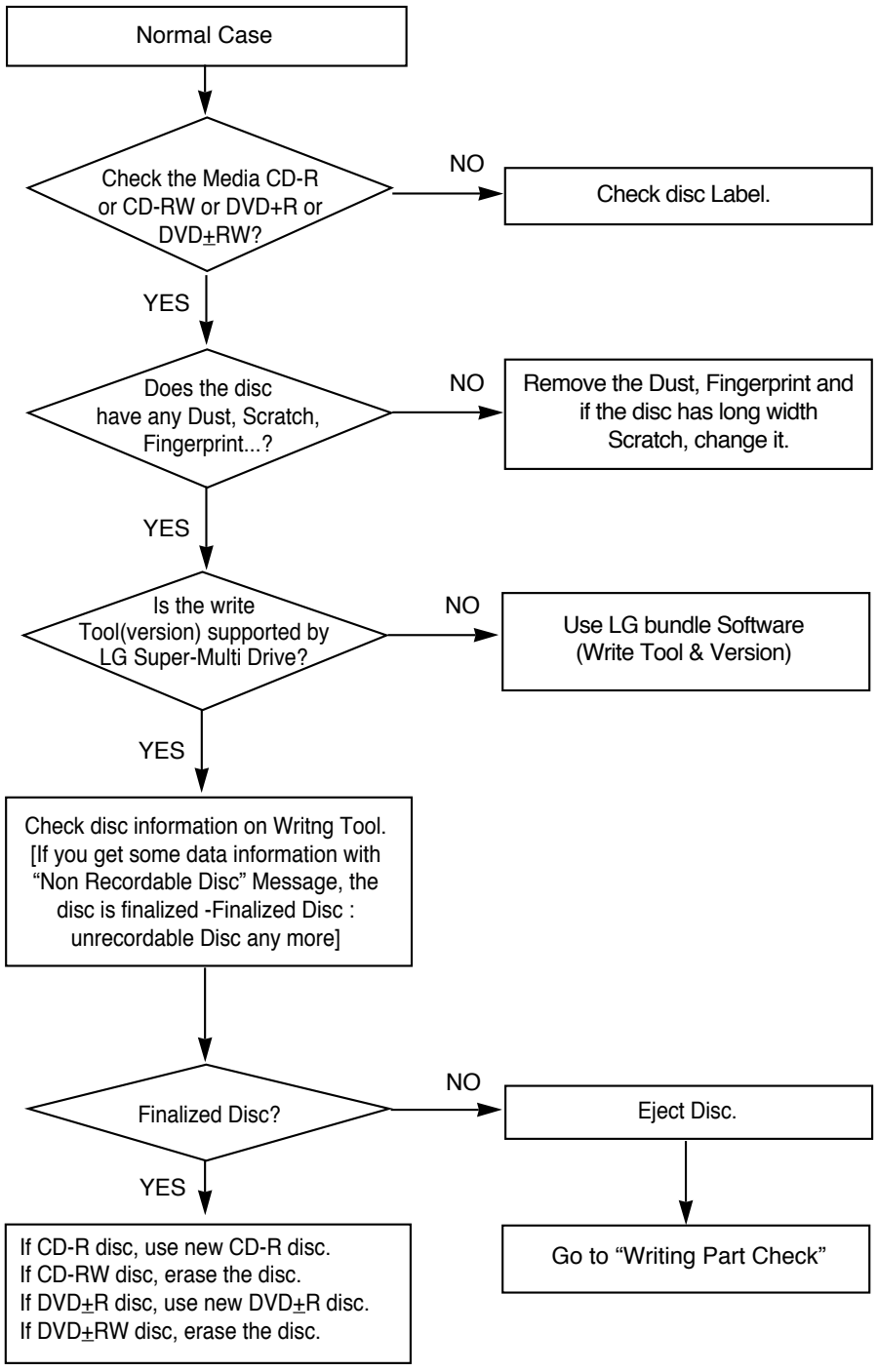

Recognition Fail Case 1:
CD-ROM Fail
Check Pickup Read Power was 1.3 ~1.7mW?
NO
Go to "LD CHECK".
YES
Does Focus Servo operate normally?
NO
Go to "Focus Servo is unstable".
YES
Check Pickup RF signal IC121(Pin83) RFOUT was about 400mV?
NO
Check the Pick-up FFC and CN101. Replace the Pick-up.
YES
Check EQOUTP waveform (IC121 Pin 65) was about 400mV?
NO
Replace IC121.
YES
Check after replacing IC201. It is OK?
NO
Go to "Tracking Servo is unstable".
YES
OK

