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LG Electronics Inc.

MODELS : LH-RH7500SA/LH-RH7700S/LH-RH7505SA  
LHS-75SA5S/LHS-75SA5C/LHS-75SA5A

SERVICE MANUAL



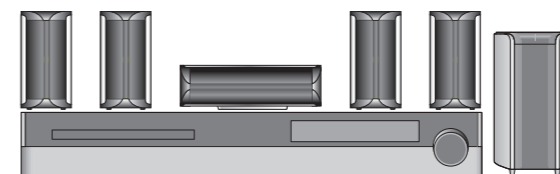
HDD/DVD Recorder Receiver System

# SERVICE MANUAL

**MODELS : LH-RH7500SA/LH-RH7700S/LH-RH7505SA  
LHS-75SA5S/LHS-75SA5C/LHS-75SA5A**

**CAUTION**

BEFORE SERVICING THE UNIT, READ THE "SAFETY PRECAUTIONS"  
IN THIS MANUAL.



# SECTION 1

## SUMMARY

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# PRODUCT SAFETY SERVICING GUIDELINES FOR VIDEO PRODUCTS

## IMPORTANT SAFETY NOTICE

This manual was prepared for use only by properly trained audio-video service technicians.

When servicing this product, under no circumstances should the original design be modified or altered without permission from LG Electronics Corporation. All components should be replaced only with types identical to those in the original circuit and their physical location, wiring and lead dress must conform to original layout upon completion of repairs.

Special components are also used to prevent x-radiation, shock and fire hazard. These components are indicated by the letter "x" included in their component designators and are required to maintain safe performance. No deviations are allowed without prior approval by LG Electronics Corporation.

Circuit diagrams may occasionally differ from the actual circuit used. This way, implementation of the latest safety and performance improvement changes into the set is not delayed until the new service literature is printed.

**CAUTION:** Do not attempt to modify this product in any way. Never perform customized installations without manufacturer's approval. Unauthorized modifications will not only void the warranty, but may lead to property damage or user injury.

Service work should be performed only after you are thoroughly familiar with these safety checks and servicing guidelines.

## GRAPHIC SYMBOLS



The exclamation point within an equilateral triangle is intended to alert the service personnel to important safety information in the service literature.



The lightning flash with arrowhead symbol within an equilateral triangle is intended to alert the service personnel to the presence of noninsulated "dangerous voltage" that may be of sufficient magnitude to constitute a risk of electric shock.



The pictorial representation of a fuse and its rating within an equilateral triangle is intended to convey to the service personnel the following fuse replacement caution notice:

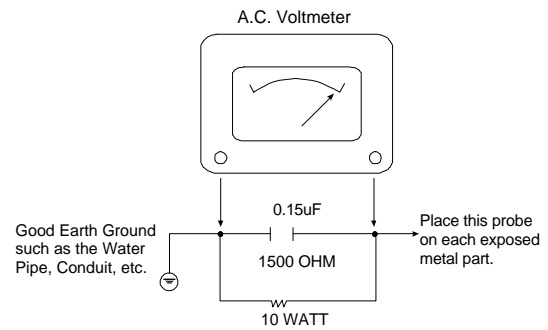
**CAUTION:** FOR CONTINUED PROTECTION AGAINST RISK OF FIRE, REPLACE ALL FUSES WITH THE SAME TYPE AND RATING AS MARKED NEAR EACH FUSE.

## SERVICE INFORMATION

While servicing, use an isolation transformer for protection from AC line shock. After the original service problem has been corrected, make a check of the following:

### FIRE AND SHOCK HAZARD

1. Be sure that all components are positioned to avoid a possibility of adjacent component shorts. This is especially important on items transported to and from the repair shop.
2. Verify that all protective devices such as insulators, barriers, covers, shields, strain reliefs, power supply cords, and other hardware have been reinstalled per the original design. Be sure that the safety purpose of the polarized line plug has not been defeated.
3. Soldering must be inspected to discover possible cold solder joints, solder splashes, or sharp solder points. Be certain to remove all loose foreign particles.
4. Check for physical evidence of damage or deterioration to parts and components, for frayed leads or damaged insulation (including the AC cord), and replace if necessary.
5. No lead or component should touch a high current device or a resistor rated at 1 watt or more. Lead tension around protruding metal surfaces must be avoided.
6. After reassembly of the set, always perform an AC leakage test on all exposed metallic parts of the cabinet (the channel selector knobs, antenna terminals, handle and screws) to be sure that set is safe to operate without danger of electrical shock. **DO NOT USE A LINE ISOLATION TRANSFORMER DURING THIS TEST.** Use an AC voltmeter having 5000 ohms per volt or more sensitivity in the following manner: Connect a 1500 ohm, 10 watt resistor, paralleled by a .15 mfd 150V AC type capacitor between a known good earth ground water pipe, conduit, etc.) and the exposed metallic parts, one at a time. Measure the AC voltage across the combination of 1500 ohm resistor and .15 mfd capacitor. Reverse the AC plug by using a non-polarized adaptor and repeat AC voltage measurements for each exposed metallic part. Voltage measured must not exceed 0.75 volts RMS. This corresponds to 0.5 milliamp AC. Any value exceeding this limit constitutes a potential shock hazard and must be corrected immediately.



## TIPS ON PROPER INSTALLATION

1. Never install any receiver in a closed-in recess, cubbyhole, or closely fitting shelf space over, or close to, a heat duct, or in the path of heated air flow.
2. Avoid conditions of high humidity such as: outdoor patio installations where dew is a factor, near steam radiators where steam leakage is a factor, etc.
3. Avoid placement where draperies may obstruct venting. The customer should also avoid the use of decorative scarves or other coverings that might obstruct ventilation.
4. Wall- and shelf-mounted installations using a commercial mounting kit must follow the factory-approved mounting instructions. A product mounted to a shelf or platform must retain its original feet (or the equivalent thickness in spacers) to provide adequate air flow across the bottom. Bolts or screws used for fasteners must not touch any parts or wiring. Perform leakage tests on customized installations.
5. Caution customers against mounting a product on a sloping shelf or in a tilted position, unless the receiver is properly secured.
6. A product on a roll-about cart should be stable in its mounting to the cart. Caution the customer on the hazards of trying to roll a cart with small casters across thresholds or deep pile carpets.
7. Caution customers against using extension cords. Explain that a forest of extensions, sprouting from a single outlet, can lead to disastrous consequences to home and family.

# SERVICING PRECAUTIONS

**CAUTION:** Before servicing the DVD Recorder Combi Receiver covered by this service data and its supplements and addends, read and follow the *SAFETY PRECAUTIONS*. **NOTE:** if unforeseen circumstances create conflict between the following servicing precautions and any of the safety precautions in this publications, always follow the safety precautions.

*Remember Safety First:*

## General Servicing Precautions

1. Always unplug the DVD Recorder Combi Receiver AC power cord from the AC power source before:
  - (1) Removing or reinstalling any component, circuit board, module, or any other assembly.
  - (2) Disconnecting or reconnecting any internal electrical plug or other electrical connection.
  - (3) Connecting a test substitute in parallel with an electrolytic capacitor.  
**Caution:** A wrong part substitution or incorrect polarity installation of electrolytic capacitors may result in an explosion hazard.
2. Do not spray chemicals on or near this DVD Recorder Combi Receiver or any of its assemblies.
3. Unless specified otherwise in this service data, clean electrical contacts by applying an appropriate contact cleaning solution to the contacts with a pipe cleaner, cotton-tipped swab, or comparable soft applicator. Unless specified otherwise in this service data, lubrication of contacts is not required.
4. Do not defeat any plug/socket B+ voltage interlocks with which instruments covered by this service manual might be equipped.
5. Do not apply AC power to this DVD Recorder Combi Receiver and / or any of its electrical assemblies unless all solid-state device heat sinks are correctly installed.
6. Always connect the test instrument ground lead to an appropriate ground before connecting the test instrument positive lead. Always remove the test instrument ground lead last.

## Insulation Checking Procedure

Disconnect the attachment plug from the AC outlet and turn the power on. Connect an insulation resistance meter (500V) to the blades of the attachment plug. The insulation resistance between each blade of the attachment plug and accessible conductive parts (Note 1) should be more than 1M-ohm.

**Note 1:** Accessible Conductive Parts include Metal panels, Input terminals, Earphone jacks, etc.

## Electrostatically Sensitive (ES) Devices

Some semiconductor (solid state) devices can be damaged easily by static electricity. Such components commonly are called Electrostatically Sensitive (ES) Devices. Examples of typical ES devices are integrated circuits and some field effect transistors and semiconductor chip components.

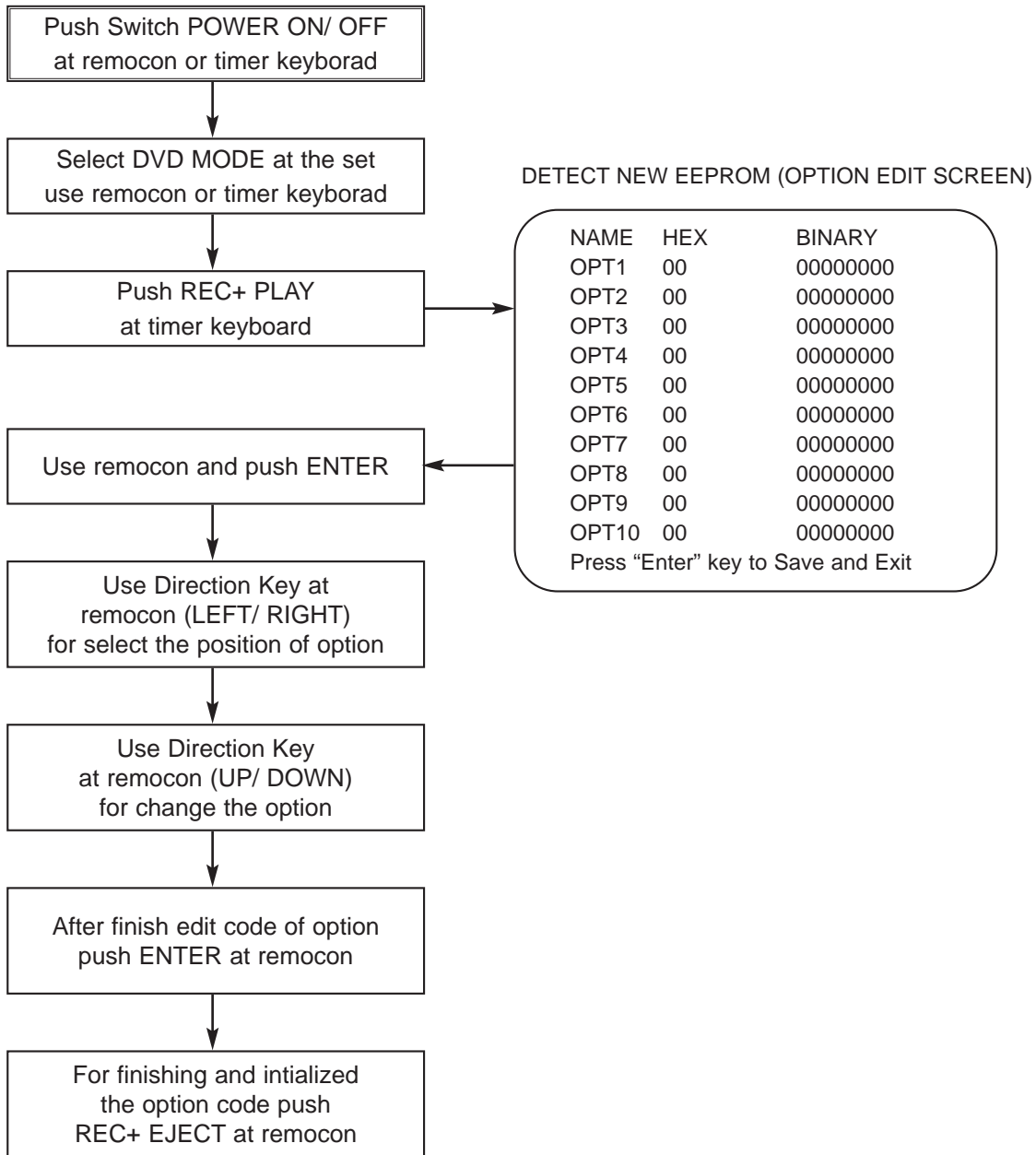
The following techniques should be used to help reduce the incidence of component damage caused by static electricity.

1. Immediately before handling any semiconductor component or semiconductor-equipped assembly, drain off any electrostatic charge on your body by touching a known earth ground. Alternatively, obtain and wear a commercially available discharging wrist strap device, which should be removed for potential shock reasons prior to applying power to the unit under test.
2. After removing an electrical assembly equipped with ES devices, place the assembly on a conductive surface such as aluminum foil, to prevent electrostatic charge buildup or exposure of the assembly.
3. Use only a grounded-tip soldering iron to solder or unsolder ES devices.
4. Use only an anti-static solder removal device. Some solder removal devices not classified as "anti-static" can generate electrical charges sufficient to damage ES devices.
5. Do not use freon-propelled chemicals. These can generate an electrical charge sufficient to damage ES devices.
6. Do not remove a replacement ES device from its protective package until immediately before you are ready to install it. (Most replacement ES devices are packaged with leads electrically shorted together by conductive foam, aluminum foil, or comparable conductive material).
7. Immediately before removing the protective material from the leads of a replacement ES device, touch the protective material to the chassis or circuit assembly into which the device will be installed.

**Caution:** Be sure no power is applied to the chassis or circuit, and observe all other safety precautions.

8. Minimize bodily motions when handling unpackaged replacement ES devices. (Normally harmless motion such as the brushing together of your clothes fabric or the lifting of your foot from a carpeted floor can generate static electricity sufficient to damage an ES device.)

# THE STEPS FOR CHANGE THE OPTION CODE



# SPECIFICATIONS

## GENERAL

Power requirements	AC 200-240V, 50/60 Hz
Power consumption	45W
Dimensions (approx.)	430 X 49 X 350 mm (w x h x d) without foot
Mass (approx.)	4.6 kg
Operating temperature	5°C to 35°C
Operating humidity	5 % to 90 %
Recording format	PAL

## RECORDING

Recording format	DVD Video Recording, DVD-VIDEO
Recordable media	HDD (160GB), DVD-ReWritable, DVD-Recordable, DVD+ReWritable, DVD+Recordable, DVD+Recordable (Double Layer)
Recordable time	DVD (4.7GB): Approx. 1 hour (HQ mode), 2 hours (SQ mode), 4 hours (LQ mode), 6 hours (EQ mode) DVD+R DL (8.5GB): Approx. 3 hour (HQ mode), 3 hours 40 minutes (SQ mode), 7 hours 10 minutes (LQ mode), 10 hours 30 minutes (EQ mode) HDD (160GB): Approx. 42 hours (HQ mode), 82 hours (SQ mode), 152 hours (LQ mode), 226 hours (EQ mode)

## VIDEO RECORDING FORMAT

Sampling frequency	27MHz
Compression format	MPEG 2 (VBR support)

## AUDIO RECORDING FORMAT

Sampling frequency	48kHz
Compression format	Dolby Digital

## PLAYBACK

Frequency response	DVD (PCM 48 kHz): 8 Hz to 20 kHz, CD: 8 Hz to 20 kHz DVD (PCM 96 kHz): 8 Hz to 44 kHz
Signal-to-noise ratio	More than 100 dB (AUDIO OUT connector)
Harmonic distortion	Less than 0.008% (AUDIO OUT connector)
Dynamic range	More than 95 dB (AUDIO OUT connector)

## INPUTS

AERIAL IN	Aerial input, 75 ohms
VIDEO IN	1.0 Vp-p 75 ohms, sync negative, RCA jack x 2 / SCART x 2
AUDIO IN	0 dBm more than 47 kohms, RCA jack (L, R) x 2 / SCART x 2
DV IN	4 pin (IEEE 1394 standard)

## OUTPUTS

VIDEO OUT	1 Vp-p 75 Ω, sync negative, RCA jack x 1 / SCART x 2
COMPONENT VIDEO OUT	(Y) 1.0 V (p-p), 75 Ω, negative sync, RCA jack x 1 (Pb)/(Pr) 0.7 V (p-p), 75 Ω, RCA jack x 2
HDMI video/audio output	19 pin (HDMI standard, Type A)
Audio output (digital audio)	0.5 V (p-p), 75 Ω, RCA jack x 1
Audio output (optical audio)	3 V (p-p), 75 Ω, Optical connector x 1
Audio output (analog audio)	2.0 Vrms (1 KHz, 0 dB), 600 Ω, RCA jack (L, R) x 1 / SCART x 2

## AMPLIFIER(LH-RH7000 SERIES)

Stereo mode	100W + 100W (6Ω at 1 kHz, THD 10 %)
Surround mode	Front: 100W + 100W (THD 10 %) Center*: 100W Surround*: 100W + 100W (6Ω at 1 kHz, THD 10 %) Subwoofer*: 200W (3Ω at 30 Hz, THD 10 %)

## AMPLIFIER(LH-RH9000 SERIES)

Stereo mode	180W + 180W (4Ω at 1 kHz, THD 10 %)
Surround mode	Front: 180W + 180W (THD 10 %) Center*: 180W Surround*: 180W + 180W (4Ω at 1 kHz, THD 10 %) Subwoofer*: 300W (3Ω at 30 Hz, THD 10 %)

**TUNER SPECIFICATIONS**

Tuning Range (FM)	87.5 - 108 MHz
Intermediate Frequency (FM)	10.7 MHz
Signal-to-noise ratio	60 dB (Mono)
Tuning Range (AM)	522 - 1,620 kHz
Intermediate Frequency (AM)	450 kHz
Antenna	Wire antenna (FM) Loop antenna (AM)

**SPEAKERS(LHS-75PA5)**

	<b>FRONT (LHS-75PA5F)</b>	<b>SATELLITE (LHS-75PA5S)</b>	<b>CENTER (LHS-75PA5C)</b>	<b>ACTIVE SUBWOOFER (LHS-75PA5A)</b>
Power consumption:	-	-	-	70W
Type:	1 Way 2 Speaker	1 Way 1 Speaker	1 Way 2 Speaker	1 Way 1 Speaker
Impedance:	6 Ω	3 Ω	6 Ω	3 Ω
Frequency Response:	100 - 20,000 Hz	100 - 20,000 Hz	80 - 20,000 Hz	35 - 1,500 Hz
Sound Pressure Level:	85 dB/W (1m)	85 dB/W (1m)	85 dB/W (1m)	83 dB/W (1m)
Max Input Power:	100W	100W	100W	200W
Net Dimensions (WxHxD):	269.5x1200x269.5mm	120x223x151mm	448x85x105mm	295x432x414mm
Net Weight:	2.9 kg	1.1 kg	1.2 kg	14 kg

**SPEAKERS(LHS-75SA5)**

	<b>SATELLITE (LHS-75SA5S)</b>	<b>CENTER (LHS-75SA5C)</b>	<b>ACTIVE SUBWOOFER (LHS-75SA5A)</b>
Power consumption:	-	-	70W
Type:	1 Way 1 Speaker	1 Way 1 Speaker	1 Way 1 Speaker
Impedance:	6 Ω	6 Ω	3 Ω
Frequency Response:	100 - 20,000 Hz	0 - 20,000 Hz	35 - 1,500 Hz
Sound Pressure Level:	85 dB/W (1m)	85 dB/W (1m)	83 dB/W (1m)
Max Input Power:	100W	100W	200W
Net Dimensions (WxHxD):	120 x 223 x 151 mm	301 x 85 x 105 mm	295 x 432 x 414 mm
Net Weight:	1.1 kg	1.2 kg	14 kg

**SPEAKERS(LHS-75TA5)**

	<b>SATELLITE (LHS-75TA5S)</b>	<b>CENTER (LHS-75TA5C)</b>	<b>ACTIVE SUBWOOFER (LHS-75TA5A)</b>
Power consumption:	-	-	70W
Type:	1 Way 2 Speaker	1 Way 2 Speaker	1 Way 1 Speaker
Impedance:	6 Ω	6 Ω	3 Ω
Frequency Response:	80 - 20,000 Hz	80 - 20,000 Hz	35 - 1,500 Hz
Sound Pressure Level:	85 dB/W (1m)	85 dB/W (1m)	83 dB/W (1m)
Max. Input Power:	100W	100W	200W
Net Dimensions (WxHxD):	269.5 x 1200 x 269.5 mm	448 x 85 x 105 mm	295 x 432 x 414 mm
Net Weight:	2.9 kg	1.2 kg	14 kg

**SPEAKERS(LHS-95TA9)**

	<b>SATELLITE (LHS-95TA9S)</b>	<b>CENTER (LHS-95TA9C)</b>	<b>ACTIVE SUBWOOFER (LHS-95TA9A)</b>
Power consumption:	-	-	110W
Type:	1 Way 2 Speaker	1 Way 2 Speaker	1 Way 1 Speaker
Impedance:	4 Ω	4 Ω	3 Ω
Frequency Response:	80 - 20,000 Hz	80 - 20,000 Hz	35 - 1,500 Hz
Sound Pressure Level:	85 dB/W (1m)	85 dB/W (1m)	83 dB/W (1m)
Max. Input Power:	180W	180W	300W
Net Dimensions (WxHxD):	269.5 x 1200 x 269.5 mm	448 x 85 x 105 mm	295 x 432 x 414 mm
Net Weight:	2.9 kg	1.2 kg	14 kg

# SECTION 2

## EXPLODED VIEWS

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# EXPLODED VIEWS

## 1. CABINET AND MAIN FRAME SECTION

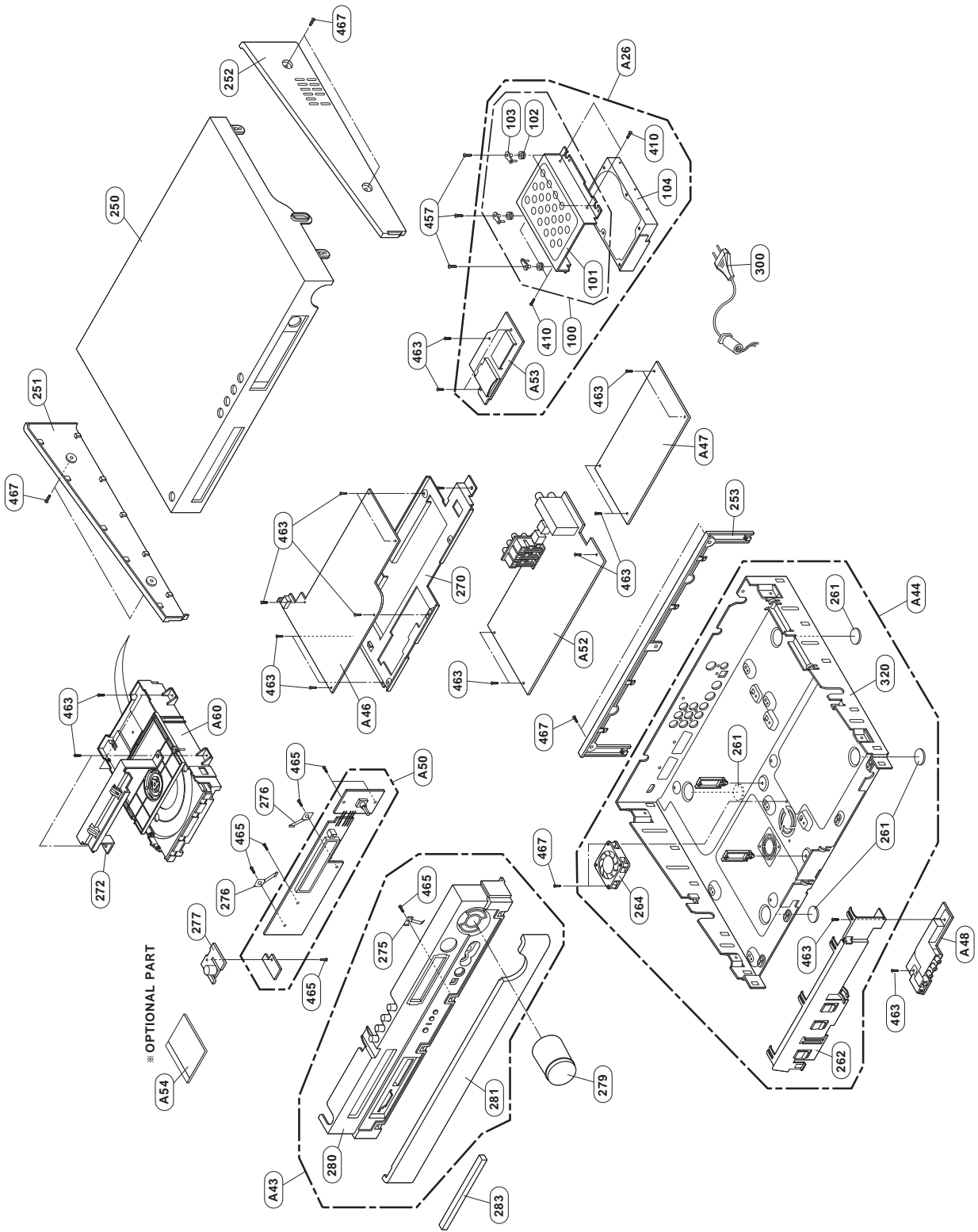
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4

3

2

1



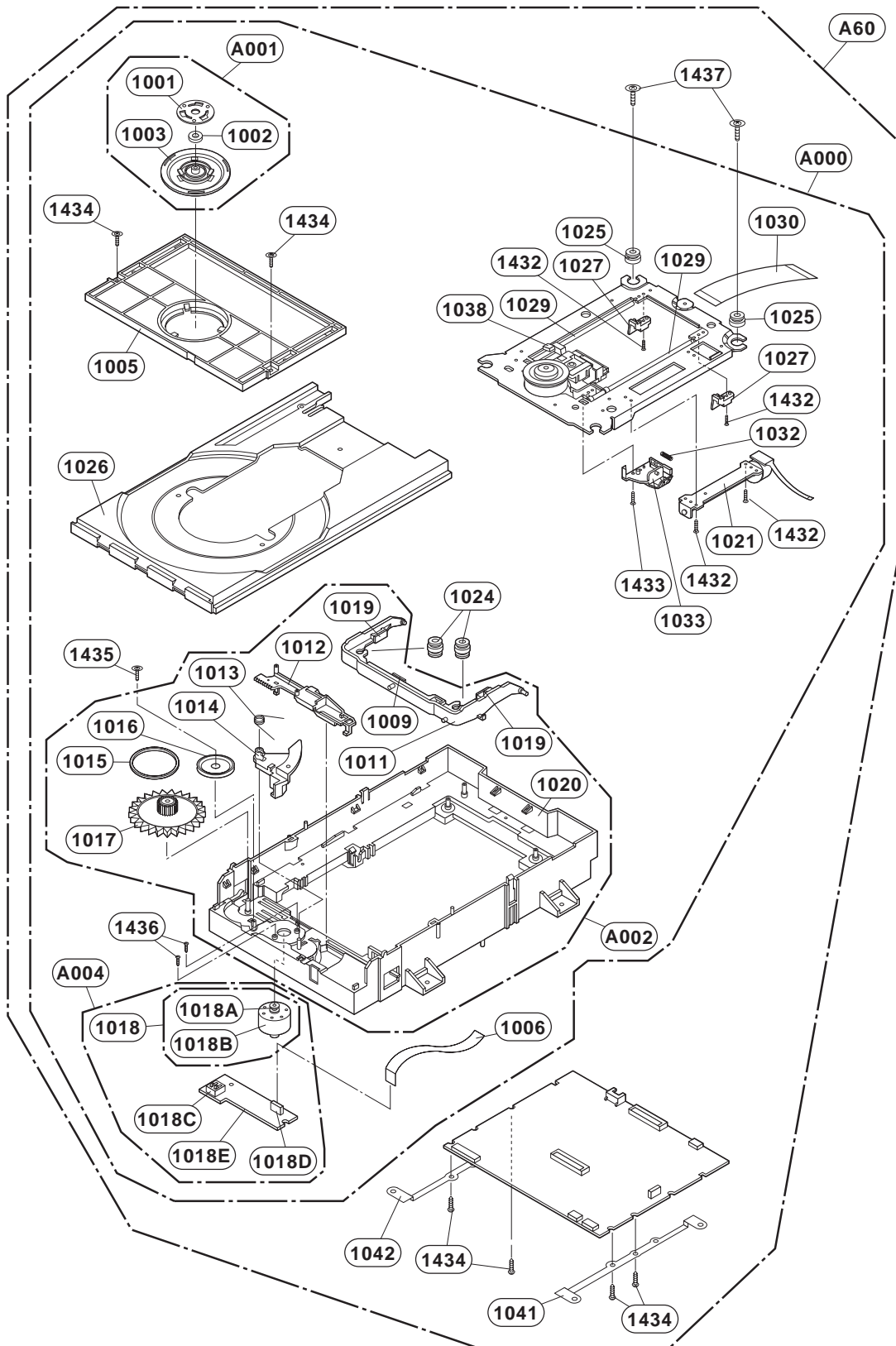
A

B

C

D

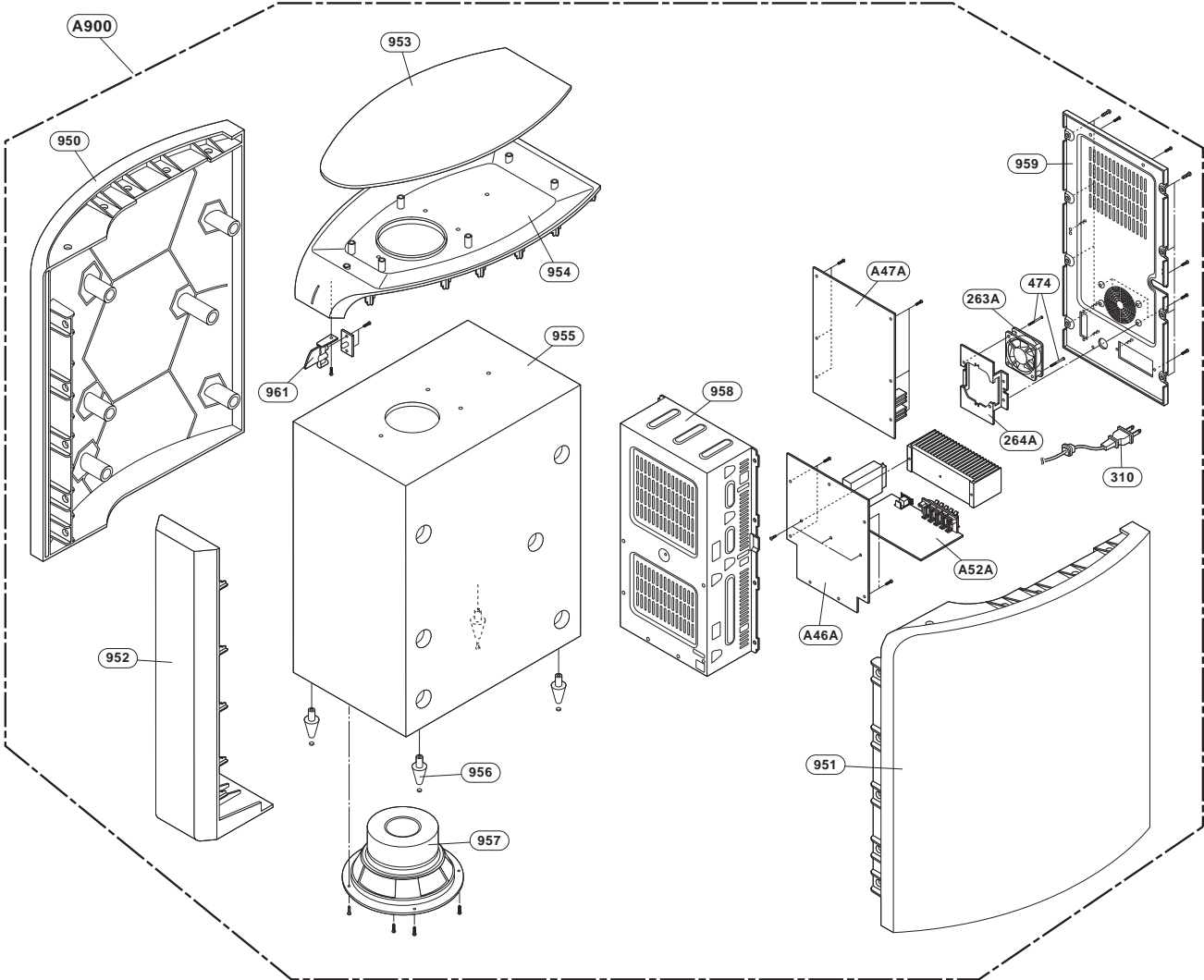
## 2. DECK MECHANISM SECTION (RL-05)



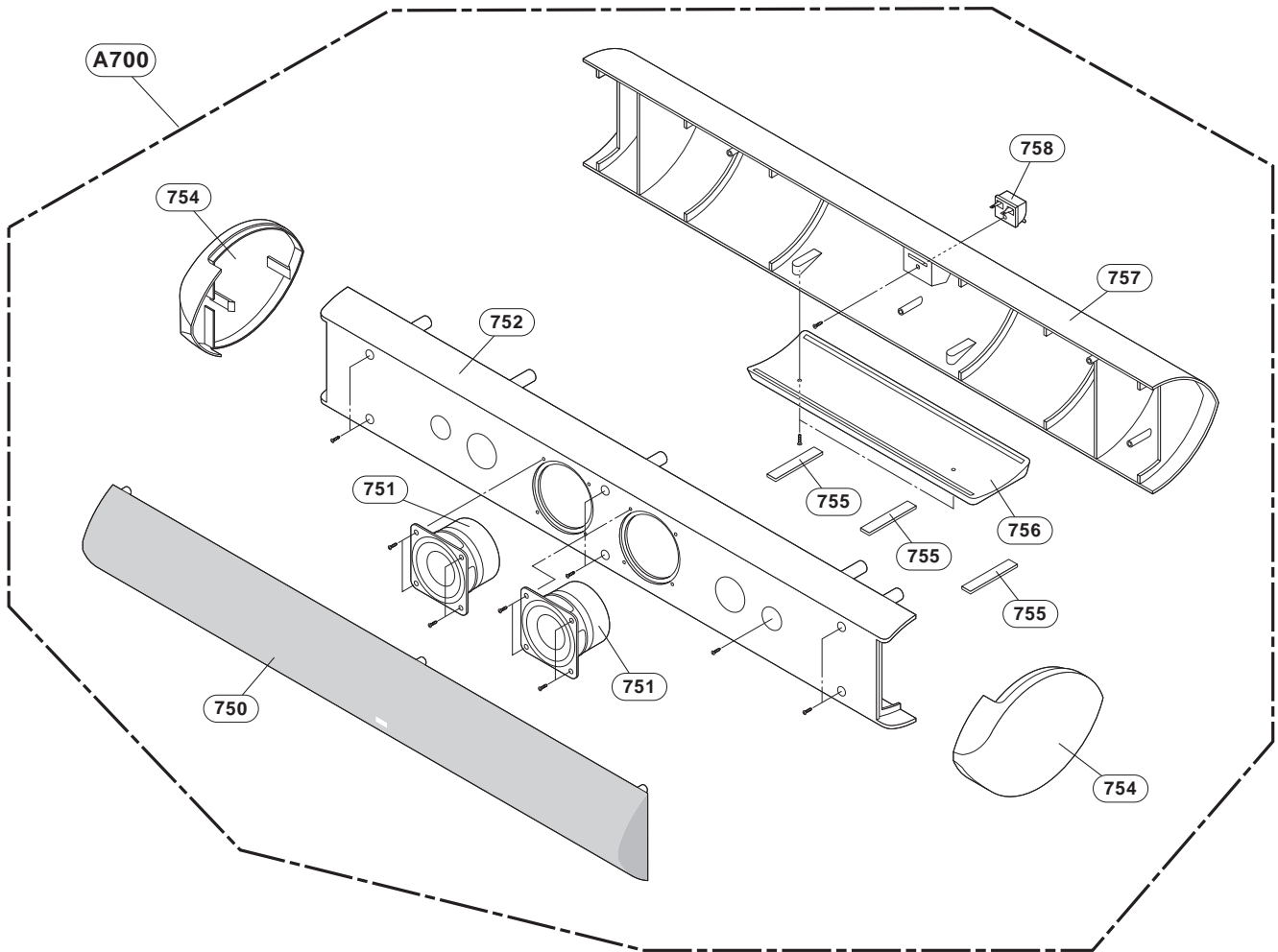
### 3. SPEAKER SECTION

#### 1) WOOFER SPEAKER SECTION

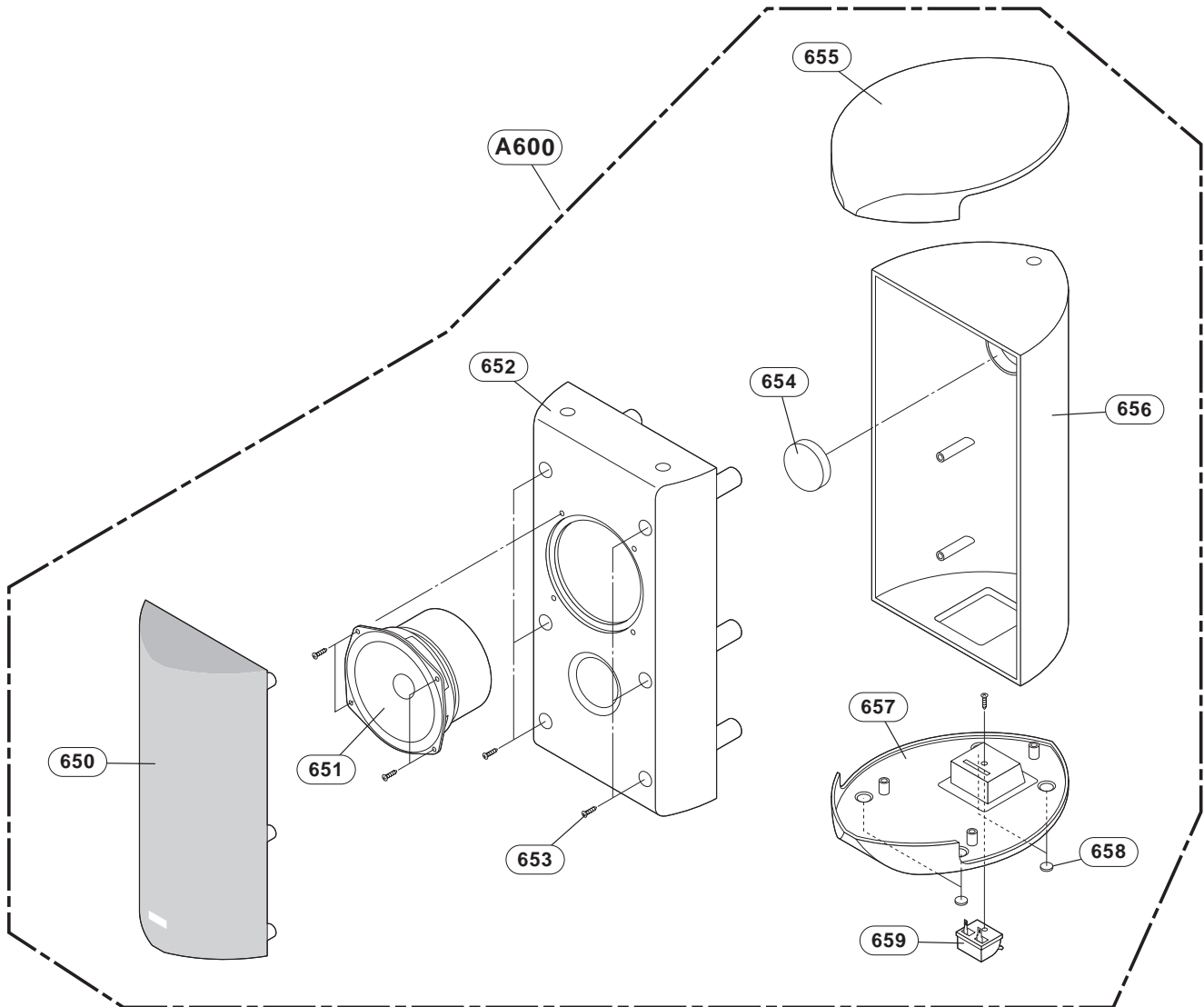
(LHS-75PA5A/LHS-75TA5A/LHS-75SA5A/LHS-95PA5A/LHS-95TA5A/LHS-95SA5A)



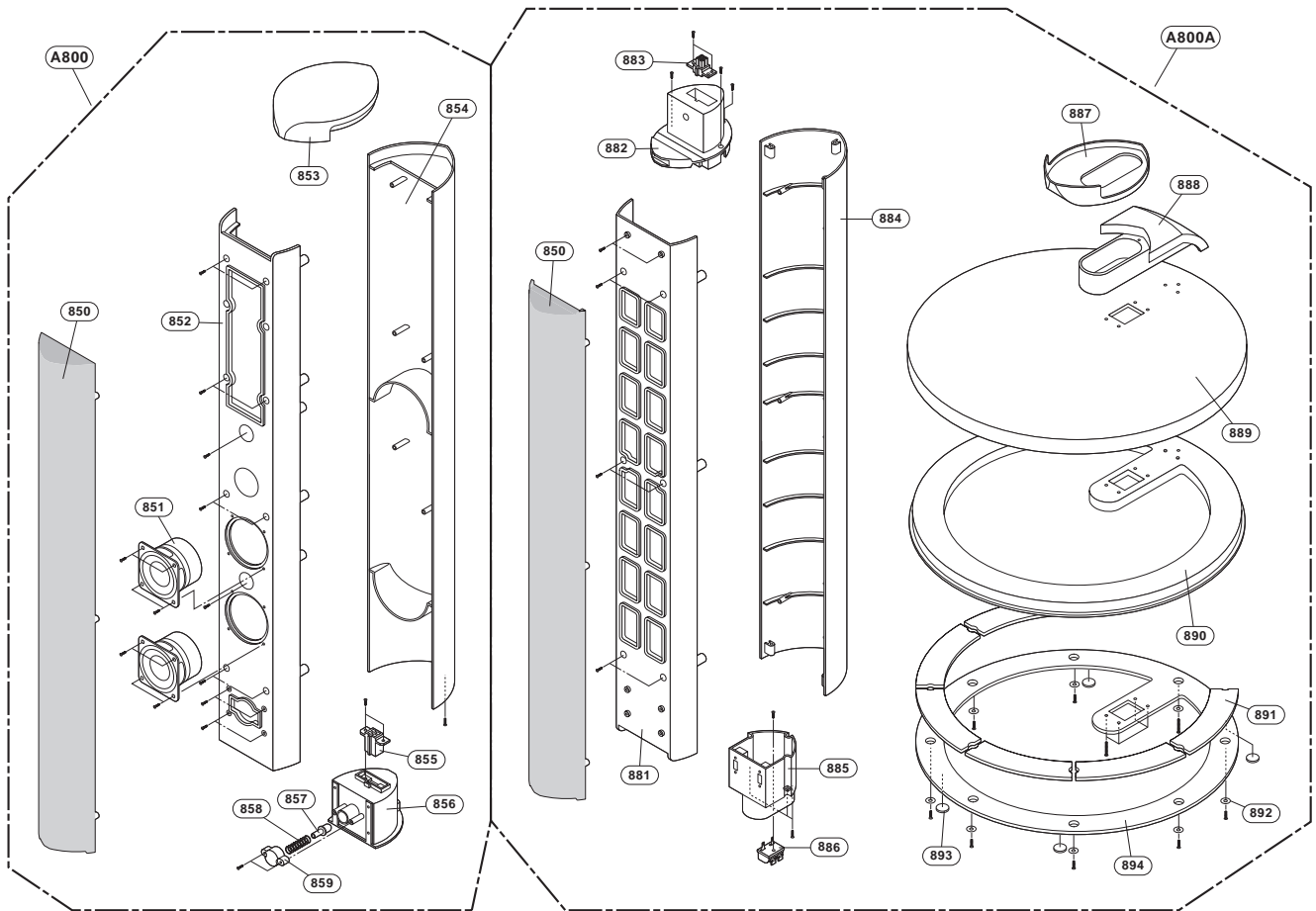
**2) CENTER SPEAKER SECTION (OPTIONAL PART)**  
**(LHS-75PA5C/LHS-75TA5C/LHS-95PA5C/LHS-95TA5C)**



**3) REAR SECTION (OPTIONAL PART)**  
**(LHS-75PA5S/LHS-75SA5S/LHS-95PA5S/LHS-95SA5S)**



**4) FRONT SPEAKER SECTION (OPTIONAL PART)**  
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# SECTION 3 ELECTRICAL CONTENTS

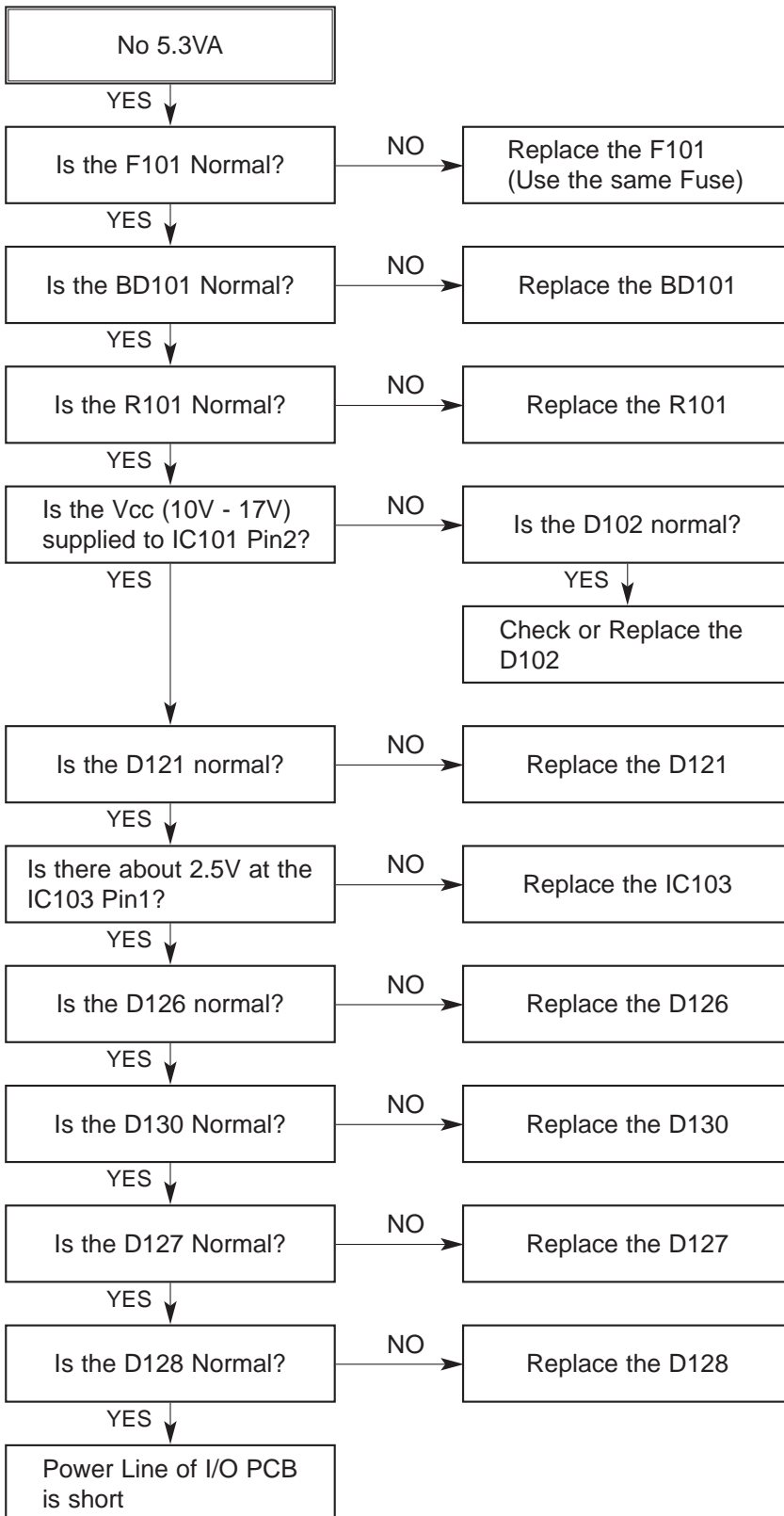
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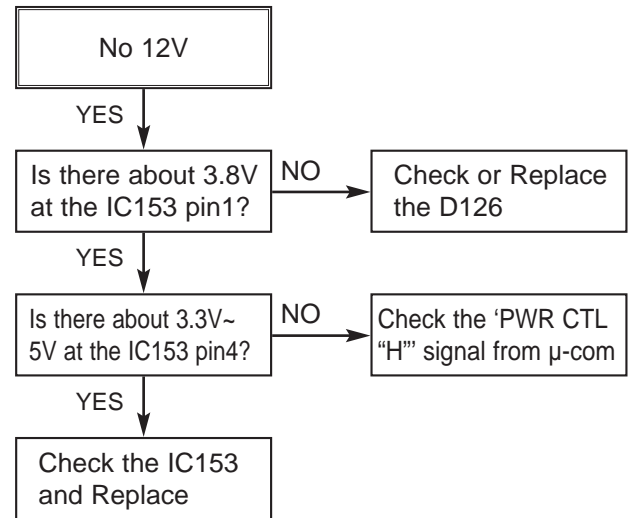
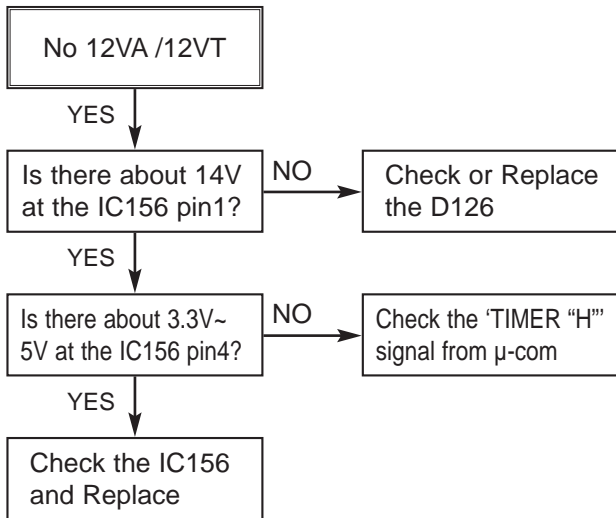
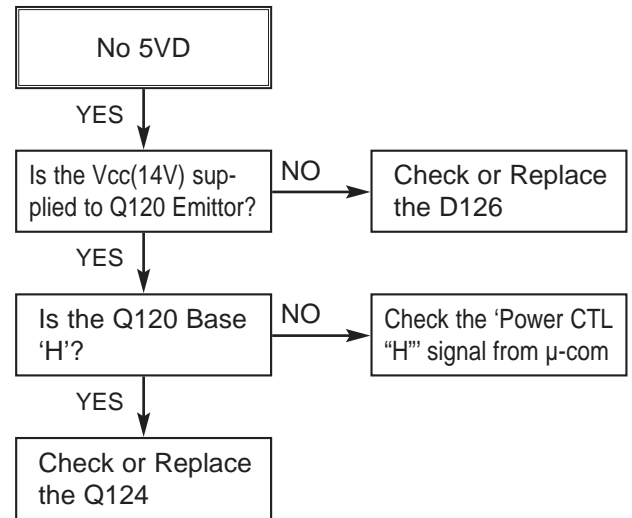
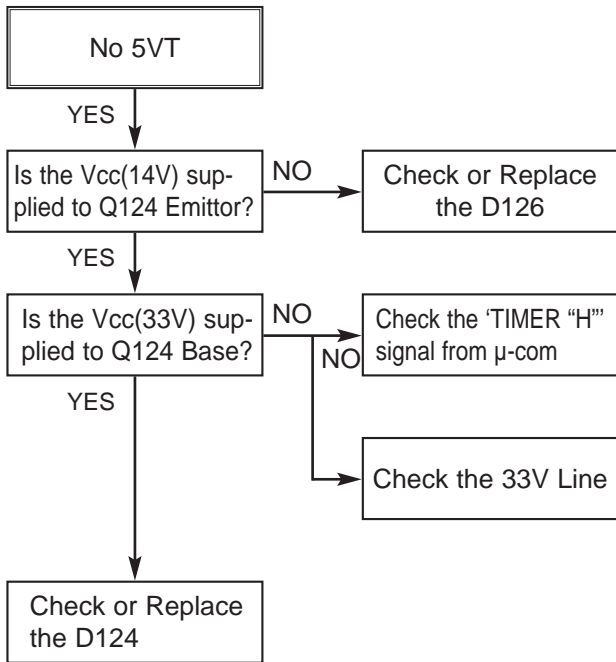