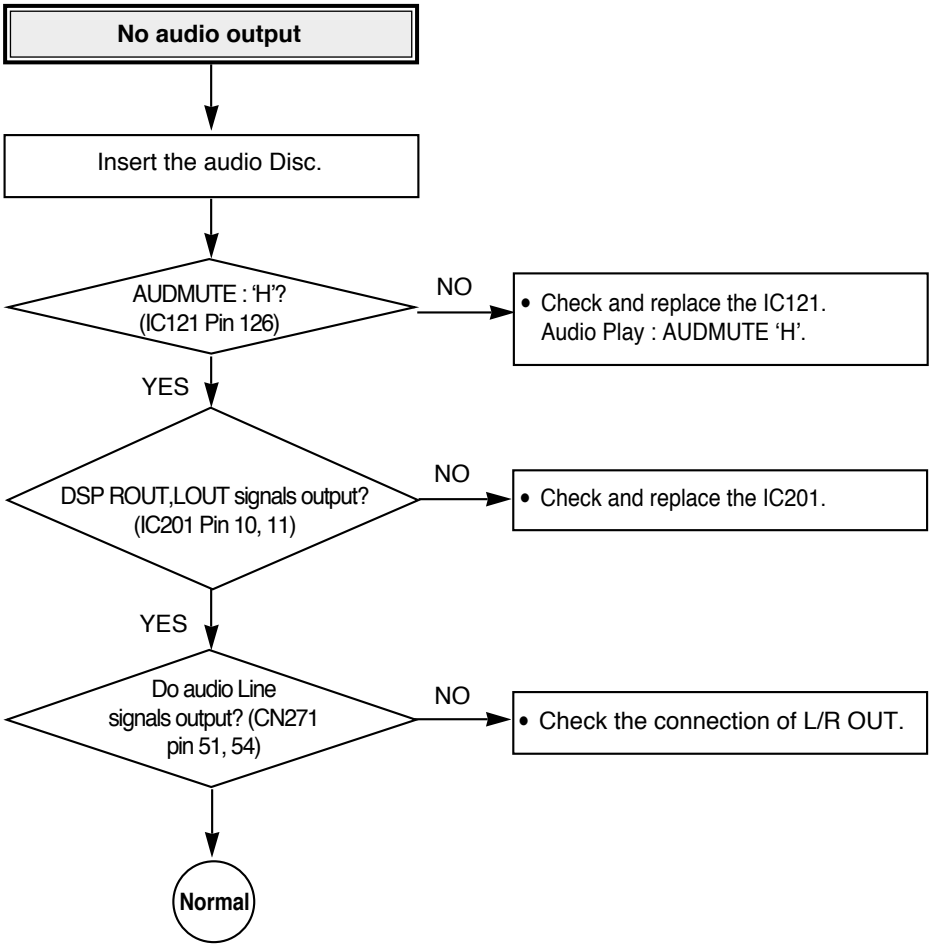

Recognition Fail Case2 :
Blank CD-R/RW
Is there WBL (IC121 pin63) signal?
YES
Is there WBL (IC201 pin36) signal?
YES
Replace the IC201.
NO
Replace IC121.
NO
Check the connection between IC201 and IC121.

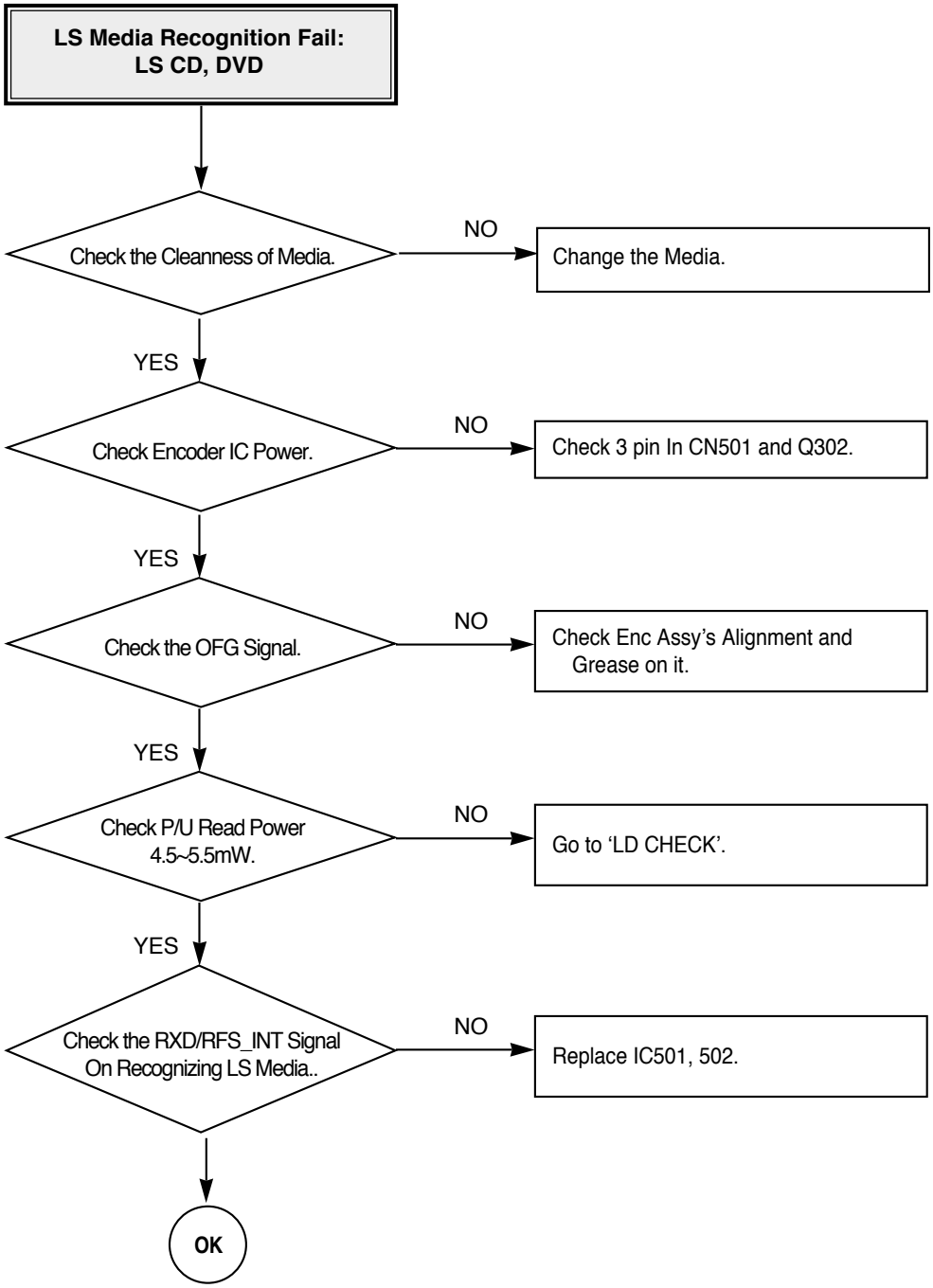

Recognition Fail Case 3 :
DVD Disc
Check Pick-up Read Power was 1.1~1.3mW.
NO
Go to 'LD CHECK'.
YES
Is there RF signal at IC121 Pin79?
NO
Replace the Pickup.
YES
Is there RF signal at IC121 Pin88(RFP) and Pin87 (RFN)?
NO
Replace the IC121.
YES
Check again after the replace IC121 It is OK?
NO
Replace the IC201.
YES
OK


Recognition Fail Case 4 :
Blank DVD+R/RW
Is there WBL (IC121 pin63) Signal?
YES
Is there WBL (IC201 pin36) Signal?
YES
Replace IC201.
NO
Replace IC121.
NO
Check the connection between IC121 and IC201.

In case of writing fail.