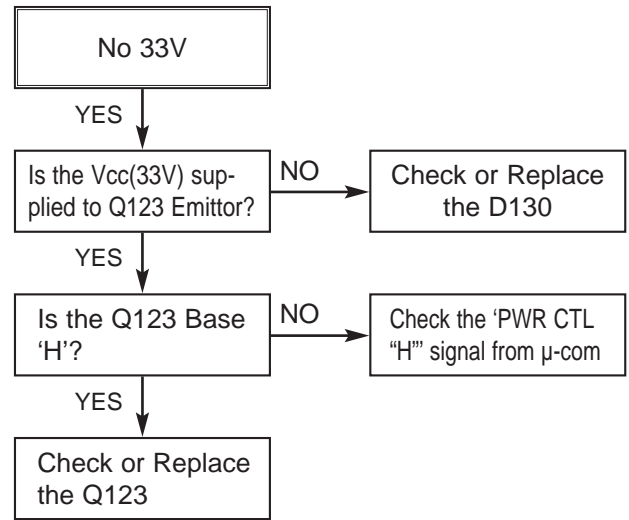
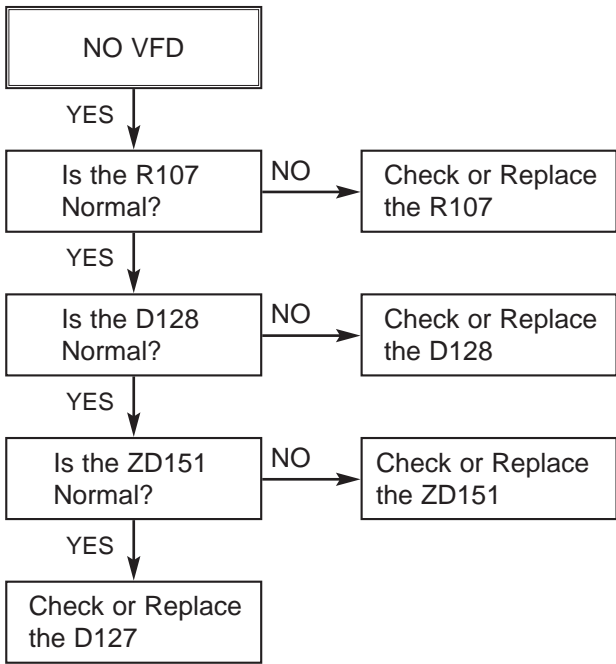
# HDR PART

## ELECTRICAL TROUBLESHOOTING GUIDE

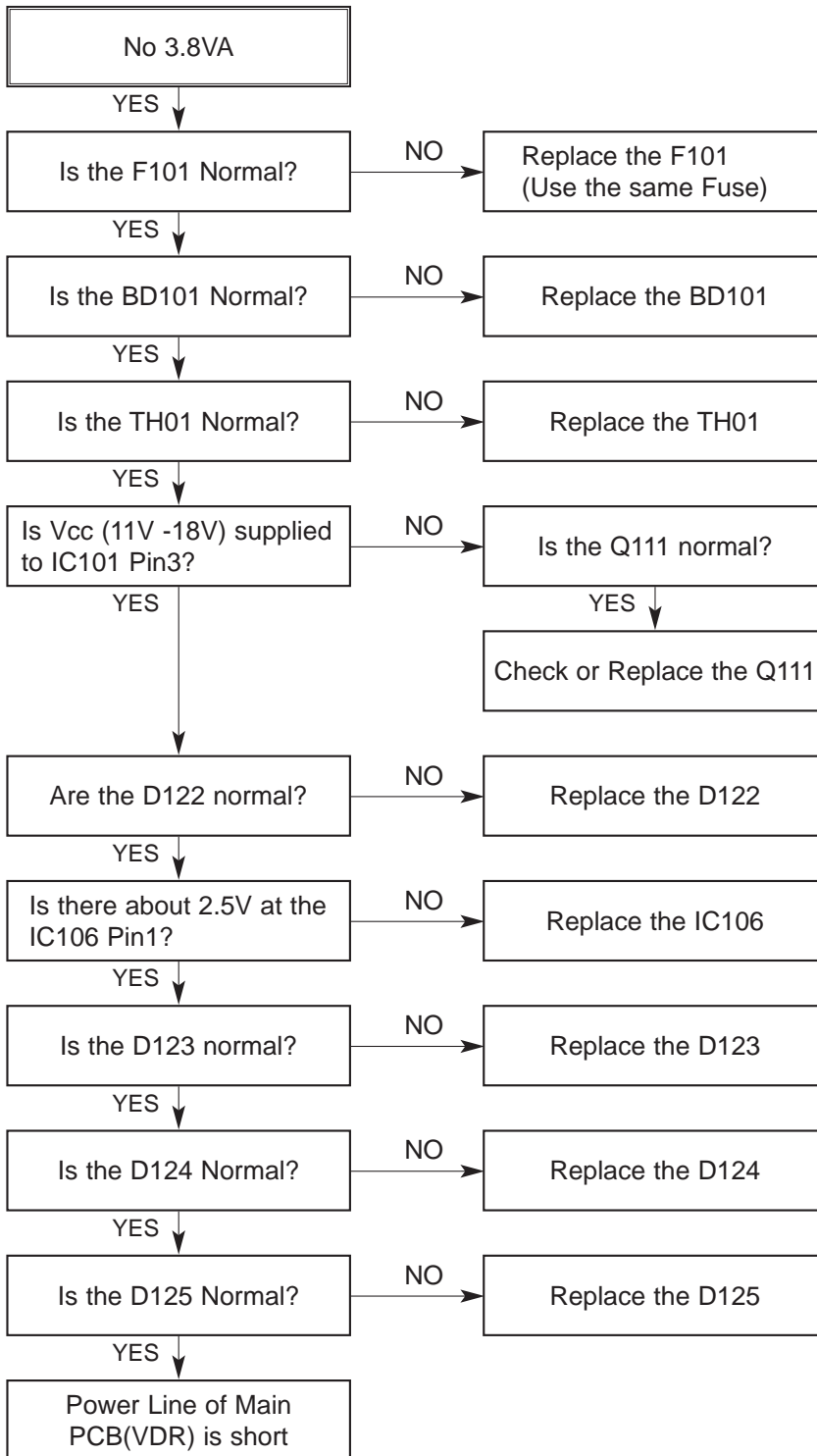
### 1. SMPS I/O PART

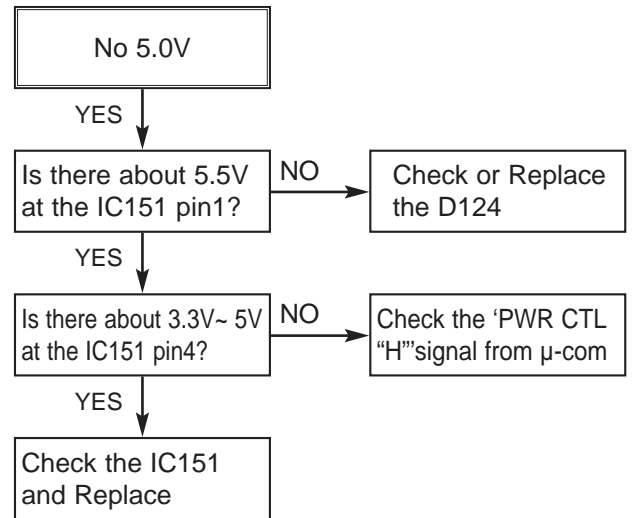
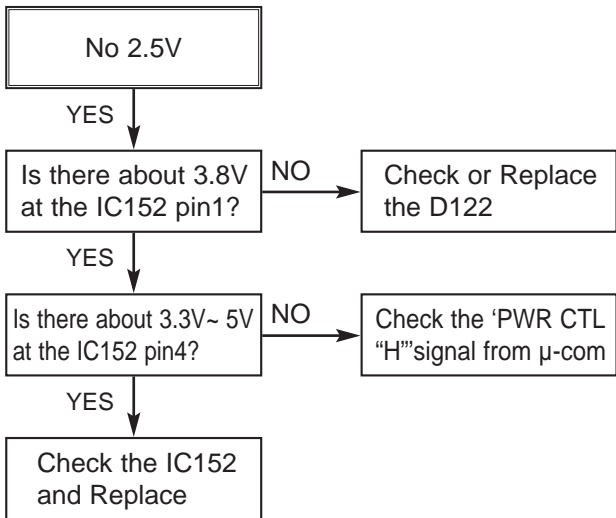
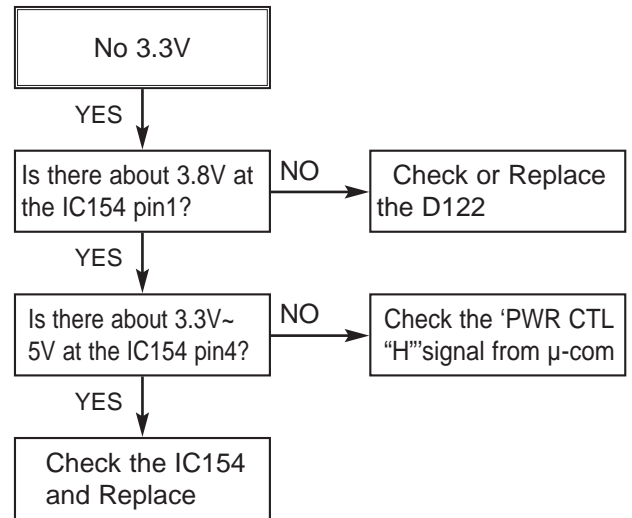
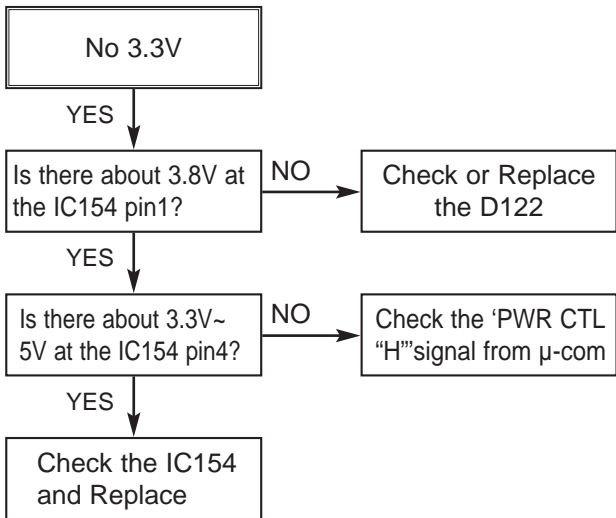


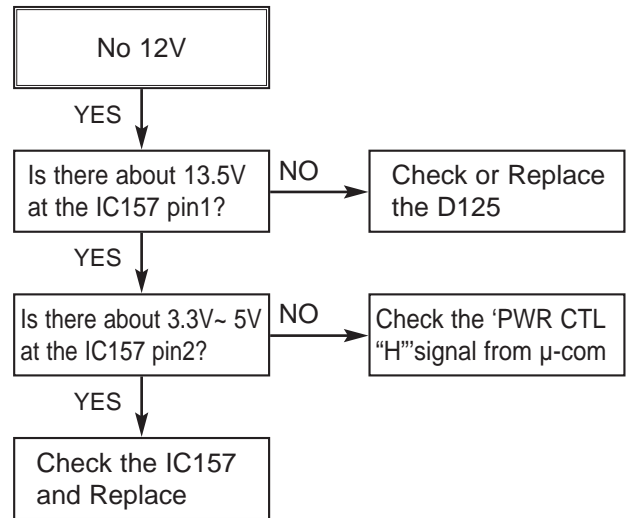
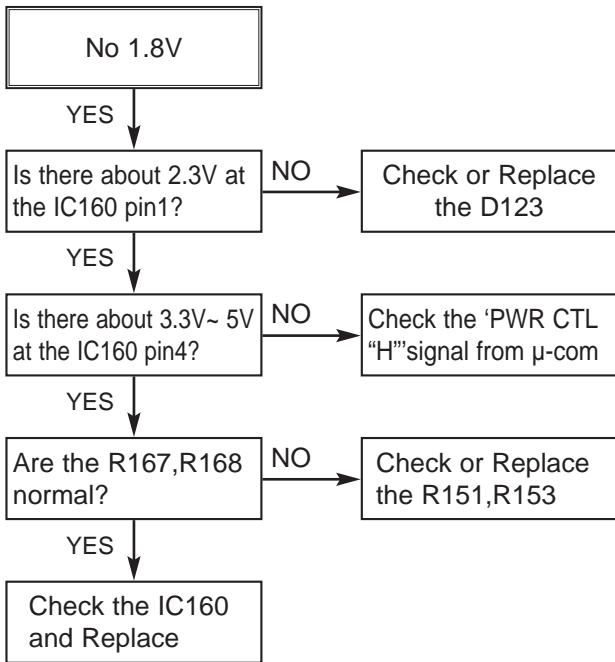




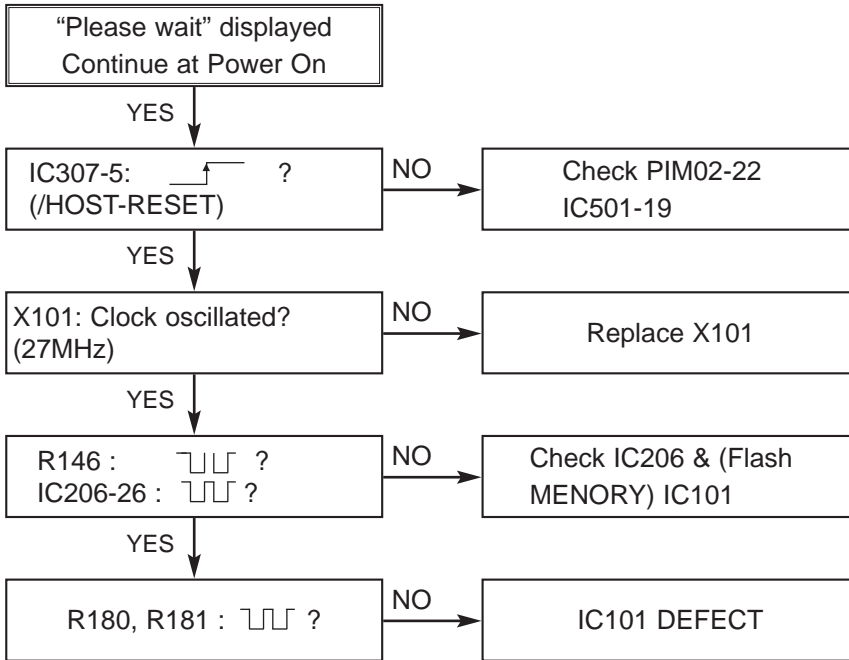
## 2. SMPS DVD/HDD PART



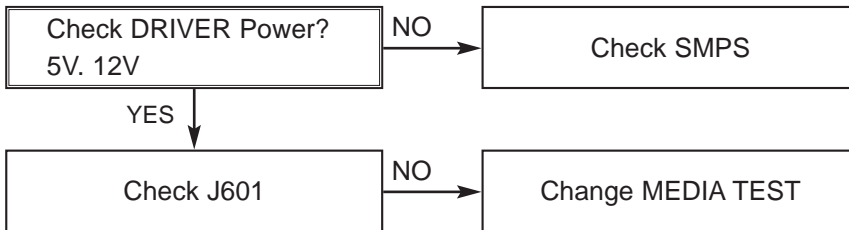




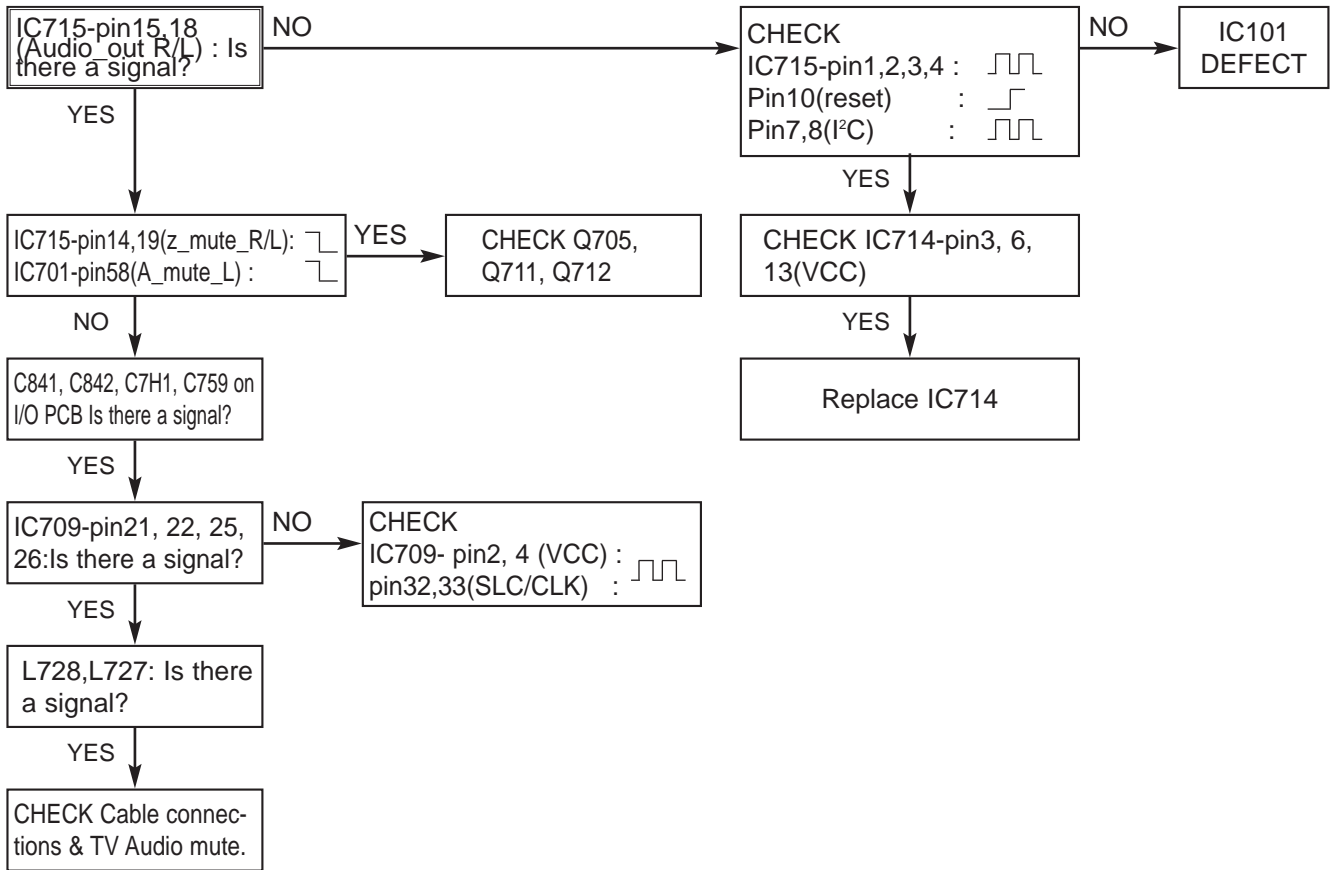
### 3. SYSTEM Circuit PART



### 4. DISC not recognized

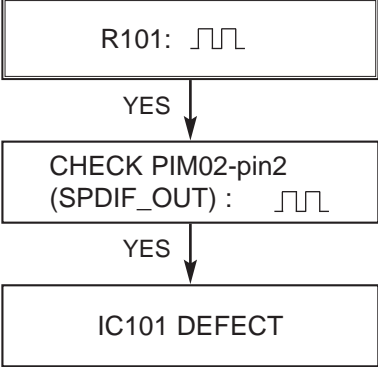


## 5. When playing DISC, no Audio output

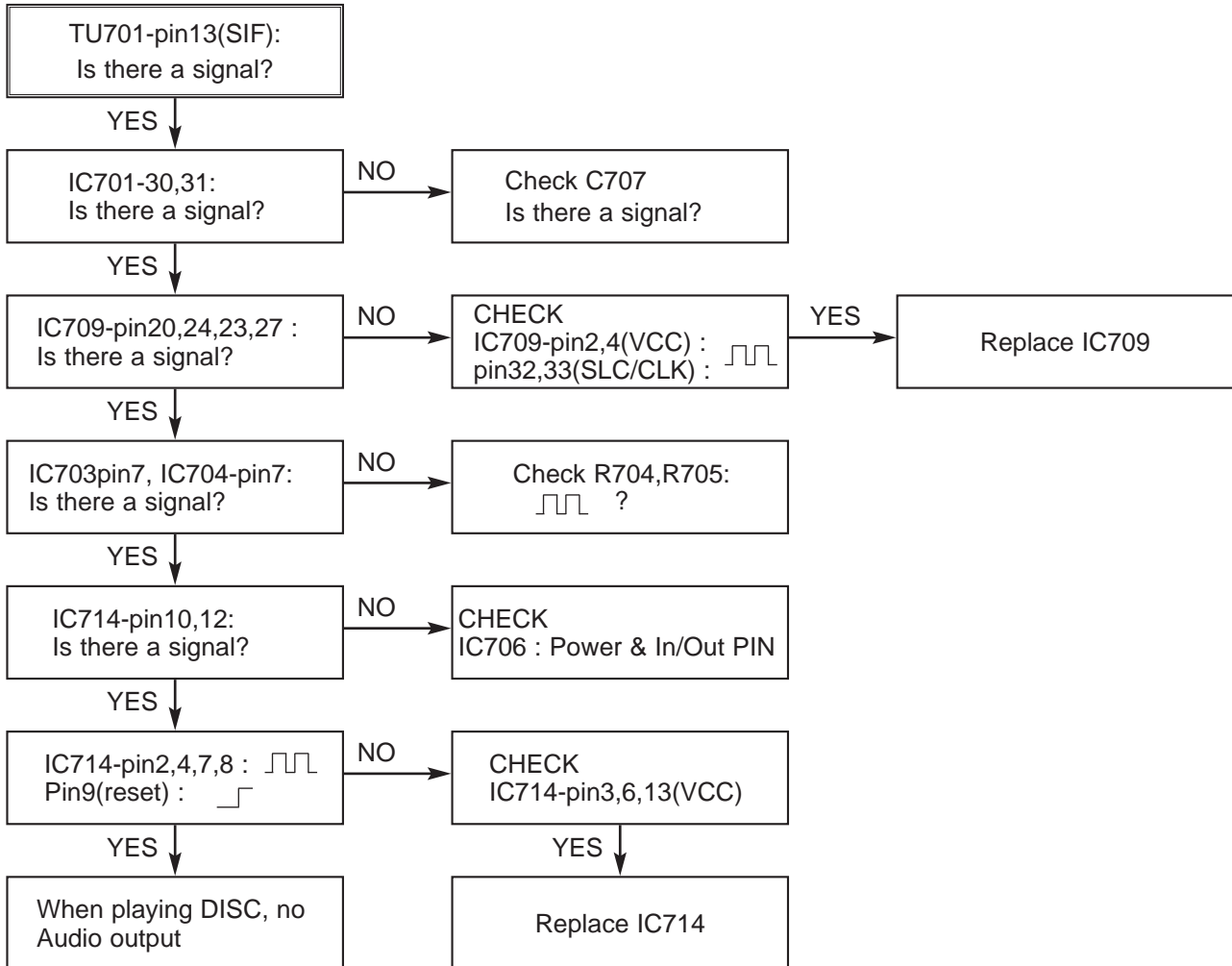




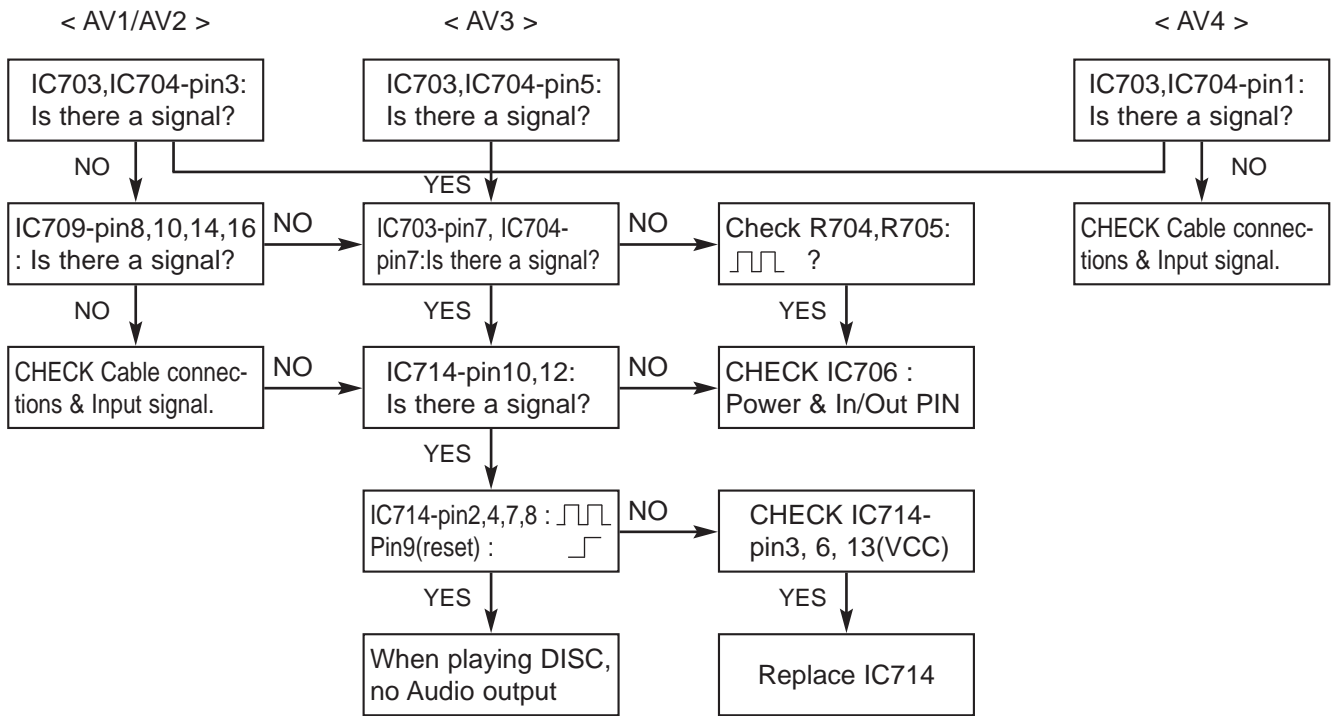
**6. No OPTICAL/DIGITAL Output**



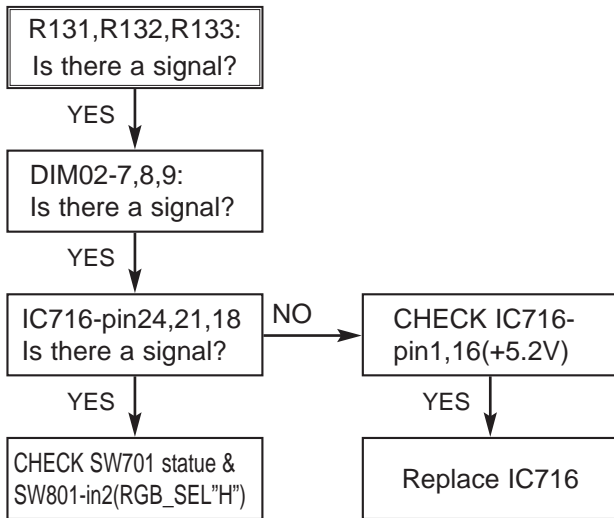
## 7. No TUNER Audio Output



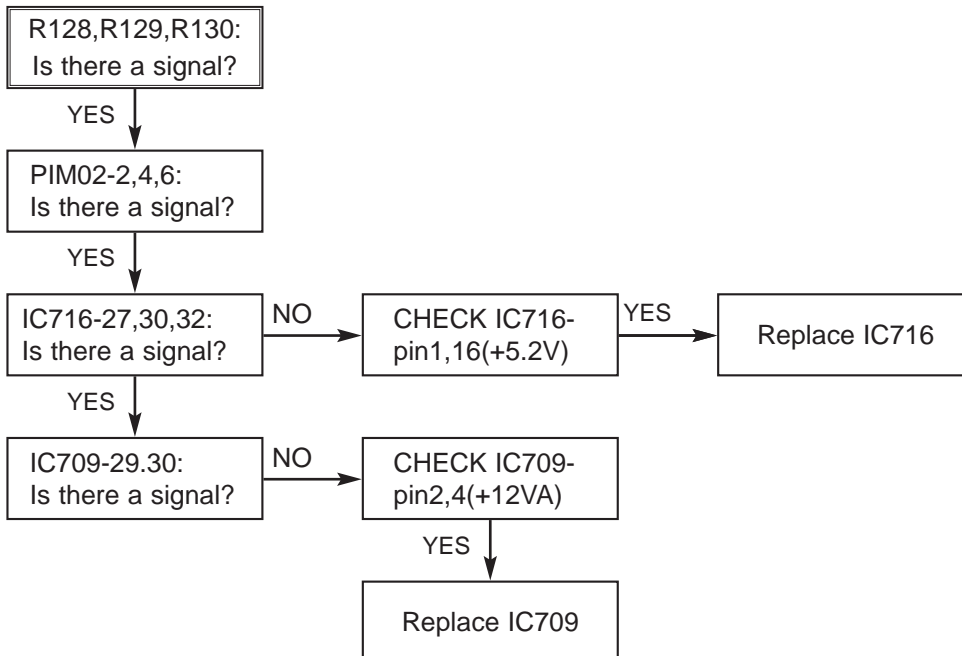
## 8. No External input Audio



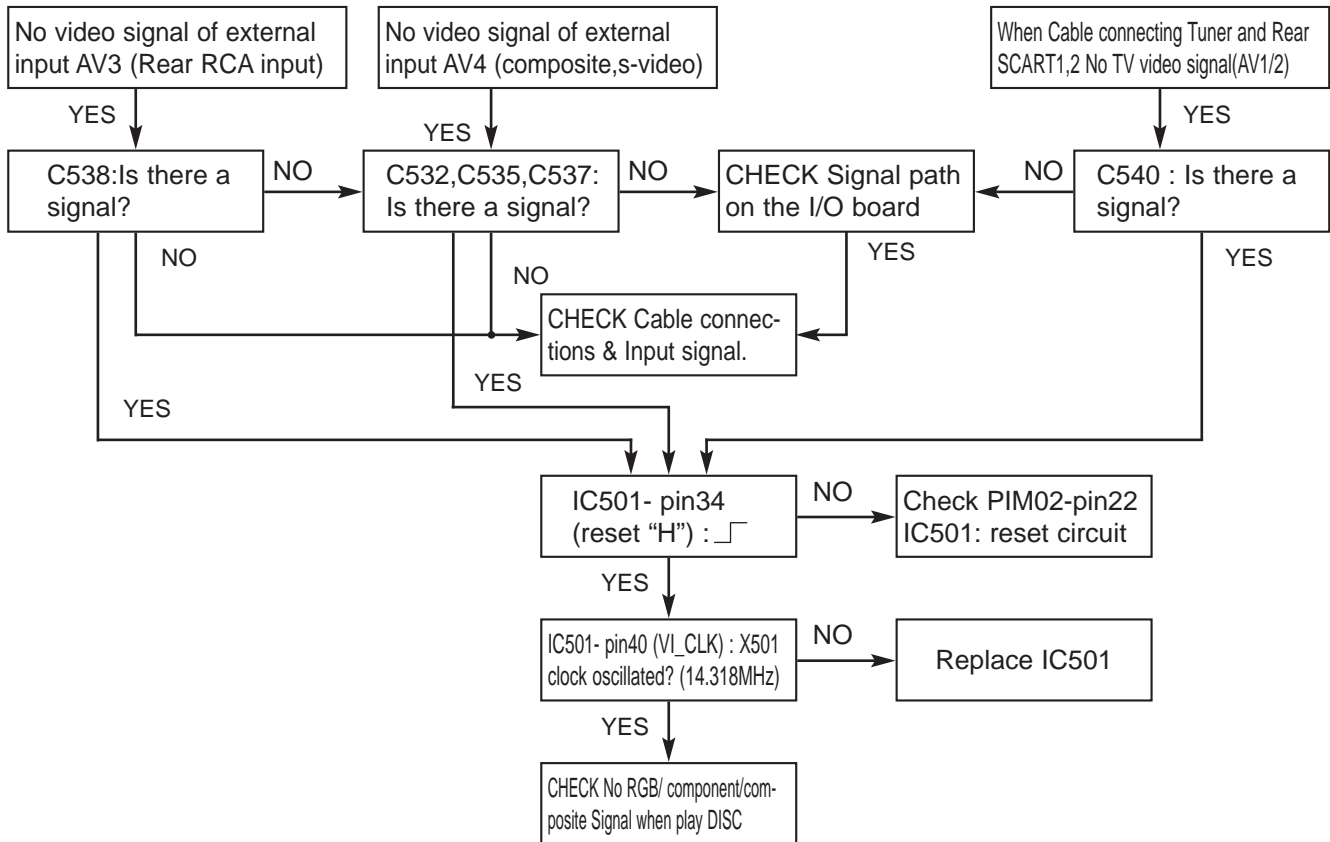
## 9. No RGB/Component Video signal when play DISC



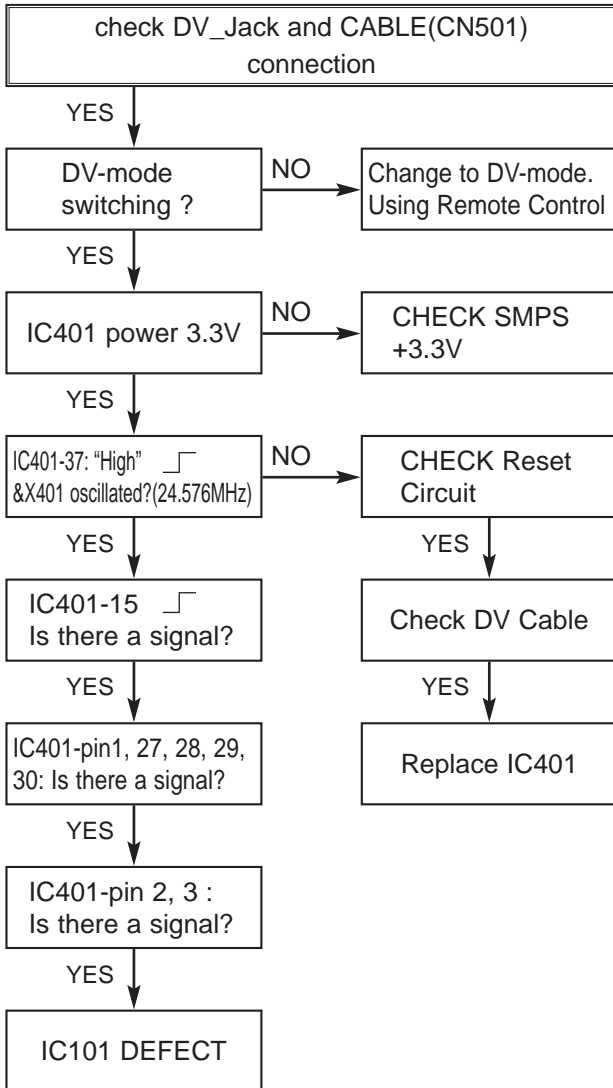
## 10. No composite/s-video Signal when play DISC



## 11. No TV, External input Video signal



## 12. No DV(IEEE 1394)input(Video/Audio) signal

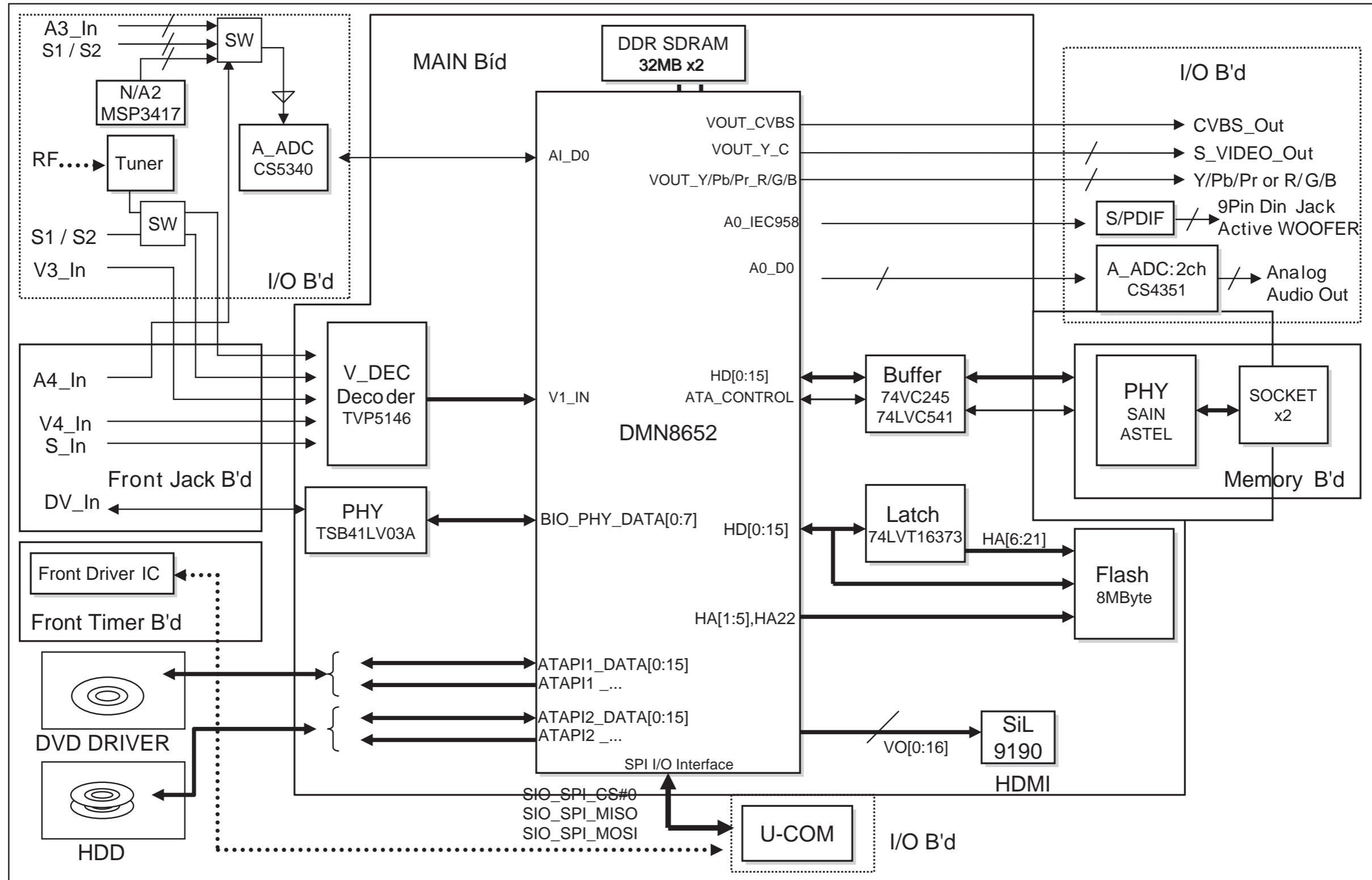


# MEMO

A series of horizontal dotted lines for writing.

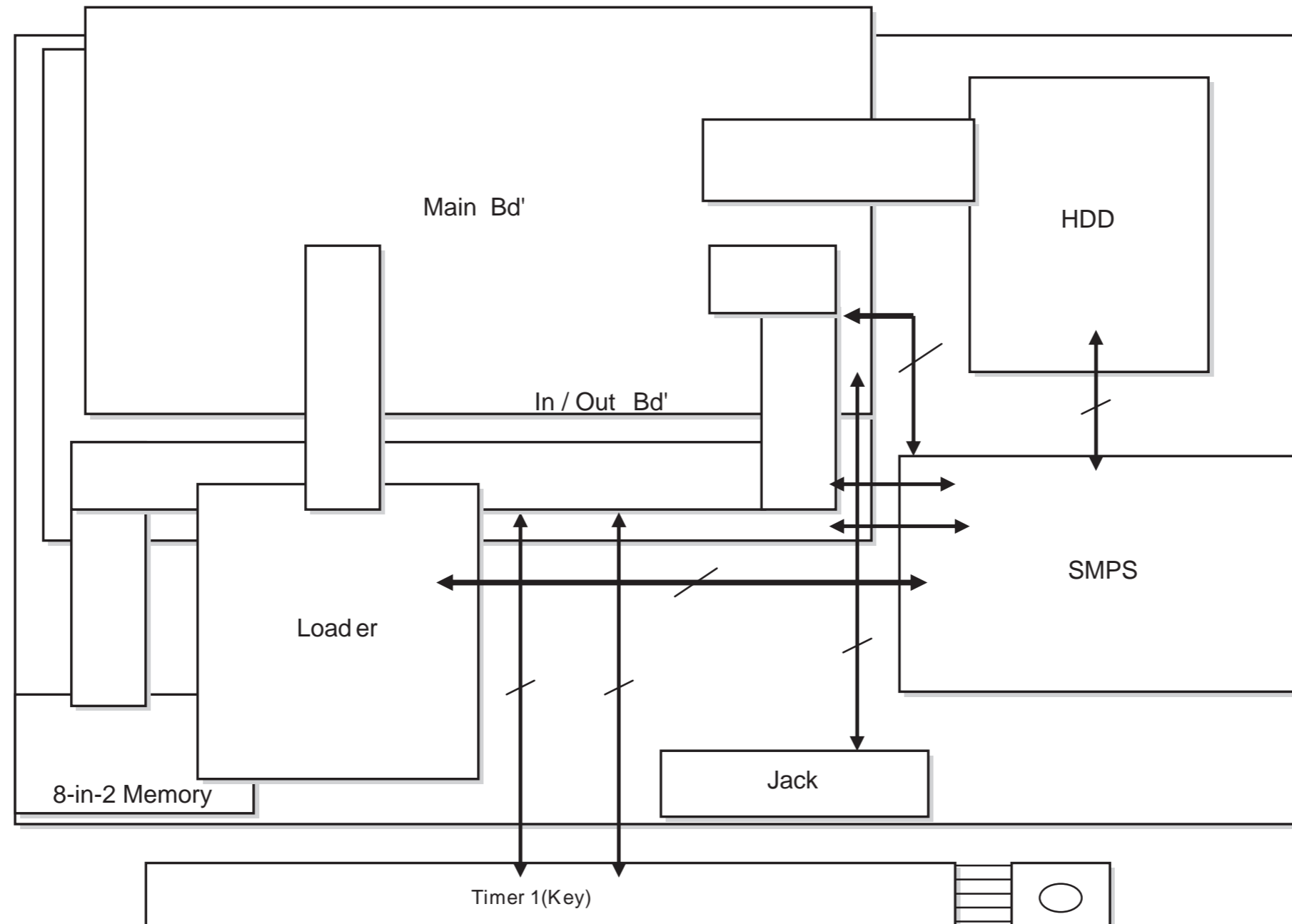
# BLOCK DIAGRAMS

## 1. OVERALL H/W BLOCK DIAGRAM

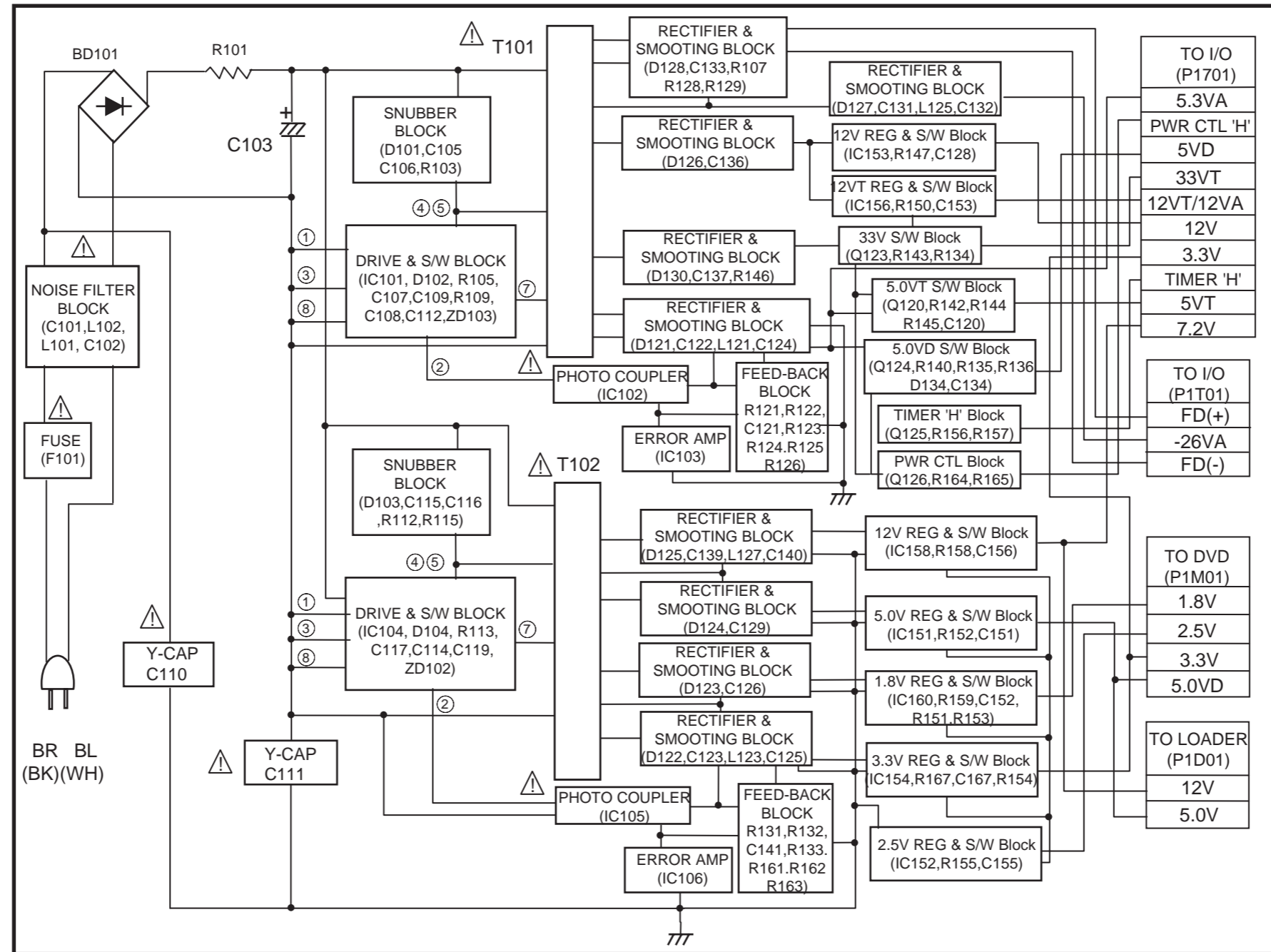




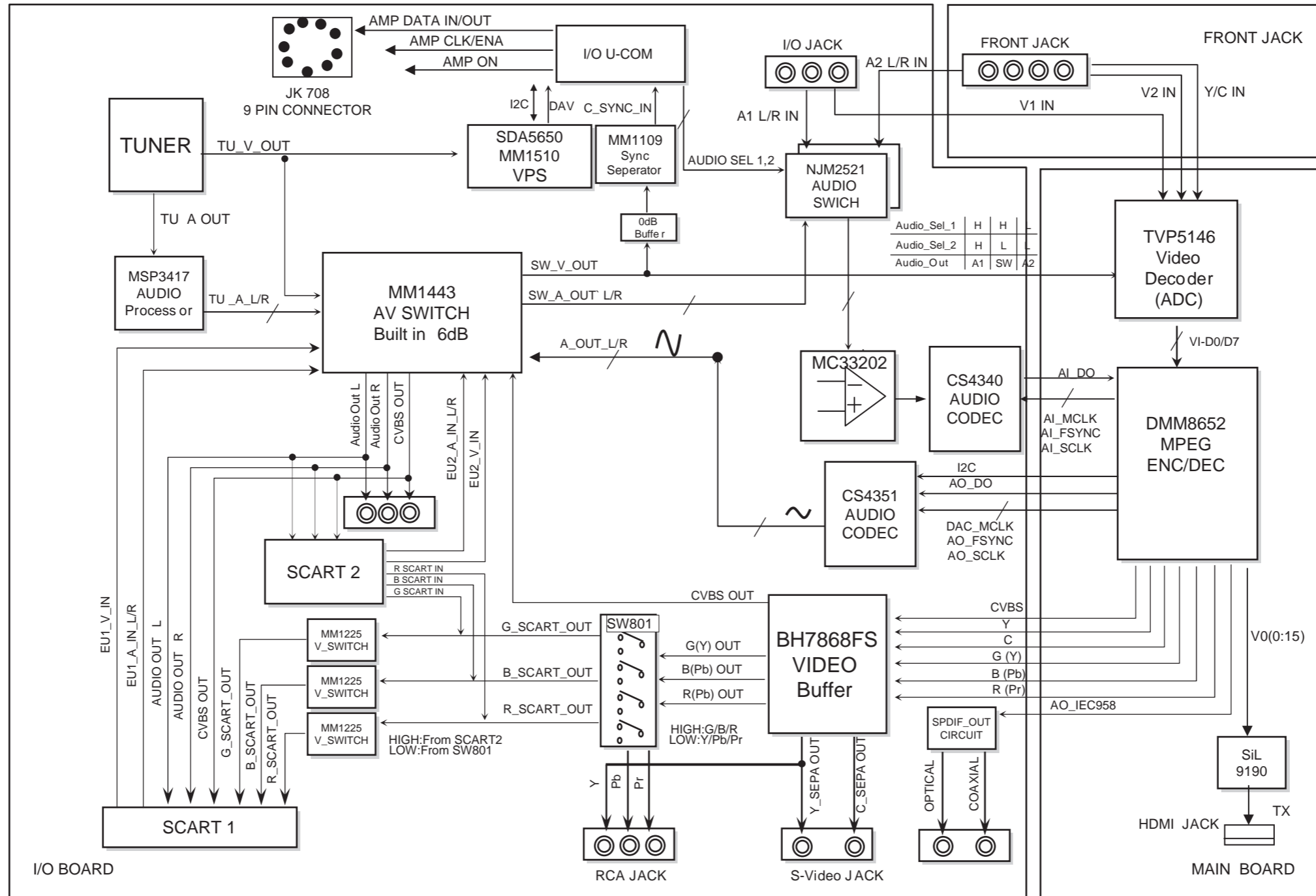
## 2. LAYOUT CONNECTION BLOCK DIAGRAM



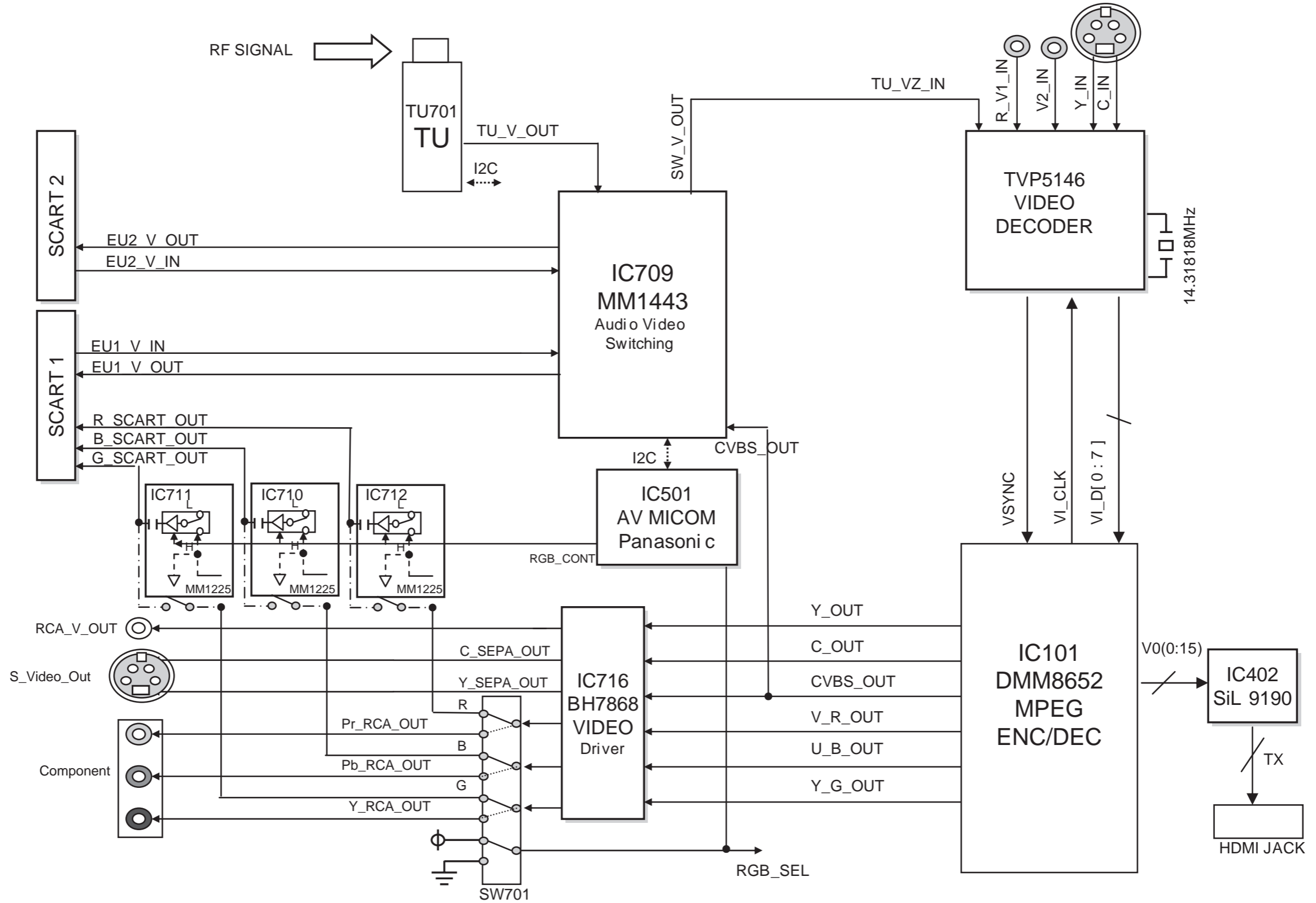
### 3. SMPS BLOCK DIAGRAM



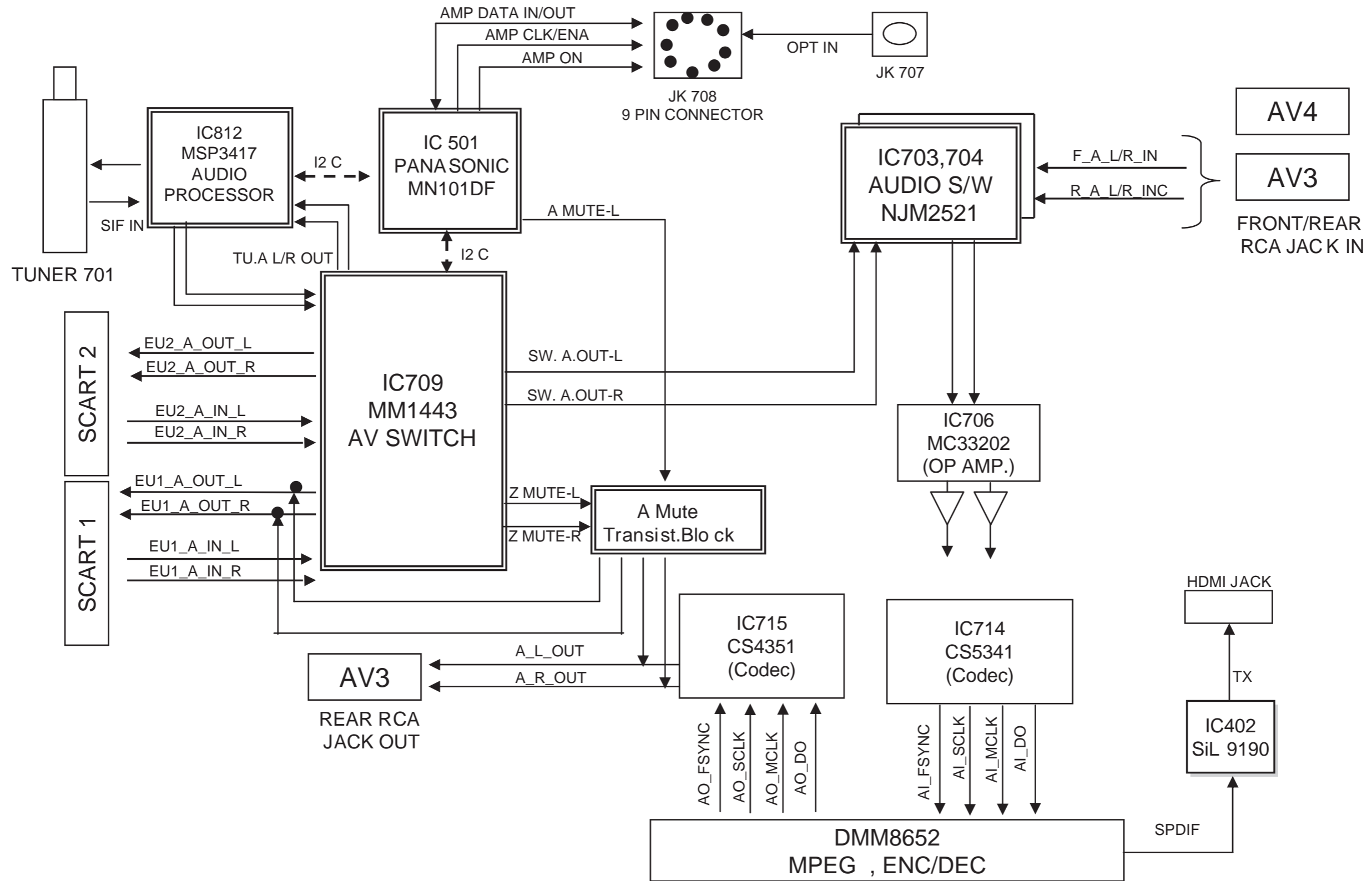
#### 4. IN/OUT BLOCK DIAGRAM



# 5. VIDEO BLOCK DIAGRAM



## 6. AUDIO BLOCK DIAGRAM



# CIRCUIT DIAGRAMS

## 1. POWER(SMPS) CIRCUIT DIAGRAM

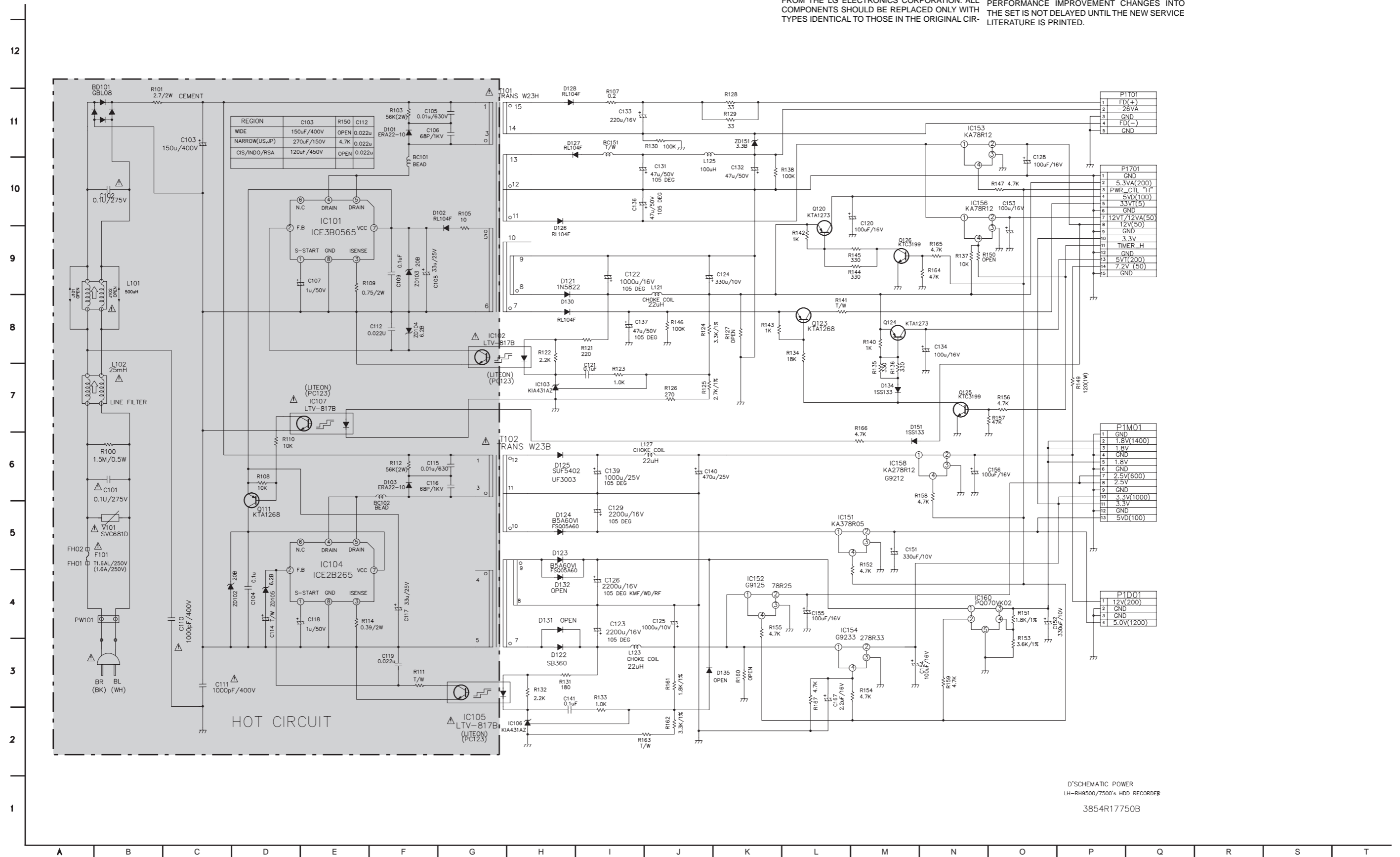
### IMPORTANT SAFETY NOTICE

WHEN SERVICING THIS CHASSIS, UNDER NO CIRCUMSTANCES SHOULD THE ORIGINAL DESIGN BE MODIFIED OR ALTERED WITHOUT PERMISSION FROM THE LG ELECTRONICS CORPORATION. ALL COMPONENTS SHOULD BE REPLACED ONLY WITH TYPES IDENTICAL TO THOSE IN THE ORIGINAL CIR-

CUIT. SPECIAL COMPONENTS ARE SHADED ON THE SCHEMATIC FOR EASY IDENTIFICATION. THIS CIRCUIT DIAGRAM MAY OCCASIONALLY DIFFER FROM THE ACTUAL CIRCUIT USED. THIS WAY, IMPLEMENTATION OF THE LATEST SAFETY AND PERFORMANCE IMPROVEMENT CHANGES INTO THE SET IS NOT DELAYED UNTIL THE NEW SERVICE LITERATURE IS PRINTED.

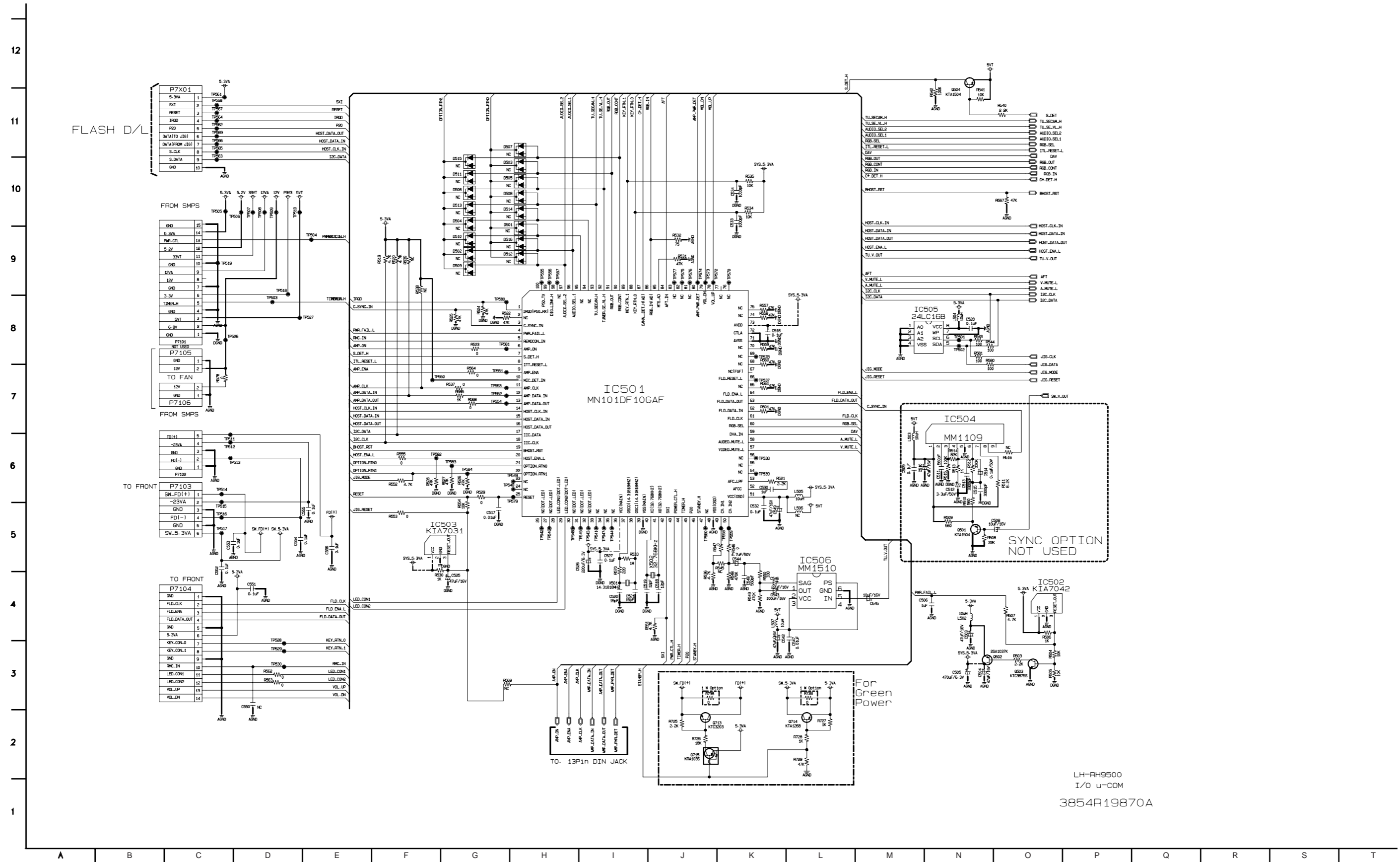
### NOTE :

1. Shaded (■) parts are critical for safety. Replace only with specified part number.
2. Voltages are DC-measured with a digital voltmeter during Play mode.



D'SCHEMATIC POWER  
LH-RH9500/7500's HDD RECORDER  
3854R17750B

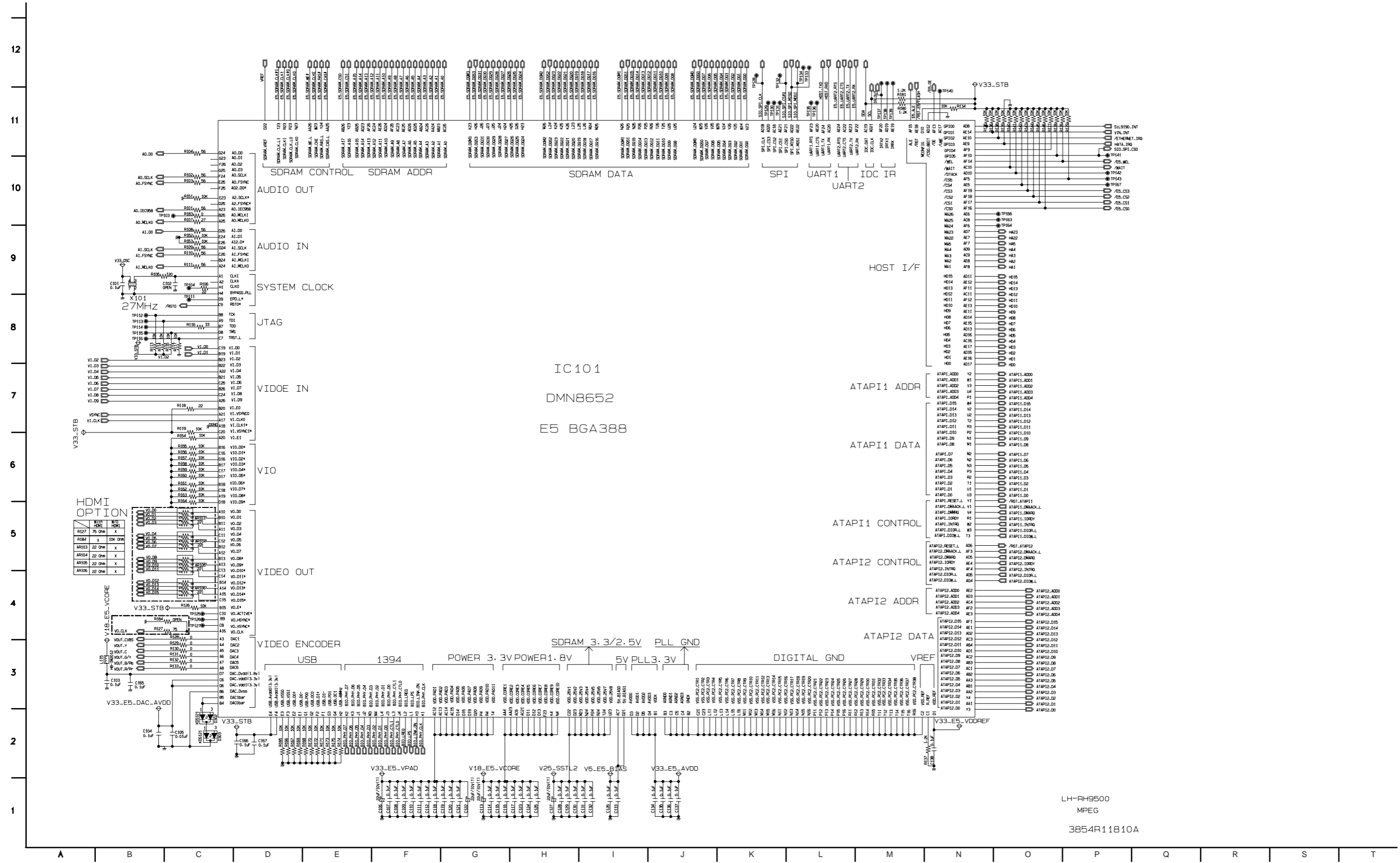
## 2. I/O MICOM CIRCUIT DIAGRAM







# 4. LSI CIRCUIT DIAGRAM



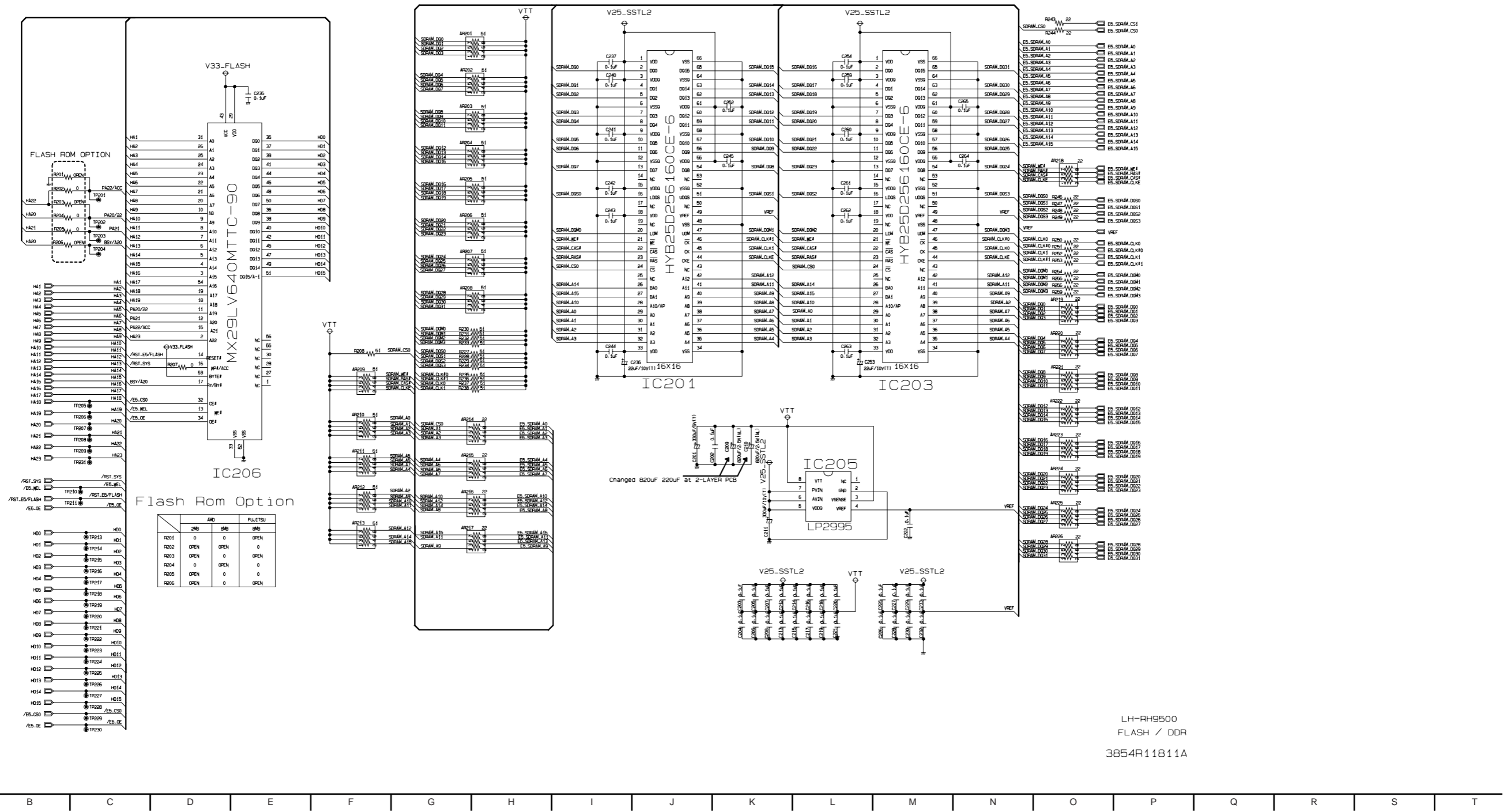
LH-RH9500  
MPEG  
3854R11810A

# 5. FLASH/DDR CIRCUIT DIAGRAM

S29GL128N : 56Pin\_16MB FOR EPG in NTSC mode1  
 S29GL064M : 48Pin\_8MB FOR A11 mode1(Sub)  
 MX29LV640MTTC : 48Pin\_8MB FOR A11 mode1(N-bit)  
 MX29LV640BTTC : 48Pin\_8MB FOR A11 mode1(Sprink)

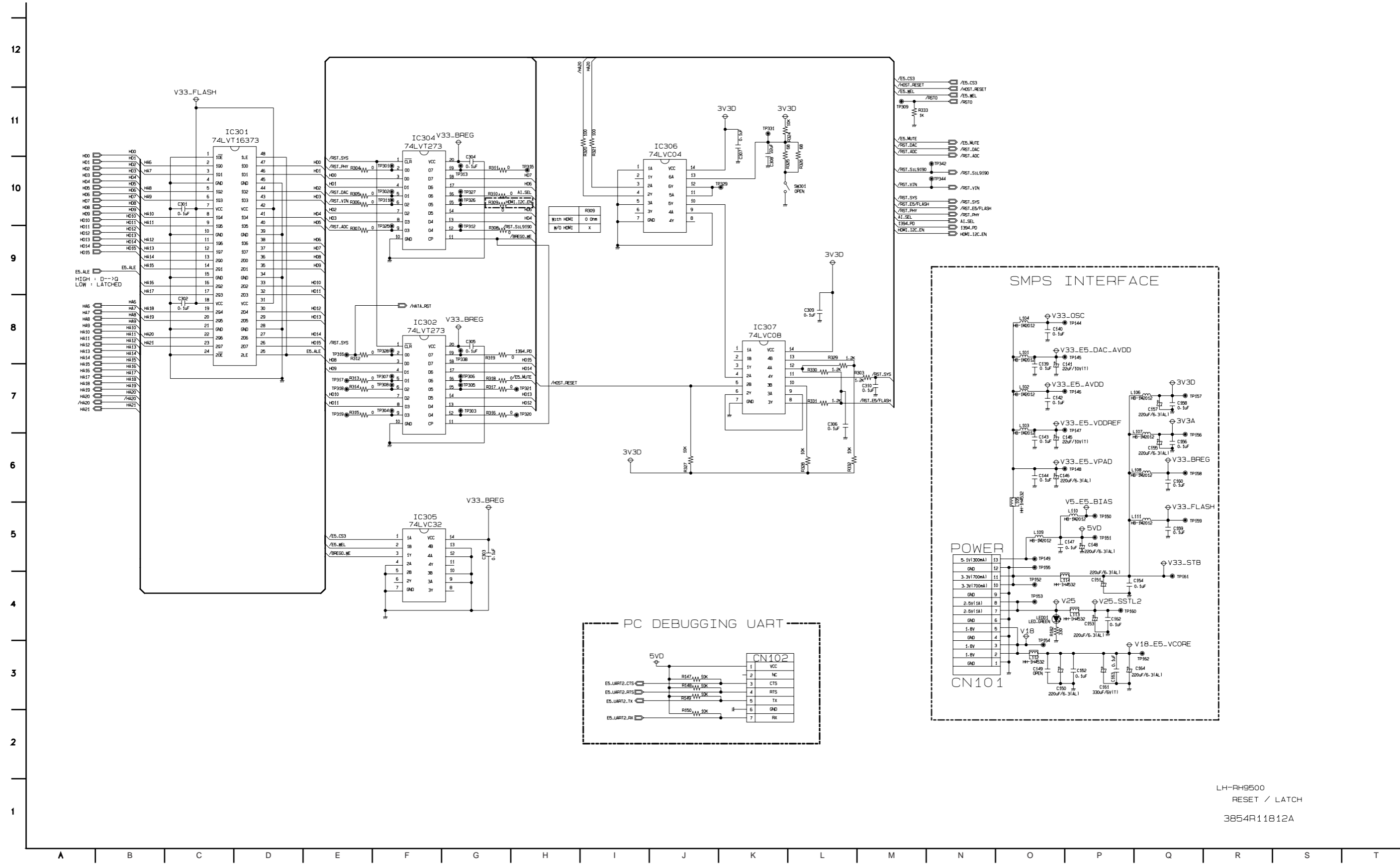
main part : MX29LV640MTTC-90G (N-bit), P/N:0IMMRR029A  
 sub part : S29GL064M90TCIR20 (Mirror-bit), P/N:0IMMRFU017A

HYB25D256160CE-6 : 32MB\_16MbX16\_DDR333  
 HYB25D512160BE-6 : 64MB\_32MbX16\_DDR333  
 Main : HY25D256160CE-6 (INFINEON; P/N:0IMMRIH038A)  
 Sub : HY50U561622DT-J (HYNIX; P/N:0IMMRHY057B)



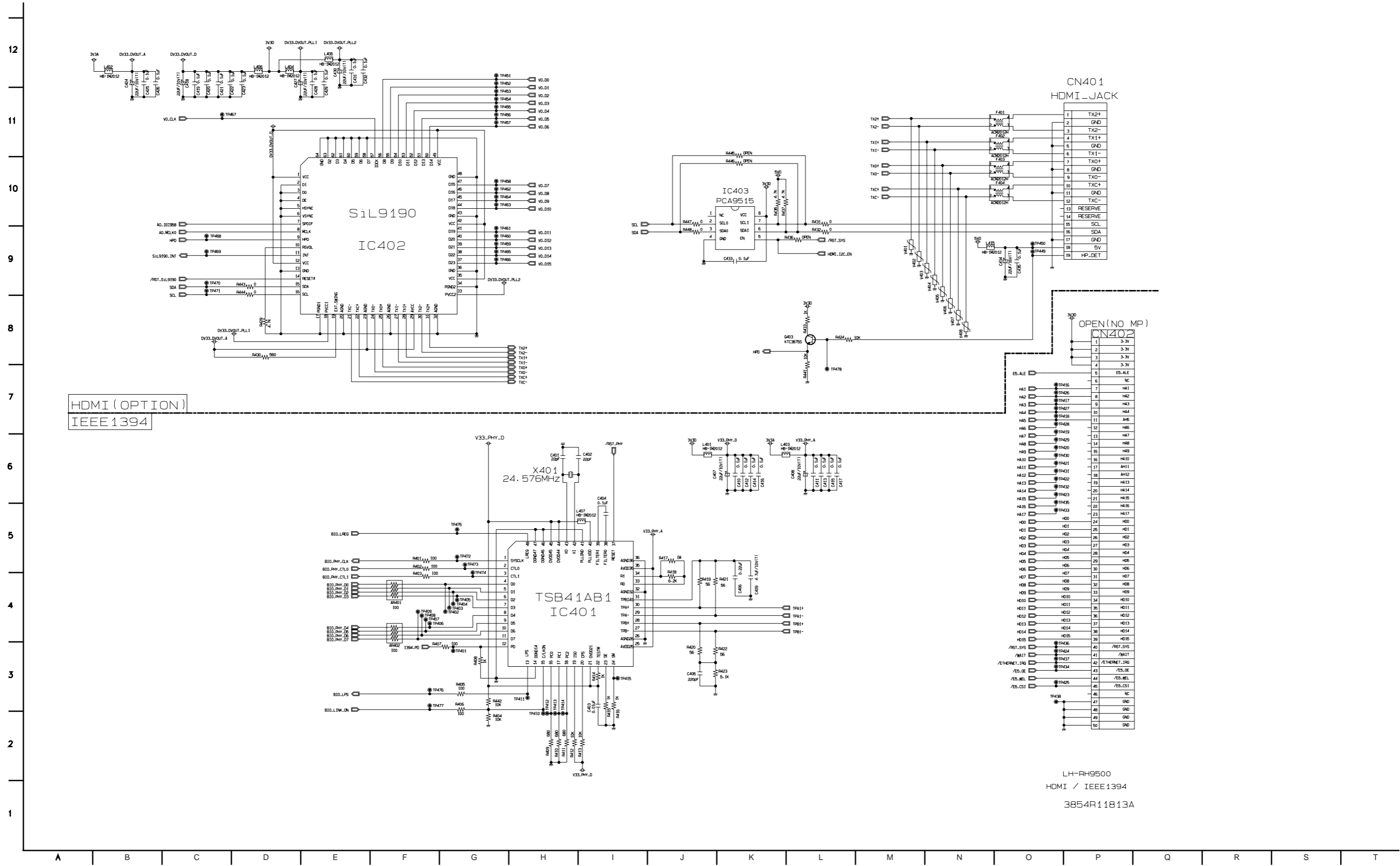
LH-RH9500  
 FLASH / DDR  
 3854R11811A

# 6. RESET/RATCH CIRCUIT DIAGRAM

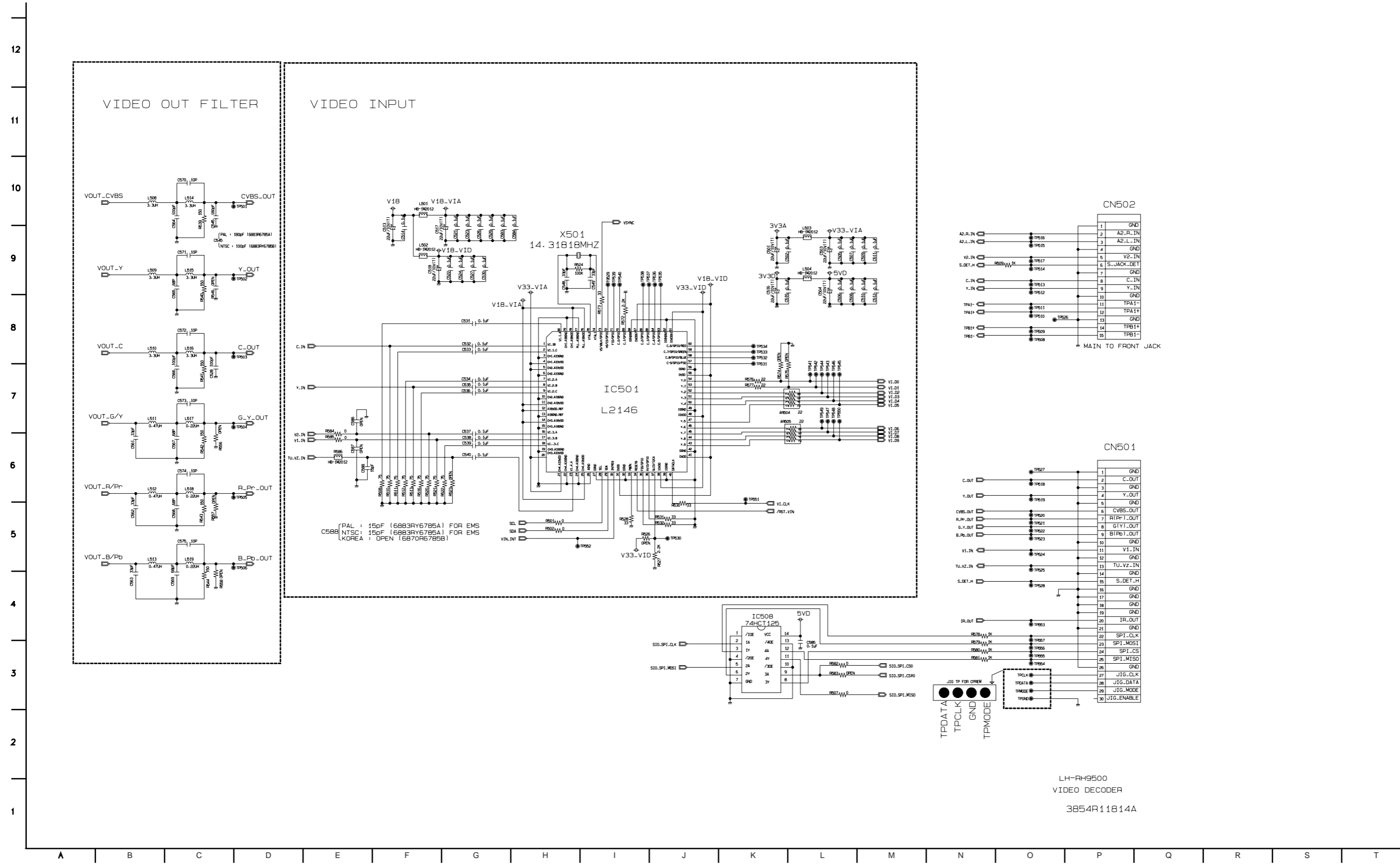


LH-RH9500  
RESET / LATCH  
3854R11812A

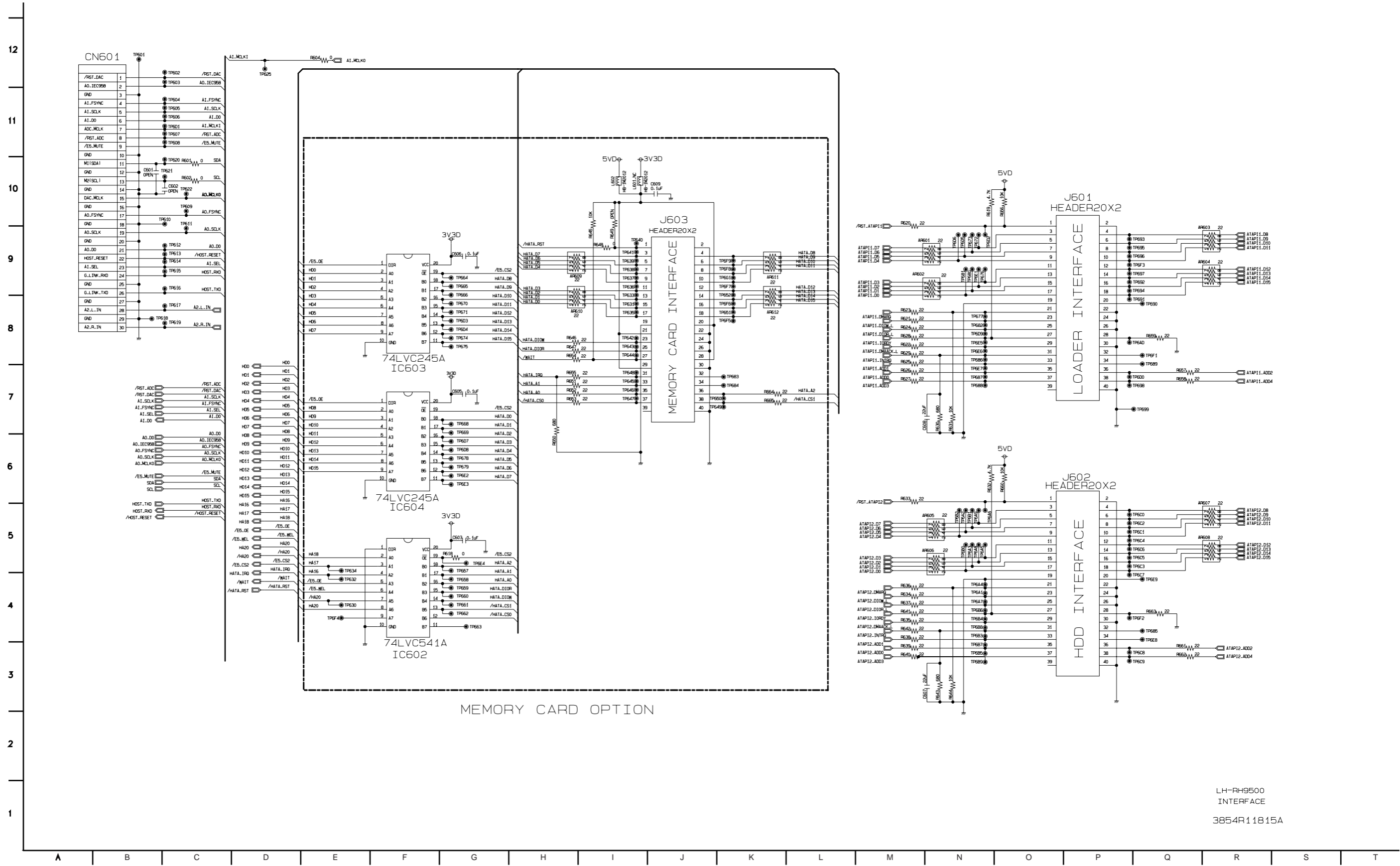
# 7. HDMI/IEEE1394 CIRCUIT DIAGRAM



# 8. VIDEO DECODER CIRCUIT DIAGRAM



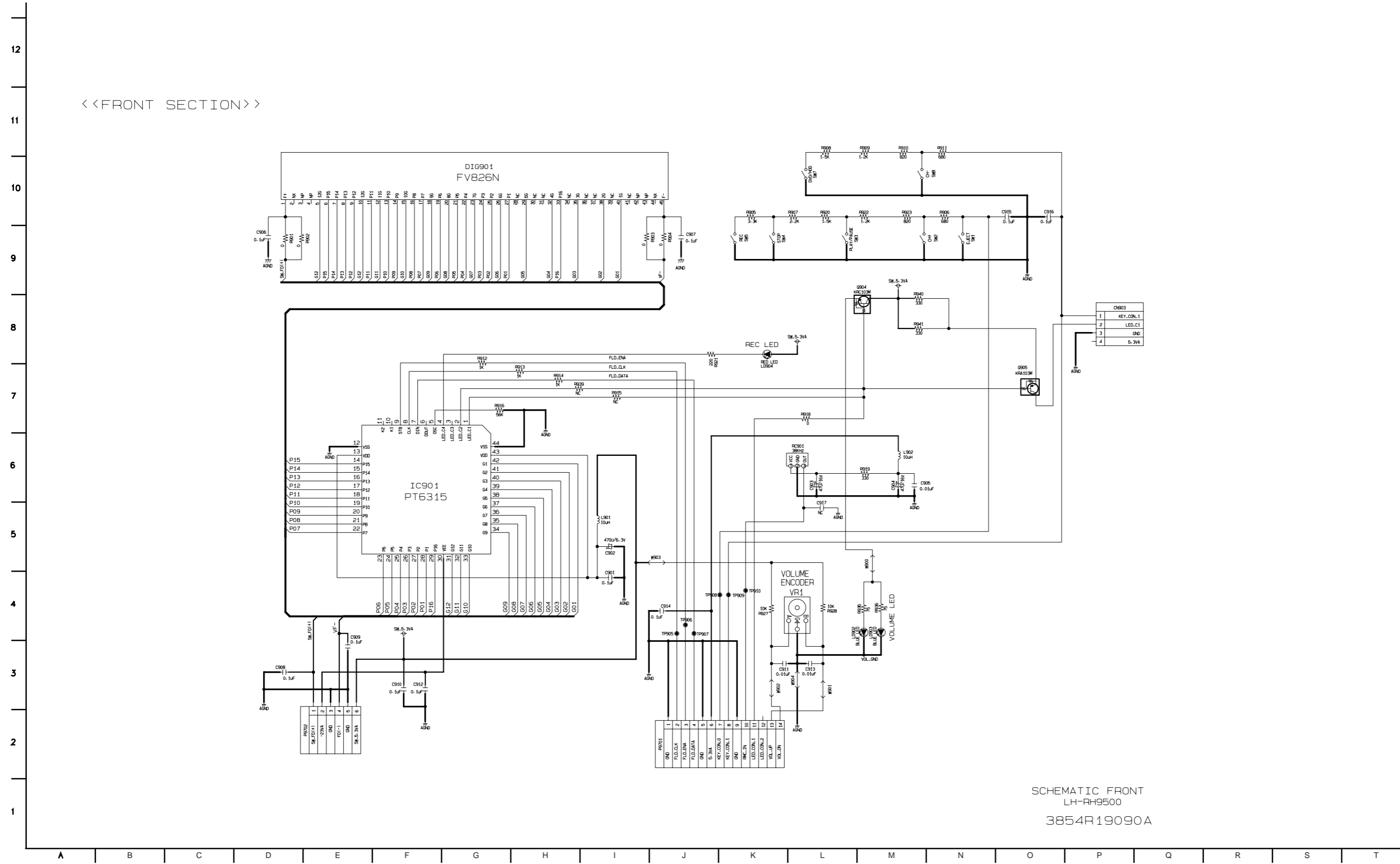
# 9. INTERFACE CIRCUIT DIAGRAM



MEMORY CARD OPTION

LH-RH9500  
INTERFACE  
3854R11815A

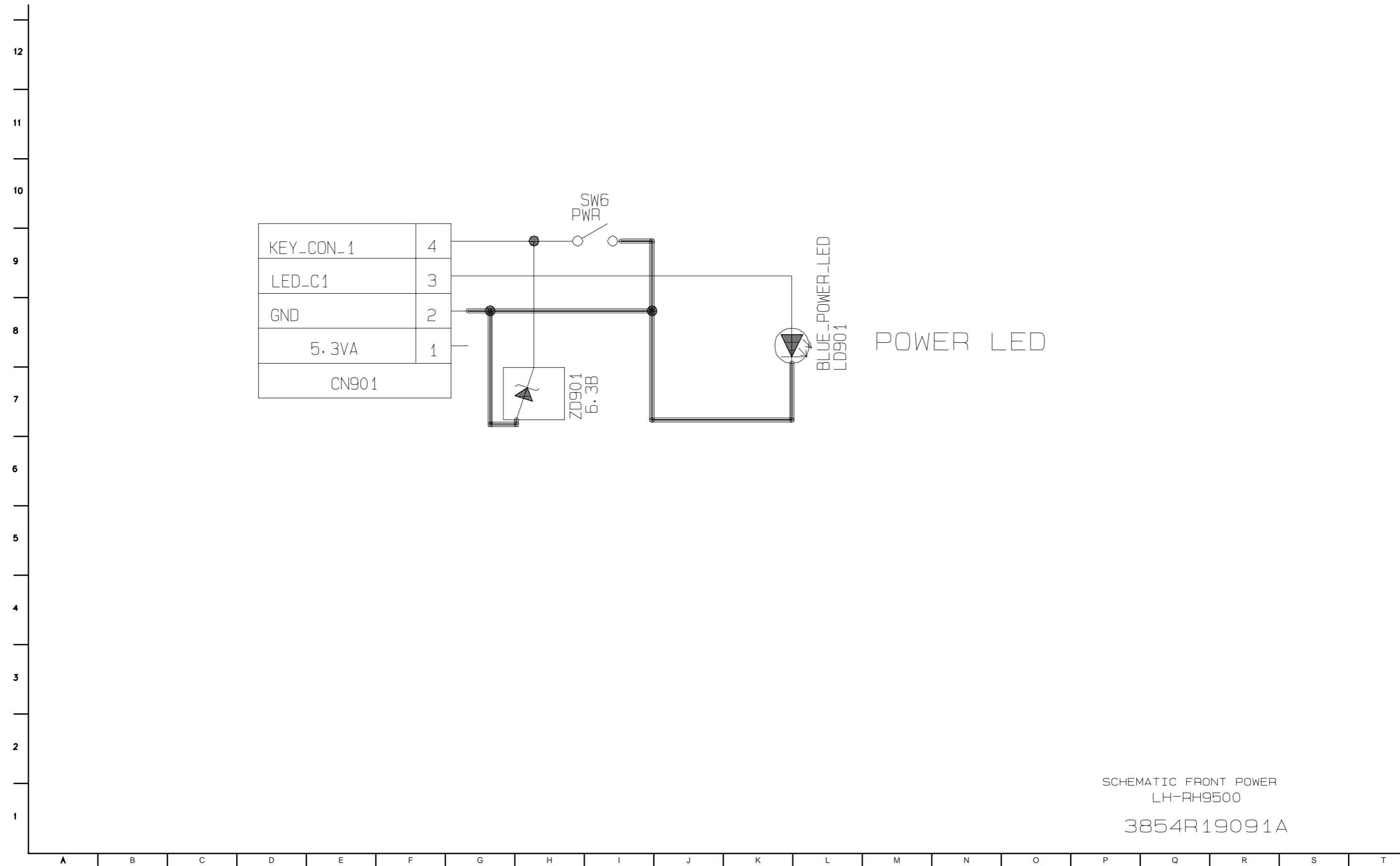
# 10. FRONT CIRCUIT DIAGRAM



CN903			
1	KEY.CON.1		
2	LED.C1		
3	GND		
4	5-3VA		

SCHEMATIC FRONT  
LH-RH9500  
3854R19090A

# 11. FRONT PWR KEYCIRCUIT DIAGRAM

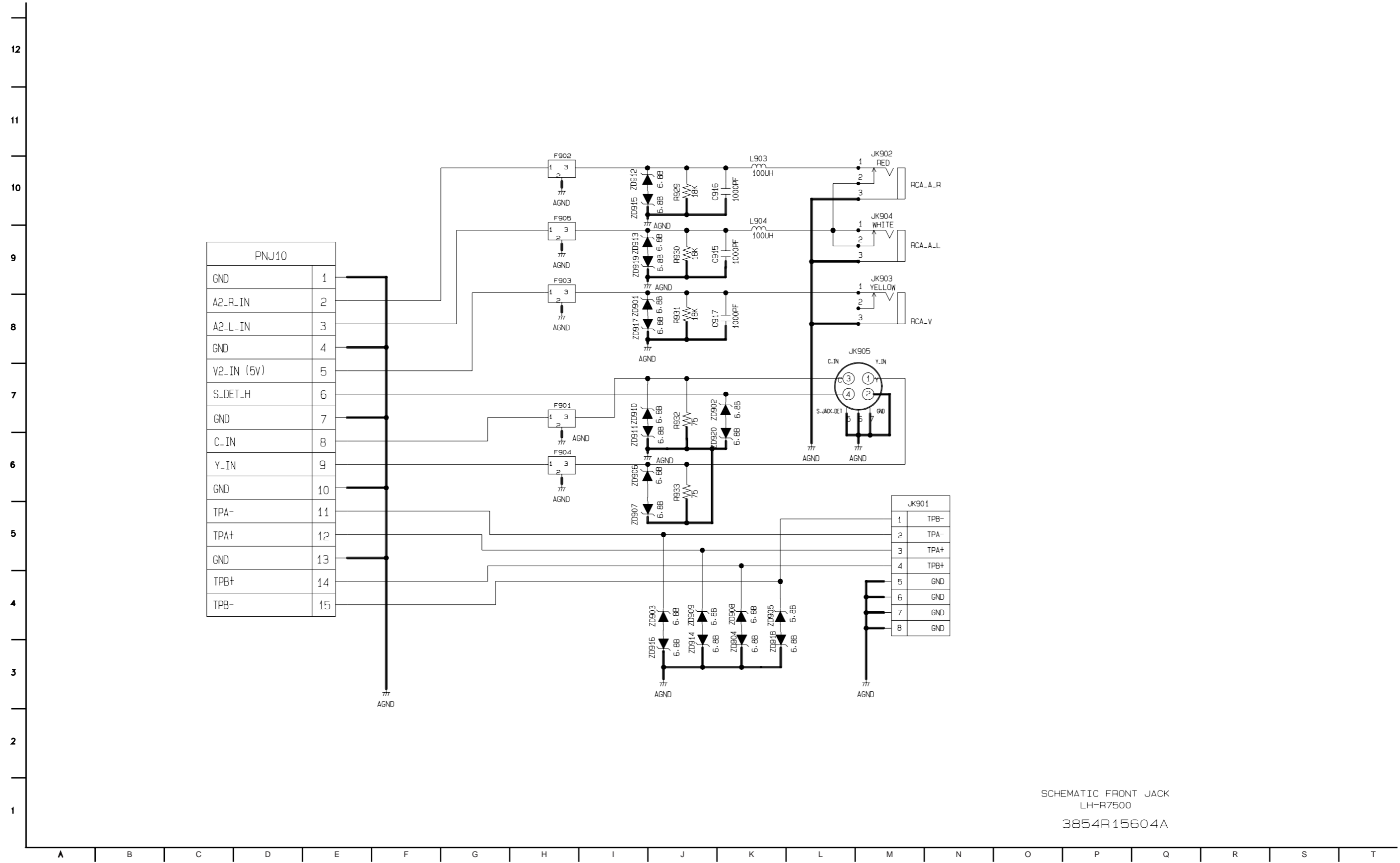


SCHEMATIC FRONT POWER  
LH-RH9500

3854R19091A



# 12. FRONT JACK CIRCUIT DIAGRAM



PNJ10	
GND	1
A2_R_IN	2
A2_L_IN	3
GND	4
V2-IN (5V)	5
S_DET_H	6
GND	7
C_IN	8
Y_IN	9
GND	10
TPA-	11
TPA+	12
GND	13
TPB+	14
TPB-	15

JK901	
1	TPB-
2	TPA-
3	TPA+
4	TPB+
5	GND
6	GND
7	GND
8	GND

SCHEMATIC FRONT JACK  
LH-R7500  
3854R15604A

• CIRCUIT VOLTAGE CHART

MODE PIN NO.	EE	PLAY
<b>IC 402</b>		
1	3.27	3.24
2	0.00	0.00
3	0.00	0.00
4	0.00	0.00
5	0.00	0.00
6	0.00	0.00
7	1.68	1.65
8	1.68	1.70
9	0.00	0.00
10	0.00	0.00
11	0.00	0.00
12	3.27	3.24
13	0.00	0.00
14	3.30	3.27
15	3.30	3.20
16	3.28	3.25
17	0.00	0.00
18	3.29	3.25
19	2.69	2.70
20	0.00	0.00
21	0.00	0.00
22	0.00	0.00
23	3.26	3.26
24	0.00	0.00
25	0.00	0.00
26	0.00	0.00
27	0.00	0.00
28	0.00	0.00
29	3.26	3.27
30	0.00	0.00
31	0.00	0.00
32	0.00	0.00
33	3.25	3.25
34	0.00	0.00
35	3.27	3.24
36	0.00	0.00
37	2.86	2.35
38	0.94	1.26
39	0.87	0.84
40	0.28	1.10
41	0.95	1.34
42	3.27	3.24
43	0.00	0.00
44	0.09	1.06
45	0.99	1.50
46	0.09	0.95
47	2.51	1.93
48	0.00	0.00
49	3.27	3.24
50	0.85	1.22
51	0.84	0.84
52	0.74	1.46
53	0.8 - 1.34	1.36
54	0.08	1.05