No audio output
Insert the audio Disc.
AUDMUTE : 'H'?
(IC121 Pin 126)
NO
• Check and replace the IC121.
Audio Play : AUDMUTE 'H'.
YES
DSP ROUT,LOUT signals output?
(IC201 Pin 10, 11)
NO
• Check and replace the IC201.
YES
Do audio Line
signals output? (CN271
pin 51, 54)
NO
• Check the connection of L/R OUT.
Normal

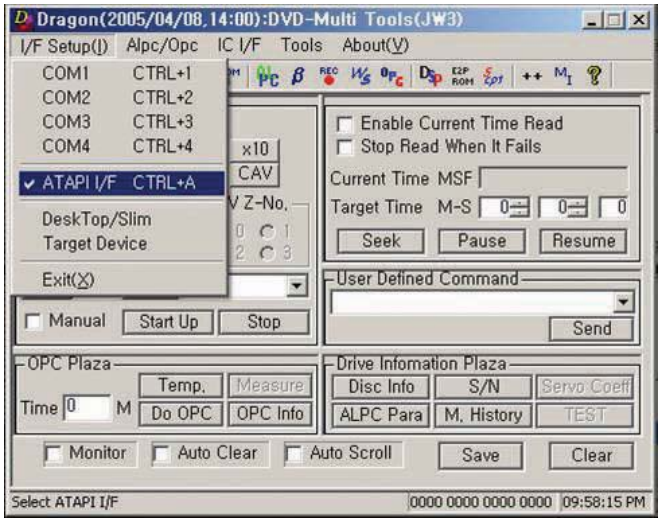

LS Media Recognition Fail:
LS CD, DVD
Check the Cleanness of Media.
NO
Change the Media.
YES
Check Encoder IC Power.
NO
Check 3 pin In CN501 and Q302.
YES
Check the OFG Signal.
NO
Check Enc Assy's Alignment and
Grease on it.
YES
Check P/U Read Power
4.5~5.5mW.
NO
Go to 'LD CHECK'.
YES
Check the RXD/RFS_INT Signal
On Recognizing LS Media..
NO
Replace IC501, 502.
OK

• How to use Test Tool

1. Dragon

A. Start

1. Install **GSA-H20L** –> PC Power ON –> **Execute** Windows.
2. Execute **Dragon_JW5.exe** on Windows (**Dragon_JW5.exe & Dragon.cfg** should be on same Directory).
3. If you use GSA-H20L, “Dragon(2005/04/08, 14:00)” will be displayed on the window Frame.
4. Select **I/F Setup** on the menu bar.
5. Select **ATAPI I/F** and then Click **OK**.
6. Select **Target Device** on the menu bar.
7. Select “**DVDRRW GSA-H20L**” on Target Device, and then Click **OK.**



[I/F Setup Menu]

[Target Device window]

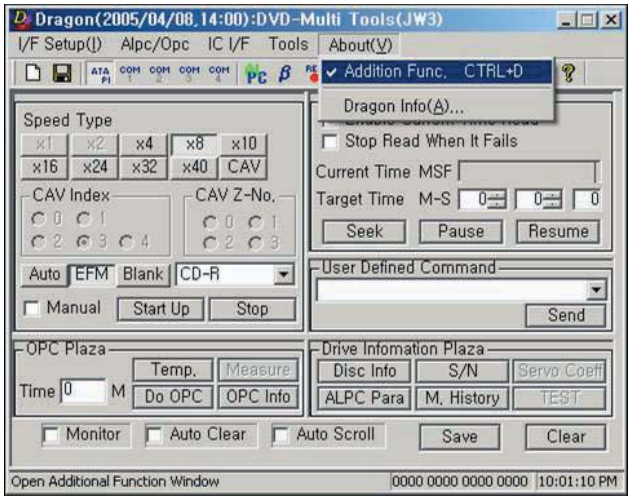
B. Check ALPC Parameters

1. Select **About** on the menu bar.
2. Click **Addition Func.** on About window -> New frame will be displayed.
3. Click **ALPC Para** tab and verify the specification.

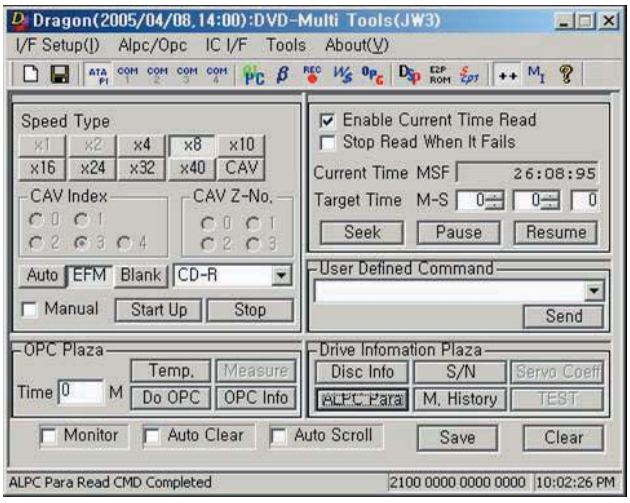
[ALPC Parameters]