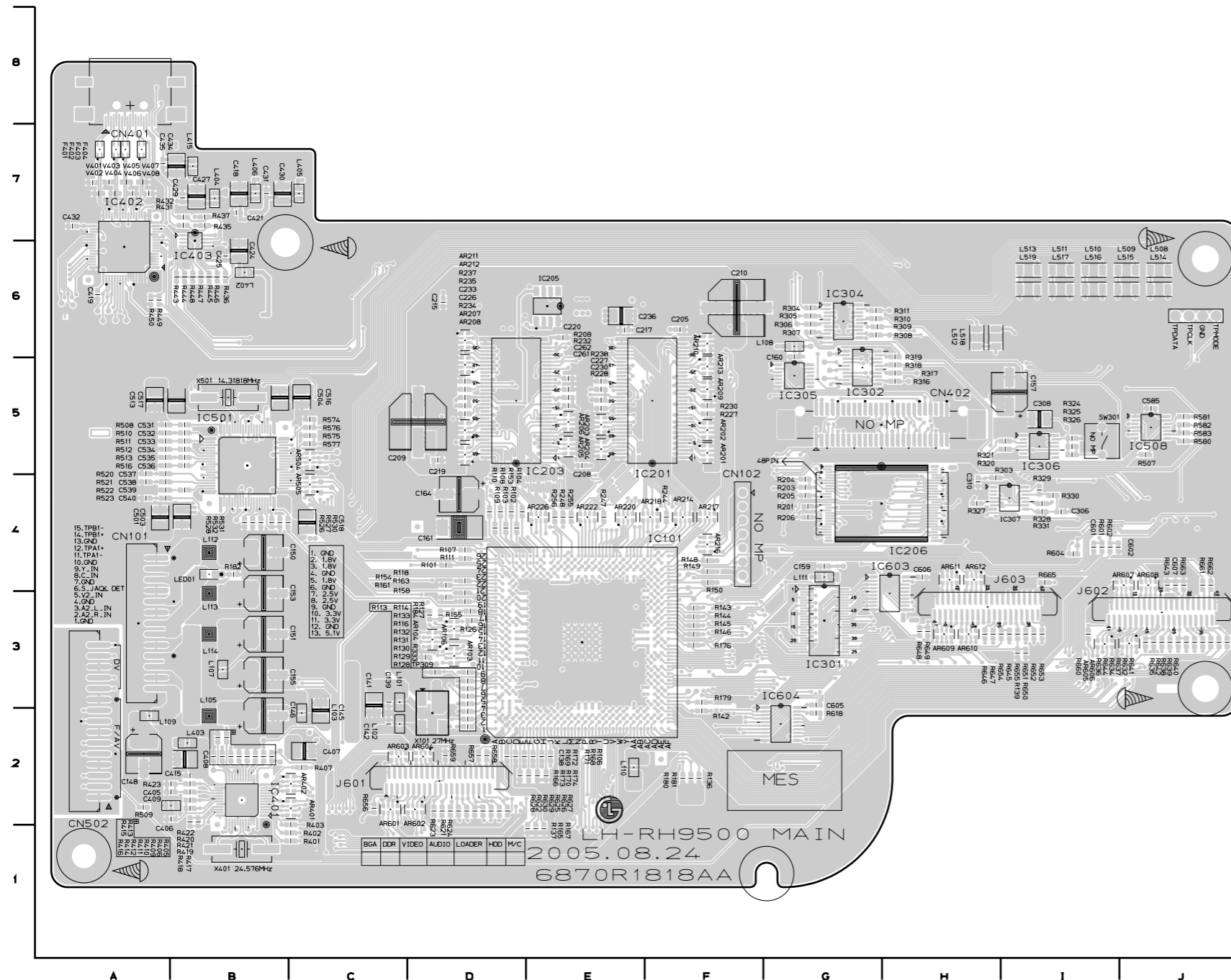
MODE PIN NO.	EE	PLAY
55	0.93	1.50
56	0.09	0.96
57	1.65	1.66
58	0.00	0.00
59	0.00	0.00
60	0.00	0.00
61	0.00	0.00
62	0.00	0.00
63	0.00	0.00
64	0.00	0.00
<b>IC 501</b>		
1	0.00	0.00
2	0.00	0.00
3	0.00	0.00
4	3.30	3.26
5	3.30	3.26
6	0.00	0.00
7	0.00	0.00
8	0.00	0.00
9	0.00	0.00
10	0.00	0.00
11	1.84	1.84
12	1.84	1.84
13	0.00	0.00
14	1.84	1.81
15	0.00	0.00
16	0.00	0.00
17	0.00	0.00
18	0.00	0.00
19	0.00	0.00
20	3.30	3.26
21	3.30	3.27
22	0.00	0.00
23	0.80	0.79
24	0.00	0.00
25	1.84	1.81
26	0.00	0.00
27	0.00	0.00
28	3.20	3.20
29	3.20	3.20
30	3.30	3.27
31	1.84	1.81
32	0.00	0.00
33	0.00	0.00
34	3.30	3.26
35	0.00	0.00
36	0.00	0.00
37	2.86	2.84
38	3.28	3.24
39	0.00	0.00
40	1.57	1.54
41	1.84	1.81
42	0.00	0.00
43	2.80	2.78
44	1.30	1.10

MODE PIN NO.	EE	PLAY
45	1.30	1.10
46	0.60	0.40
47	1.70	1.12
48	3.20	3.24
49	0.00	0.00
50	0.30	0.10
51	1.20	1.12
52	1.20	1.12
53	0.10	0.11
54	0.10	0.11
55	1.84	1.81
56	0.00	0.00
57	1.63	1.74
58	1.61	1.54
59	1.58	1.55
60	1.60	1.55
61	3.25	3.24
62	0.00	0.00
63	1.62	1.62
64	1.62	1.62
65	1.60	1.61
66	1.62	1.62
67	1.84	1.80
68	0.00	0.00
69	0.00	0.00
70	1.60	1.58
71	1.61	1.60
72	1.62	1.62
73	3.25	3.20
74	0.88	2.62
75	0.64	0.83
76	1.84	1.80
77	0.00	0.00
78	1.84	1.80
79	0.00	0.00
80	0.00	0.00
<b>IC 101</b>		
AA23	1.82	1.82
AA4	1.82	1.82
AC12	3.30	3.30
AC13	3.30	3.30
AC14	3.30	3.30
AC15	3.30	3.30
AC21	1.82	1.82
AC6	1.82	1.82
AC7	5.03	5.03
B1	3.30	3.30
C1	1.29	1.29
C22	2.50	2.49
C6	3.30	3.30
D11	1.82	1.82
D12	1.82	1.82
D13	1.82	1.82
D19	3.30	3.30
D2	3.30	3.30

MODE PIN NO.	EE	PLAY
D20	3.30	3.30
D21	5.03	5.03
D23	2.50	2.49
D3	3.30	3.30
D4	3.30	3.30
D5	3.30	3.30
D6	3.30	3.30
D7	1.82	1.82
F23	1.82	1.82
K4	1.82	1.82
M23	2.50	2.49
N24	2.50	2.49
N4	1.82	1.82
P24	2.50	2.49
P4	3.30	3.30
R24	2.50	2.49
R4	3.30	3.30
T24	2.50	2.49
T4	3.30	3.30
U24	2.50	2.49

# PRINTED CIRCUIT DIAGRAMS

## 1. MAIN P.C.BOARD (TOP VIEW)

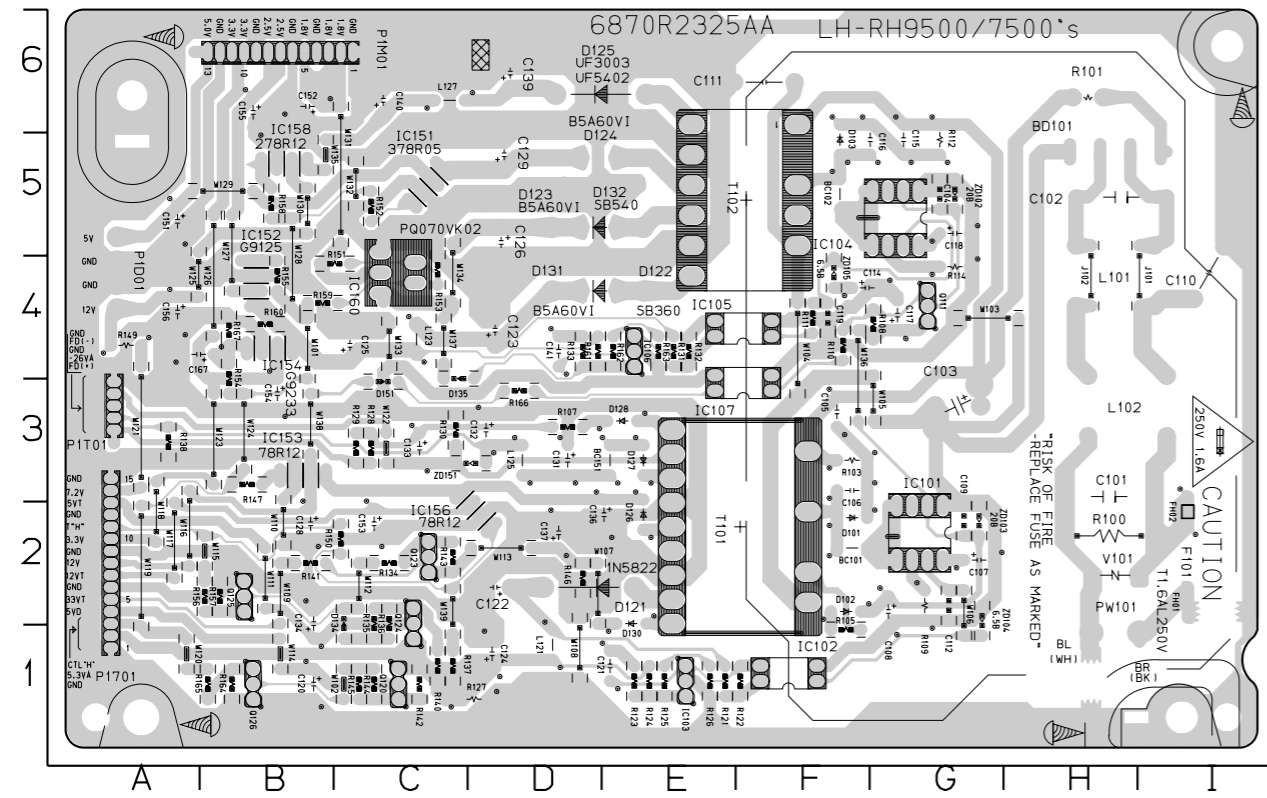


## LOCATION GUIDE

AR103	D3	C209	D5	CN101	A3	L516	I6	R181	F2	R414	B2	R625	D2	TP162	B4
AR104	D3	C210	F6	CN102	F4	L517	I6	R182	B4	R415	B2	R626	D2	TP164	F3
AR106	D3	C215	D6	CN401	A8	L518	H6	R184	D3	R416	B2	R627	D2	TP166	F3
AR201	F5	C217	E6	CN402	G5	L519	I6	R201	G4	R417	B2	R628	D2	TP304	G5
AR202	F5	C219	D5	CN502	A2	LED01	B4	R203	G4	R418	B2	R629	D2	TP307	G5
AR203	E5	C220	E6	F401	A7	R101	D4	R204	G4	R419	B2	R630	D2	TP308	G5
AR204	E5	C226	D5	F402	A7	R102	D4	R205	G4	R420	B2	R632	J3	TP309	D3
AR205	E5	C227	E5	F403	A7	R103	D4	R206	G4	R421	B2	R634	J3	TP315	H6
AR206	E5	C230	E5	F404	A7	R104	D4	R208	E5	R422	B2	R635	J3	TP320	H5
AR207	D5	C233	D5	GND	J6	R106	E2	R227	F5	R423	B2	R636	J3	TP321	H5
AR208	D5	C236	E6	IC101	E3	R107	D4	R228	E5	R431	B7	R637	J3	TP328	G6
AR209	F5	C261	E5	IC201	F5	R108	D4	R230	F5	R432	B7	R638	J3	TP331	I5
AR210	F6	C262	E5	IC203	D5	R109	D4	R232	E5	R435	B7	R639	J3	TP411	B2
AR211	D6	C306	I4	IC205	E6	R110	D4	R234	D5	R436	B6	R640	J3	TP415	B2
AR212	D5	C308	I5	IC206	G4	R111	D4	R235	D5	R437	B7	R641	J3	TP451	A6
AR213	F5	C310	H4	IC301	G3	R113	D3	R237	D5	R443	B6	R642	J3	TP453	A6
AR214	F4	C405	B2	IC302	G5	R114	D3	R238	E5	R444	B6	R643	J4	TP455	A6
AR216	F4	C406	B2	IC304	G6	R116	D3	R244	F4	R445	B6	R644	J3	TP456	A6
AR217	F4	C407	C2	IC305	G5	R118	D4	R247	E4	R446	B6	R645	I3	TP457	A6
AR218	F4	C408	B2	IC306	I5	R126	D3	R248	E4	R447	B6	R646	H3	TP459	A6
AR220	E4	C409	B2	IC307	I4	R127	D3	R255	E4	R448	B6	R647	H3	TP466	A6
AR222	E4	C415	B2	IC401	B2	R128	D2	R256	E4	R449	A6	R648	H3	TP467	A6
AR226	E4	C418	B7	IC402	A6	R129	D2	R303	H4	R450	A6	R649	H3	TP469	B6
AR401	C2	C419	A6	IC403	B6	R130	D2	R304	G6	R507	J5	R650	I3	TP476	B2
AR402	C2	C421	B7	IC501	B5	R131	D3	R305	G6	R508	A5	R651	I3	TP477	B2
AR504	C5	C424	B6	IC508	J5	R132	D3	R306	G6	R509	A2	R652	I3	TP537	B5
AR505	C4	C425	B6	IC603	H3	R133	D3	R307	G6	R510	A5	R653	I3	TP543	C5
AR601	C2	C427	B7	IC604	G2	R136	F2	R308	G6	R511	A5	R654	I3	TP544	C5
AR602	D2	C429	B7	J601	D2	R137	E1	R309	G6	R512	A5	R655	I3	TP545	C5
AR603	C2	C430	B7	J602	J3	R139	I3	R310	G6	R513	A5	R656	C2	TP546	C5
AR604	D2	C431	B7	J603	H3	R142	F2	R311	G6	R516	A5	R657	D2	TP547	C4
AR605	I3	C432	A7	L101	C3	R143	F3	R316	H5	R520	A4	R658	D2	TP548	C4
AR606	J3	C434	B7	L102	C2	R144	F3	R317	H5	R521	A4	R659	D2	TP549	C4
AR607	J4	C435	A7	L103	C2	R145	F3	R318	H5	R522	A4	R660	I3	TP550	C4
AR608	J4	C501	A4	L105	B2	R146	F3	R319	H6	R523	A4	R661	J4	TP552	B4
AR609	H3	C503	B4	L107	B3	R148	F4	R320	I5	R526	B4	R662	J4	TP625	I4
AR610	H3	C504	B5	L108	G6	R149	F4	R321	I5	R527	B4	R663	J4	TPCLK	J6
AR611	H4	C513	A5	L109	A2	R150	F4	R324	I5	R528	B4	R665	I4	TPDATA	J6
AR612	H4	C516	C5	L110	E2	R153	D4	R325	I5	R530	B4	SW301	I5	TPMODE	J6
C138	D2	C517	B5	L111	G4	R154	D4	R326	I5	R531	B4	T342	H6	V401	A7
C139	C3	C518	C4	L112	B4	R155	D3	R327	H4	R532	B4	T344	G6	V402	A7
C141	C3	C531	B5	L113	B3	R158	D3	R328	I4	R574	C5	TP126	D3	V403	A7
C142	C2	C532	B5	L114	B3	R161	D3	R329	I4	R575	C5	TP132	F4	V404	A7
C145	C2	C533	B5	L402	B6	R163	D3	R330	I4	R576	C5	TP134	F4	V405	A7
C146	B2	C534	B5	L403	B2	R165	E1	R331	I4	R577	C5	TP137	F3	V406	A7
C148	A2	C535	B5	L404	B7	R166	D2	R333	D3	R580	J5	TP143	F3	V407	A7
C150	B4	C536	B5	L405	C7	R167	E1	R401	C1	R581	J5	TP144	D3	V408	A7
C151	B3	C537	A4	L406	B7	R168	E2	R402	C1	R582	J5	TP145	C3	X101	D2
C153	B3	C538	A4	L415	B7	R169	D2	R403	C1	R583	J5	TP146	C2	X401	B1
C155	B3	C539	B4	L508	J6	R170	E2	R405	B2	R601	I4	TP148	C3	X501	B5
C157	I5	C540	A4	L509	J6	R171	E2	R406	B2	R602	I4	TP150	F2		
C159	G4	C585	J5	L510	I6	R172	D2	R407	C2	R604	I4	TP151	A2		
C160	G6	C601	I4	L511	I6	R173	E2	R409	B2	R618	G2	TP156	A4		
C161	D4	C602	I4	L512	H6	R174	E2	R410	B2	R621	D2	TP158	G6		
C164	D4	C605	G3	L513	I6	R176	F3	R411	B2	R622	D2	TP159	G4		
C205	F6	C606	H4	L514	J6	R179	F3	R412	B2	R623	D2	TP160	B3		
C208	E5	C607	J4	L515	J6	R180	F2	R413	B2	R624	D2	TP161	B3		



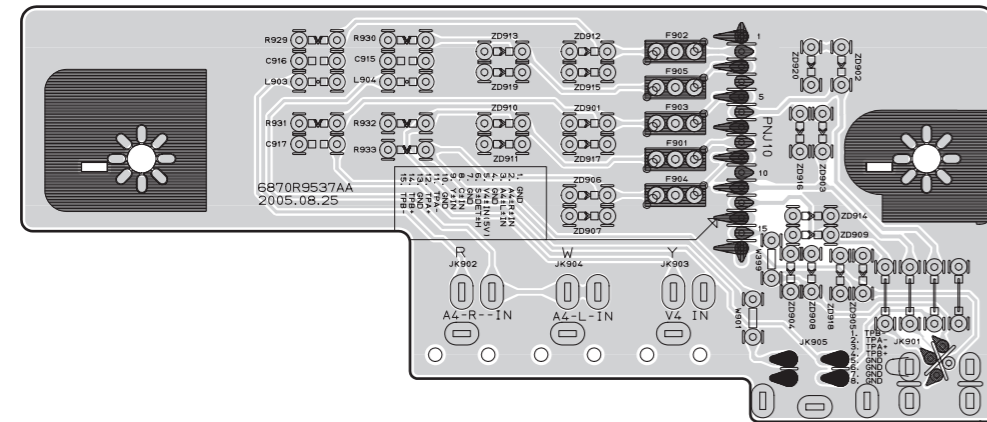
### 3. POWER P.C.BOARD



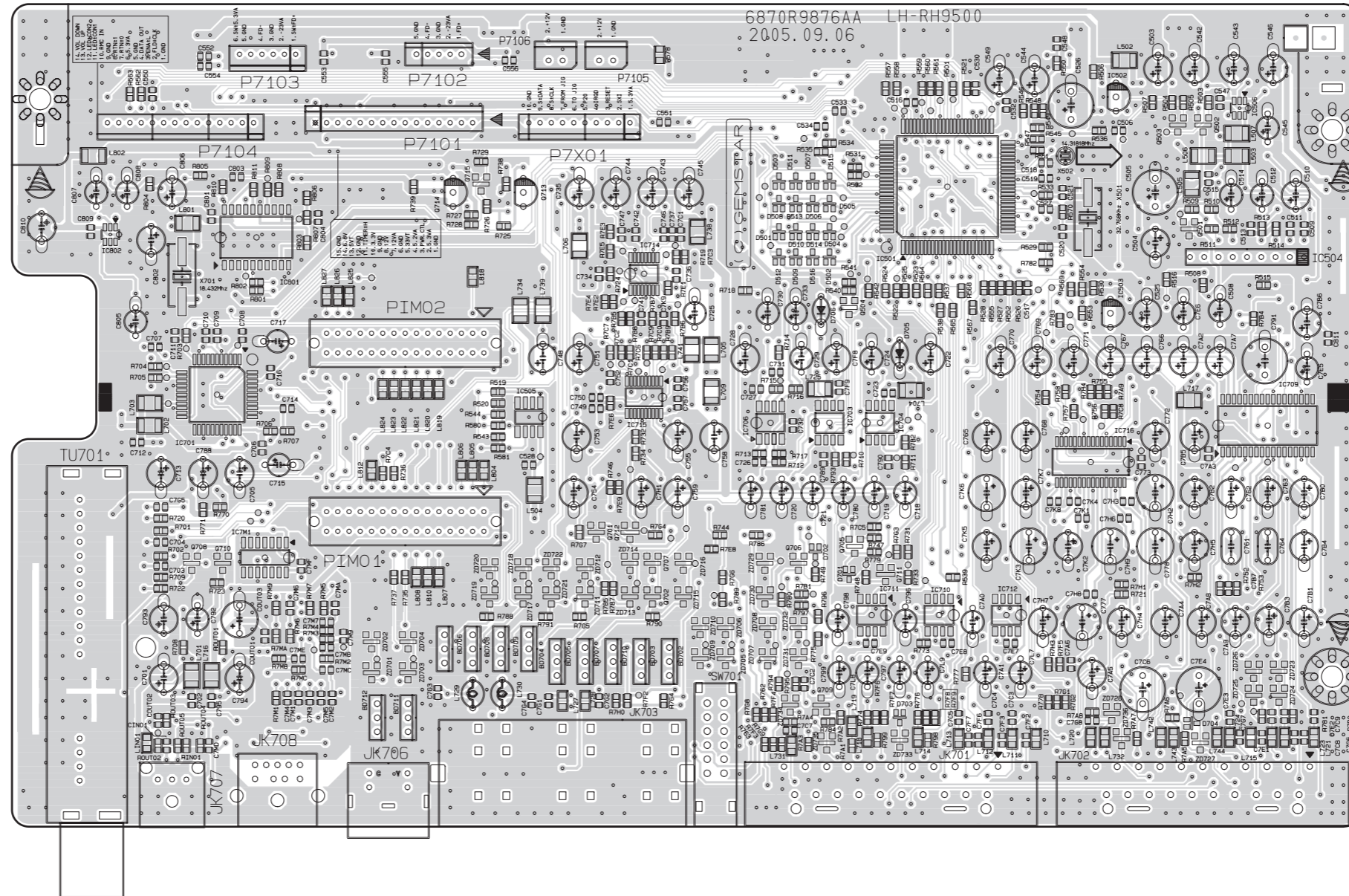
#### LOCATION GUIDE

BC101	F2	C133	C3	IC101	G2	R100	H2	R144	C1
BC102	F5	C134	B2	IC102	F1	R101	H6	R145	C1
BC151	E3	C136	E2	IC103	E1	R103	F3	R146	D2
BD101	H5	C137	D2	IC104	G5	R105	F1	R147	B3
C101	H3	C139	D6	IC105	E4	R107	D3	R149	A4
C102	H5	C140	C6	IC106	E4	R108	G4	R150	C2
C103	G3	C141	D4	IC107	E3	R109	G2	R151	C4
C104	G5	C151	A5	IC151	C5	R110	F4	R152	C5
C105	F3	C152	B6	IC152	B4	R111	F4	R153	C4
C106	F3	C153	C2	IC153	B3	R112	G5	R154	B4
C107	G2	C154	B3	IC154	B4	R114	G4	R155	B4
C108	G2	C155	B6	IC156	D2	R121	E1	R156	B2
C109	G2	C156	A4	IC158	B5	R122	F1	R157	B2
C110	I4	C167	A4	IC160	C4	R123	E1	R158	B5
C111	F6	D101	F2	J101	I4	R124	E1	R159	B4
C112	G2	D102	F2	J102	H4	R125	E1	R160	B4
C114	F4	D103	F5	L101	H4	R126	E1	R161	D4
C115	G5	D121	D2	L102	H3	R127	D1	R162	E4
C116	G5	D122	D4	L121	D1	R128	C3	R163	E4
C117	G4	D123	D5	L123	C4	R129	C3	R164	B1
C118	G5	D124	D5	L125	D3	R130	C3	R165	B1
C119	F4	D125	D6	L127	C6	R131	E4	R166	D3
C120	B1	D126	E2	P1701	A1	R132	E4	R167	B4
C121	E1	D127	E3	P1D01	A4	R133	D4	T101	F2
C122	D2	D128	E3	P1M01	C6	R134	C2	T102	F5
C123	D4	D130	E2	P1T01	A3	R135	C2	V101	H2
C124	D1	D131	D4	PW101	H1	R136	C2	ZD102	G5
C125	C4	D132	D5	Q111	G4	R137	C1	ZD103	G2
C126	D5	D134	C2	Q120	C1	R138	A3	ZD104	G2
C128	B2	D135	C3	Q123	C2	R140	C1	ZD105	F4
C129	D5	D151	C3	Q124	C2	R141	B2	ZD151	D3
C131	D3	FH01	I2	Q125	B2	R142	C1		
C132	D3	FH02	I2	Q126	B1	R143	C2		

### 4. JACK P.C.BOARD



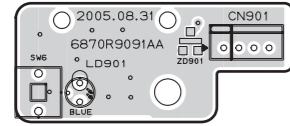
# 5. I/O P.C.BOARD (TOP VIEW)



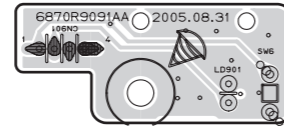


## 7. KEY P.C.BOARD

(TOP VIEW)

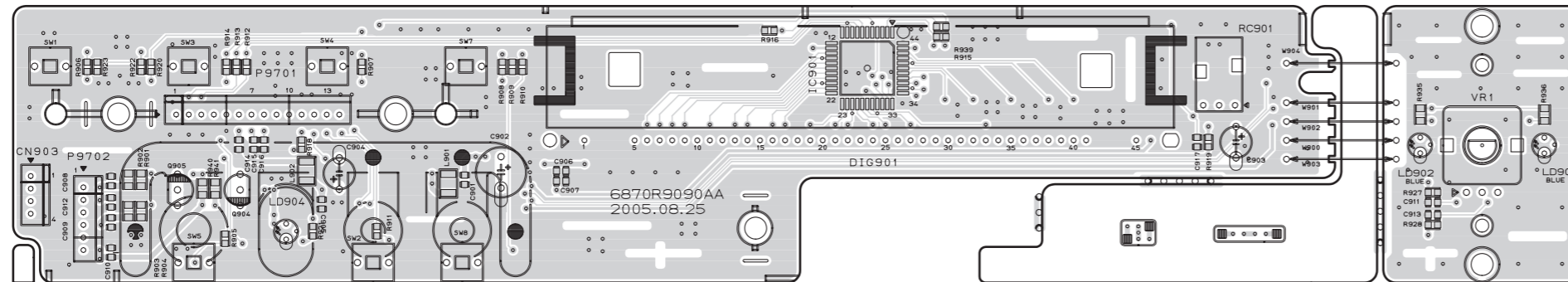


(BOTTOM VIEW)

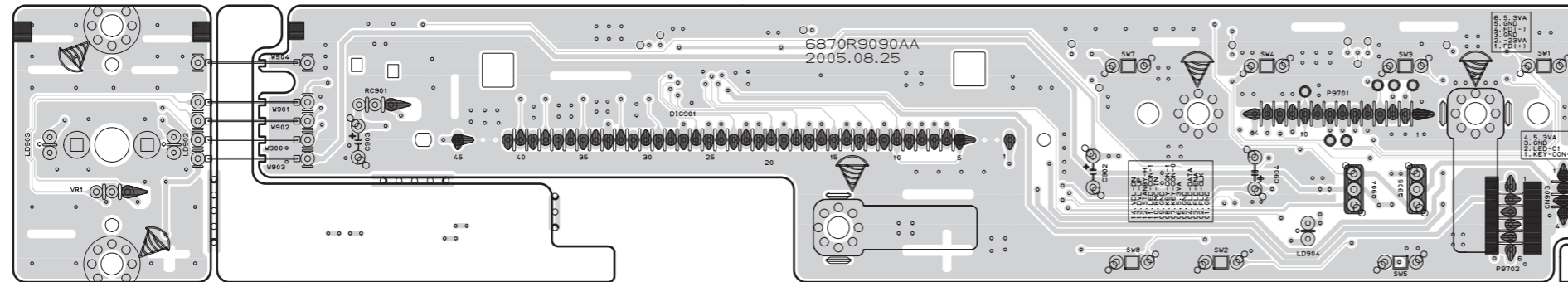


## 8. TIMER P.C.BOARD

(TOP VIEW)



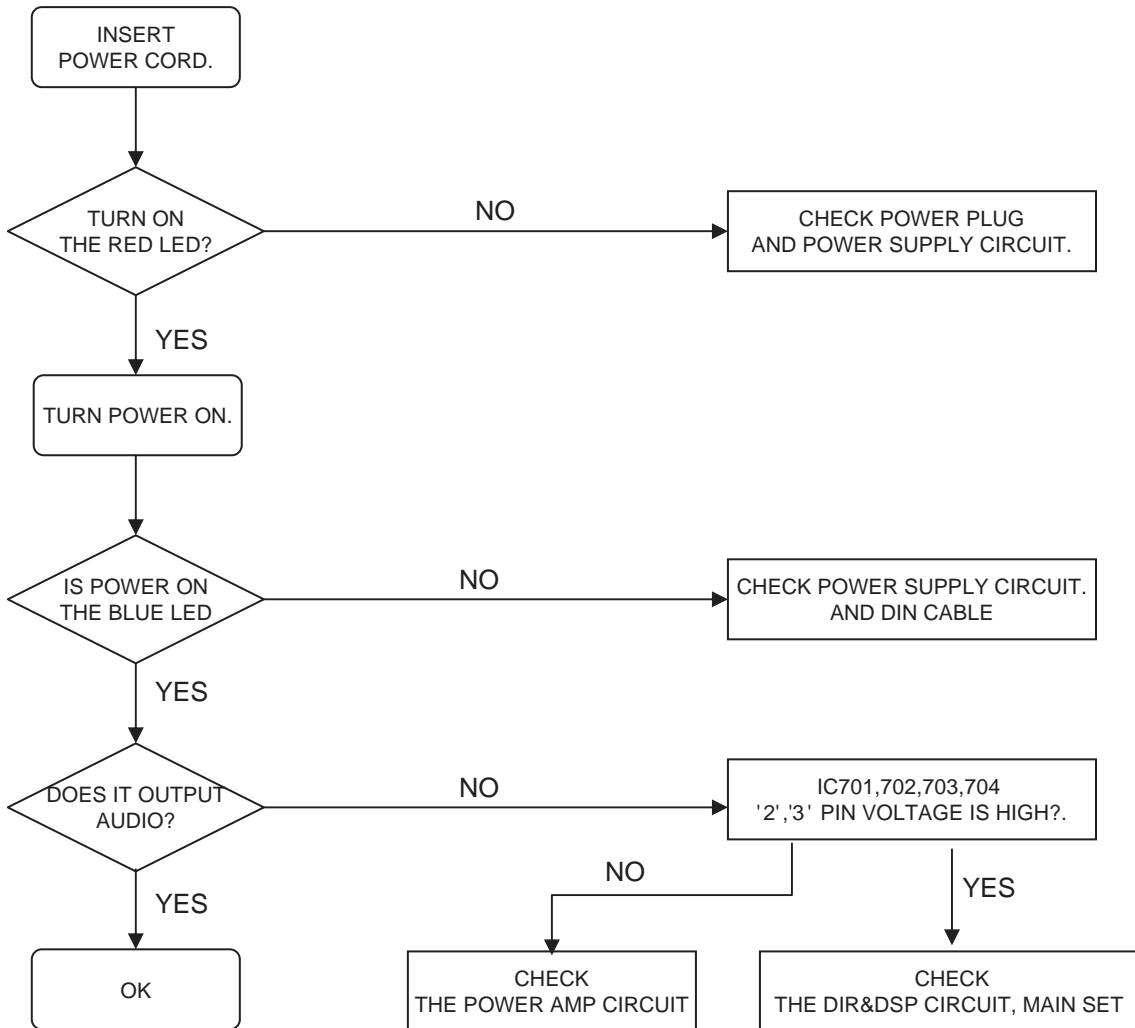
(BOTTOM VIEW)







# WOOFER PART ELECTRICAL TROUBLESHOOTING GUIDE

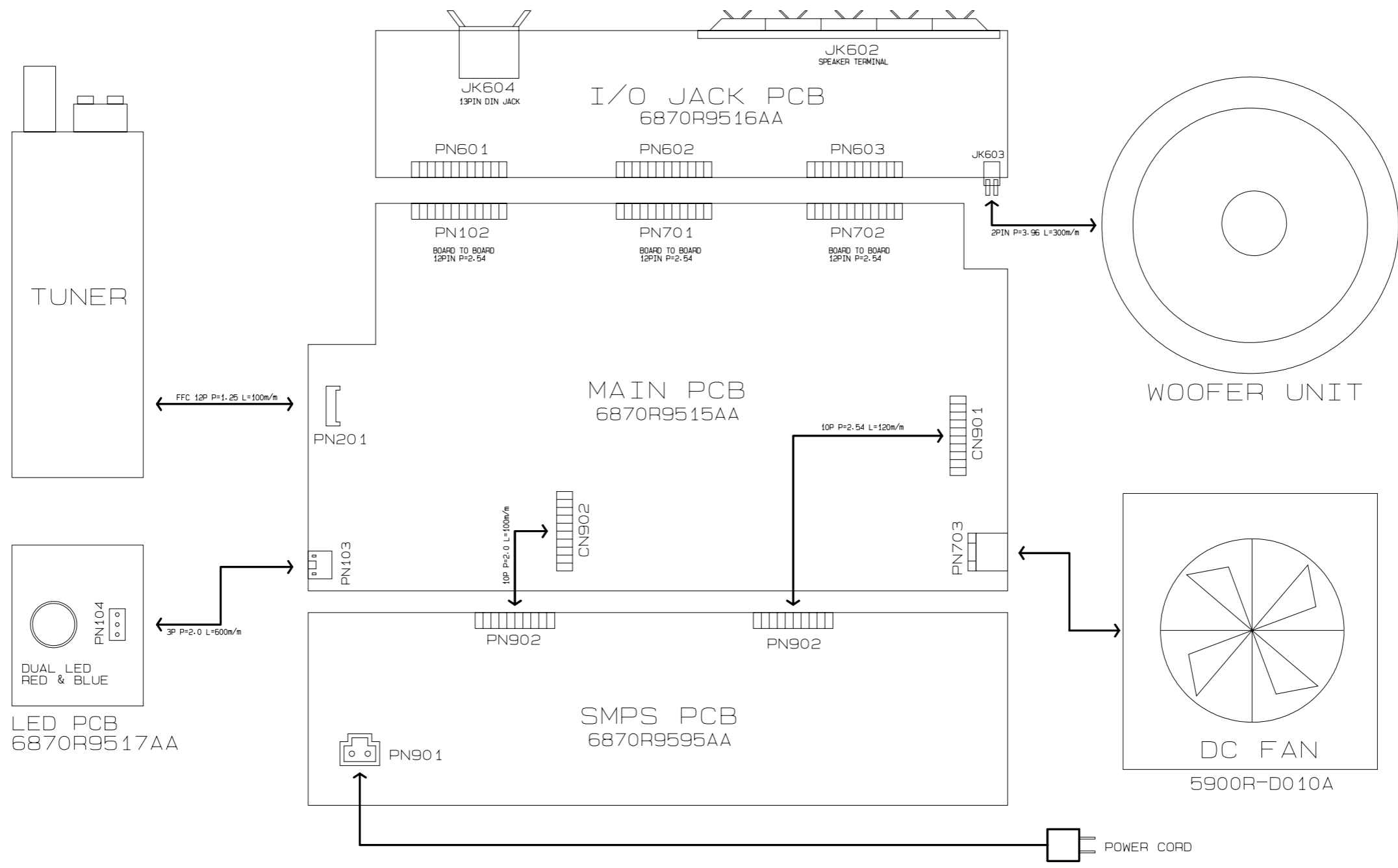


**MEMO**

Horizontal dotted lines for writing.

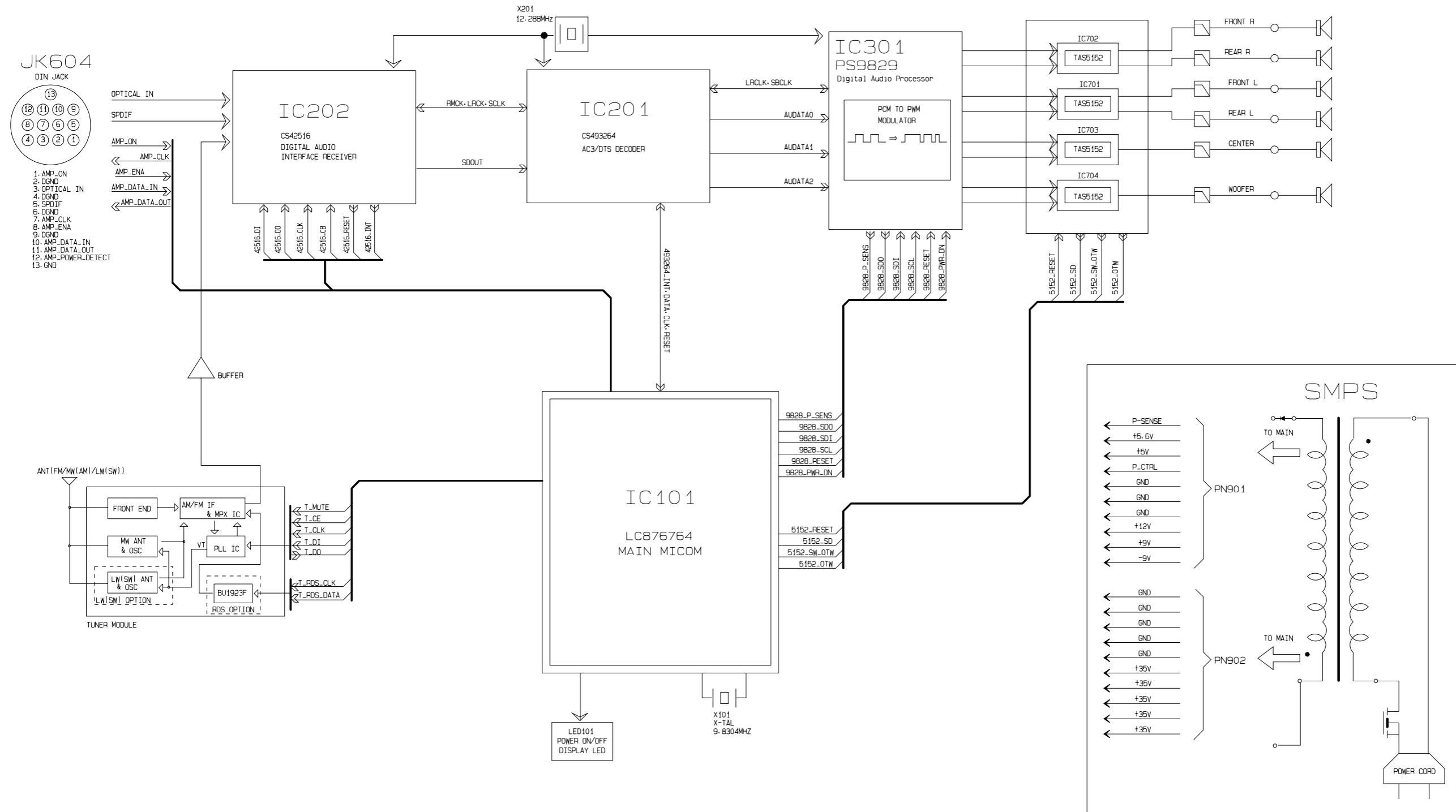
# BLOCK DIAGRAMS

## 1. WIRING DIAGRAM



WIRING DIAGRAM(SHT#6)  
 LHS-95PAA 2005.02.25  
 3854R19510A

## 2. BLOCK DIAGRAM

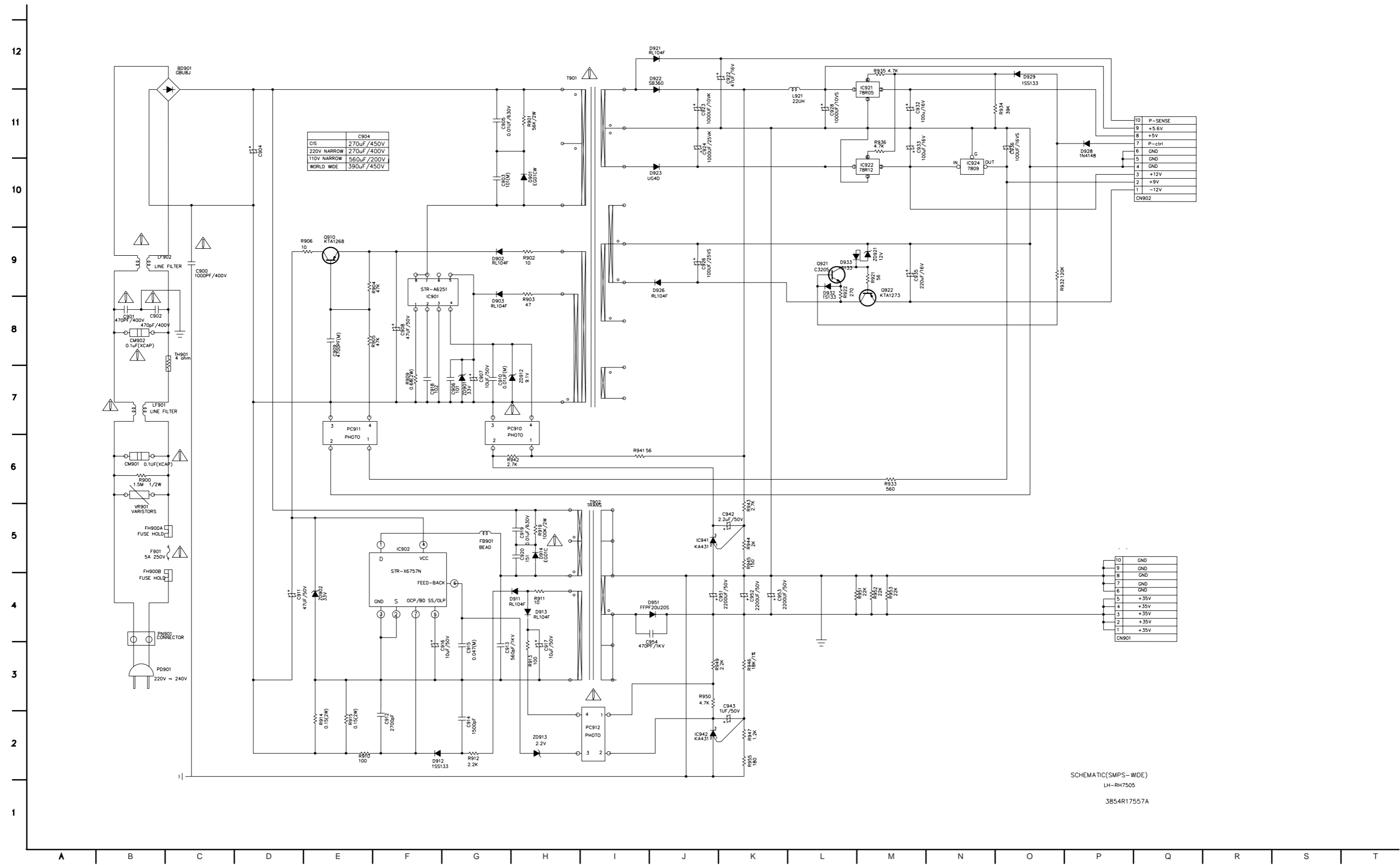


BLOCK DIAGRAM(SHT#5)  
LHS-95PAA 2005.02.01

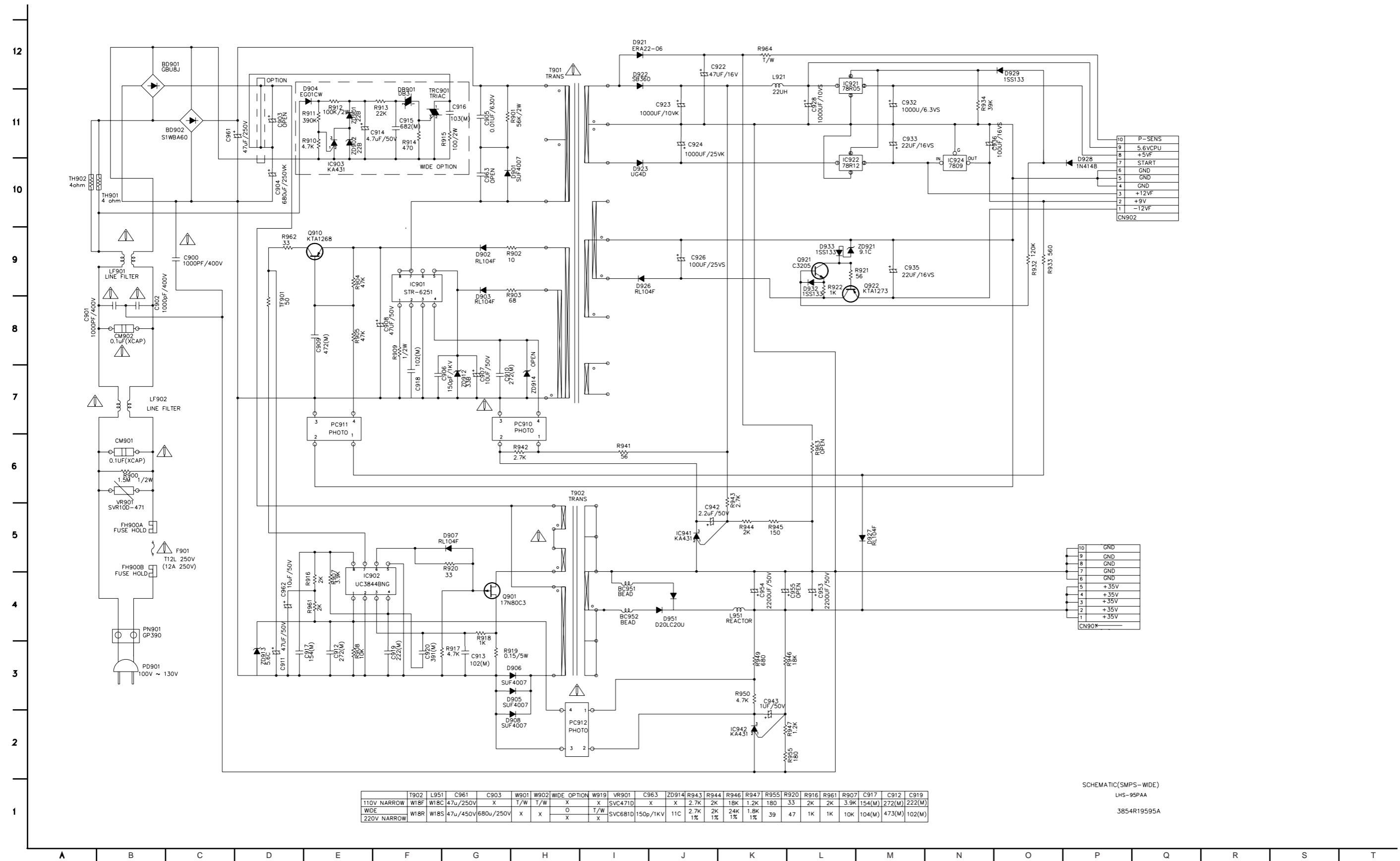
3854R19510A

# CIRCUIT DIAGRAMS

## 1. SMPS CIRCUIT DIAGRAM\_700W



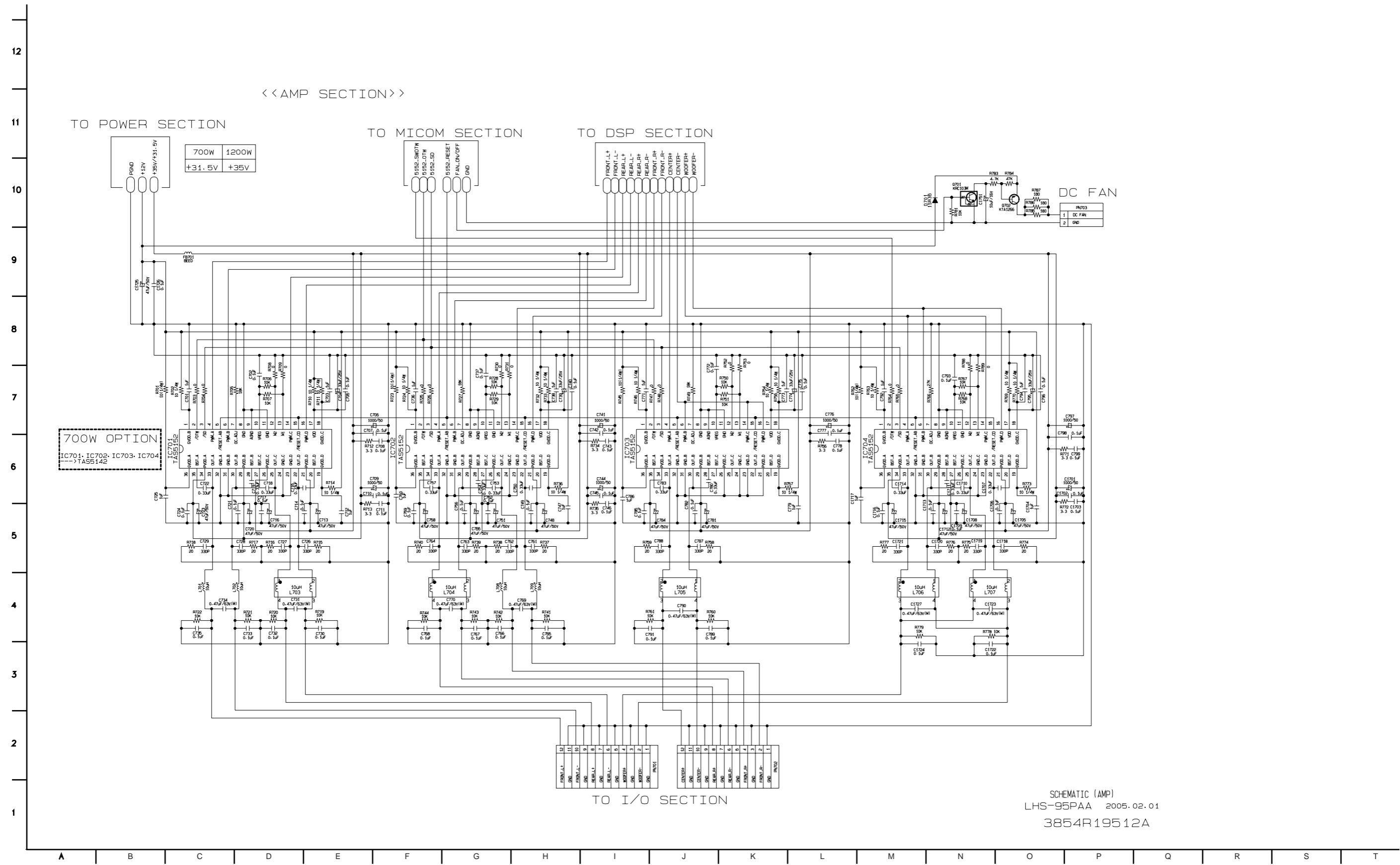
## 2. SMPS CIRCUIT DIAGRAM\_1200W



	T902	L951	C961	C903	W901	W902	WIDE	OPTION	W919	VR901	C963	ZD914	R943	R944	R946	R947	R955	R920	R916	R961	R907	C917	C912	C919
110V NARROW	W18F	W18C	47u/250V	X	T/W	T/W	X	X	SVC471D	X	X	2.7K	2K	18K	1.2K	180	33	2K	2K	3.9K	154(M)	272(M)	222(M)	
WIDE	W18R	W18S	47u/450V	680u/250V	X	X	X	T/W	SVC681D	150p/1KV	11C	2.7K	2K	24K	1.8K	1%	39	47	1K	1K	10K	104(M)	473(M)	102(M)
220V NARROW																								

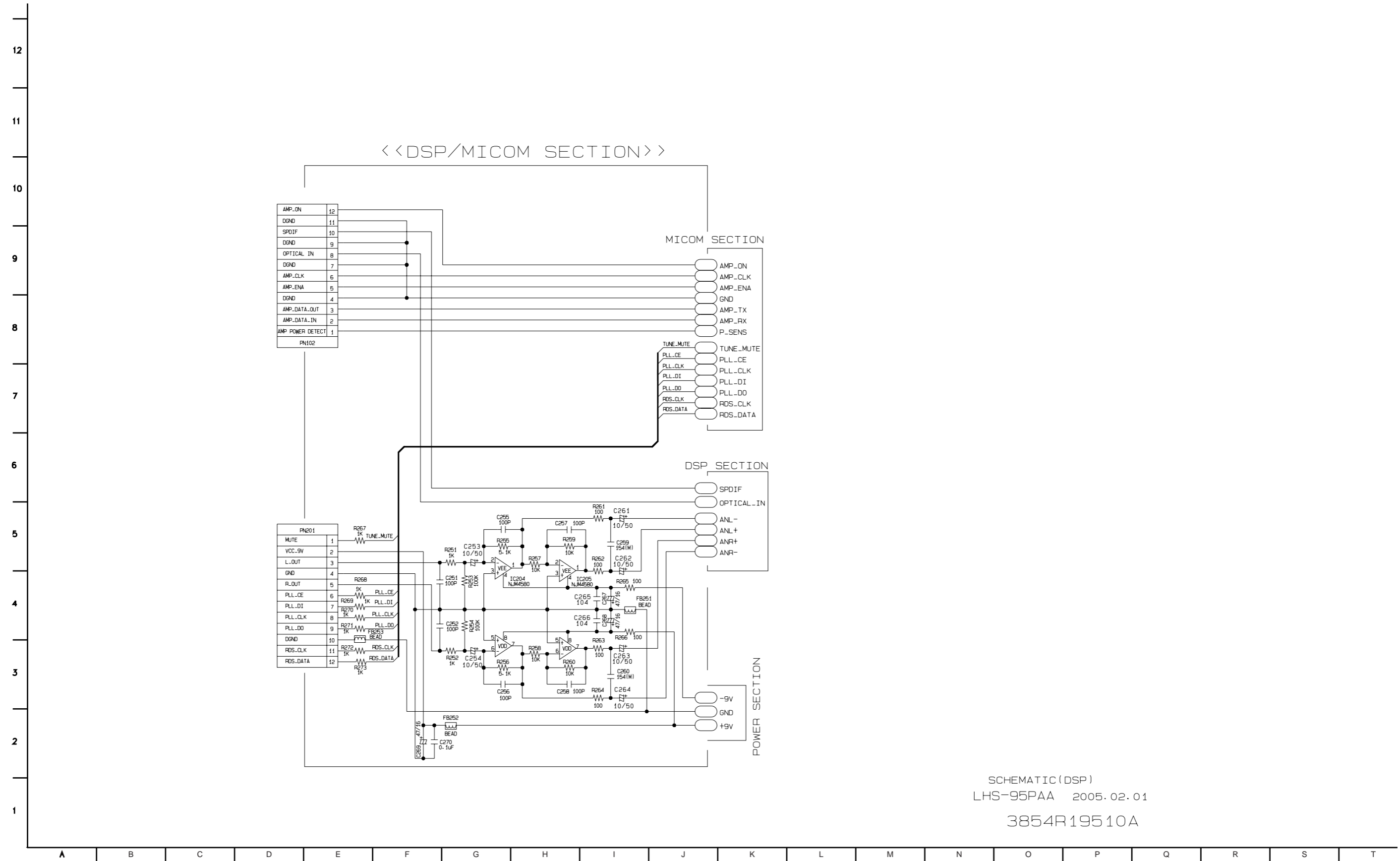
SCHEMATIC(SMPS-WDE)  
LHS-95PAA  
3854R19595A

### 3. AMP CIRCUIT DIAGRAM



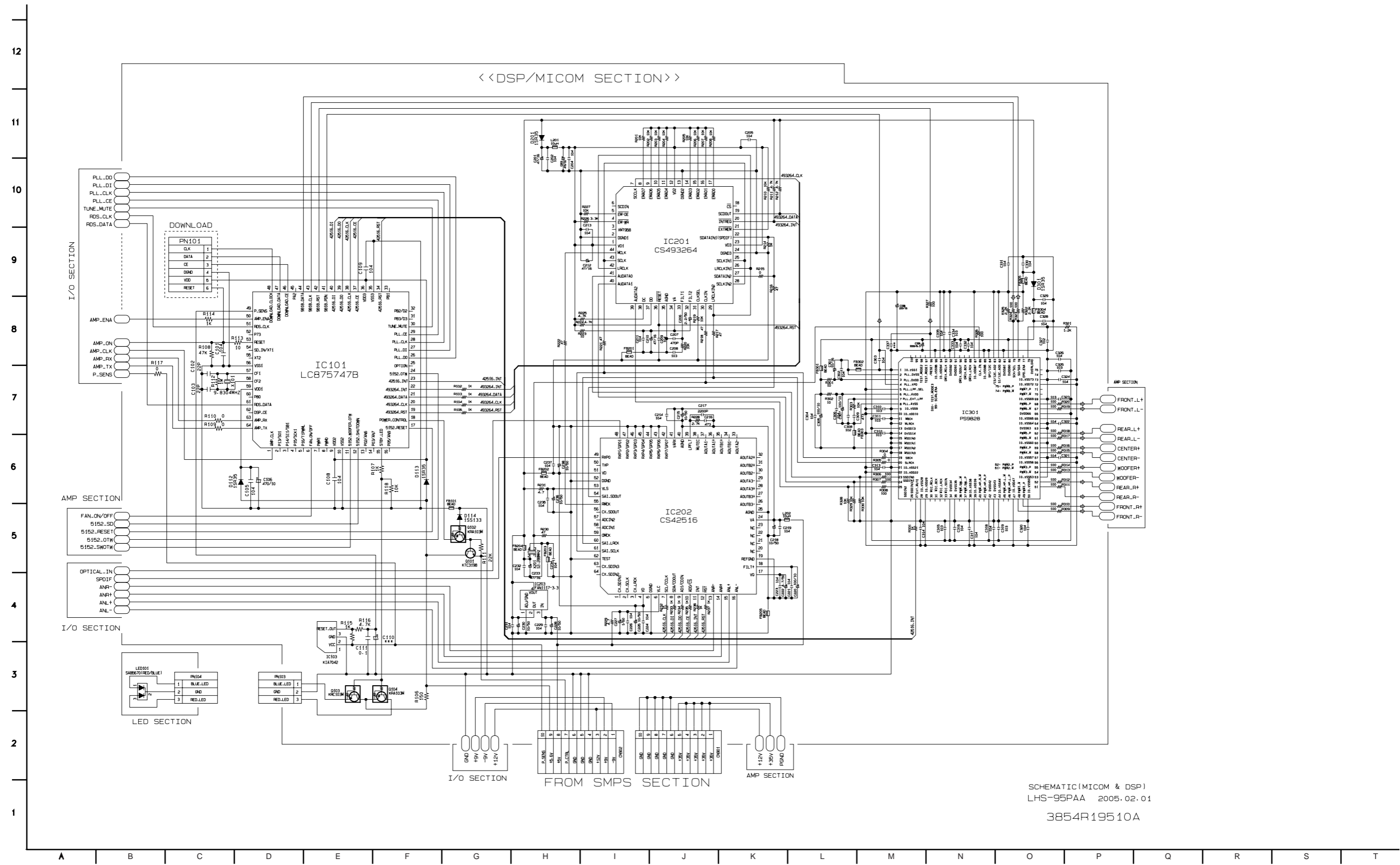


# 4. MICOM & DSP CIRCUIT DIAGRAM



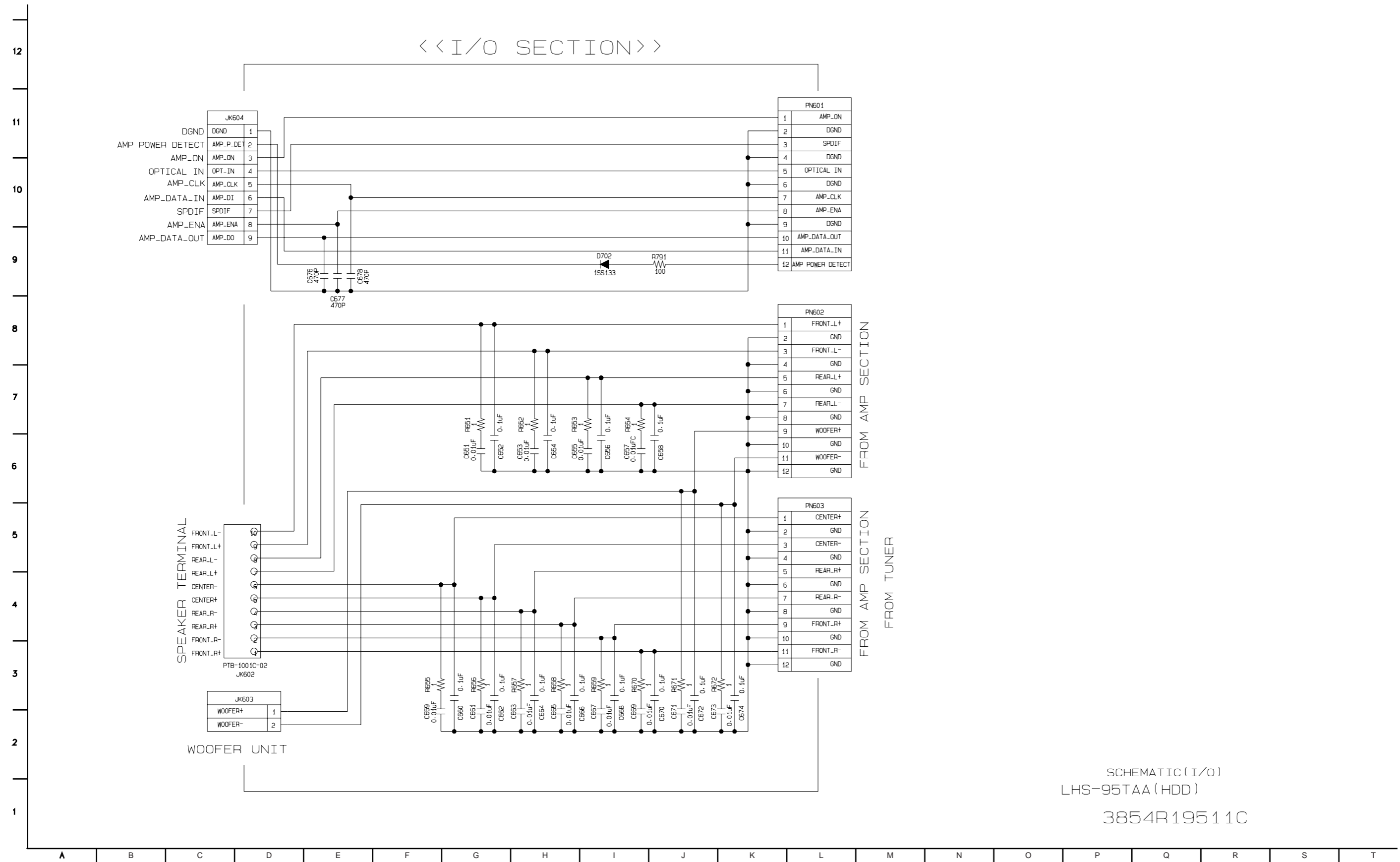
SCHMATIC (DSP)  
 LHS-95PAA 2005.02.01  
 3854R19510A

# 5. DSP CIRCUIT DIAGRAM



SCHMATIC (MICOM & DSP)  
LHS-95PAA 2005.02.01  
3854R19510A

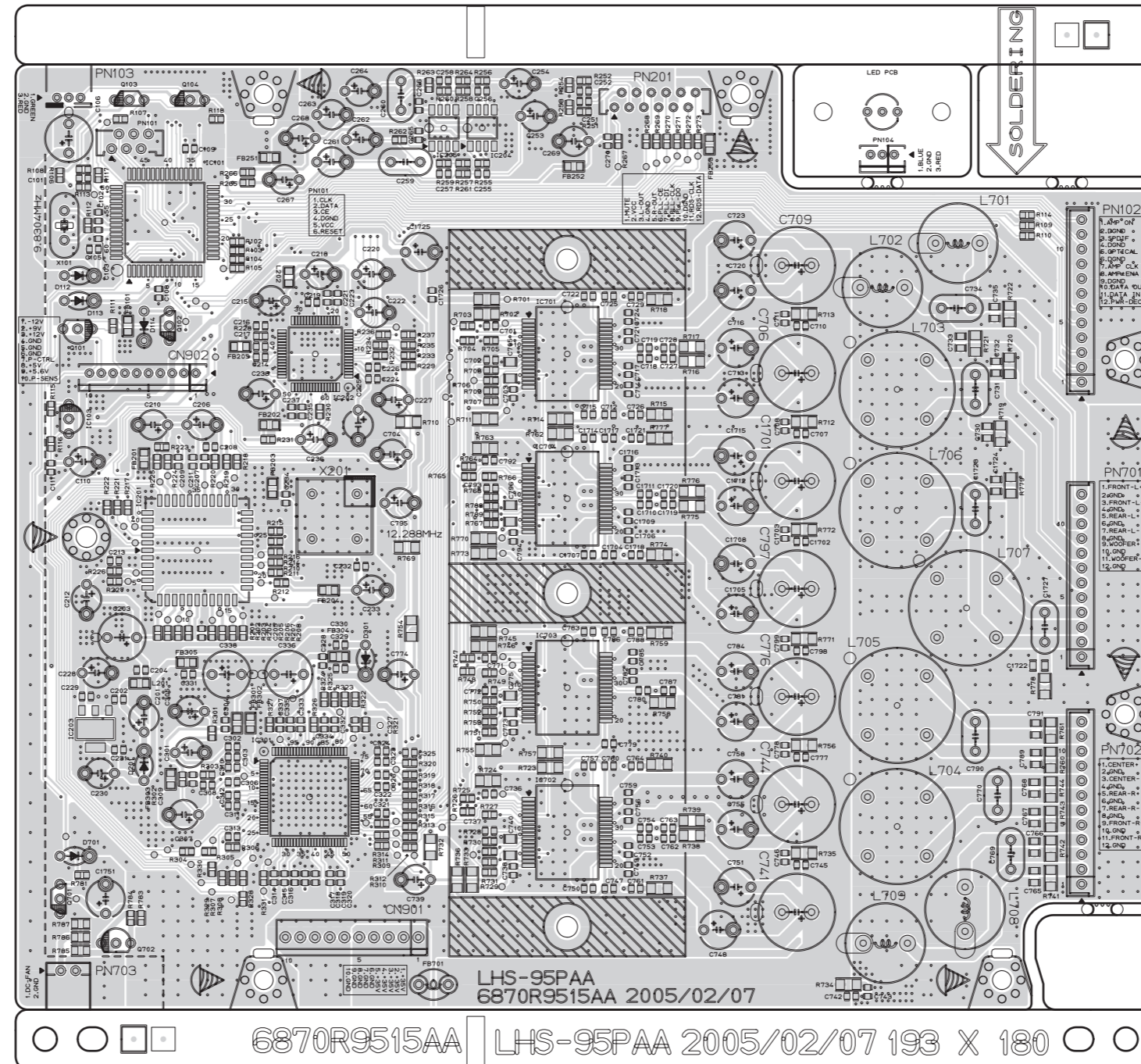
# 6. I/O JACK CIRCUIT DIAGRAM



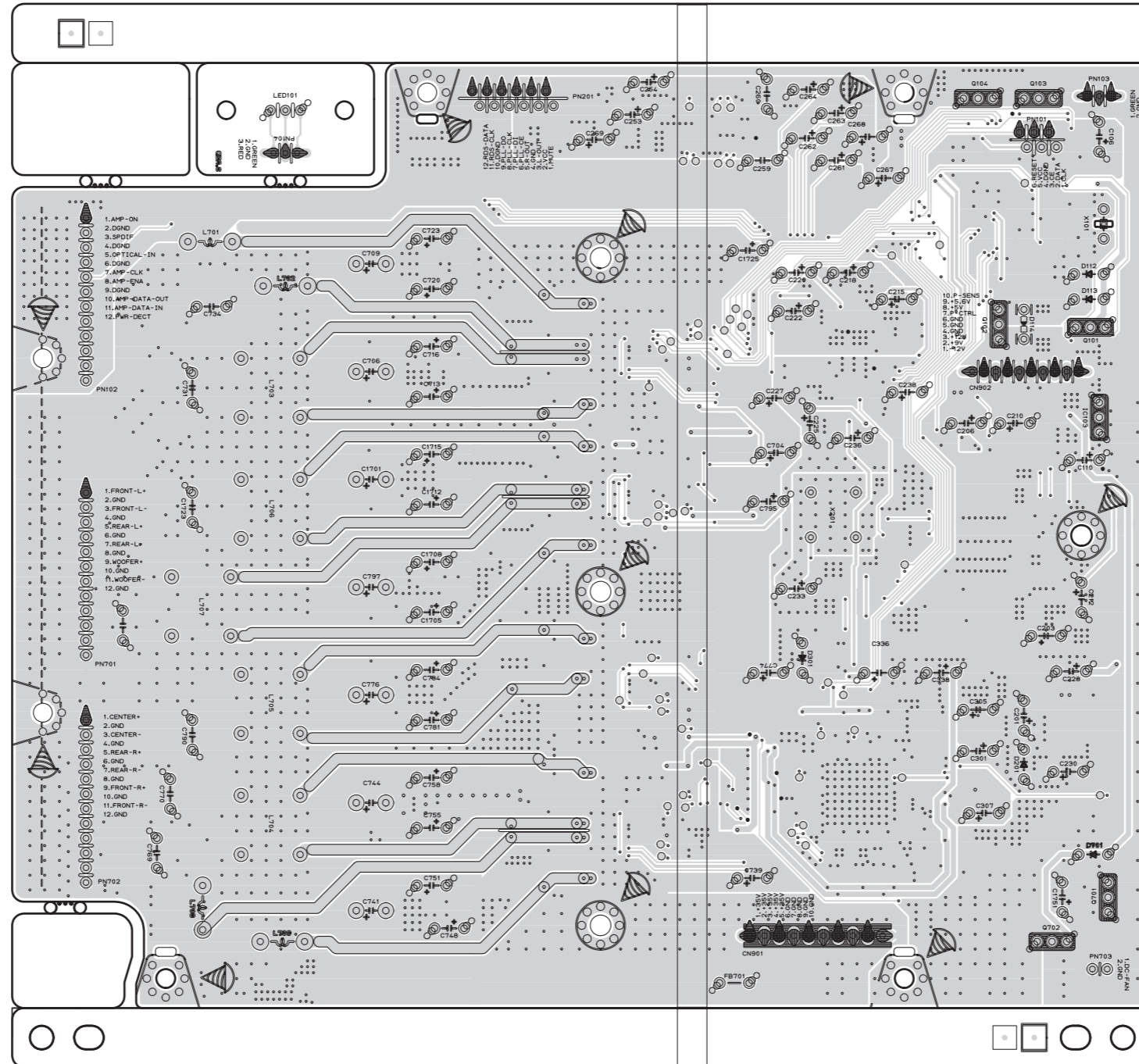
SCHEMATIC (I/O)  
LHS-95TAA (HDD)  
3854R19511C

# PRINTED CIRCUIT DIAGRAMS

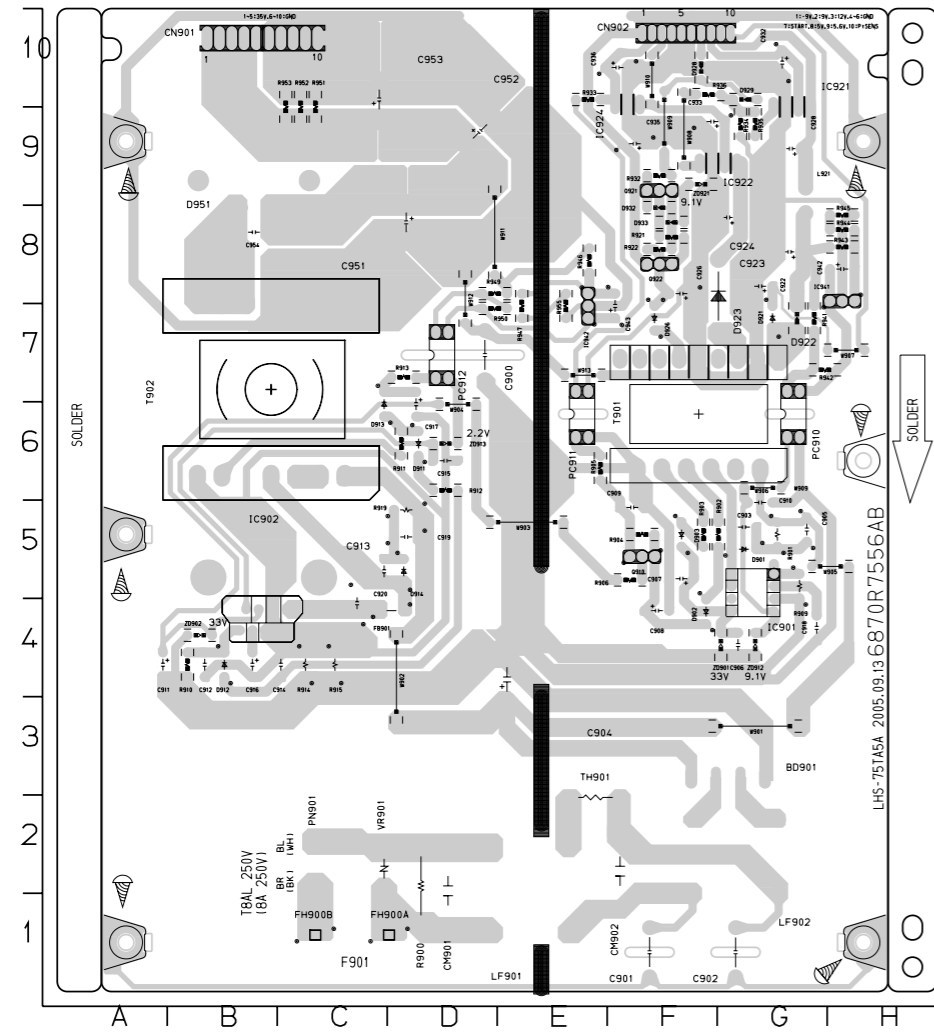
## 1. MAIN & WOOFER P.C.BOARD (TOP VIEW)



## 2. MAIN & WOOFER P.C.BOARD (BOTTOM VIEW)

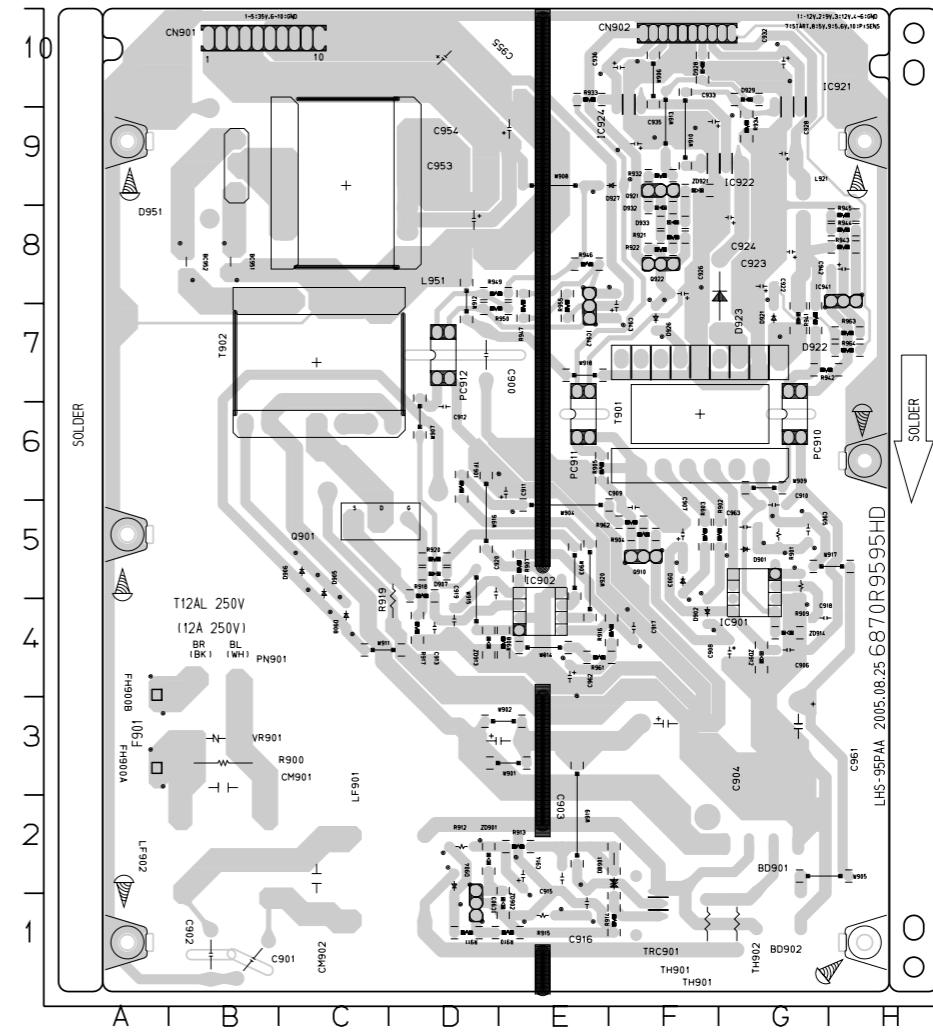


### 3. POWER P.C.BOARD



LOCATION GUIDE

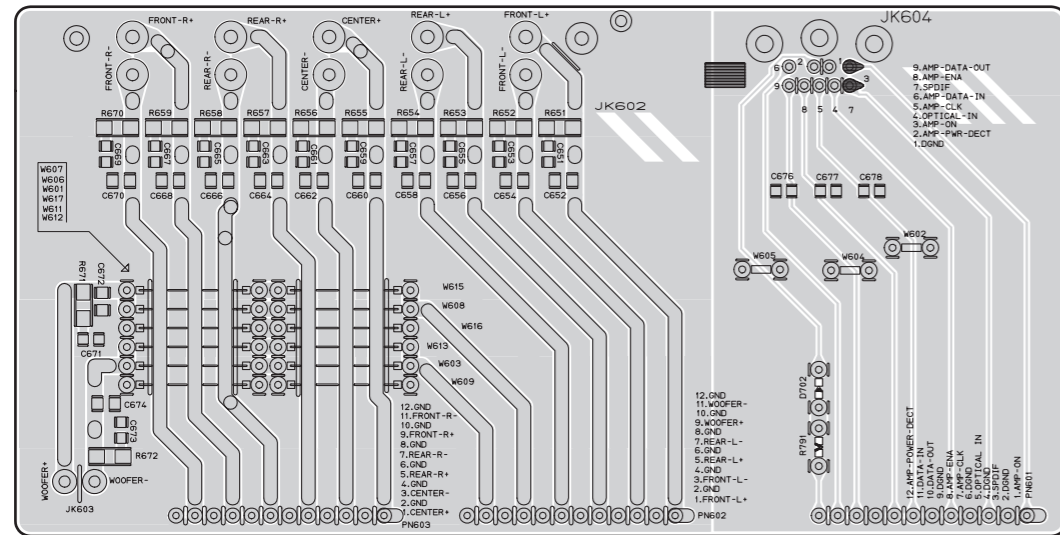
BD901	G3	IC902	B5
C900	D7	IC921	G9
C901	F1	IC922	G9
C902	G1	IC924	F10
C903	G5	IC941	H8
C904	E4	IC942	E7
C905	G5	L921	G9
C906	G4	LF901	E2
C907	F5	LF902	G2
C908	F4	PC910	G7
C909	F5	PC911	E7
C910	G5	PC912	D7
C911	A4	PN901	C2
C912	B4	Q910	F5
C913	C4	Q921	F9
C914	C4	Q922	F8
C915	D6	R900	D2
C916	B4	R901	G5
C917	D6	R902	G5
C918	G4	R903	F5
C919	D5	R904	F5
C920	C5	R905	E6
C922	G8	R906	F5
C923	G8	R909	G5
C924	G8	R910	B4
C926	F8	R911	D6
C928	G9	R912	D6
C932	G10	R913	D7
C933	F9	R914	C4
C935	F9	R915	C4
C936	F10	R919	D5
C942	H8	R921	F8
C943	F7	R922	F8
C951	D8	R932	F9
C952	D9	R933	E10
C953	C10	R934	G9
C954	B8	R935	G9
CM901	D2	R936	F10
CM902	F2	R941	G7
CM901	B10	R942	G7
CM902	F10	R943	H8
D901	G5	R944	H8
D902	F4	R945	H8
D903	F5	R946	E8
D911	D6	R947	E7
D912	B4	R949	D8
D913	C6	R950	D7
D914	D5	R951	C9
D921	G7	R952	C9
D922	G7	R953	C9
D923	G8	R955	E7
D926	F7	T901	F6
D928	F10	T902	B7
D929	G10	TH901	E2
D932	F8	VR901	C2
D933	F8	ZD901	G4
D951	B8	ZD902	B4
FB901	D4	ZD912	G4
FH900A	D1	ZD913	D6
FH900B	C1	ZD921	F9
IC901	G5		



LOCATION GUIDE

BC951	B8	D902	F4	R908	E4
BC952	B8	D903	F5	R909	G5
BD901	G2	D904	D2	R910	E1
BD902	G1	D905	C5	R911	D1
C900	D7	D906	C5	R912	D2
C901	B1	D907	D5	R913	E2
C902	B1	D908	C4	R914	F1
C903	E3	D921	G7	R915	E1
C904	G5	D922	G7	R916	F4
C905	G5	D923	G8	R917	D4
C906	G4	D926	F7	R918	D5
C907	F5	D927	F9	R919	D4
C908	G4	D928	F10	R920	D5
C909	F5	D929	G10	R921	F8
C910	G5	D932	F8	R922	F8
C911	E6	D933	F8	R932	F9
C912	D6	D951	B9	R933	E10
C913	D4	D8901	F2	R934	C9
C914	E2	FH900A	A3	R941	G7
C915	E2	FH900B	A4	R942	G7
C916	E1	IC901	G5	R943	H8
C917	F4	IC902	E4	R944	H8
C918	G4	IC903	D1	R945	H8
C919	D4	IC921	G9	R946	E8
C920	D5	IC922	G9	R947	E7
C922	G8	IC924	F10	R949	D8
C923	G8	IC941	H8	R950	D7
C924	G8	IC942	E7	R955	E7
C926	F8	L921	G8	R961	E4
C928	G9	L951	C9	R962	F5
C932	G10	LF901	C2	R963	H7
C933	F9	LF902	B2	R964	H7
C935	F9	PC910	G7	T901	F6
C936	F10	PC911	E7	T902	C7
C942	H8	PC912	D7	TF901	D6
C943	F7	PN901	B4	TH901	F1
C953	D8	Q901	C5	TH902	G1
C954	D9	Q910	F5	TRC901	F1
CM901	D2	Q921	F9	VR901	B3
CM902	F2	Q922	F8	ZD901	D2
CM901	B10	R900	B3	ZD902	E1
CM902	F10	R901	G5	ZD912	G4
D901	G5	R902	G5	ZD913	D4
D902	F4	R903	F5	ZD914	G4
D903	F5	R904	F5	ZD921	F9
D911	D6	R905	E6		
D912	B4	R906	F5		
D913	C6	R907	E5		
D914	D5				
D921	G7				
D922	G7				
D923	G8				
D926	F7				
D928	F10				
D929	G10				
D932	F8				
D933	F8				
D951	B8				
FB901	D4				
FH900A	D1				
FH900B	C1				
IC901	G5				

## 4. I/O JACK P.C.BOARD



# SECTION 4

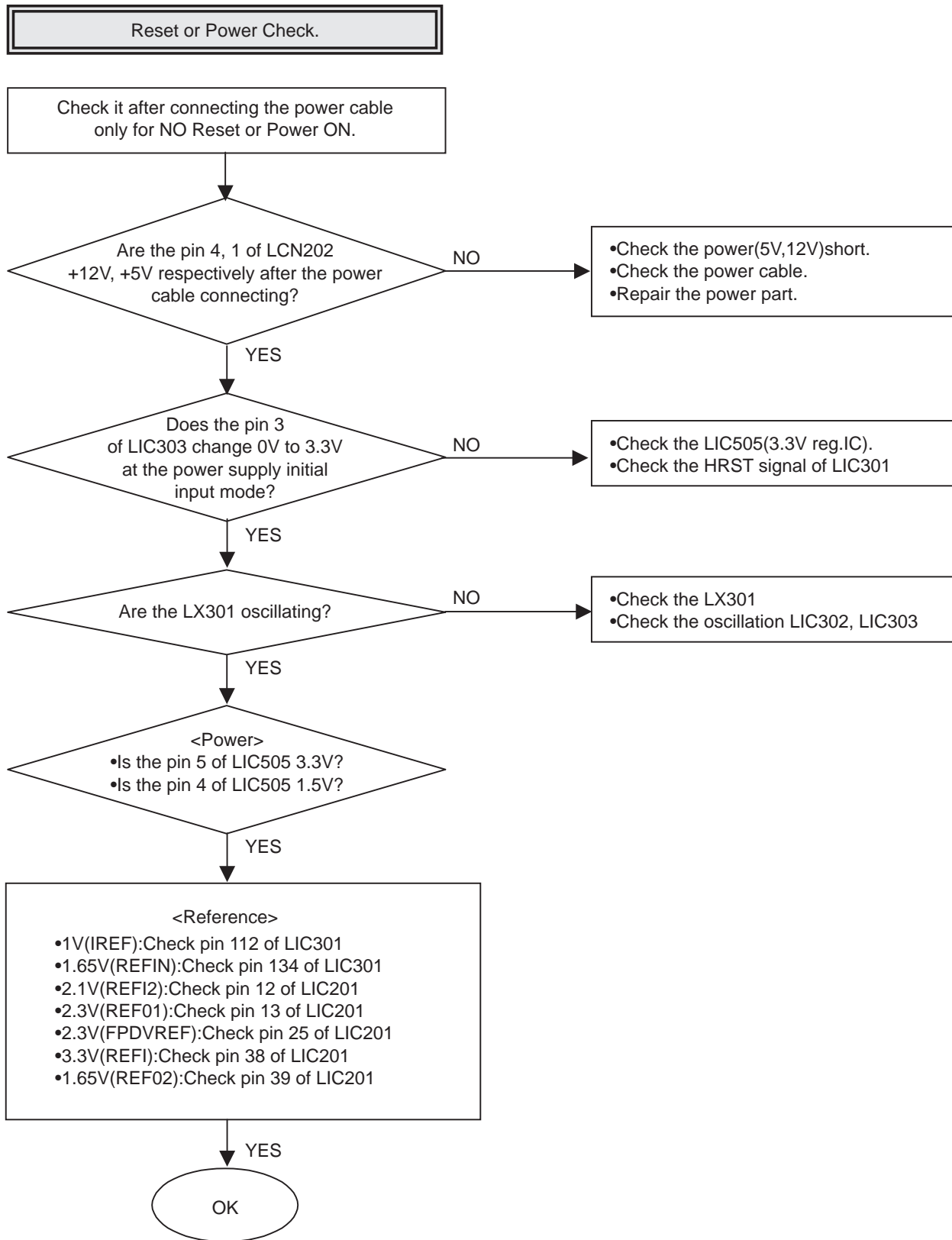
## RL-05 LOADER PART

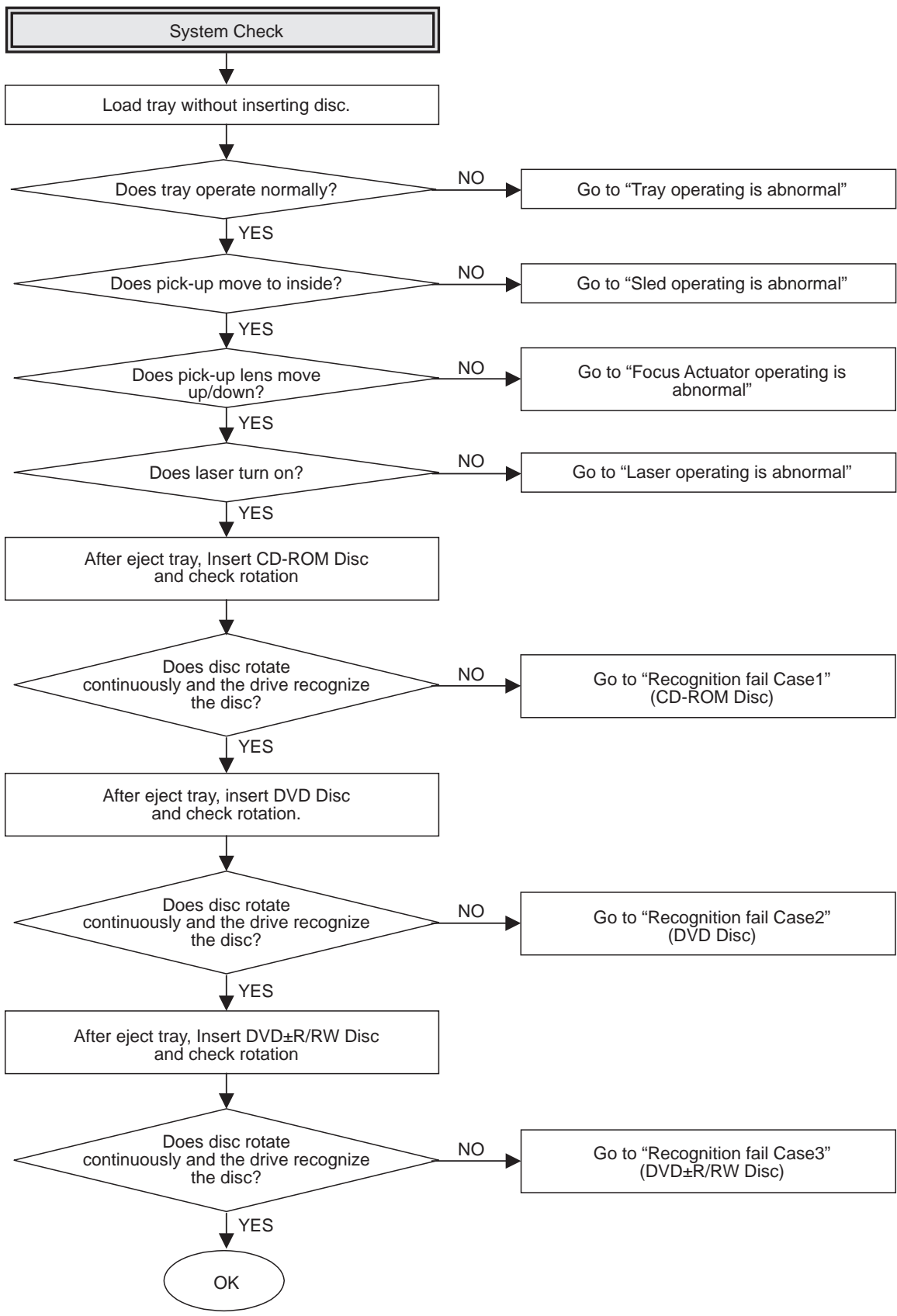
### CONTENTS

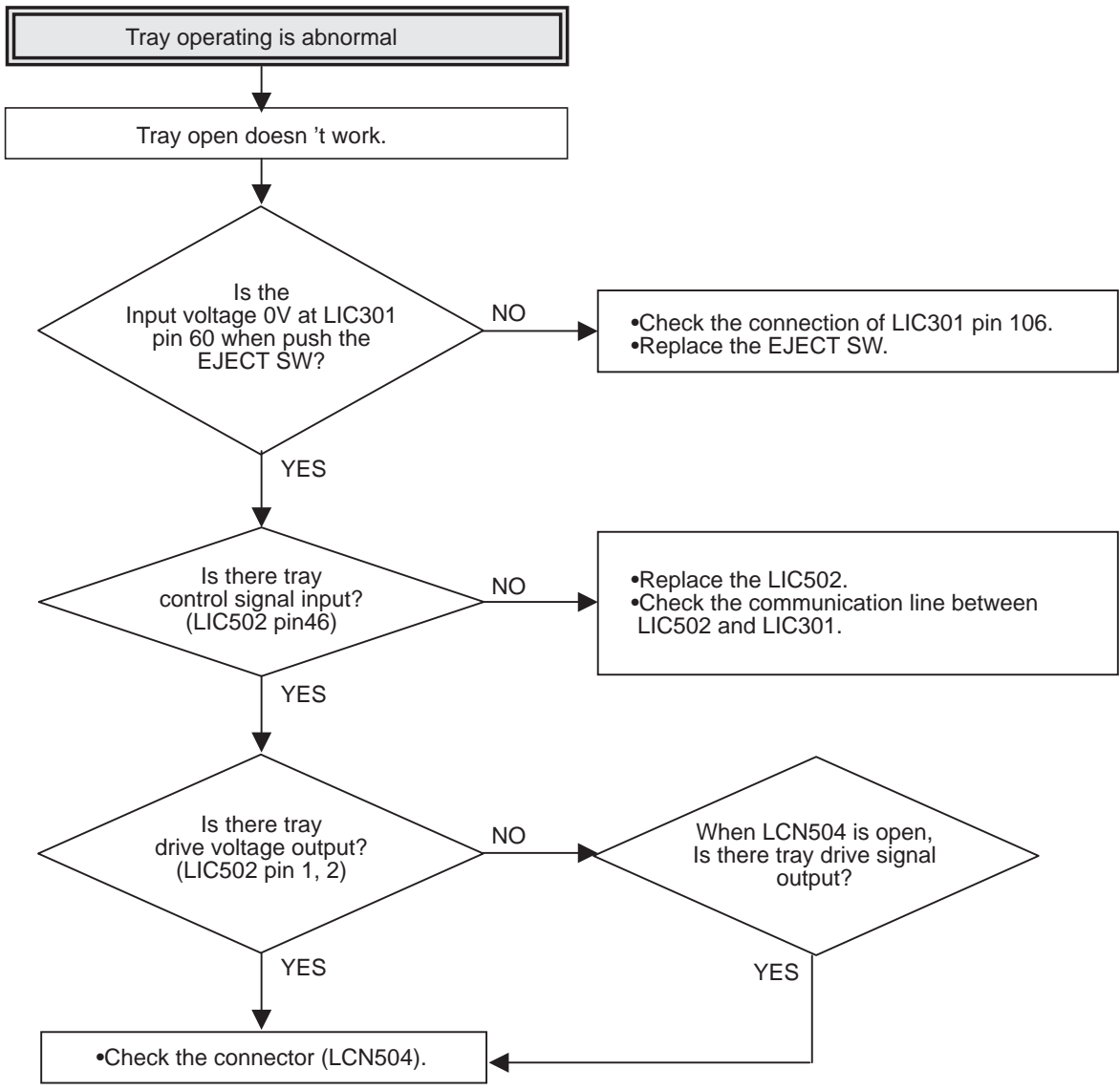
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1. MAIN P.C.BOARD .....	4-63
2. MAIN P.C.BOARD .....	4-65

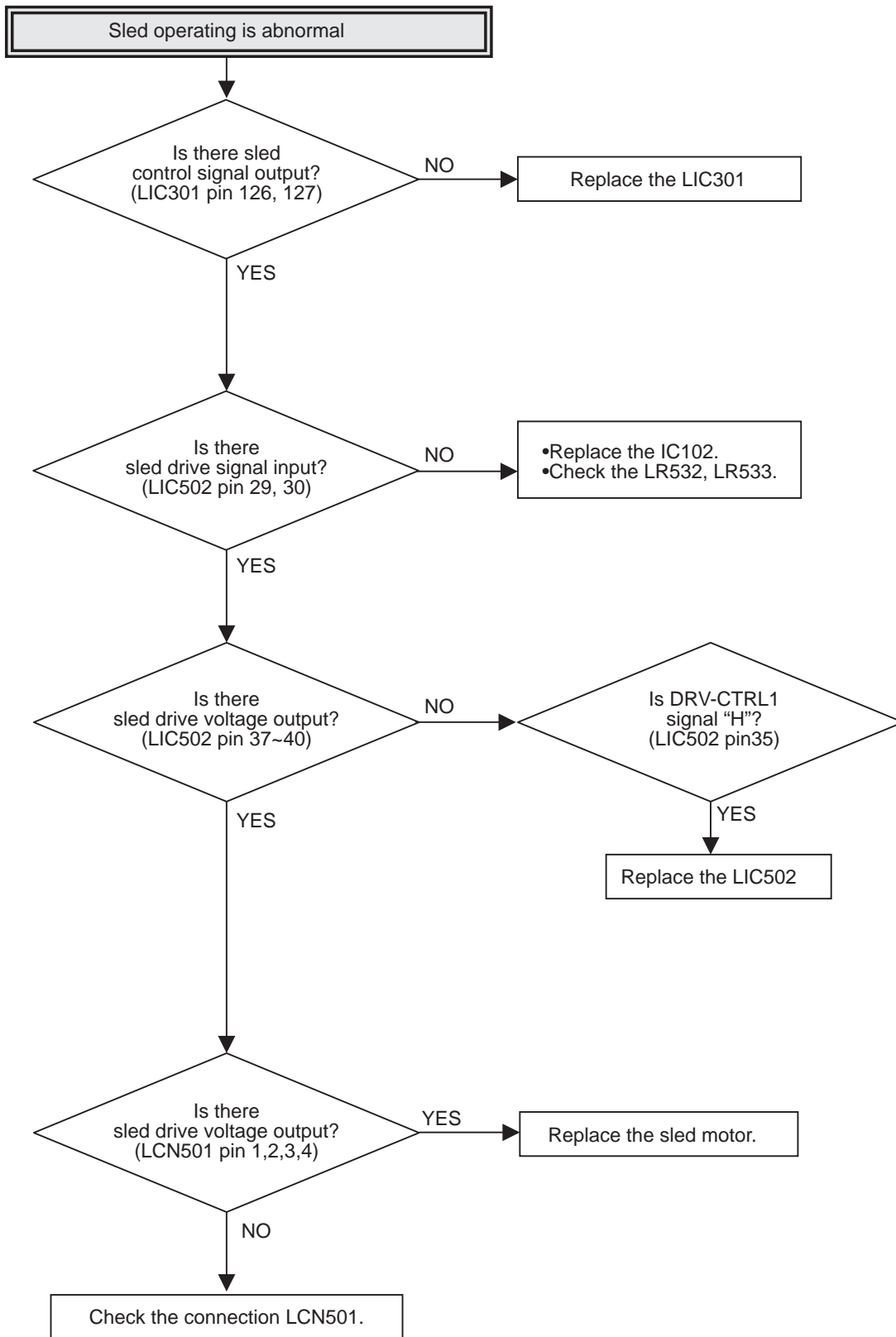


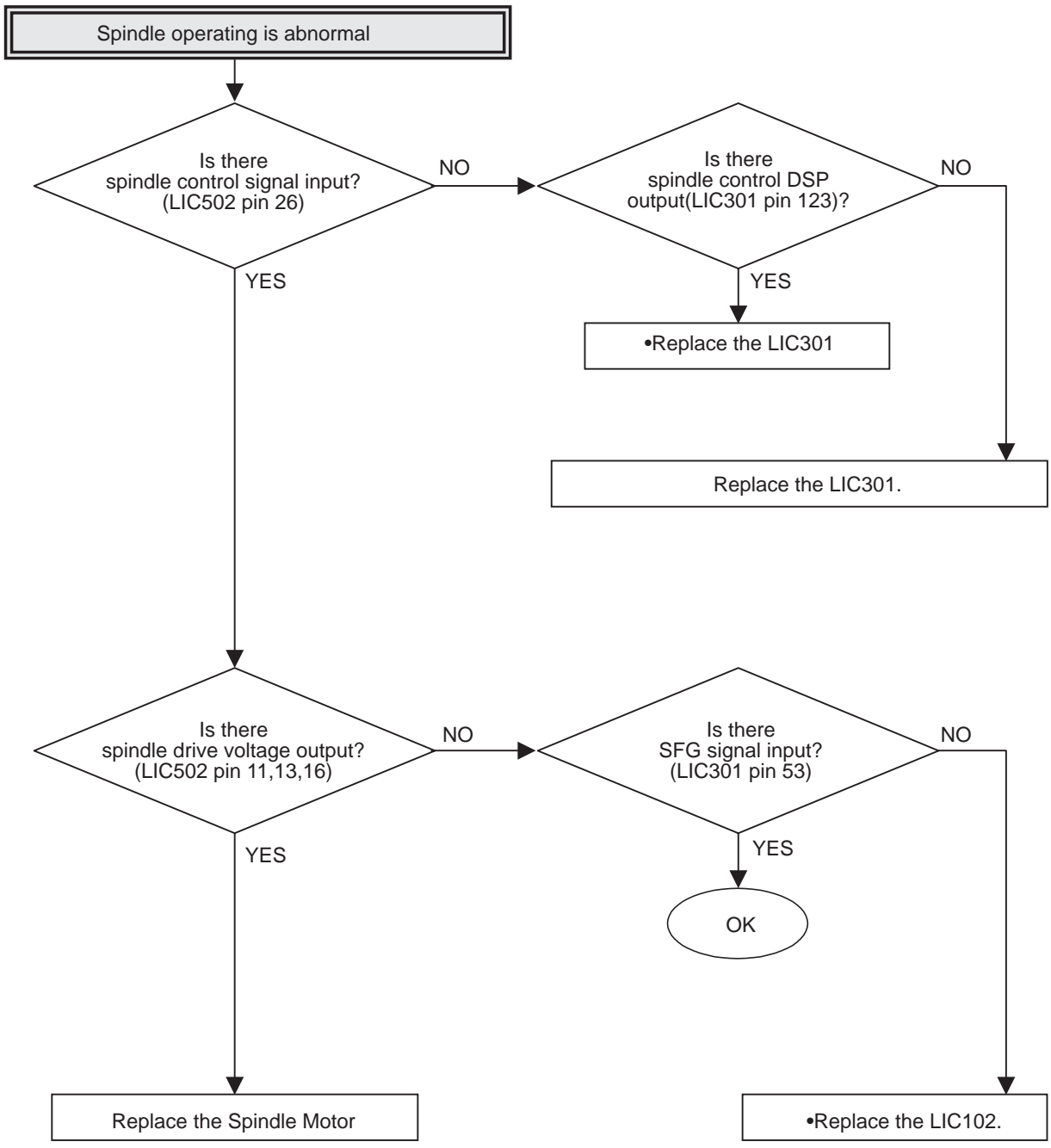
# ELECTRICAL TROUBLESHOOTING GUIDE

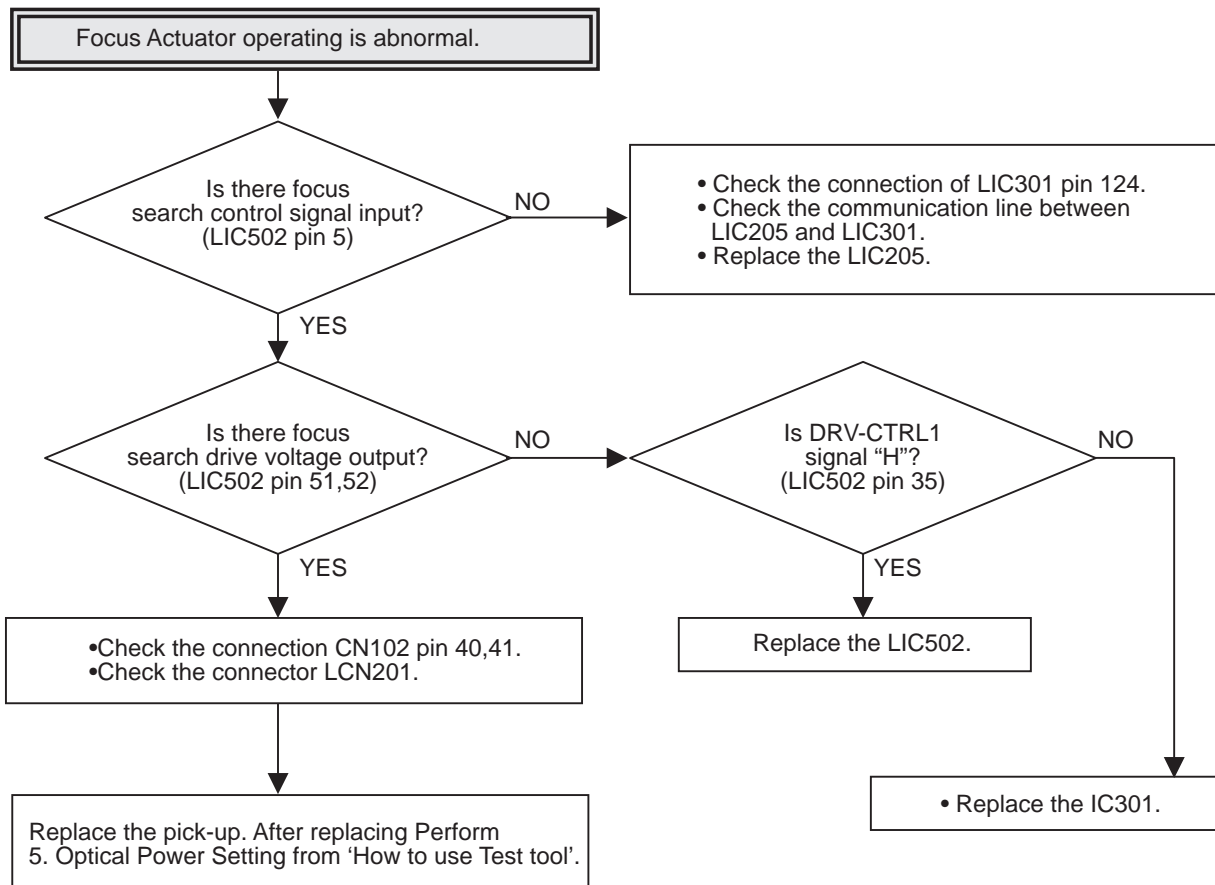
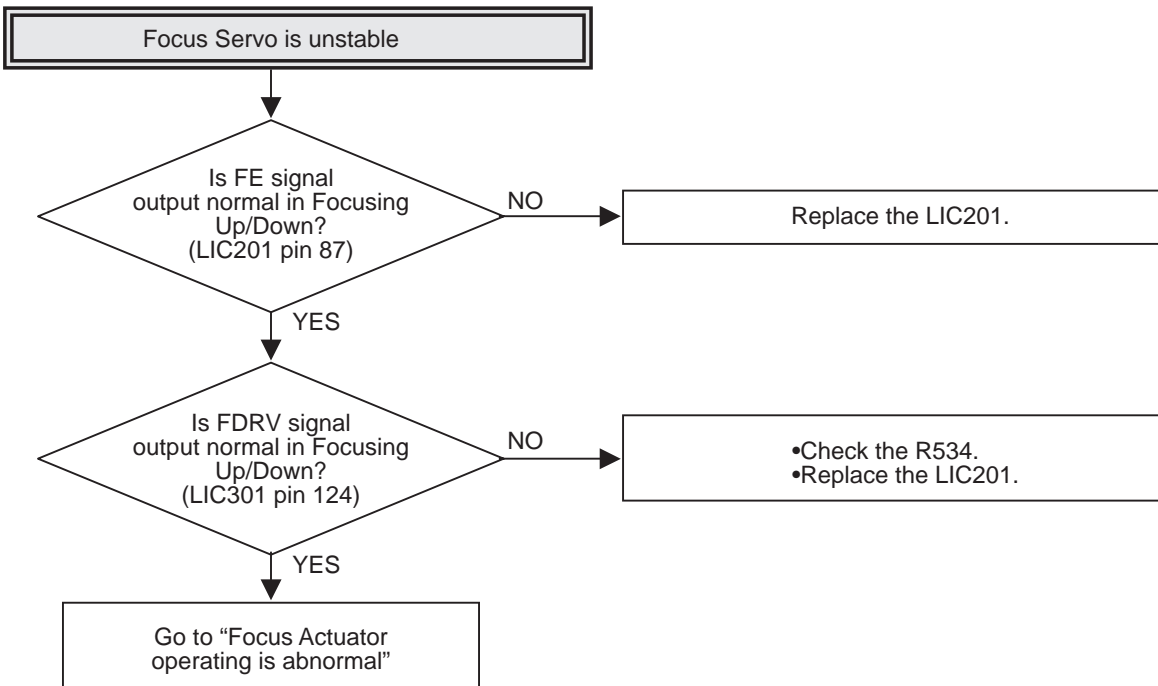