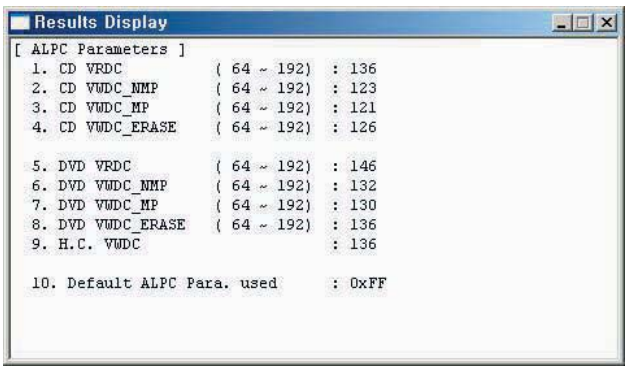
1) CD VRDC	: 117~153
2) CD VWDC_NMP	: 100~135
3) CD VWDC_MP	: 100~137
4) CD VWDC_ERASE	: 105~135
5) DVD VRDC	: 115~157
6) DVD VWDC_NMP	: 100~135
7) DVD VWDC_MP	: 100~135
8) DVD VWDC_ERASE	: 105~140
9) H.C. VWDC	: 100~150
10) Default ALPC Para. used	: 0xFF

4. **Close** window.



[Additional Function Menu]

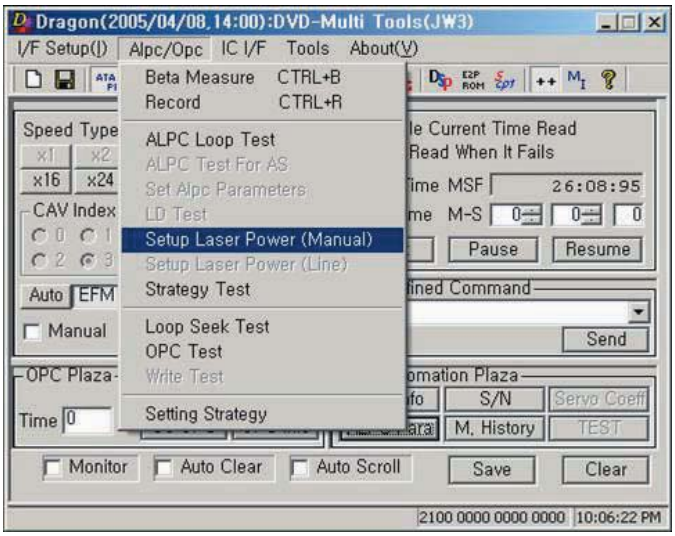




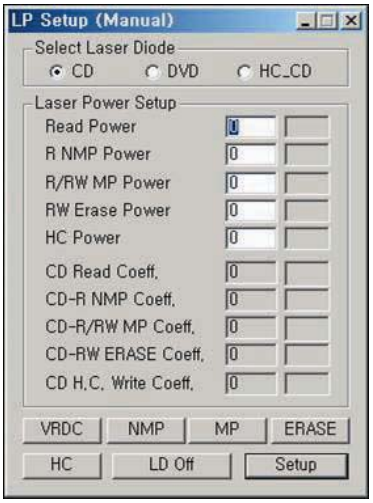
[ALPC Parameters Menu]