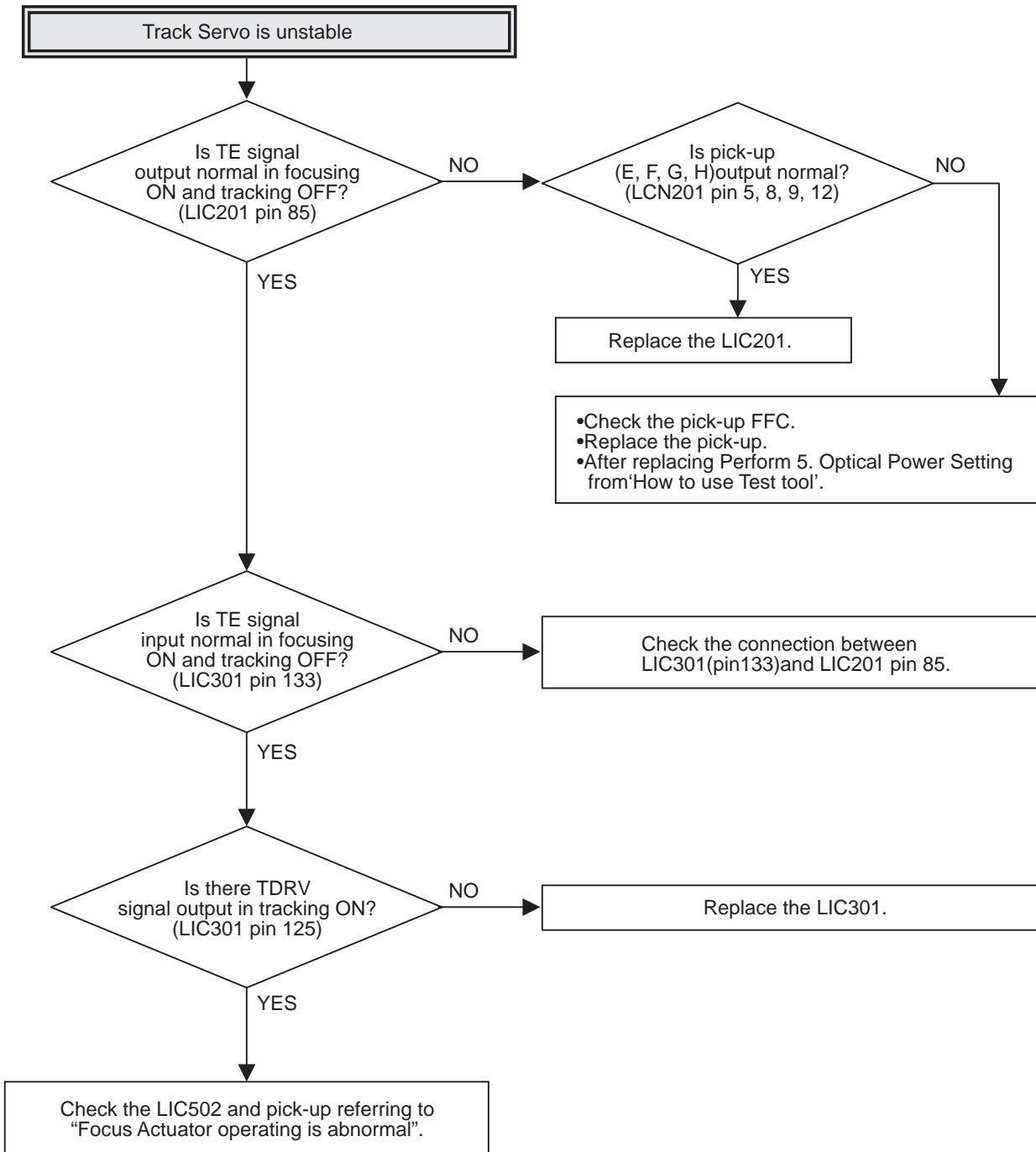


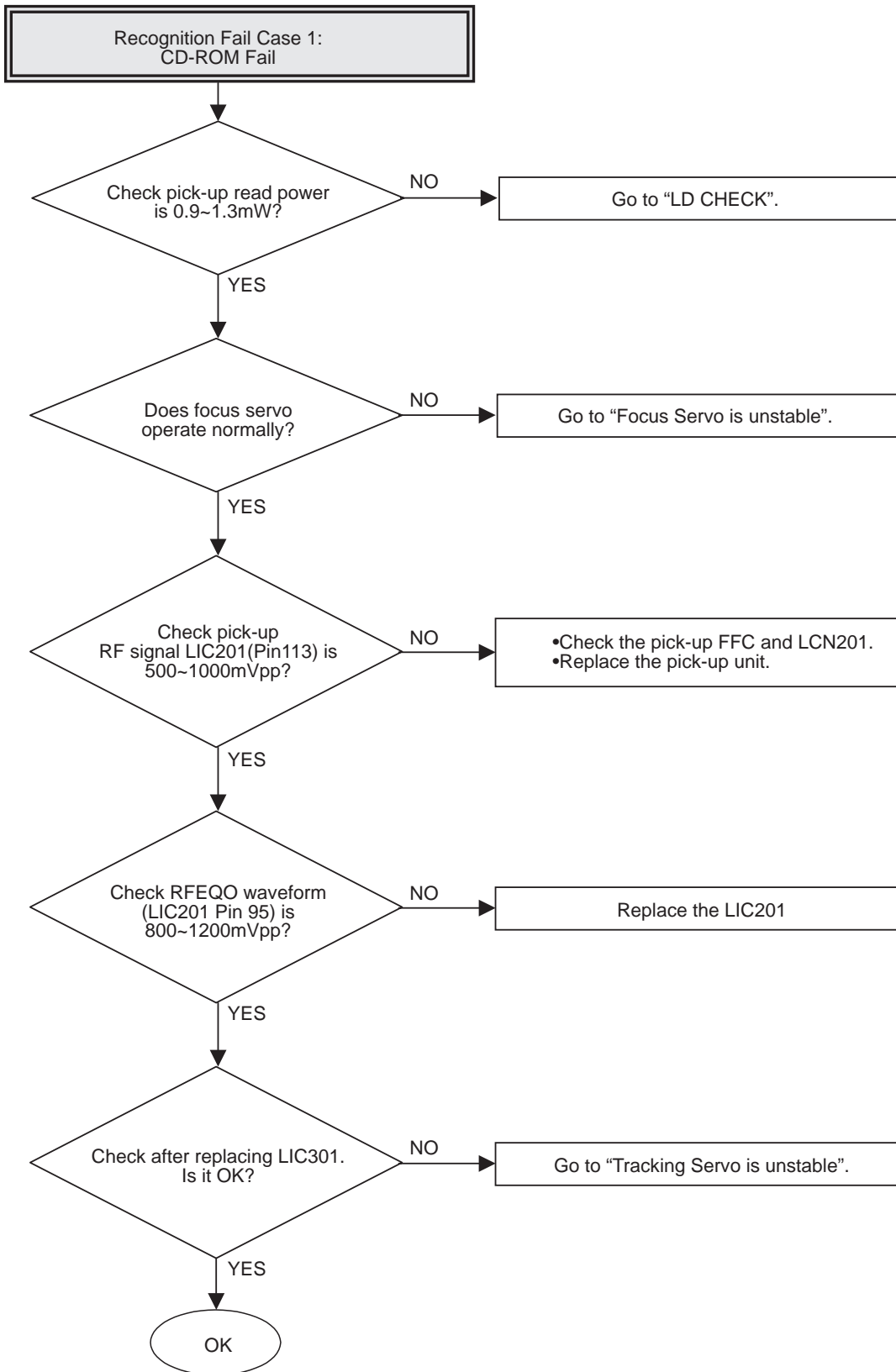




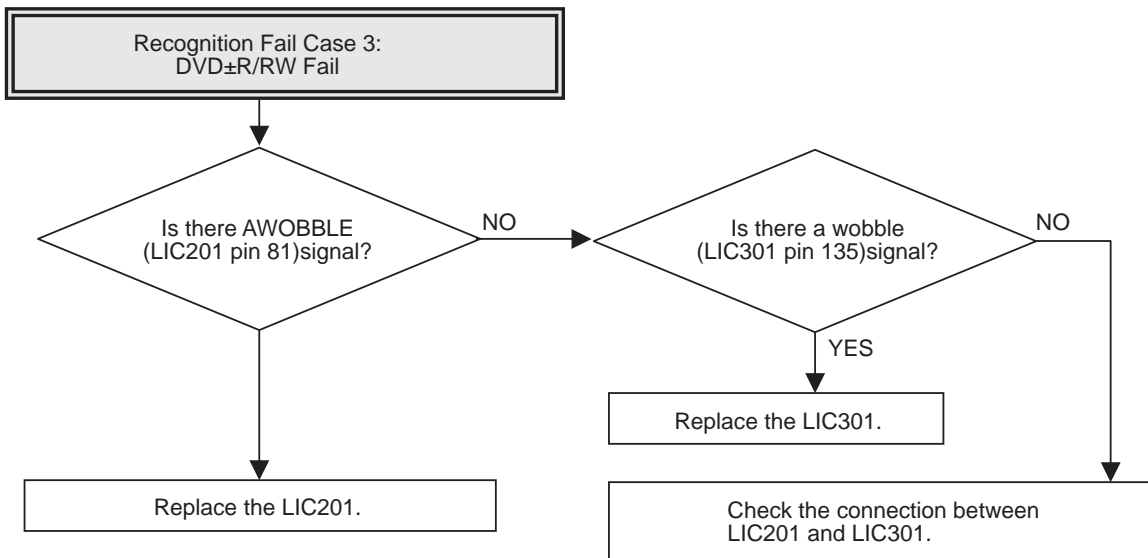
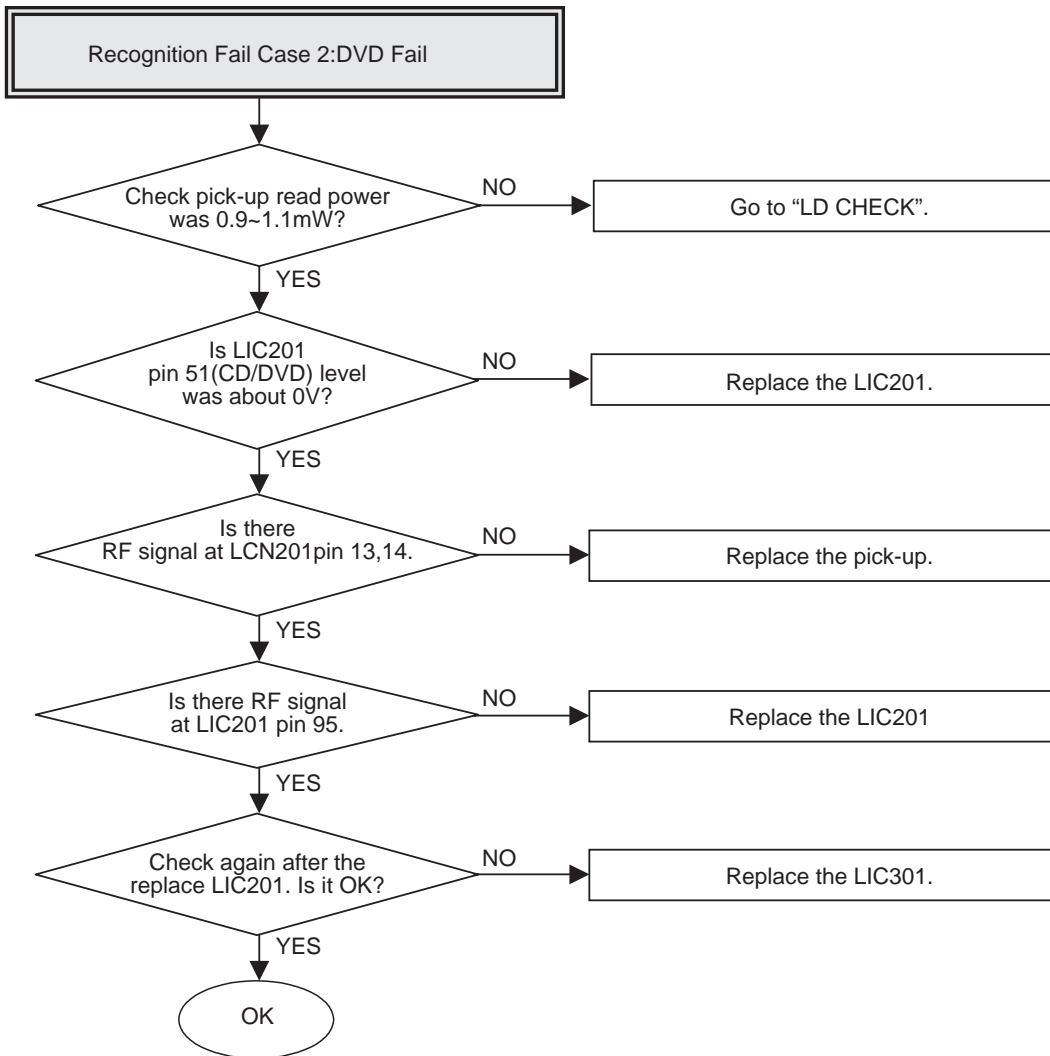


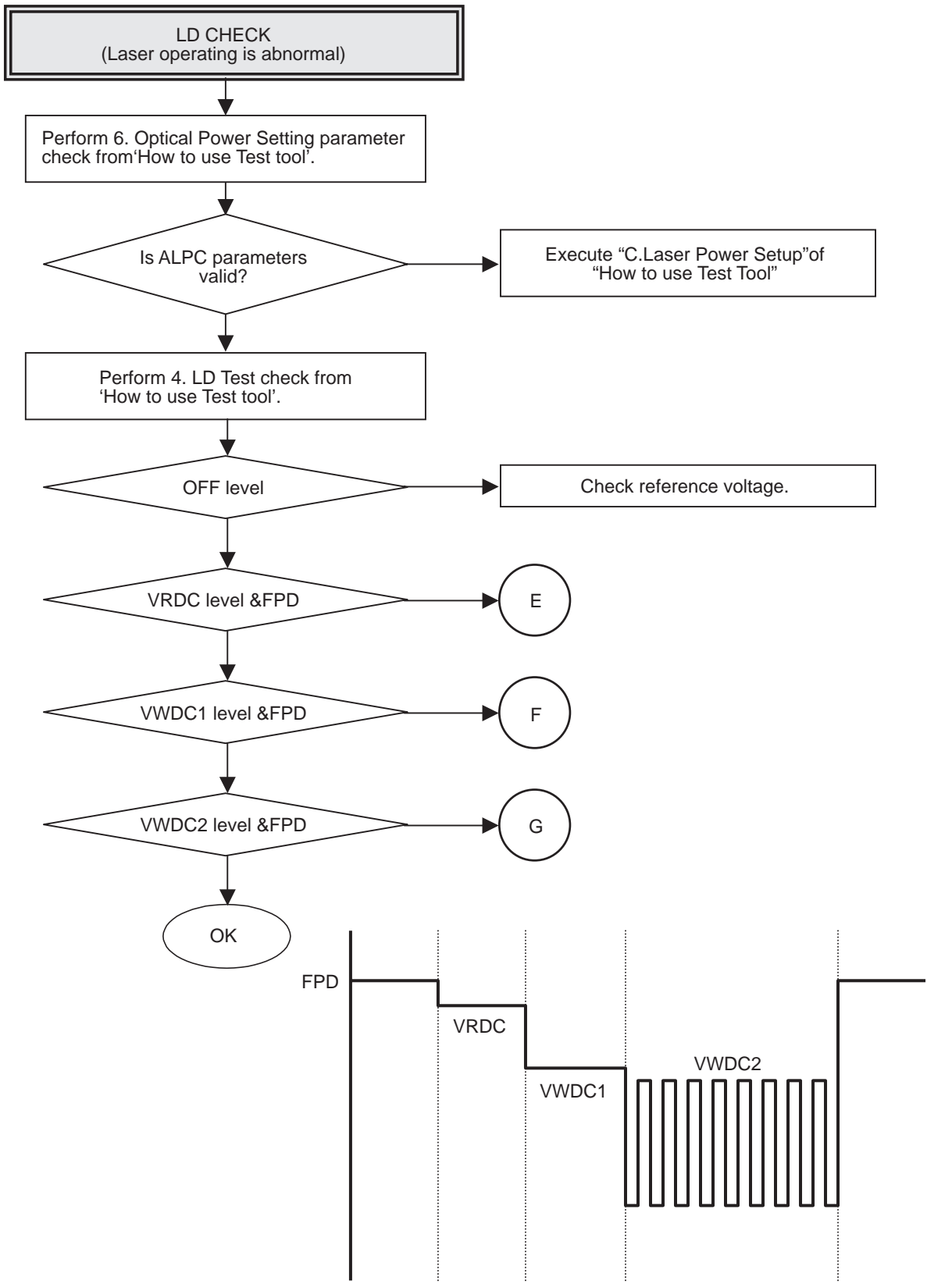


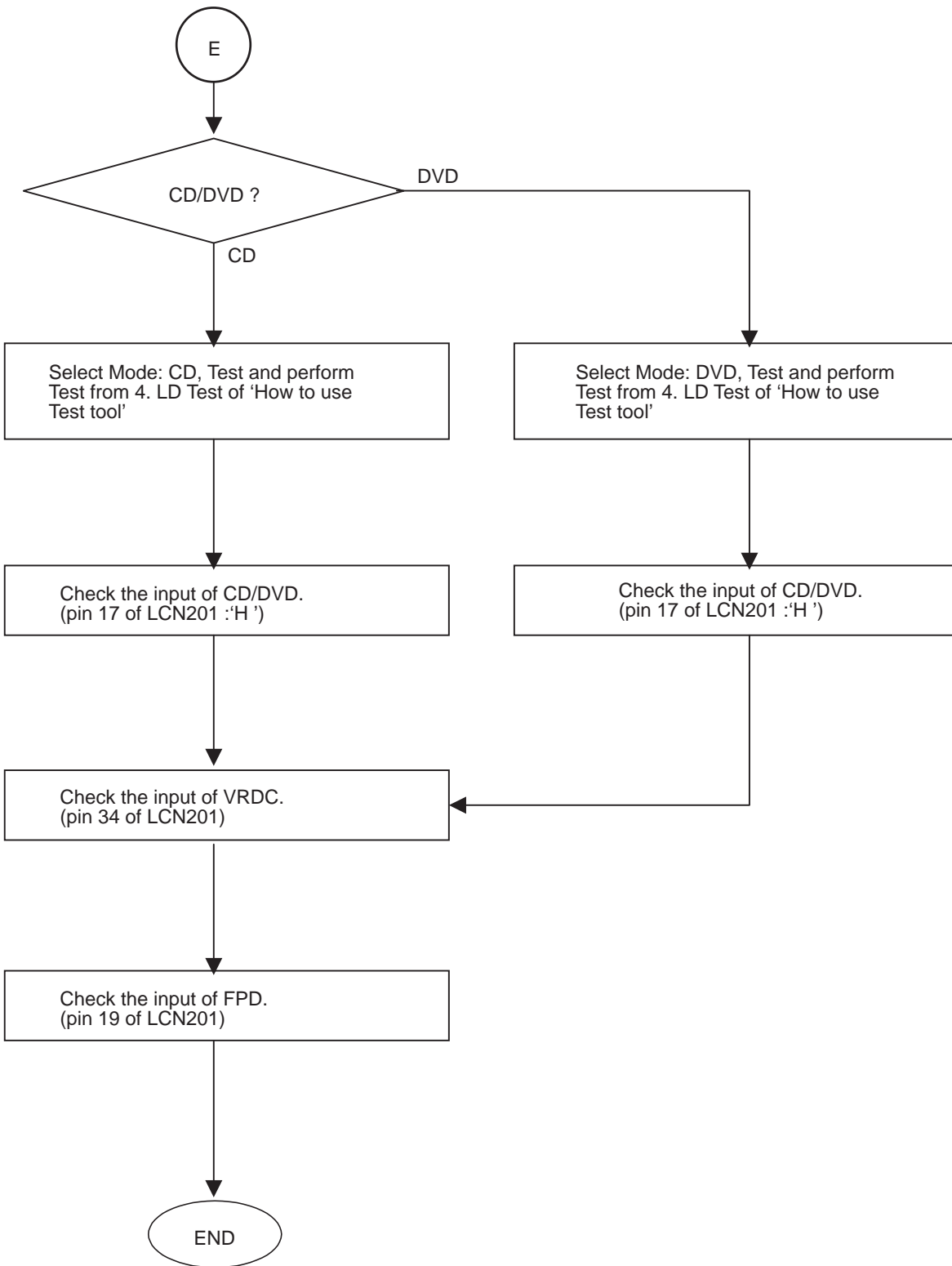


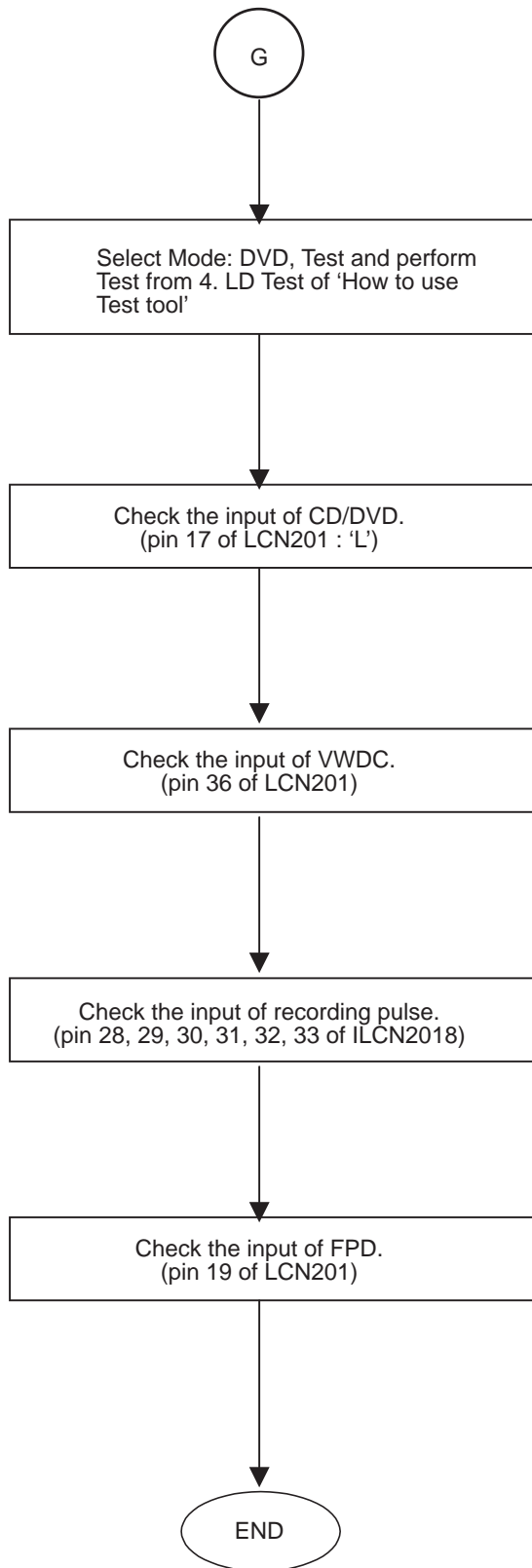
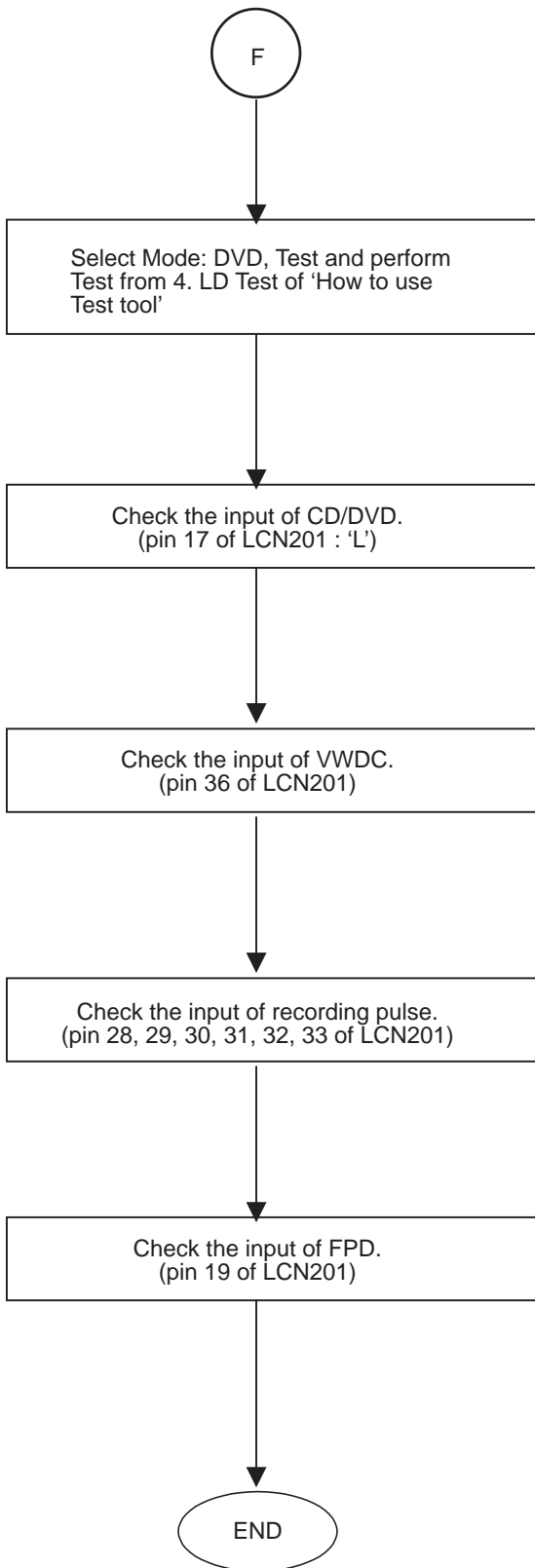


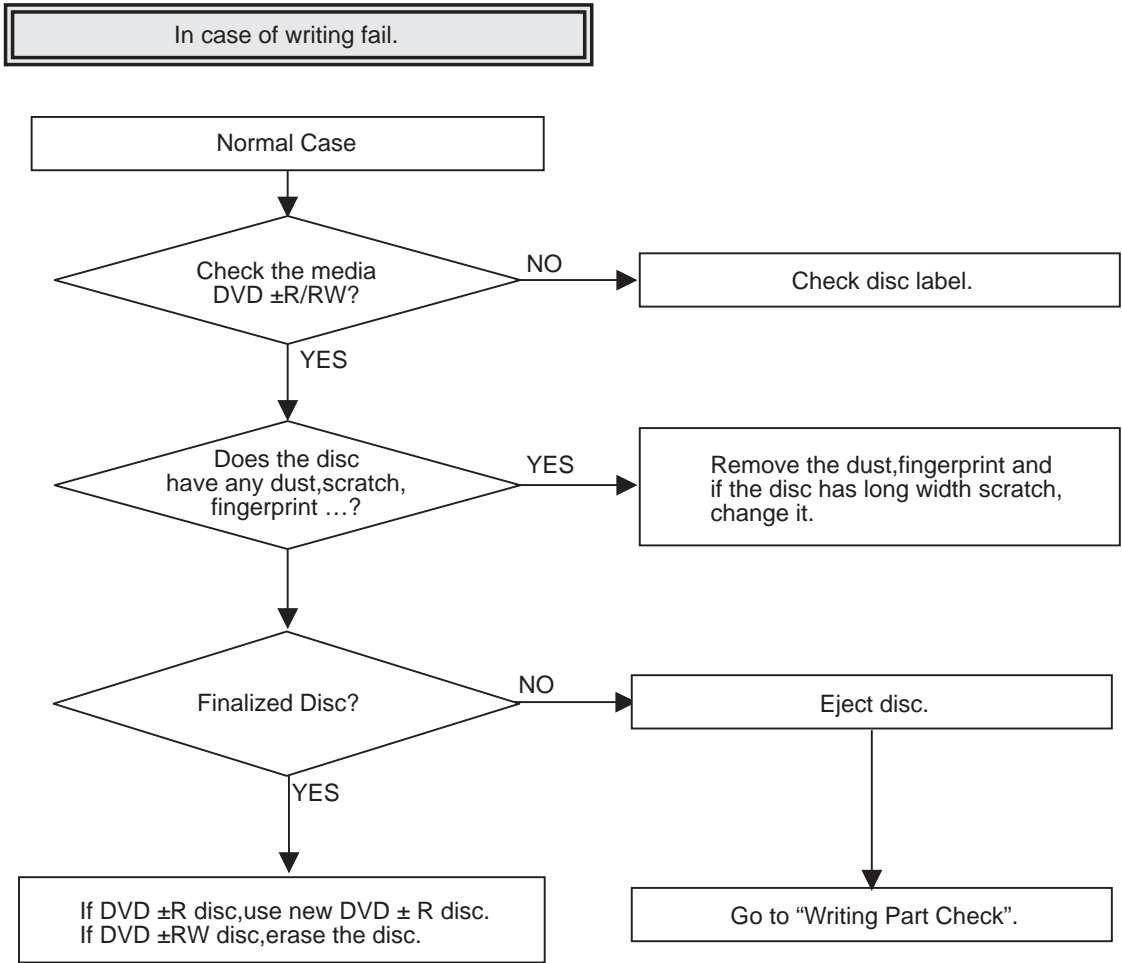


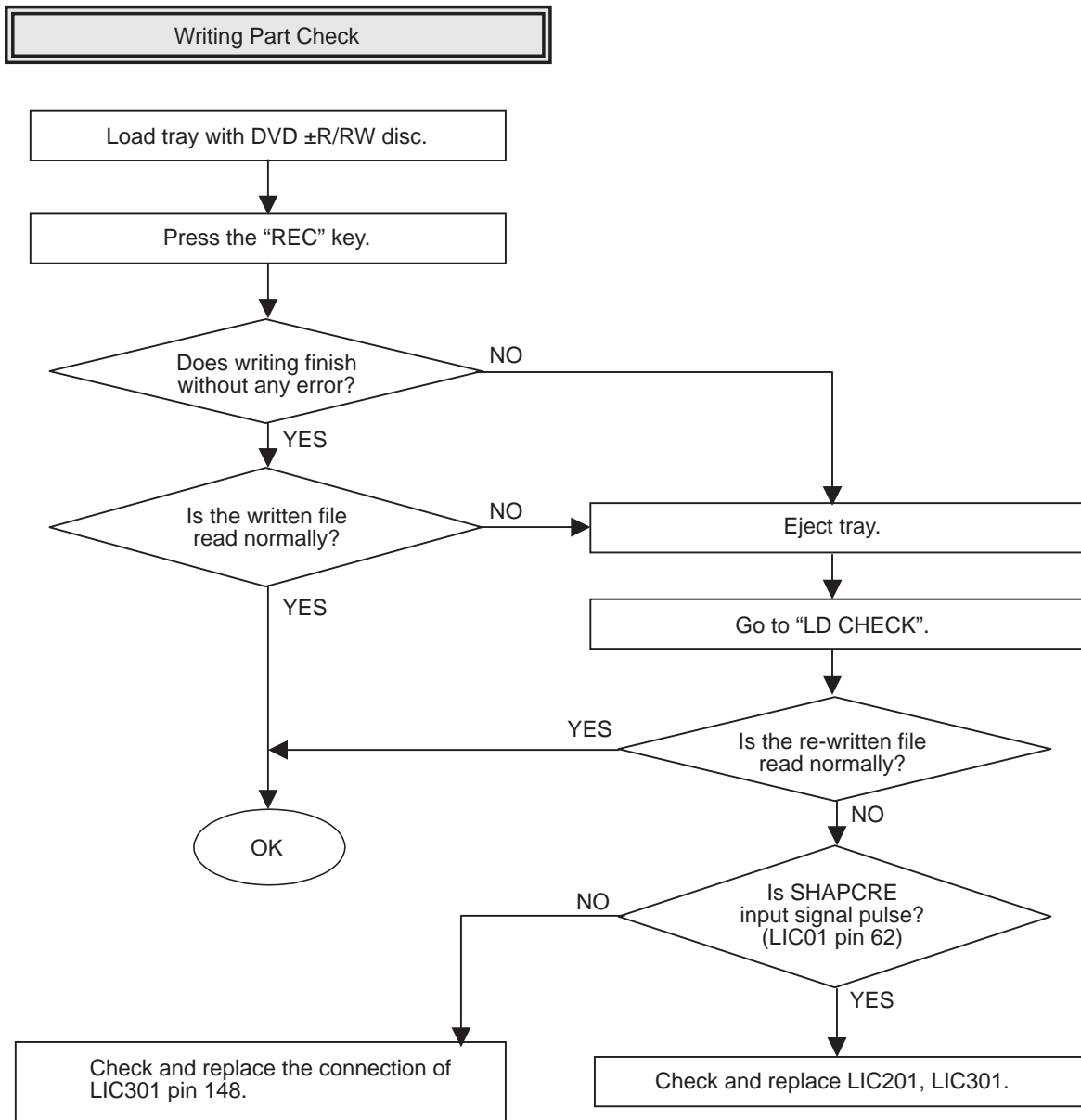






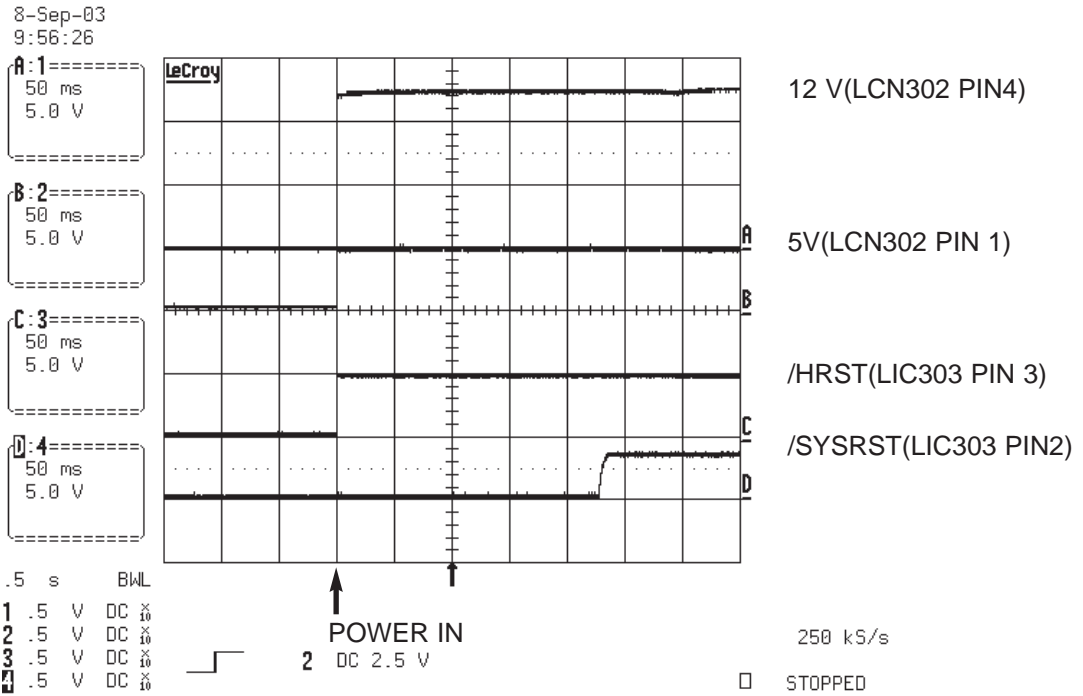




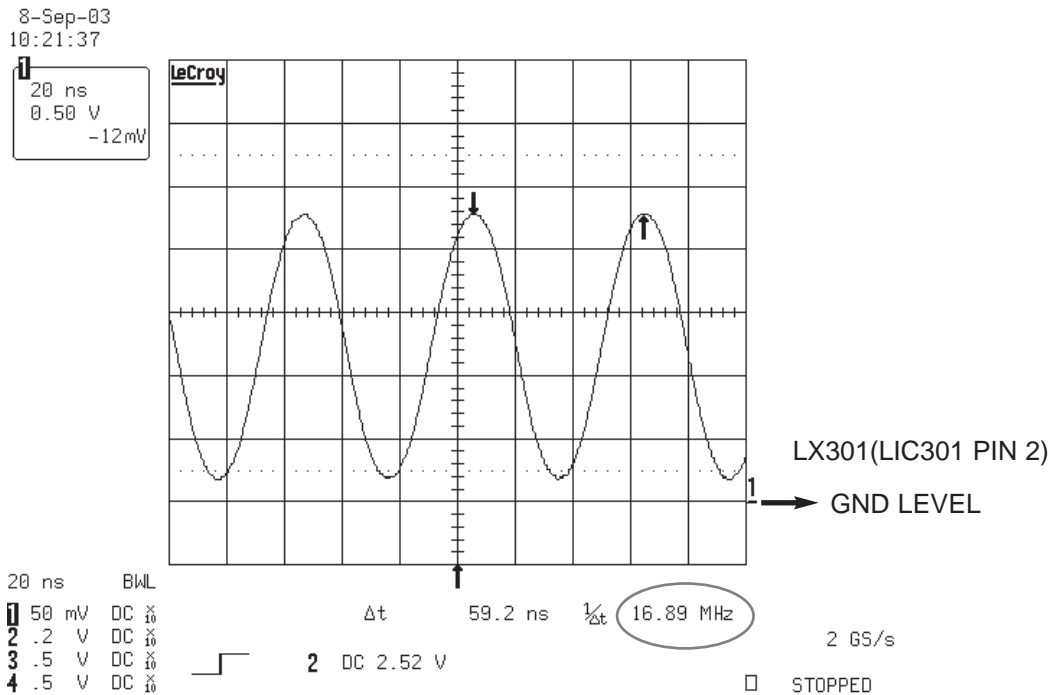


# WAVEFORMS

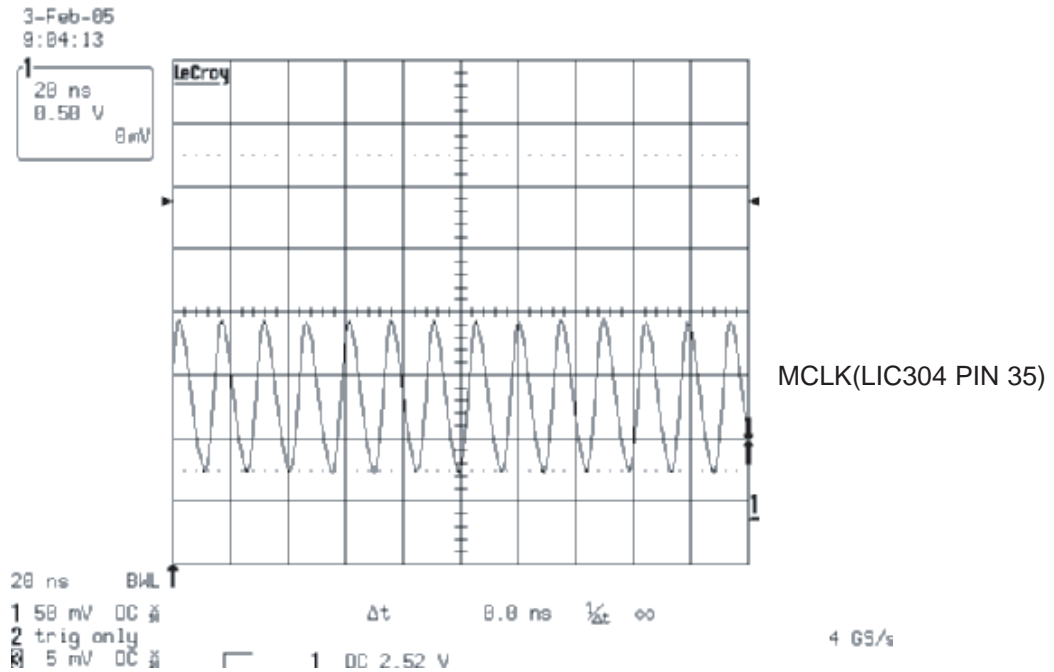
## 1. POWER & RESET Signal



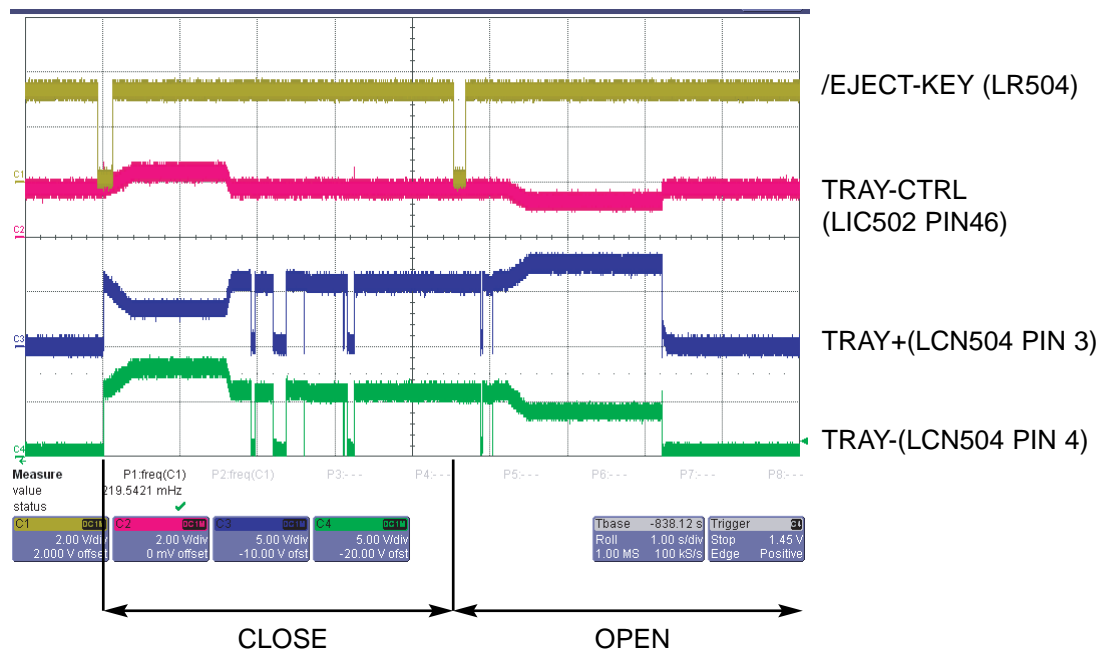
## 2. Main Clock1 for IC202 (16.9MHz)



### 3. SDRAM Clock

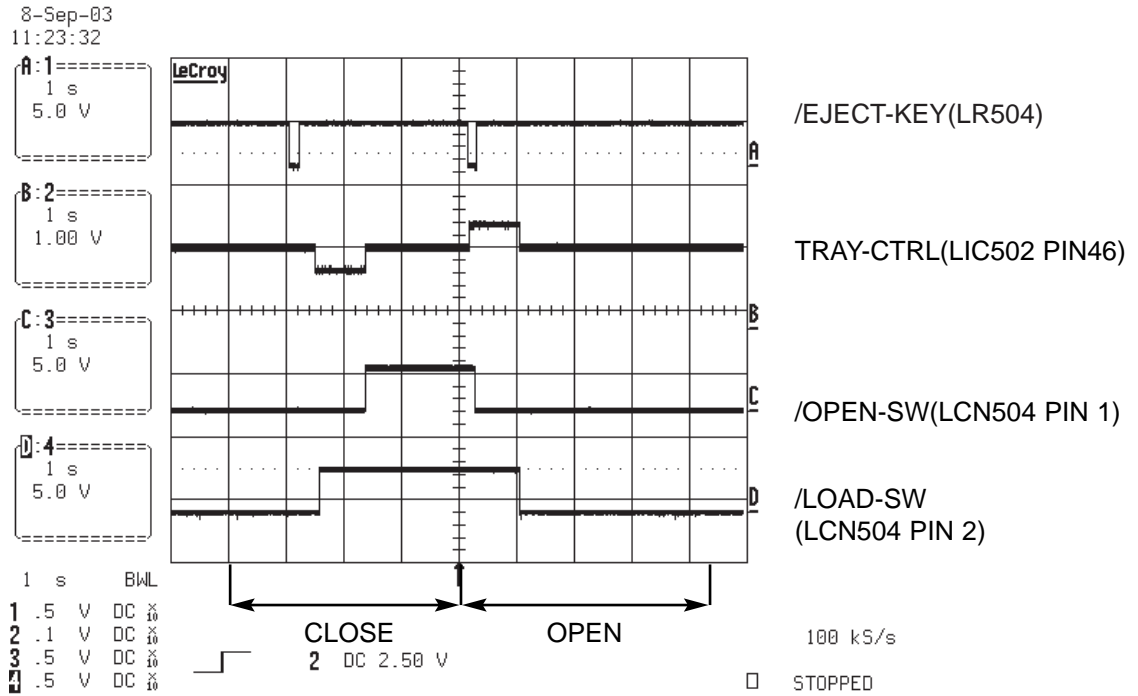


### 4. TRAY OPEN/CLOSE SIGNAL 1

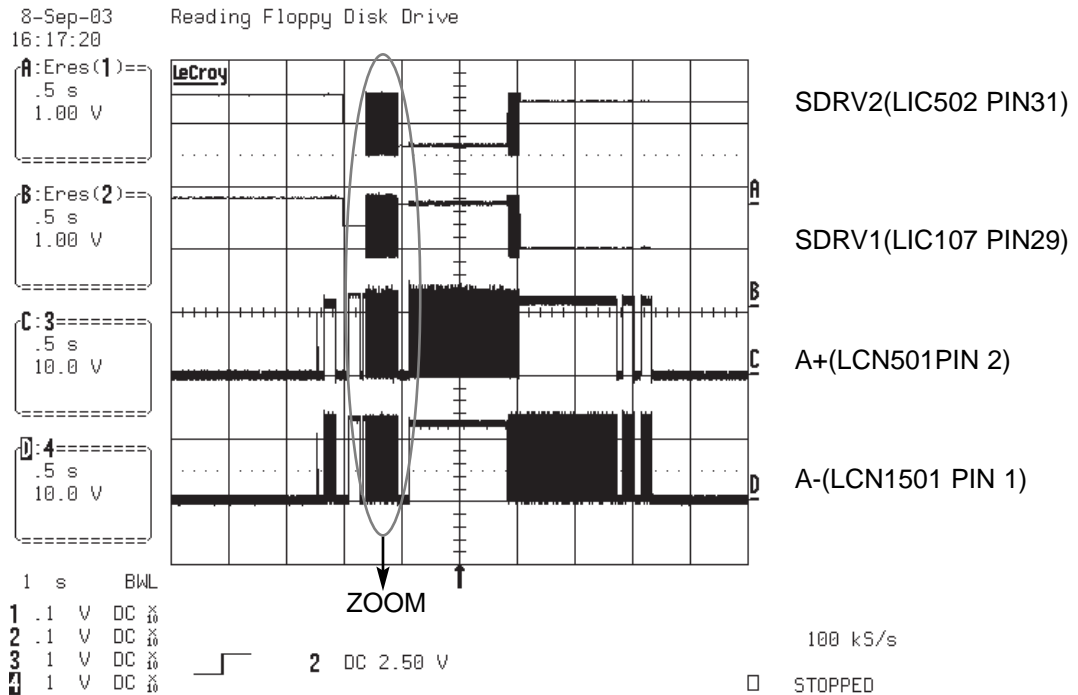




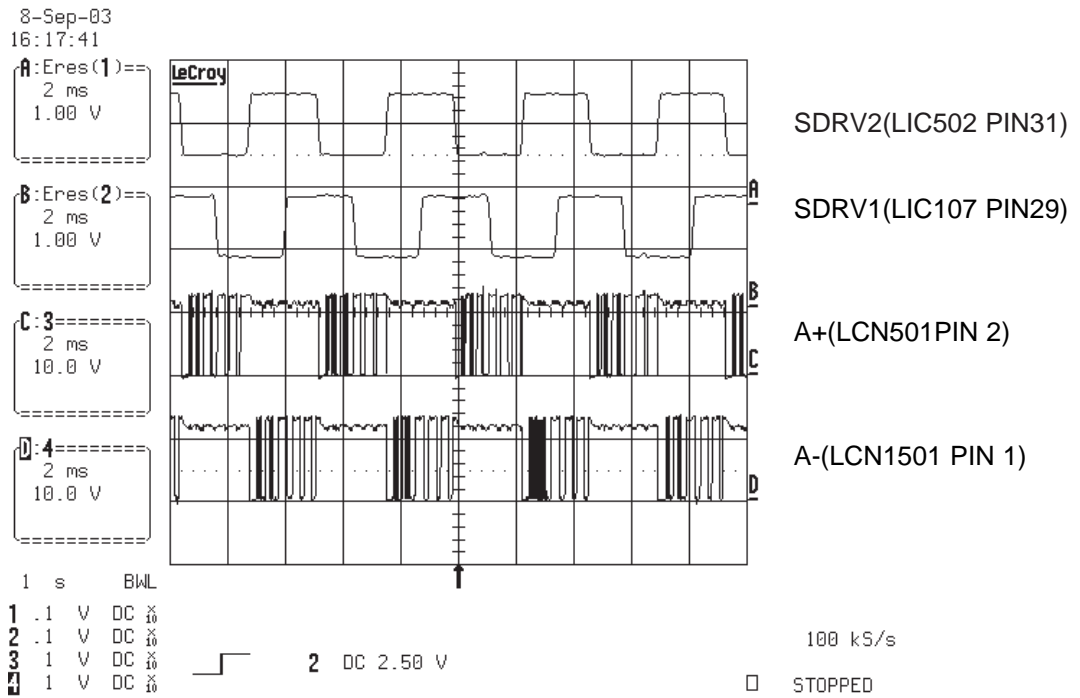
## 5. TRAY OPEN/CLOSE SIGNAL 2



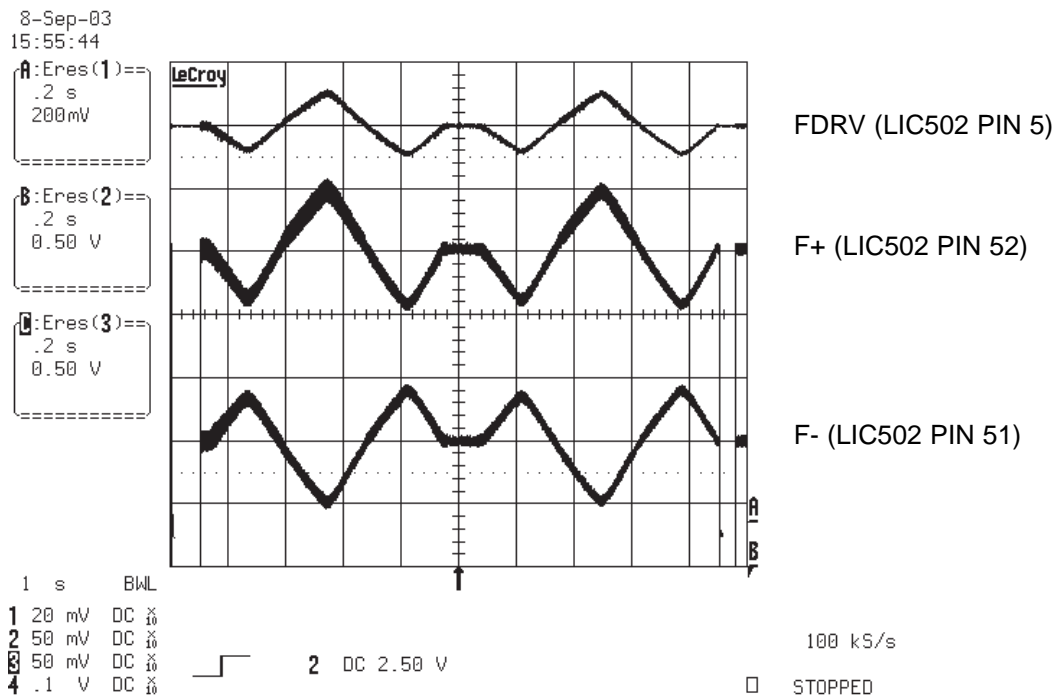
## 6. SLED MOVE SIGNAL 1



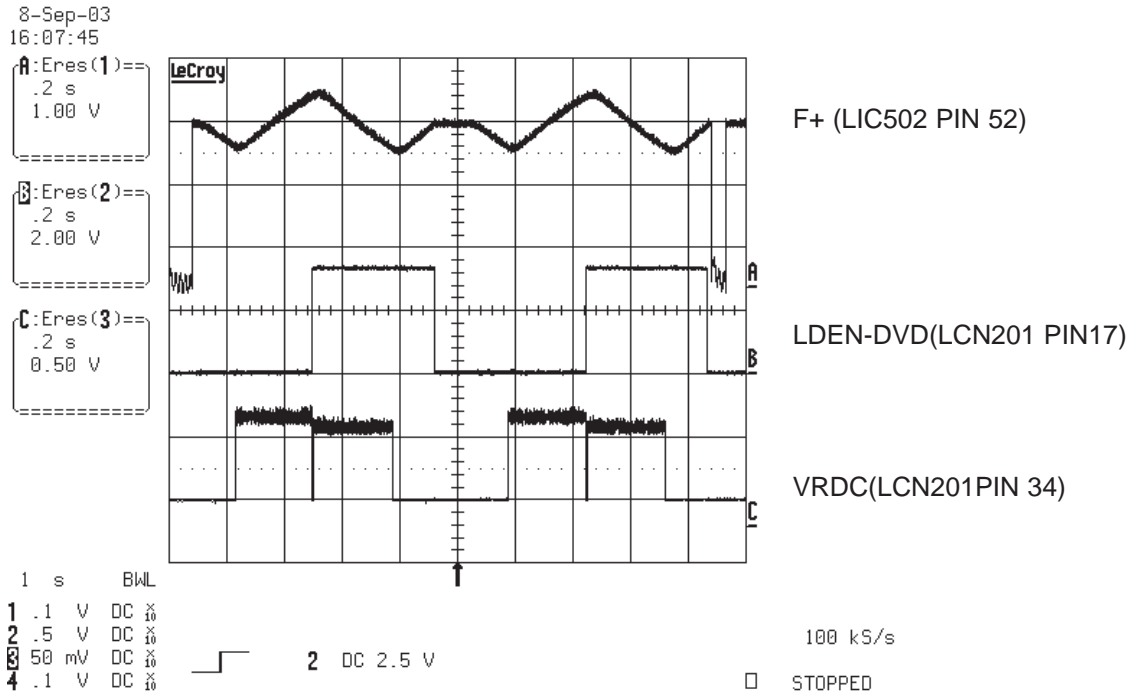
## 7. SLED MOVE SIGNAL 2



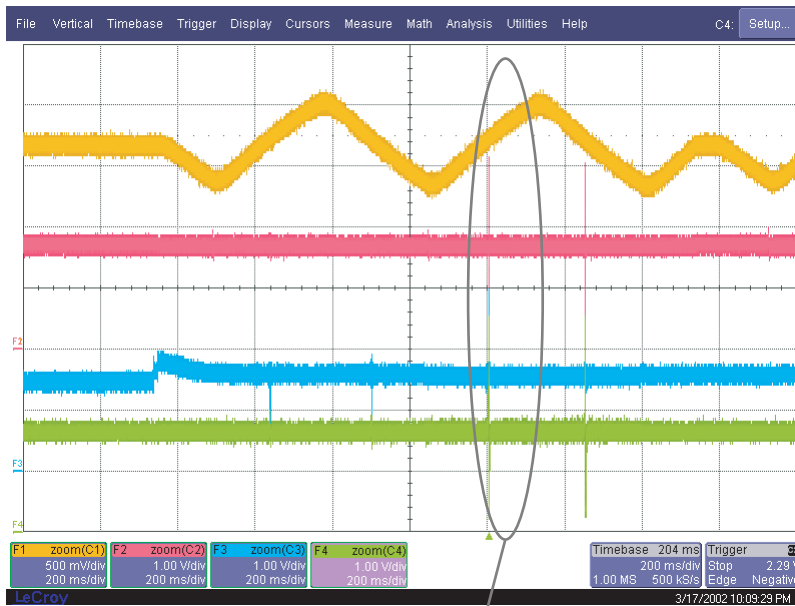
## 8. FOCUS SEARCH SIGNAL



# 9. LASER TURN ON SIGNAL



## 10. DISC TYPE JUDGEMENT WAVEFORM (CD SERIES)



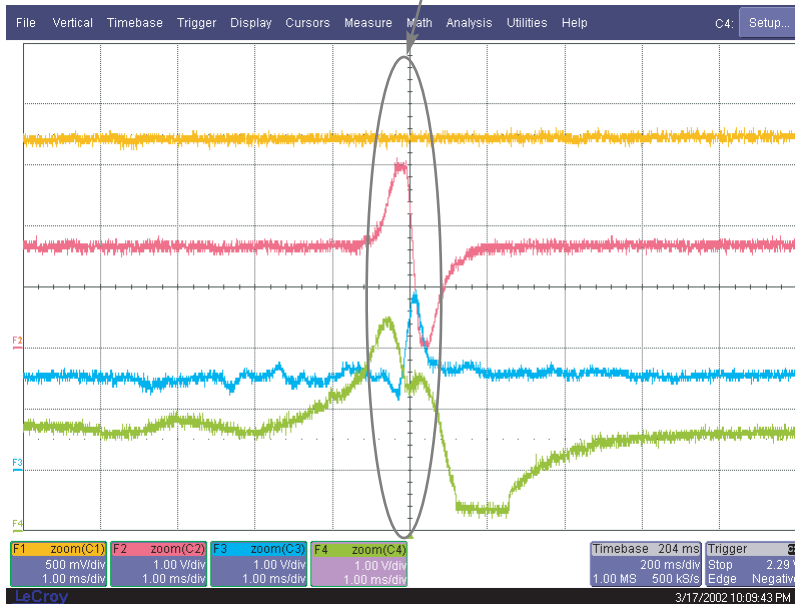
FDRV(LIC502 PIN 5)