C. Laser Power Setup

1. **Remove** disc on the tray.
2. Select **ALPC/OPC** on the menu bar, and then select **Setup Laser Power(Manual)** menu.
3. First, select CD and setup wave length of LD Power meter (780nm)
   (Wave Length : **CD(780nm), DVD(660nm)**, Measure Range : 0.01mW unit).
4. Click **VRDC** button on the **Laser Power Setup** window. Laser beam will be emitted from LD.
5. Measure LD Power with LD Power meter. Type the result in the blank(**Read Power** box).
   ex) 1.44mW -> 144, 0.99mW -> 99)
6. Click **NMP** button and measure LD Power with Power meter. Type the result in the blank(R NMP Power box).
   ex) 16.45mW -> 1645, 12.08mW -> 1208
7. Click **MP** button and measure LD Power with Power meter. Type the result in the blank(RW Erase Power box).
8. Click **ERASE** button and measure LD Power with Power meter. Type the result in the blank(RW Erase Power box).
9. Click **LD Off** button and then click **Setup** button, and result witll be displayed with **OK** or **NG**.
10. Select **HC_CD** and then click **HC** button.
11. Measure LD Power with Power meter. Type the result in the blank (HC Power).
12. Click **LD Off** button and then click **Setup** button, and result will be displayed with **OK** or **NG.**
13. Select **DVD** and change wave length of LD Power meter (660nm).
14. Follow above step 5, 6, 7, 8, 9.
15. Close **Laser Power Setup** window.

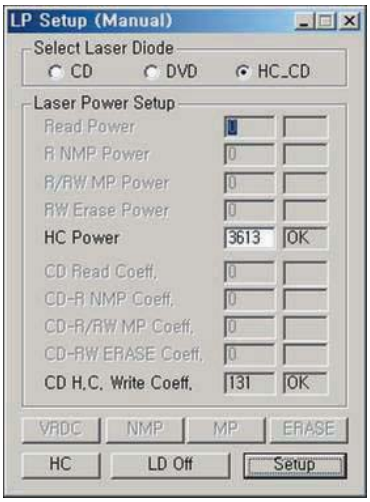


[Laser Power Setup window]



[Laser Power Setup Frame]

[CD Laser Power Setup Result]



[HC_CD Laser Power Setup Result]

[DVD Laser Power Setup Result]

2. Camus

A. Start

1. Install GSA-H20L -> PC Power On -> Execute Window.
2. Execute ***Camus.exe*** on Windows.
3. Click ① and select ***GSA-H20L.***

B. Check ALPC Parameter

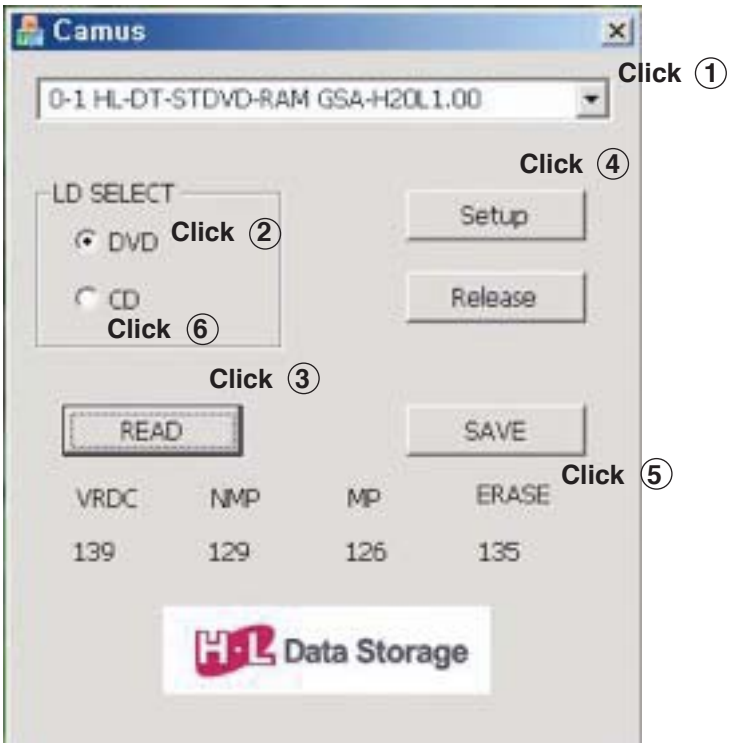
1. Check **DVD** Radio Button and click **READ** Button.
2. Check **CD** Radio Button and click **READ** Button.

C. Laser Power Setup

1. Remove disc on the tray.
2. Check DVD Radio Button and click **Setup** Button.
3. After the ALPC parameter displayed and click **SAVE** Button.
4. Check CD Radio Button and click **Setup** Button.
5. After the ALPC parameter displayed and click **SAVE** Button.

DVD Setup : ② -> ④ -> ⑤

CD Setup : ⑥ -> ④ -> ⑤



BLOCK DIAGRAM