FE(LIC201 PIN87)

TE(LIC201 PIN85)

RF(LIC201PIN 113)

## 11. DISC TYPE JUDGEMENT WAVEFORM (CD&CD-R)



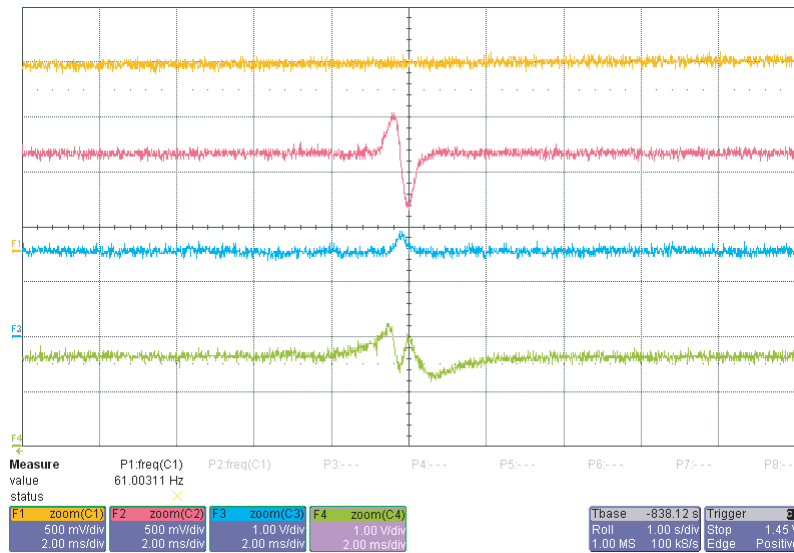
FDRV(LIC502 PIN 5)

FE(LIC201 PIN87)

TE(LIC201 PIN85)

RF(LIC201PIN 113)

## 12. DISC TYPE JUDGEMENT WAVEFORM (CD-RW)



FDRV(LIC502 PIN 5)

FE(LIC201 PIN87)

TE(LIC201 PIN85)

RF(LIC201PIN 113)

## 13. DISC TYPE JUDGEMENT WAVEFORM (DVD SERIES)



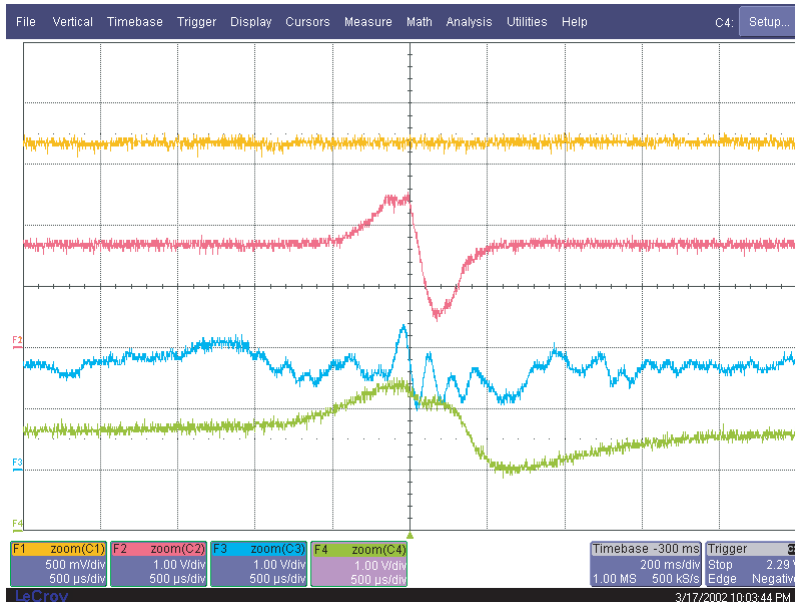
FDRV(LIC502 PIN 5)

FE(LIC201 PIN87)

TE(LIC201 PIN85)

RF(LIC201PIN 113)

## 14. DISC TYPE JUDGEMENT WAVEFORM (DVD\_SINGLE&R)



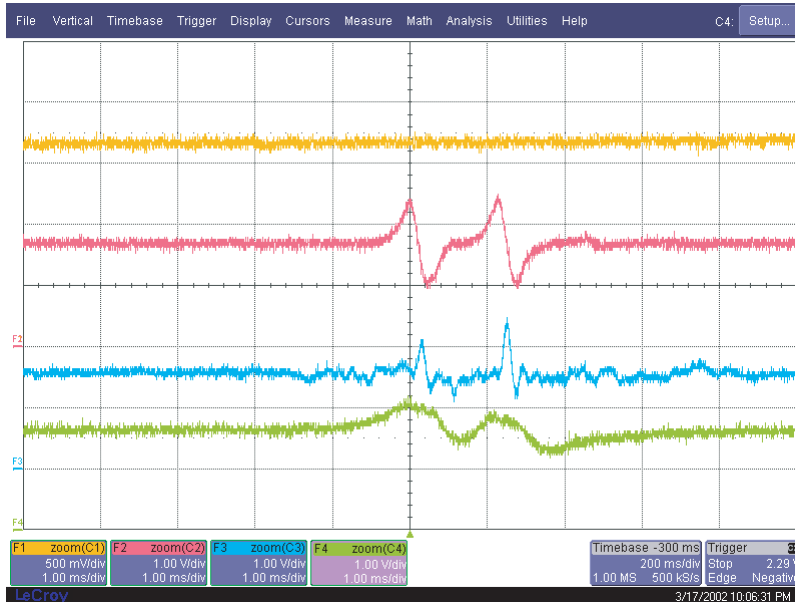
FDRV(LIC502 PIN 5)

FE(LIC201 PIN87)

TE(LIC201 PIN85)

RF(LIC201PIN 113)

## 15. DISC TYPE JUDGEMENT WAVEFORM (DVD\_DUAL)



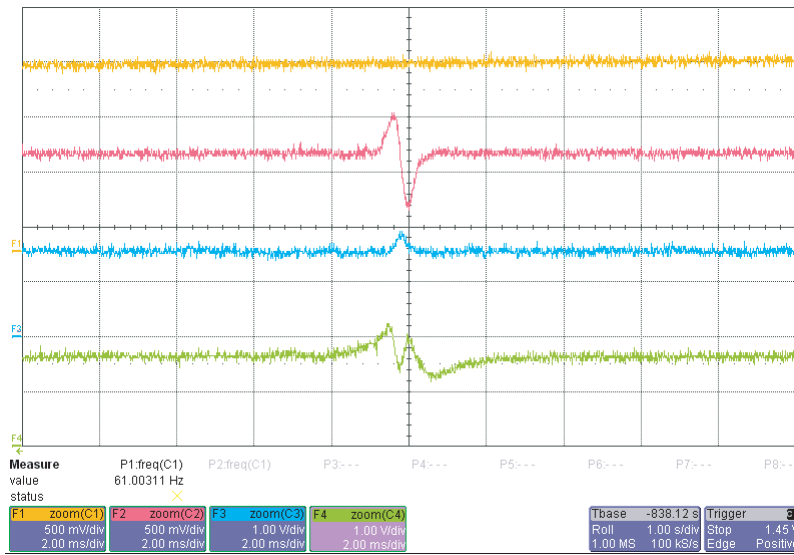
FDRV(LIC502 PIN 5)

FE(LIC201 PIN87)

TE(LIC201 PIN85)

RF(LIC201PIN 113)

## 16. DISC TYPE JUDGEMENT WAVEFORM (DVDRW)



FDRV(LIC502 PIN 5)

FE(LIC201 PIN87)

TE(LIC201 PIN85)

RF(LIC201PIN 113)

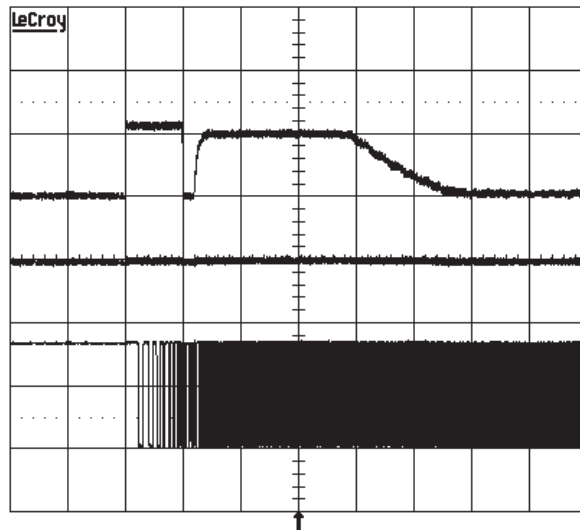
## 17. SPINDLE WAVEFORM1

8-Sep-03  
16:58:06

A: Eres(1) ==  
.2 s  
1.00 V

B: Eres(2) ==  
.2 s  
1.00 V

C: Eres(3) ==  
.2 s  
2.00 V



MDRV (LIC502 PIN 26)

REFOUT (LIC502 PIN 42)

SFG((LIC502 PIN43)

1 s BWL

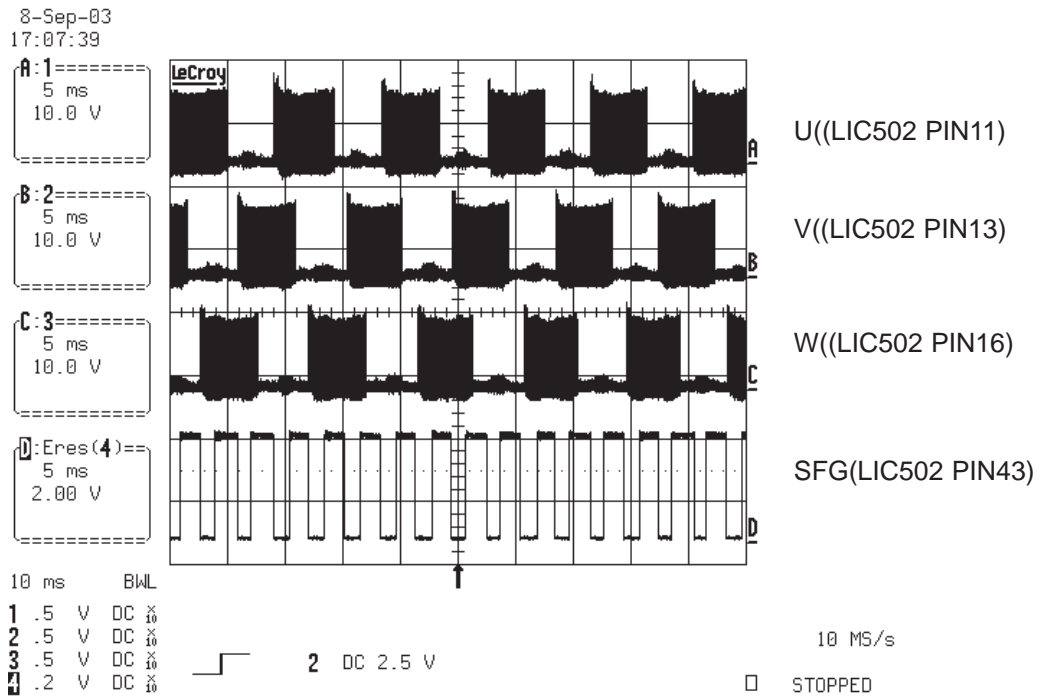
1 .1 V DC  $\frac{\infty}{10}$   
2 .1 V DC  $\frac{\infty}{10}$   
3 .2 V DC  $\frac{\infty}{10}$   
4 .5 V DC  $\frac{\infty}{10}$

2 DC 2.50 V

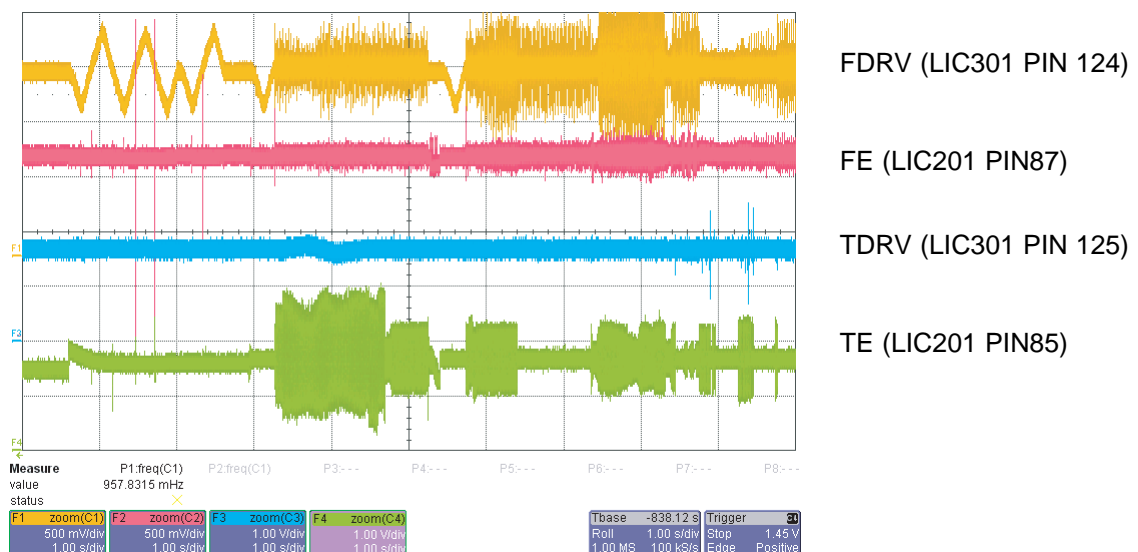
100 kS/s

STOPPED

## 18. SPINDLE WAVEFORM2

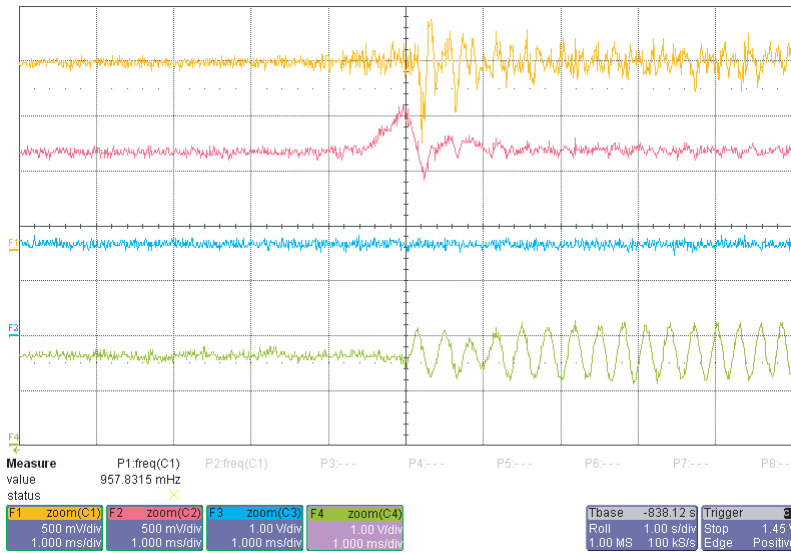


## 19. FOCUS ON SIGNAL(CD)





## 20. FOCUS ON SIGNAL(CD)



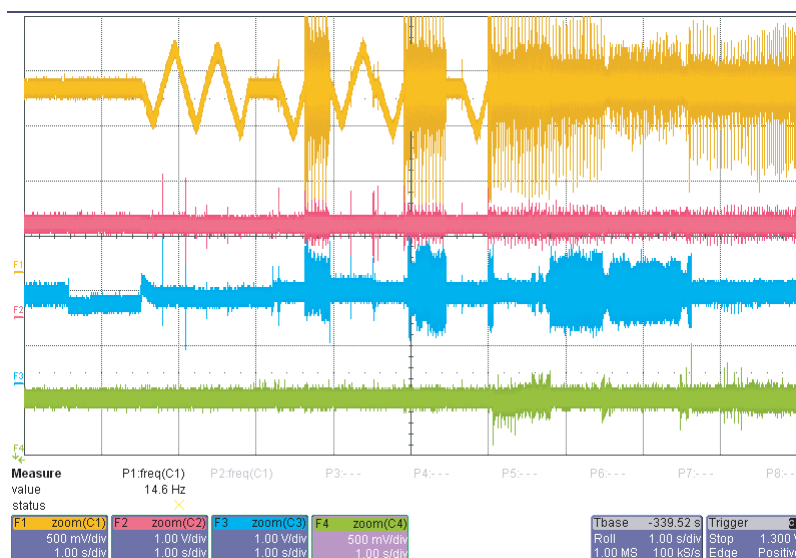
FDRV (LIC301 PIN 124)

FE (LIC201 PIN87)

TDRV (LIC301 PIN 125)

TE (LIC201 PIN85)

## 21. FOCUS ON SIGNAL(DVD)



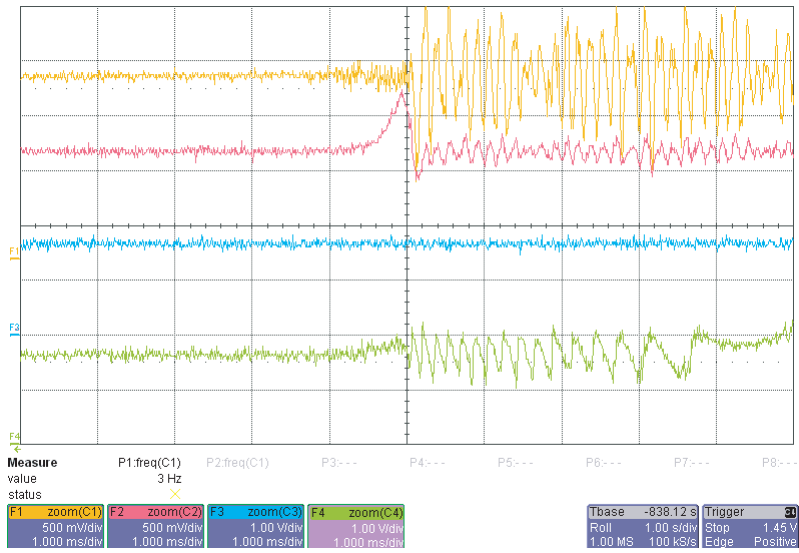
FDRV (LIC301 PIN 124)

FE (LIC201 PIN87)

TDRV (LIC301 PIN 125)

TE (LIC201 PIN85)

## 22. FOCUS ON SIGNAL (DVD)



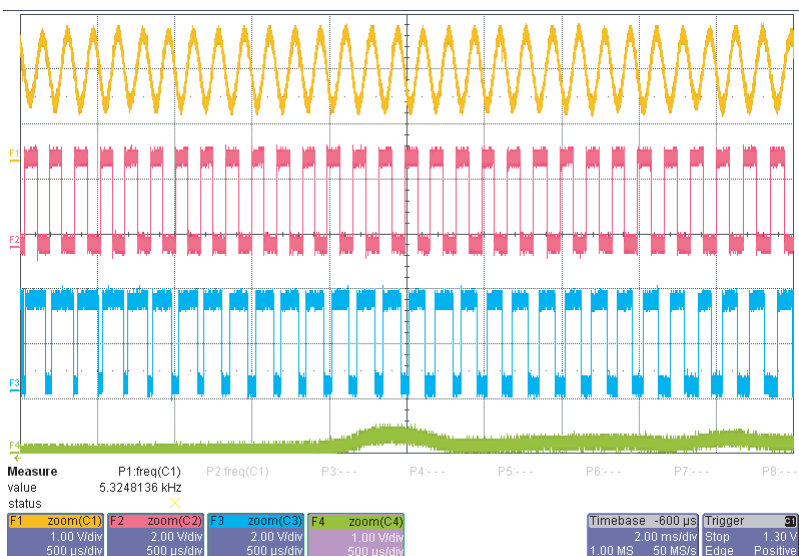
FDRV (LIC301 PIN 124)

FE (LIC201 PIN87)

TDRV (LIC301 PIN 125)

TE (LIC201 PIN85)

## 23. TRACK OFF SIGNAL(CD)

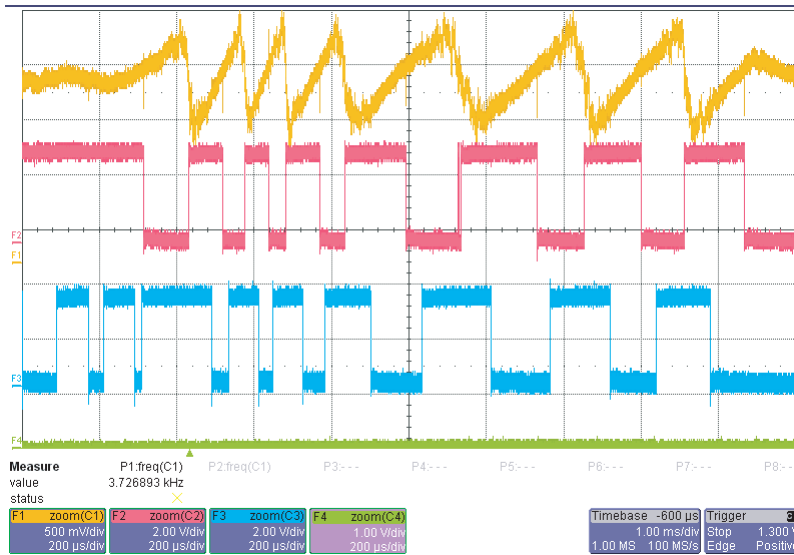


TE (LIC106 PIN85)

TZC(LIC106 PIN74)

MIRRBCA(LIC106 PIN77)

## 24. TRACK OFF SIGNAL(DVD)

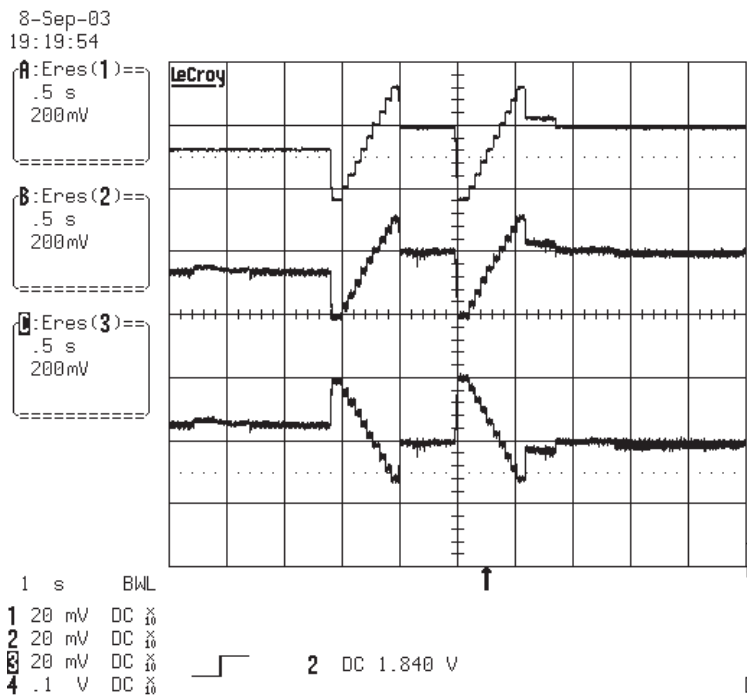


TE (LIC106 PIN85)

TZC(LIC106 PIN74)

MIRRBCA(LIC106 PIN77)

## 25. Tilt Driver signal(Disc reading)

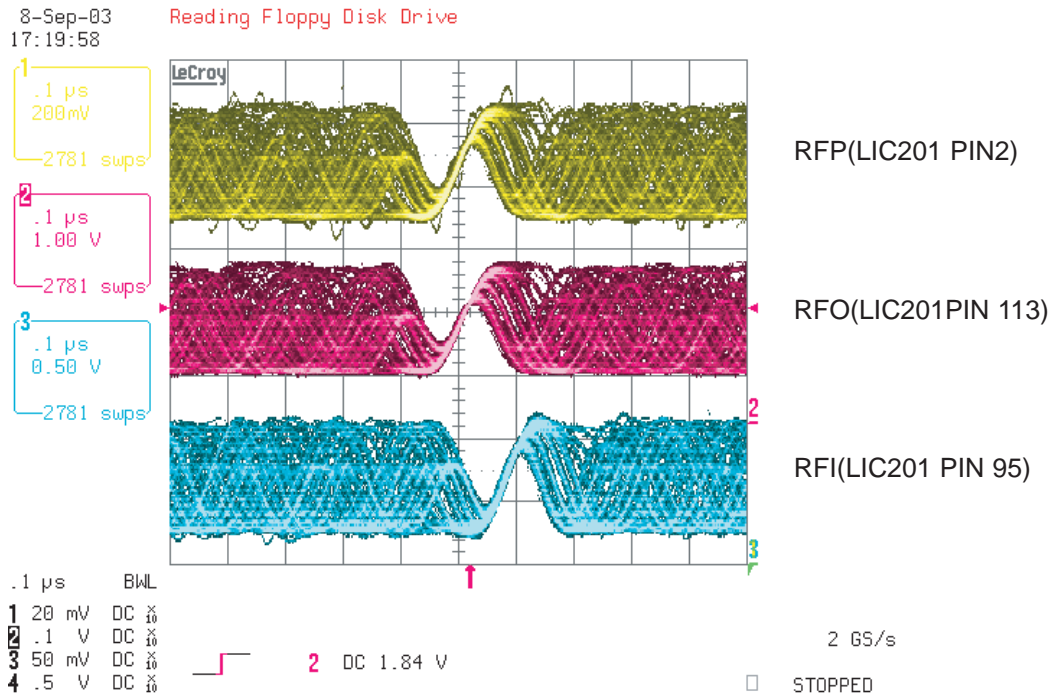


TILTDRV(LIC502 PIN47)

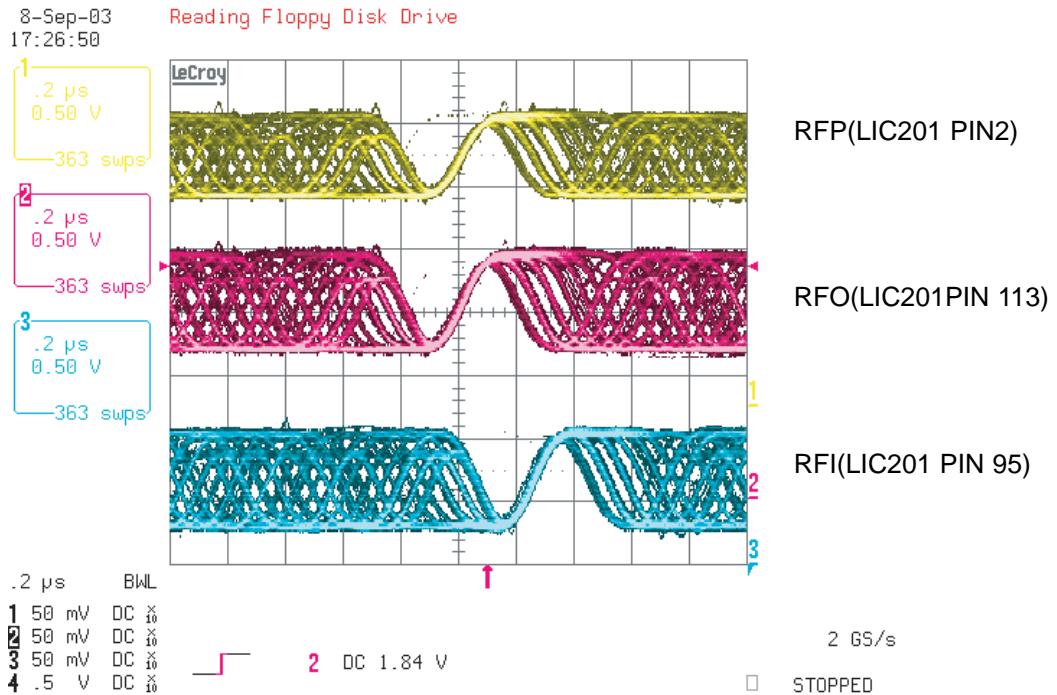
TILT+(LIC502 PIN50)

TILT-(LIC502 PIN49)

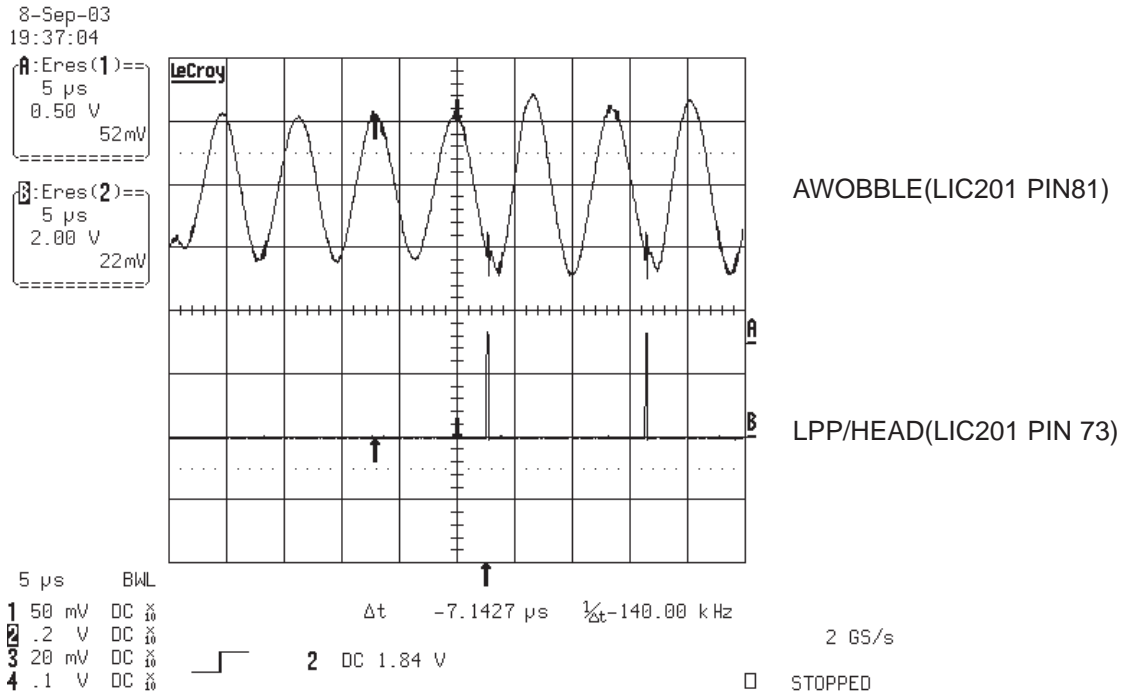
## 26. RF WAVEFORM(DVD)



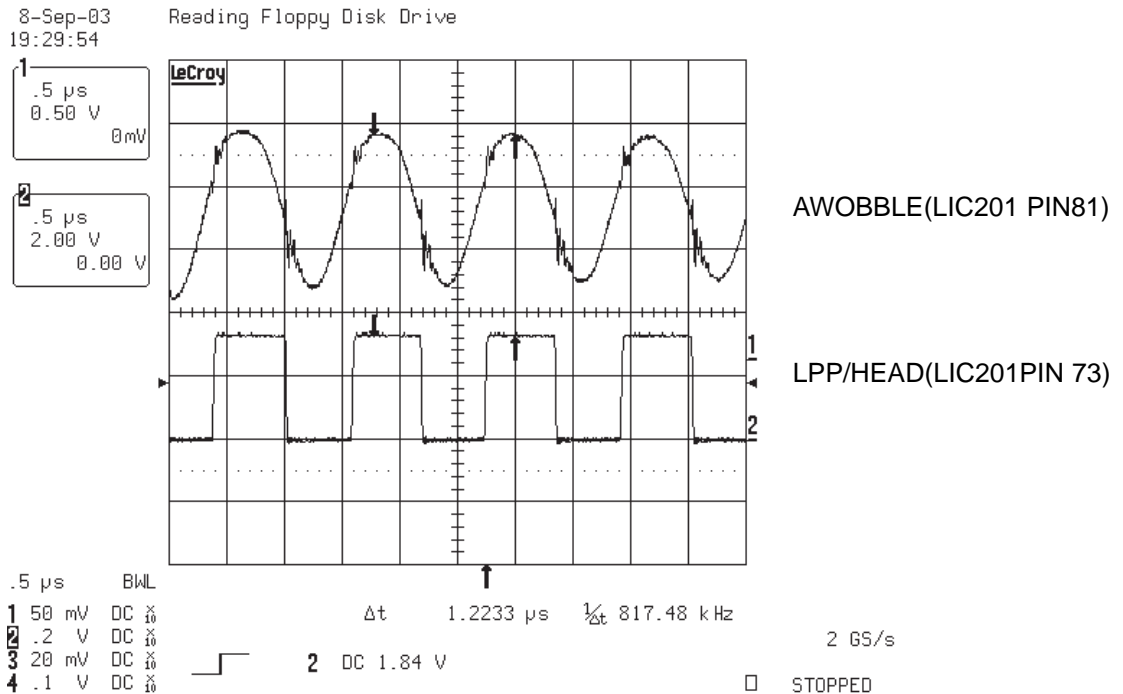
## 27. RF WAVEFORM(CD)



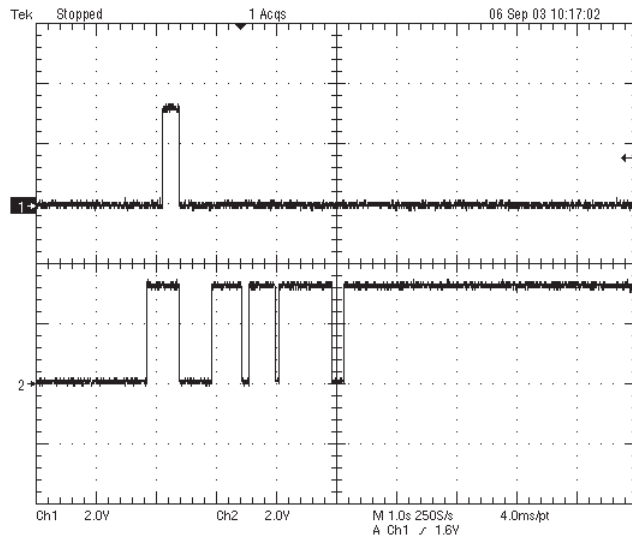
## 28. WOBBLE(DVD-R/RW)\_READING



## 29. WOBBLE(DVD+R/RW)\_READING& WRITING => X1 SPEED



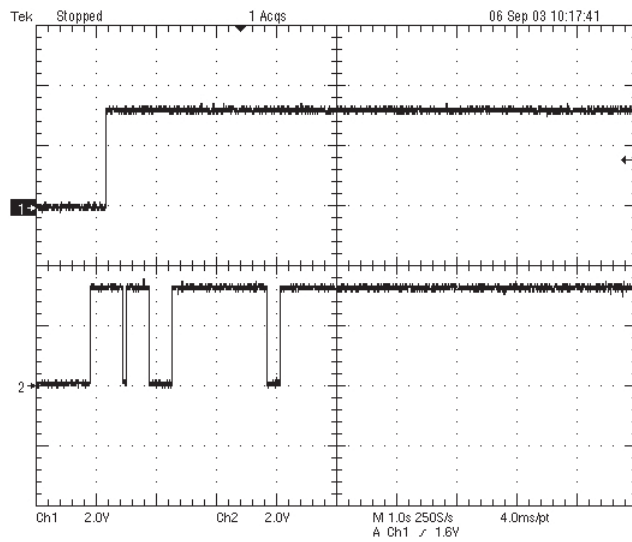
### 30. LD Enable(DVD)



CD/DVD(LCN201 PIN 17)

LDEN(LCN PIN 38)

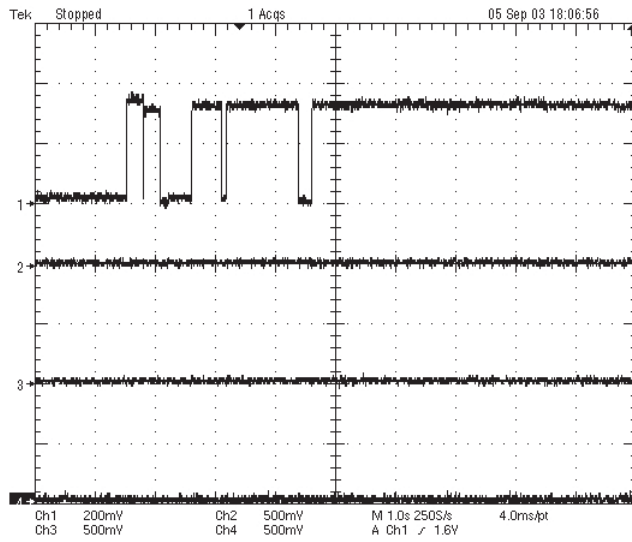
### 31. LD Enable(CD)



CD/DVD(LCN201 PIN 17)

LDEN(LCN102 PIN 38)

### 32. Laser Power(reading) \_ DVD+RW



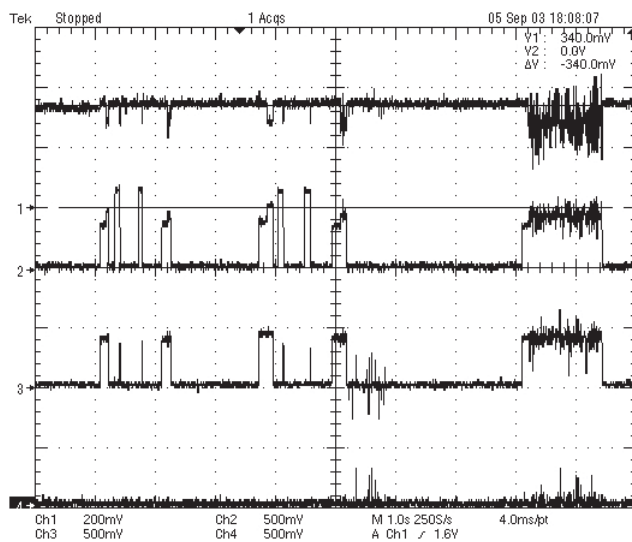
VRDC(LCN201 PIN 34)

VWDC(LCN201 PIN 36)

VWDC2(LCN201 PIN 35)

OPCTRG(LIC301 PIN 151)

### 33. Laser Power(Erase) \_ DVD+RW



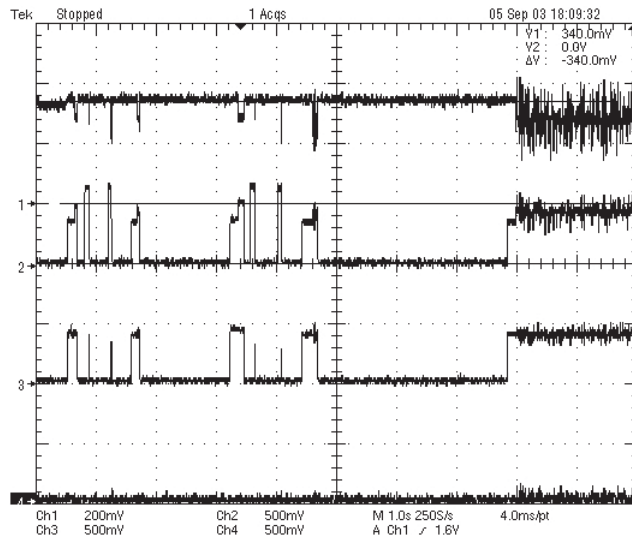
VRDC(LCN201 PIN 34)

VWDC(LCN201 PIN 36)

VWDC2(LCN201 PIN 35)

OPCTRG(LIC301 PIN 151)

### 34. Laser Power(Writing) \_ initial state



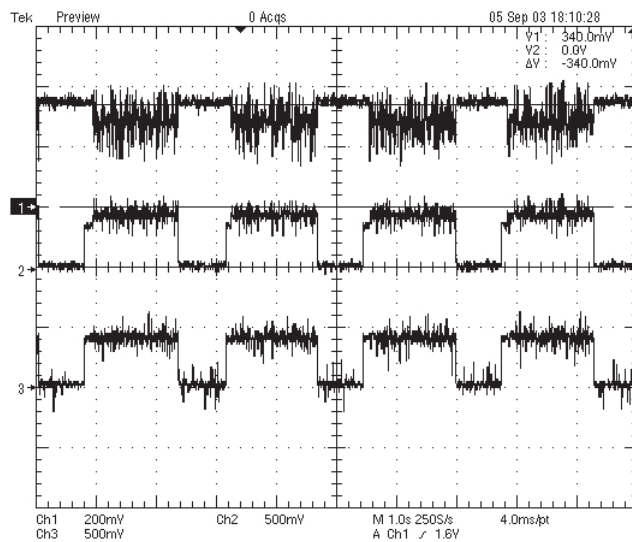
VRDC(LCN201 PIN 34)

VWDC(LCN201 PIN 36)

VWDC2(LCN102 PIN 35)

OPCTRG(LIC301 PIN 151)

### 35.Laser Power(Writing)\_Processing



VRDC(LCN201 PIN 34)

VWDC(LCN201 PIN 36)

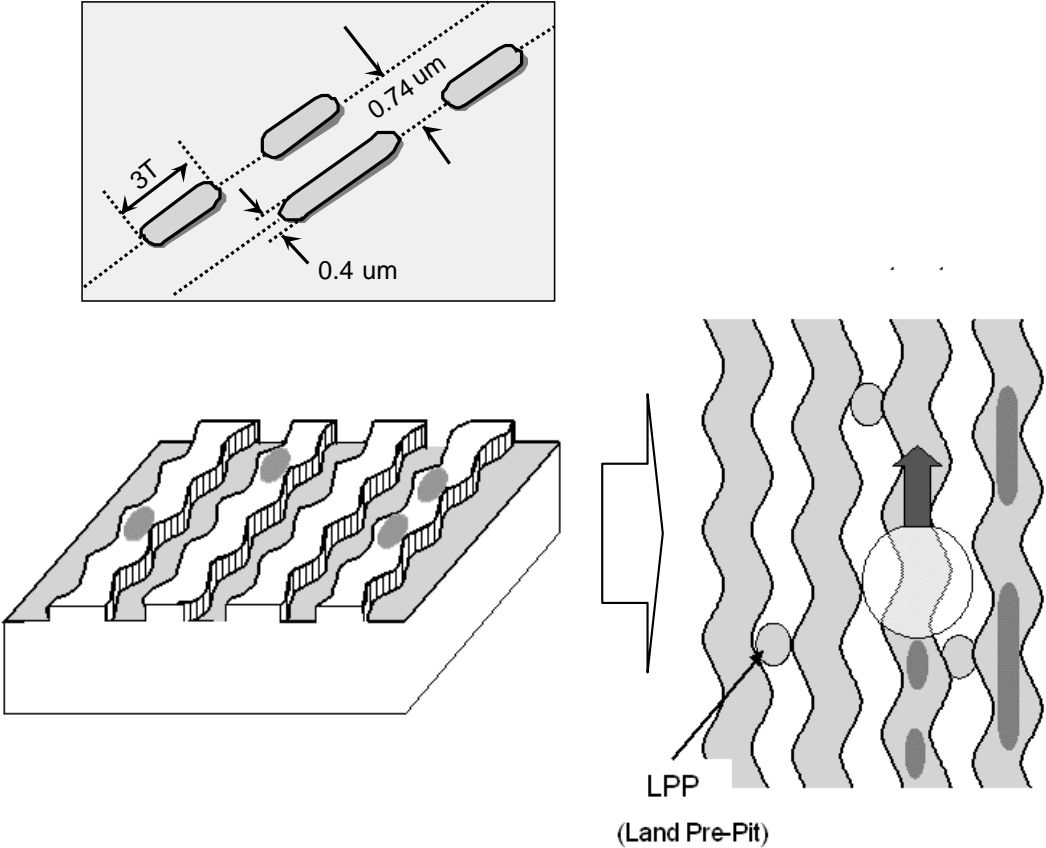
VWDC2(LCN201 PIN 35)



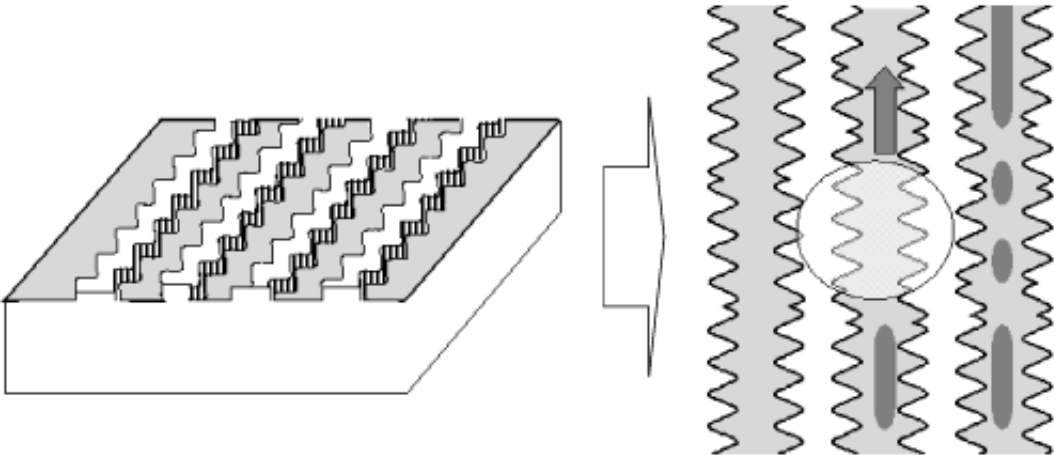
# The difference of DVD-R/RW, DVD+R/RW discs and DVD-ROM

## 1. Recording Layer

- DVD-ROM (Read Only Disc)



- DVD+R/RW Disc

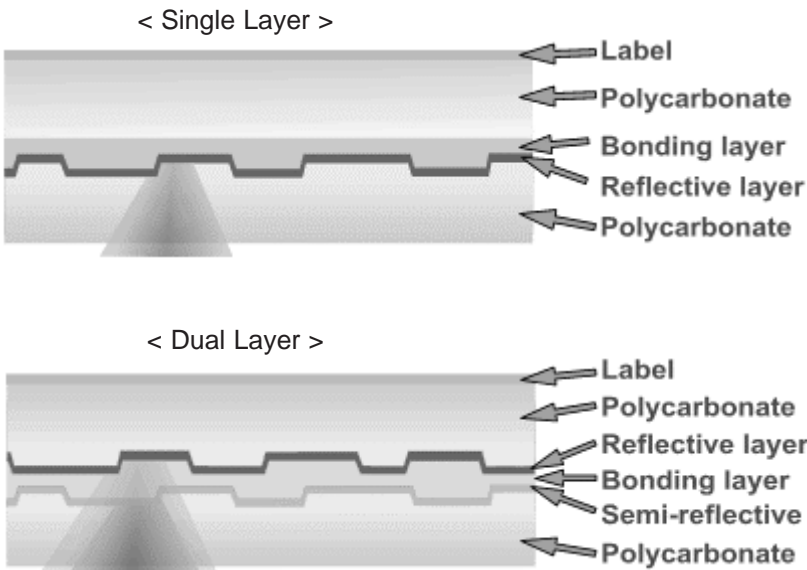


## 2. Disc Specification

	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 $\mu$ m	0.74 $\mu$ m	0.74 $\mu$ m	0.74 $\mu$ m	0.74 $\mu$ m	0.74 $\mu$ m
Minimum pit length	0.4 $\mu$ m	0.4 $\mu$ m	0.4 $\mu$ m	0.4 $\mu$ m	0.4 $\mu$ m	0.4 $\mu$ m
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 $\pm$ 0.1	0.7 $\pm$ 0.1
Write Power (mW)	–					
Jitter	<8%	<8%	<8%	<8%	<9%	<9%

## 3. Disc Materials

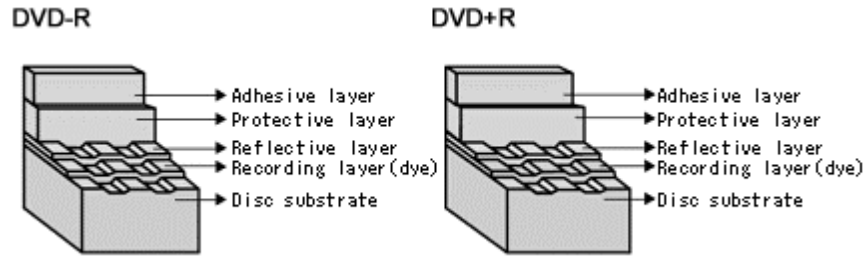
### 1) DVD-ROM



## 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.

### g Disc structure



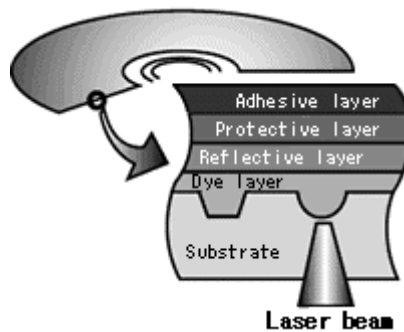
### g Recording principles

#### [ Recording ]

Recording is done by changing the organic dye layer and the substrate with a laser. When a strong laser is applied to a disc, the temperature of the organic 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 ]

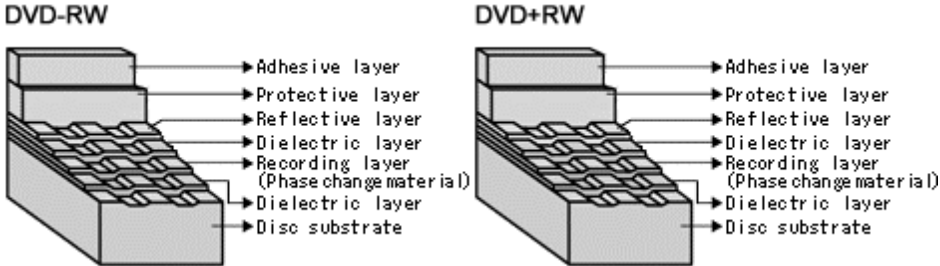
Signals are read with the differences of the reflection of a laser from pits.



### 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.

G Disc structure



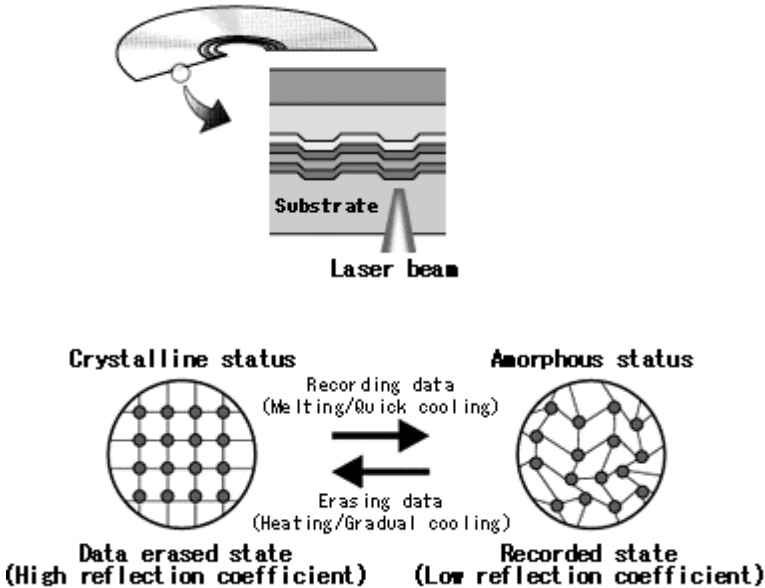
G Recording principles

**[ 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.

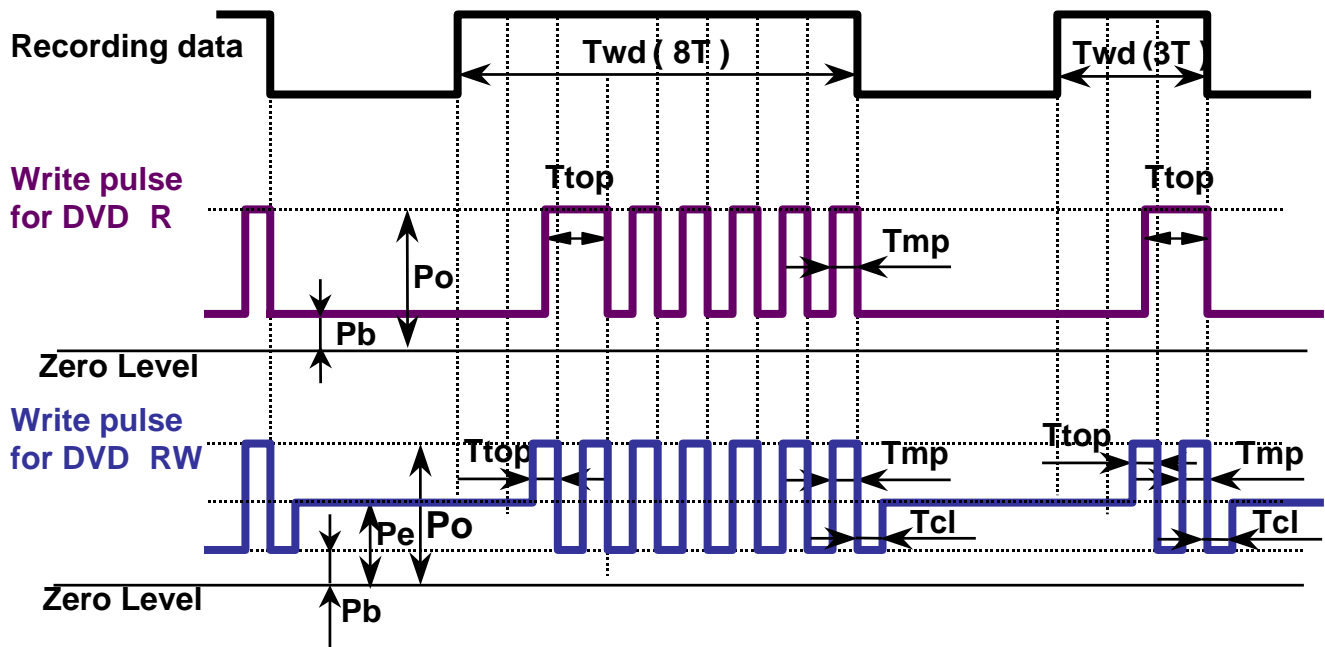


To make recordings, it is necessary to modulate the write pulse, which is called "Write Strategy".

There can be many types in Write Strategy. Typically Write Strategy for DVD  $\pm$ R has NMP(Non Multi-Pulse) type and MP(Multi-Pulse) type. In NMP type each single mark is created by subsequent separated short pulses. In MP type each single mark is created by one continuous pulse.

Write Strategy for DVD  $\pm$ RW has Type 1 and Type2. In Type 1 the mark with  $nT$  width is created by one top pulse and  $(n-2)$  multi-pulses. Thus mark  $3T$  is made by one top pulse and one multi-pulse. In Type 2 the mark with  $nT$  width is created by one top pulse and  $(n-3)$  multi-pulses. Thus mark  $3T$  is made by one top pulse only.

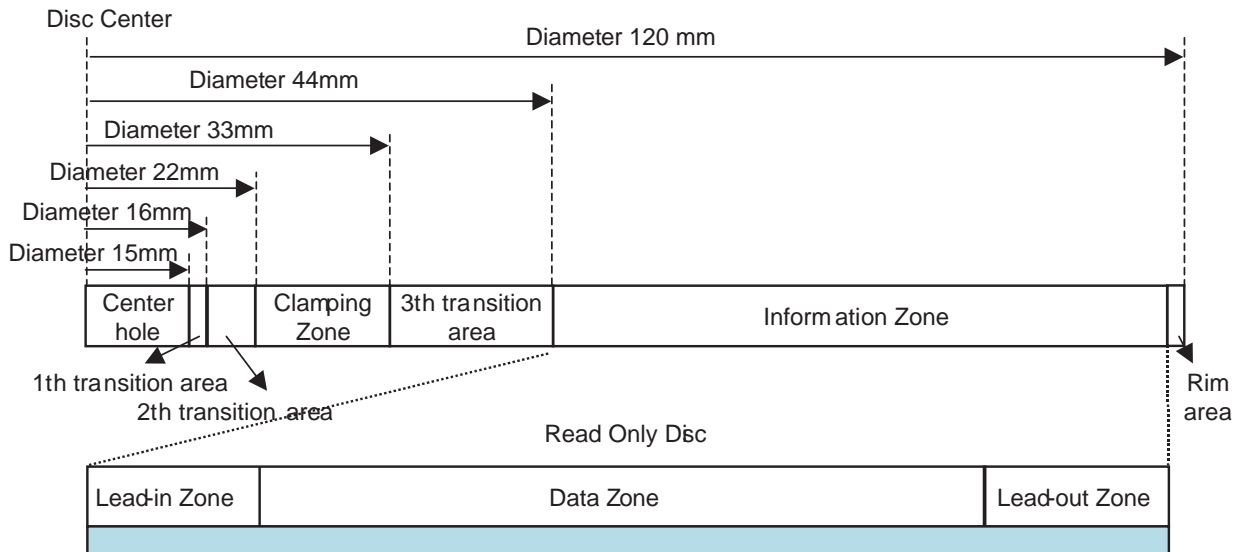
RL-02A uses MP type Write Strategy for DVD  $\pm$ R and Type 1 for DVD  $\pm$ RW as shown below.



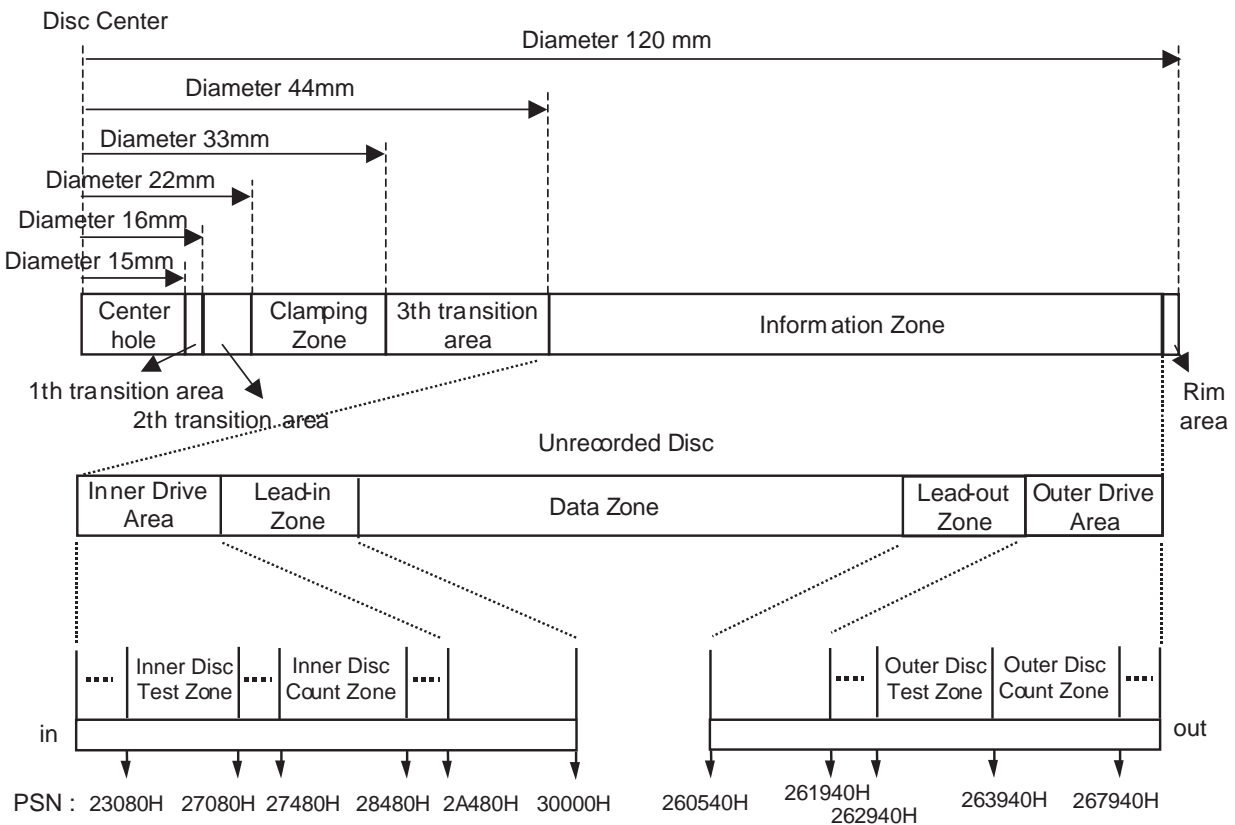
$P_o$  :Write Power (Peak Power)  
 $P_e$  :Erase Power  
 $P_b$  :Bias Power

## 4. 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



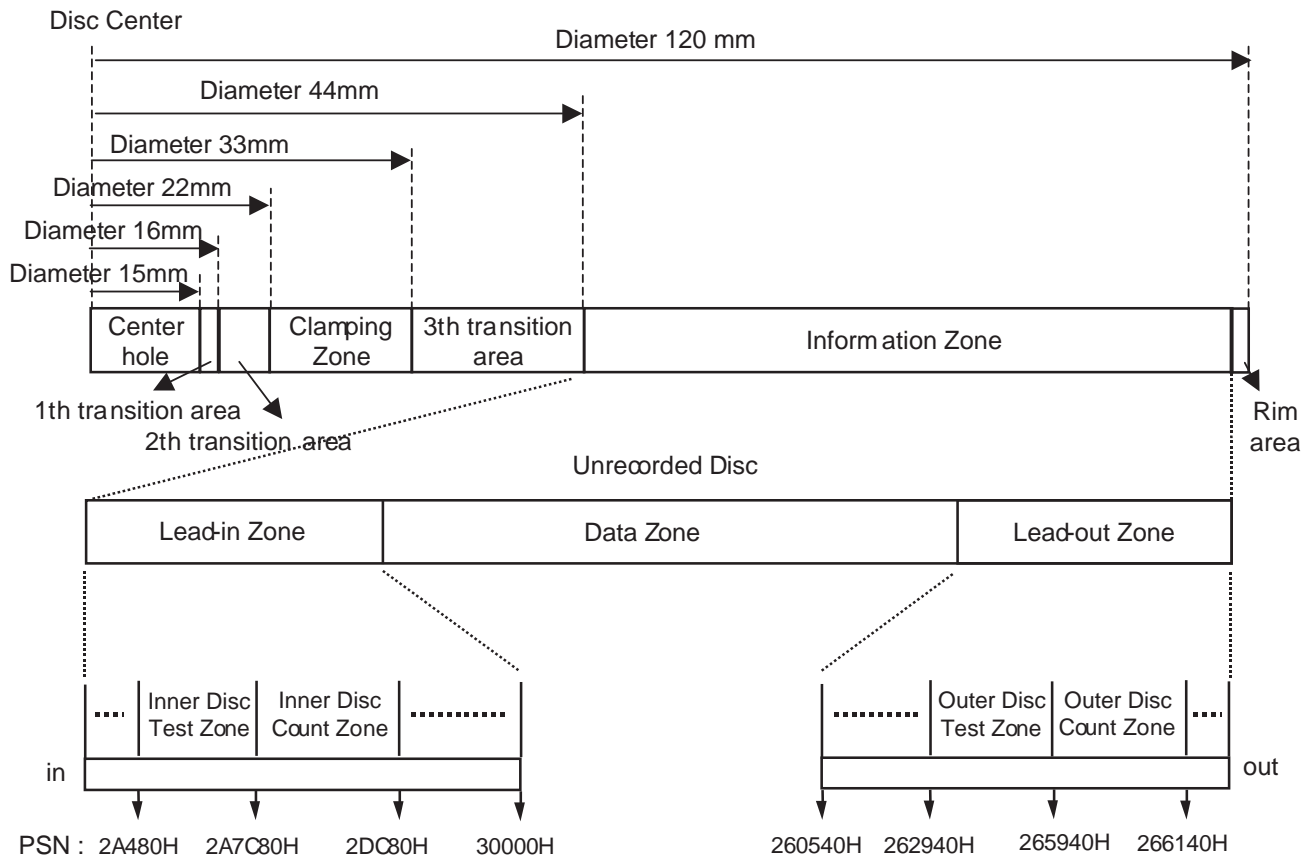
Inner Disc Test Zone : for performing OPC procedures.

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 number of OPC algorithm performed in IDT Zone.

### 3) Layout of DVD+RW disc



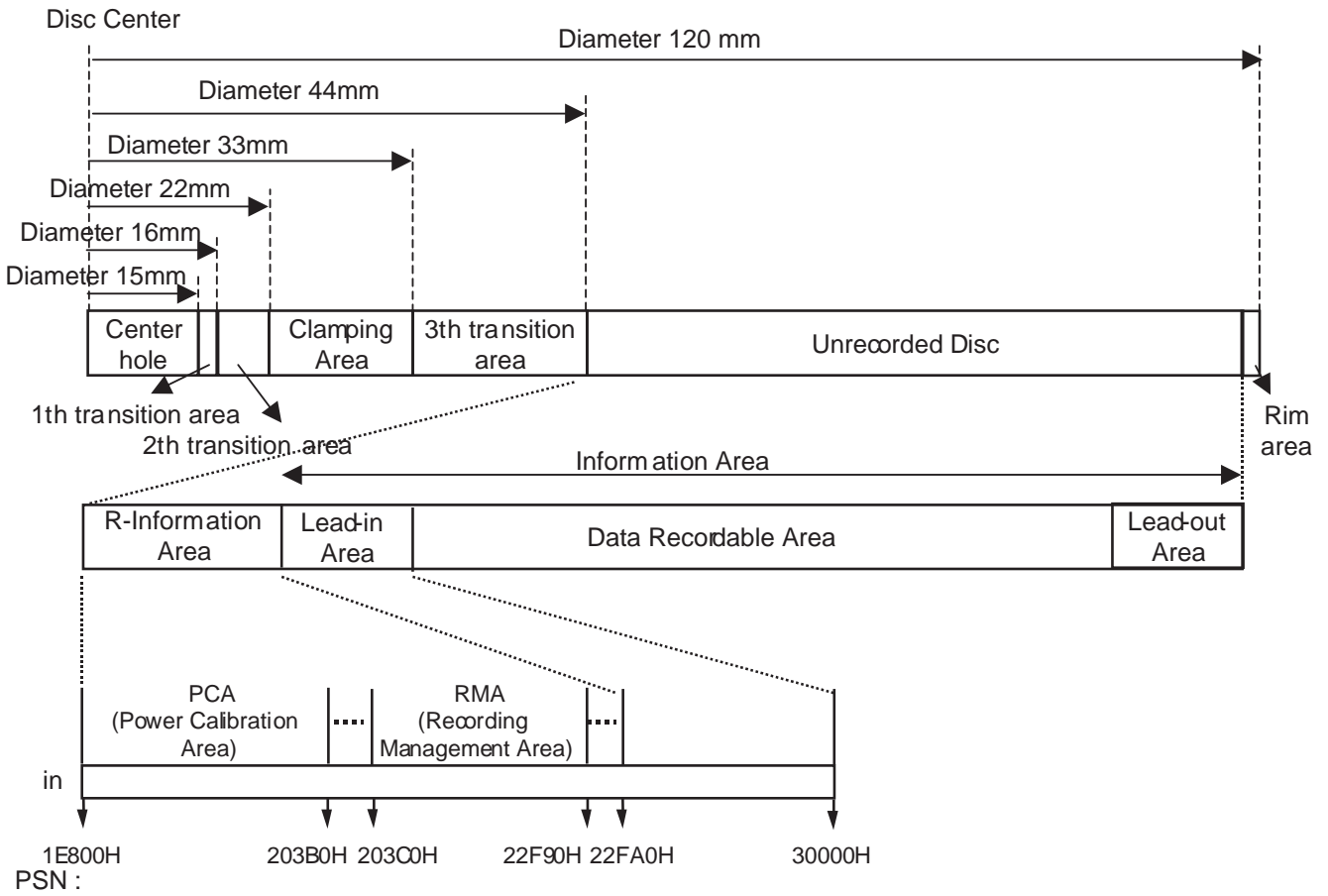
Inner Disc Test Zone : for performing OPC procedures.

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.

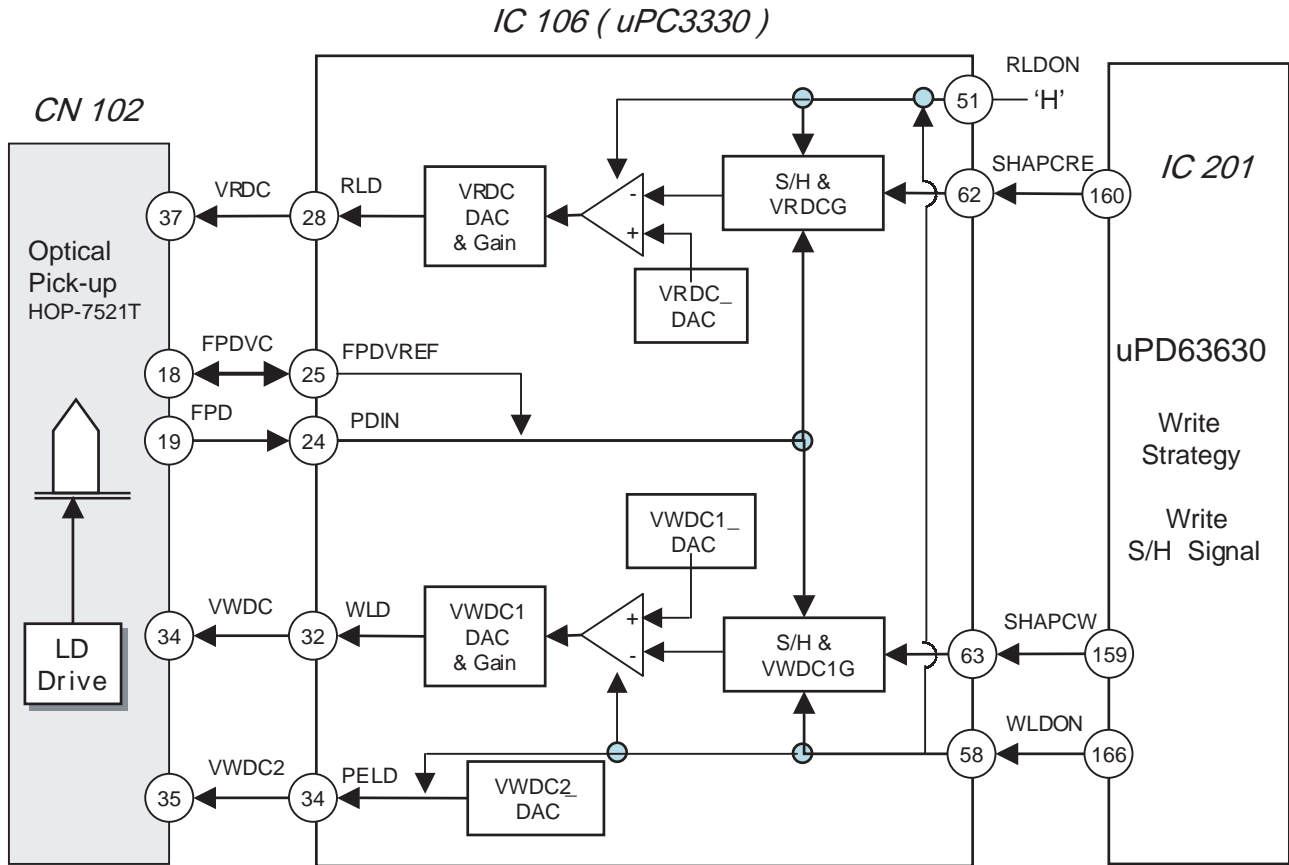
#### 4) Layout of DVD-R/RW disc





## 5. ALPC(Automatic Laser Power Control) Circuit

### 1) Block Diagram



### 2) ALPC(Automatic Laser Power Control) Circuit Operation

ALPC function in CD-R/RW,DVD+R/RW analog front-end is for constant power level control purpose.

Based on the accurate power sensor(FPD) in OPU, ALPC feedback loop maintains constant power level against laser diode's temperature variation.

There are two power control loops in uPC3330, which are used with different combination for different applications. Generally, the first ALPC loop is used for read-power control. The 2nd ALPC loop is used for write(erase) power control for CD-R/RW and DVD+R/RW disc.

Owing to the small signal level in read-power control mode, the first ALPC loop amplifies the FPD signal to enhance the accuracy of read power control. The built-in 10-bit DAC(VRDC\_DAC) is used to set the read power level.

Moreover, the 2nd ALPC loop is used for high power control. The built-in 10-bit DAC(VWDC1\_DAC) is used to set the wanted power level.

And the register VWDC1G is employed to adjust the gain of FPD signal.

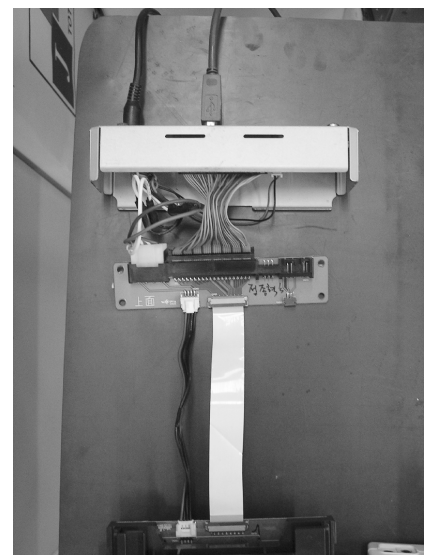
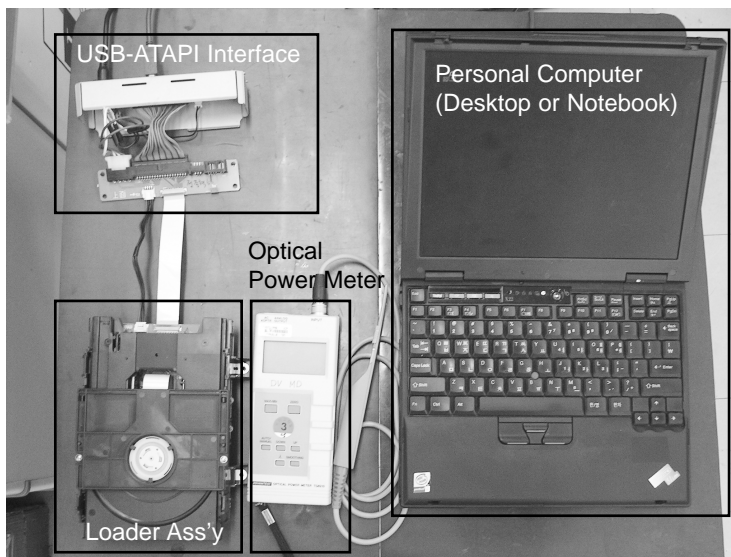
The following potentiometers(VRDC\_DAC, VWDC1\_DAC, and VWDC2\_DAC) and amplifiers (VRDCG and VWDC1G) are used to set the wanted levels of the output pins RLD, WLD, and PELD

# How to use test tool

## 1. ALPC Measurement System Configuration

In order to measure and adjust DVD RW optical power, The following measurement equipments are needed.

- N Compulsory equipment
  - ① Optical Power meter & Sensor (ADVANTEST, TQ8210/Q82017A or equivalent)
  - ② Personal Computer (Pentium 3, 500MHz Above, , RAM:64M Above, Win98 Above)
  - ③ Adjustment Program (Dragon or ALPC) for SVC, ALPC Program recommended
  
- N FI optional equipment
  - ① USB-ATAPI Interface (needed when using USB Port from the laptop computer without ATAPI interface or a desktop computer)
  - ② Connector-ATAPI Interface Board (Part Mo:6881R-7677A) (needed when ATAPI is not attached to Loader)



Connector-ATAPI Interface Board

## 2. ALPC Program Configuration

ALPC Program consists of total 4 files.

ALPC.exe  
LgBada.dll  
modelnm.txt  
WNASPI32.DLL

These 4 files should be located in one directory.  
ALPC.exe is a program execution file.  
modelnm.txt is a configuration file.

### Determine how to connect

The following contents are included when you open "modelnm.txt" file.

The following contents are included when you open LGE connect=0

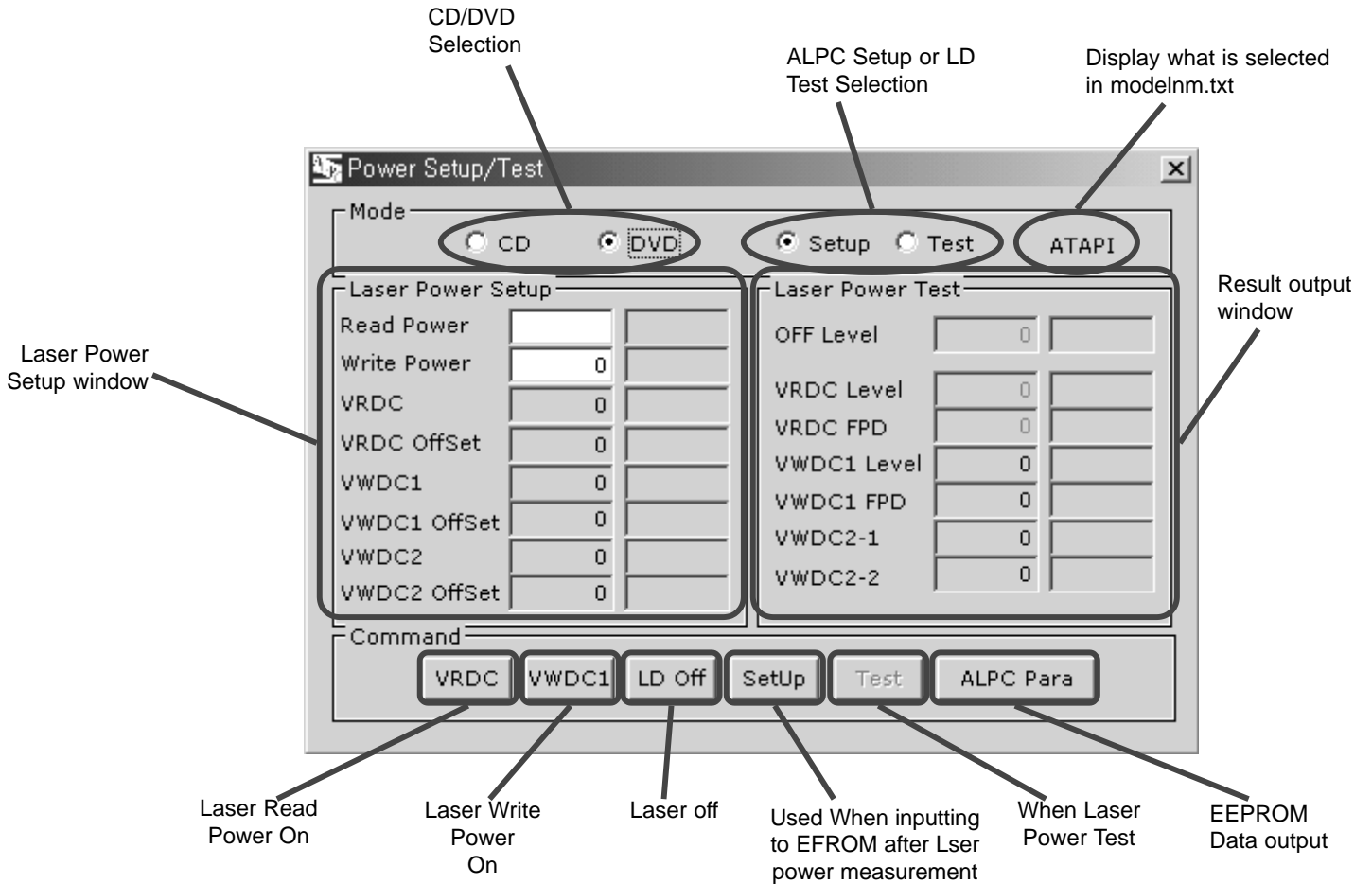
connect=0 is the item which you can determine whether you use Serial or ATAPI.

0 : ATAPI  
1 : Serial

Thus, select connect=0 to use ATAPI, or select connect=1 to use Serial, then save the file.  
(For SVC, ATAPI setting is recommended.)

### 3. Running ALPC Program

When running ALPC.exe file, the following screen appears.



## 4 LD Test

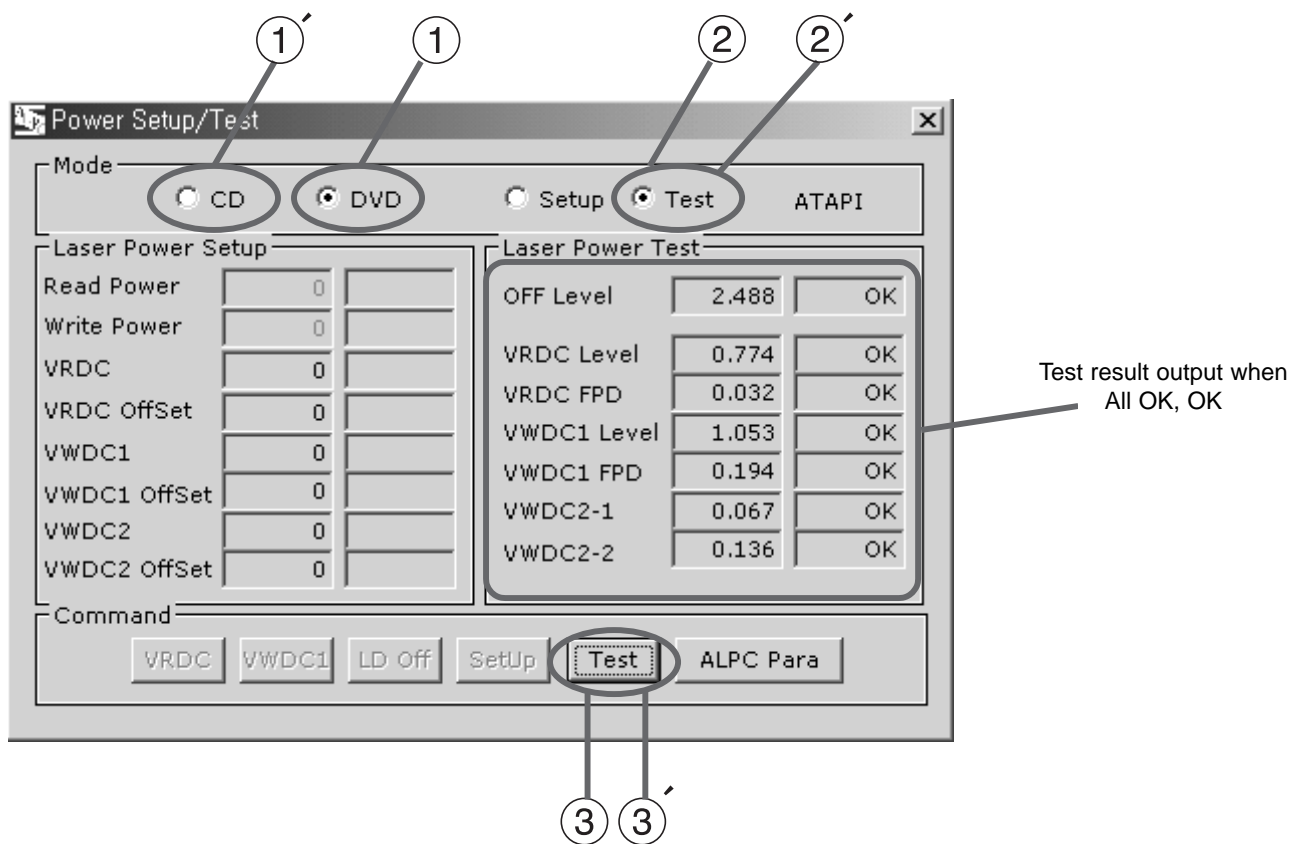
### \* Test DVD LD

- ① Select DVD mode
- ② Select Test mode
- ③ Click

### \* Test DVD CD

- ① Select CD mode
- ② Select Test mode
- ③ Click

Section	Off	VRDC	VR_FPD	VWDC1	VW_FPD	VW2-1	VW2-2
CD	2.4±0.08	0.53±0.22	0.02±0.01				
DVD	2.4±0.08	0.7±0.2	0.04±0.01	0.43±0.05	0.2±0.02	0.08±0.02	0.2±0.03



Specification can be changed according to pick-up type, circuit, program, and chipset.  
 If specification is changed, program can be sent by supervisor.  
 Specification above is temporary reference.

## 5. Optical Power Setting

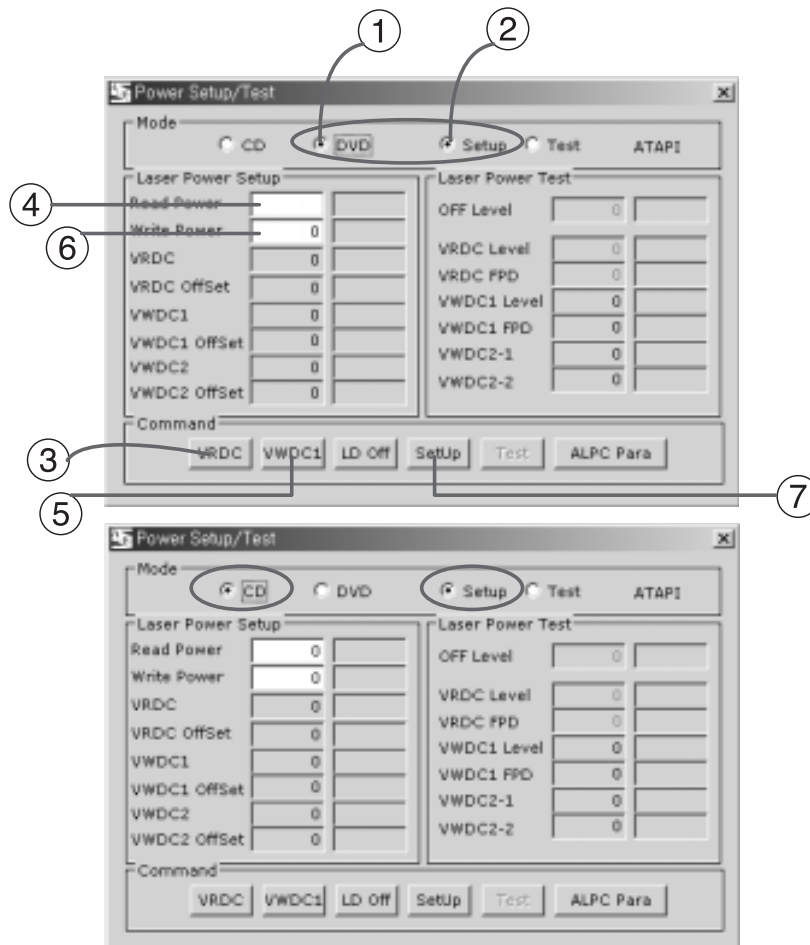
When replacing Travers ass'y including Pick-up or Loader PCB, Optical Power Setting should be performed for Pick-up and Loading PCB's matching.

### ① DVD LD optical Power Setting

- Select DVD and Setup mode
- Push **VRDC**. (Read Power On. Strong Red light can be seen from pick up optical lens.)
- Measure optical power.
- Write measurement value in Read Power.
- Push **VWDC1**. (Write power On.) (Caution) Light is very strong. Never look at the light directly.
- Measure optical power
- Write measurement value in Read Power and push LD off **LD OFF**.
- Push **Setup**. (Measurement value is inputted to EEPROM)

### ② DVD LD optical Power Setting

- Select CD and Setup mode
- Push **VRDC**. (Read Power On. Weak Red light can be seen from pick up optical lens.)
- Measure optical power.
- Write measurement value in Read Power.
- Push **VWDC1**. (Write power On. Weak Red light can be seen.)
- Measure optical power and push LD off **LD OFF**.
- Write measurement value in Read Power.
- Push **Setup**. (Measurement value is inputted to EEPROM)



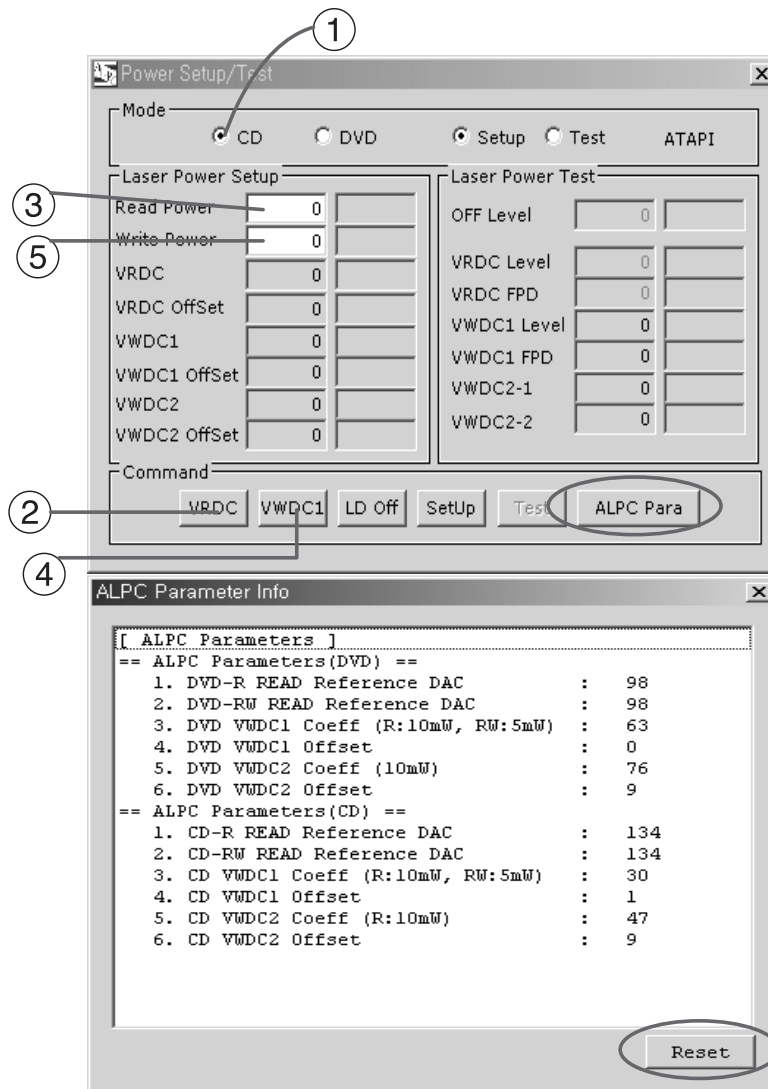
## 6. Optical Power Setting Parameter Check

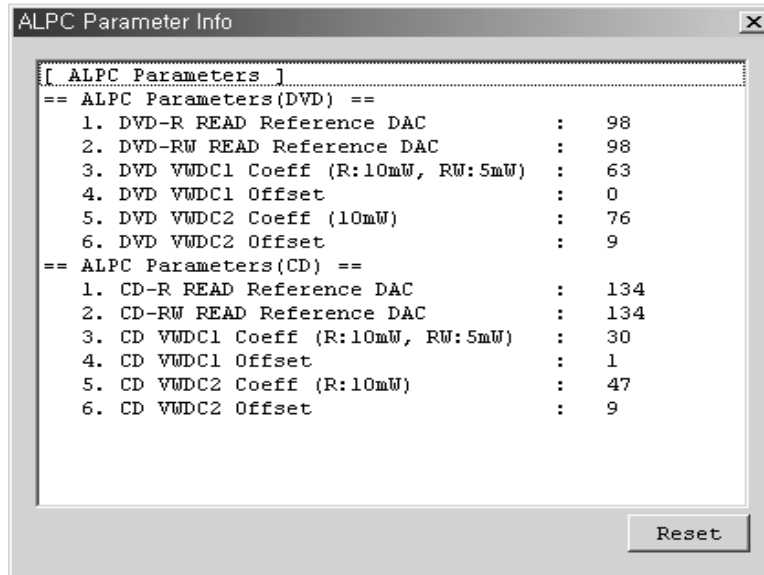
Use when defective happens even though LD test result is normal.

When defective can be found but power test result is OK, You need to check current settings whether they are proper or not. In this case, Pressing **ALPC Para** will display ALPC Parameter Info window and show current optical power settings recorded in EEPROM(IC302).

Write down these settings on the paper, perform optical power setting and press **ALPC Para** again, then new optical power settings will appear. Compare these two parameters. If there is a big difference, optical power setting may have been wrong at first or pick-up optical output may have been changed. If pick-up is normal, problem can be solved by resetting optical power without replacing pick-up.

In order to remove previous ALPC Parameter from ALPC Parameter Info, press **Reset** at the bottom of ALPC Parameter Info window.





[VALID ALPC Parameters]

<CD>

- 1) CD-R READ Reference DAC : 70 ~ 100
- 2) CD-RW READ Reference DAC : 70 ~ 100

<DVD>

- 1) DVD-R READ Reference DAC : 42 ~ 107
- 2) DVD-RW READ Reference DAC : 42 ~ 107
- 3) VWDC1 : 35 ~ 65
- 4) VWDC1 Offset : 0 ~ 6
- 5) VWDC2 : 20 ~ 43
- 6) VWDC2 Offset : 0 ~ 10



## Appendix. How to measure optical power

Optical power measurement is measuring actual optical power coming out from an object lens with LD turned on. thus, In order to measure optical power, LD should be turned on and environment need to be dark enough.

If necessary, Cover the top side of the sensor with black paper or hand when measuring.

Generally, fluorescent light is about 50  $\mu\text{W}$ , sun light is about 100 mW. so, If this is ignored, optical power setting may not be set correctly.

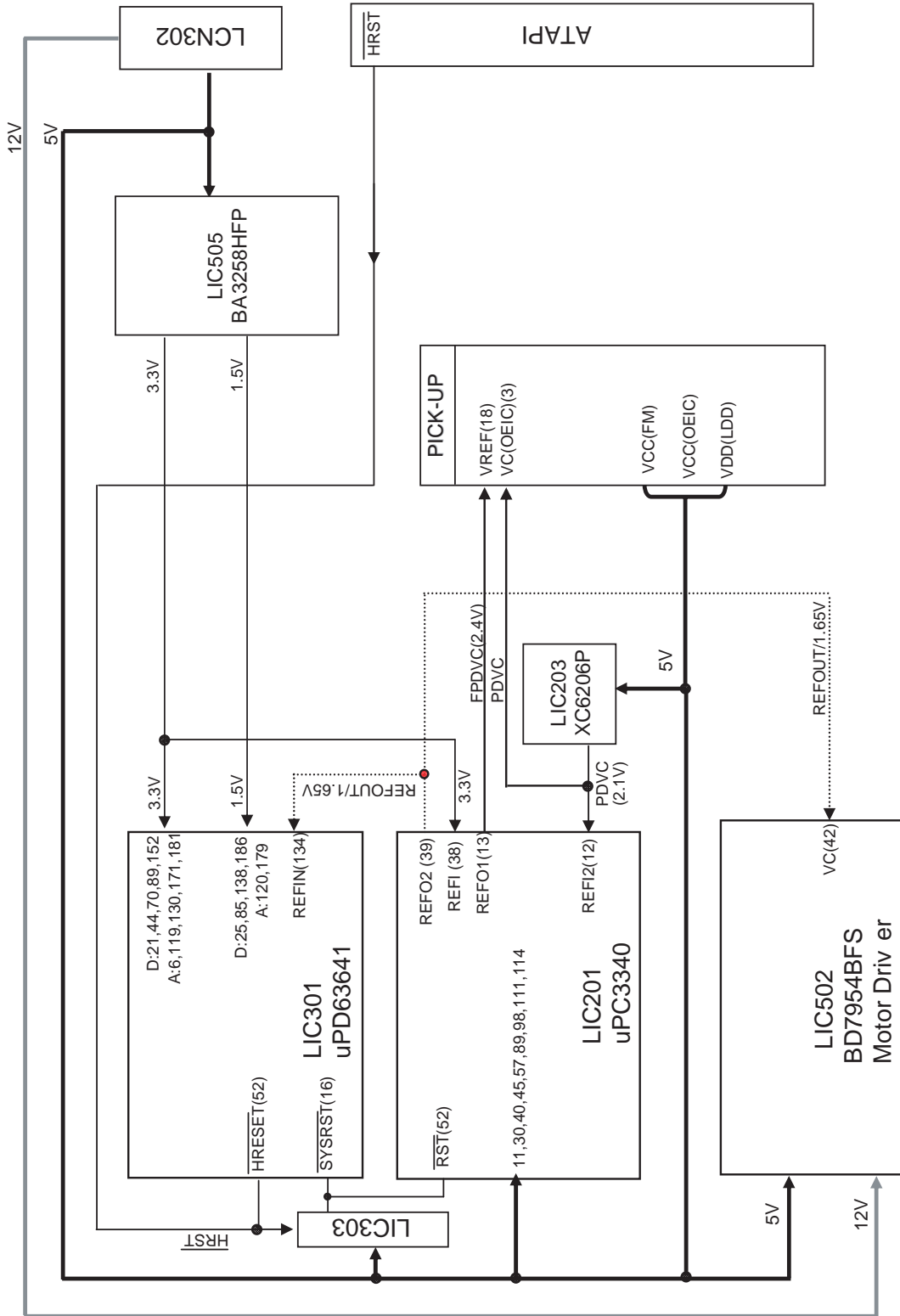
Optical power measurement procedure

1. Adjust optical power meter's  $\lambda$ (wave length) to DVD. (Generally 660 nm)
2. Turn DVD LD on.
3. Place sensor less than 3mm apart from pick-up object lens, perpendicular to lens.  
Adjust position so that the center of object lens match to  $\perp$  mark on the sensor.
4. Read monitor's value. (Read Maximum value as moving position slightly)  
(Check working unit. Unit should be mW. When LD is dead,  $\mu\text{W}$  or nW unit may not be read correctly.)
5. Multiply monitor's value by 100, round off to the nearest integer, then write constant part.
6. Adjust optical power meter's  $\lambda$  (wave length) to CD. (Generally 780 nm)
7. Turn CD LD on.
8. Repeat step 3~5 above.

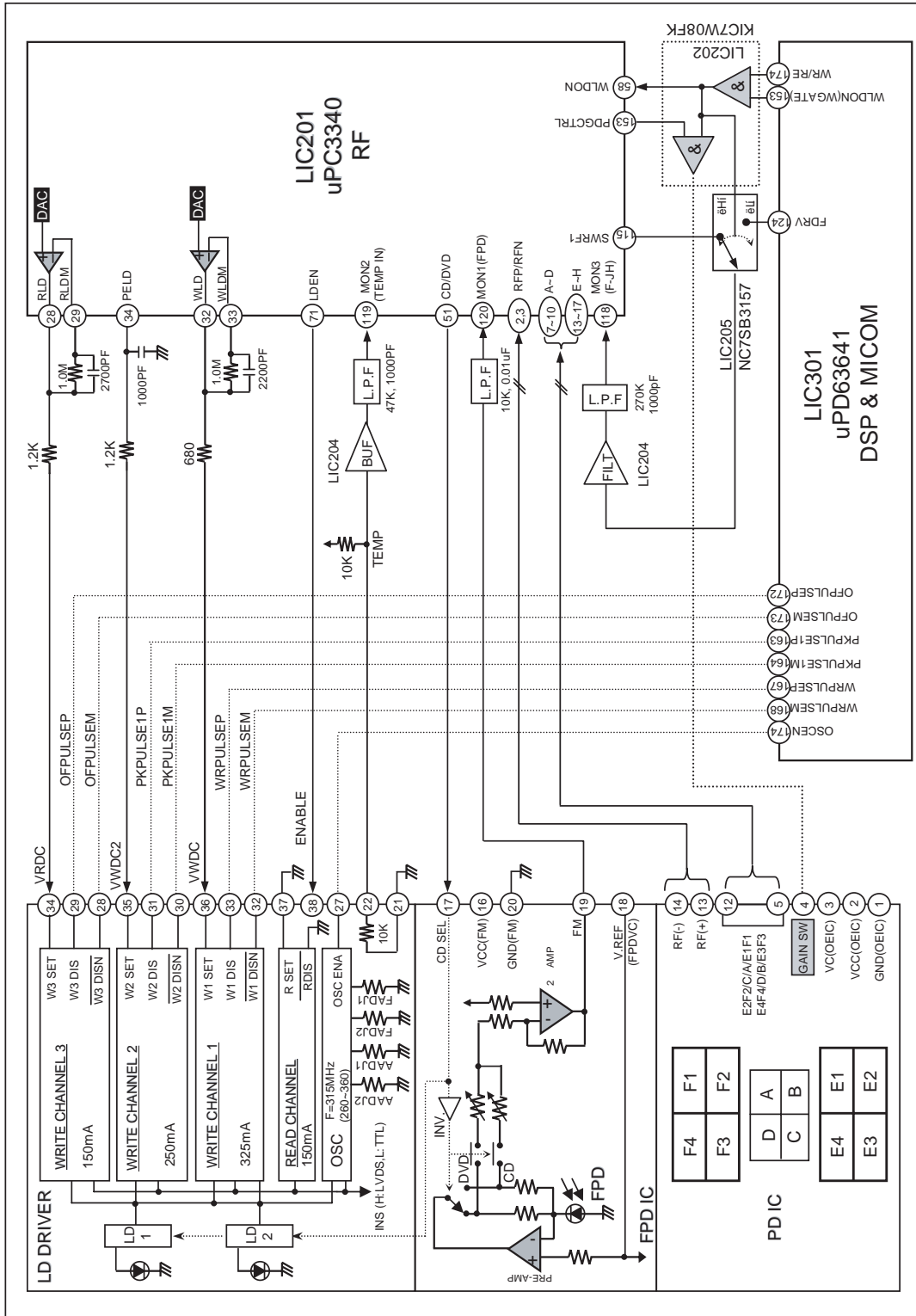


# BLOCK DIAGRAMS

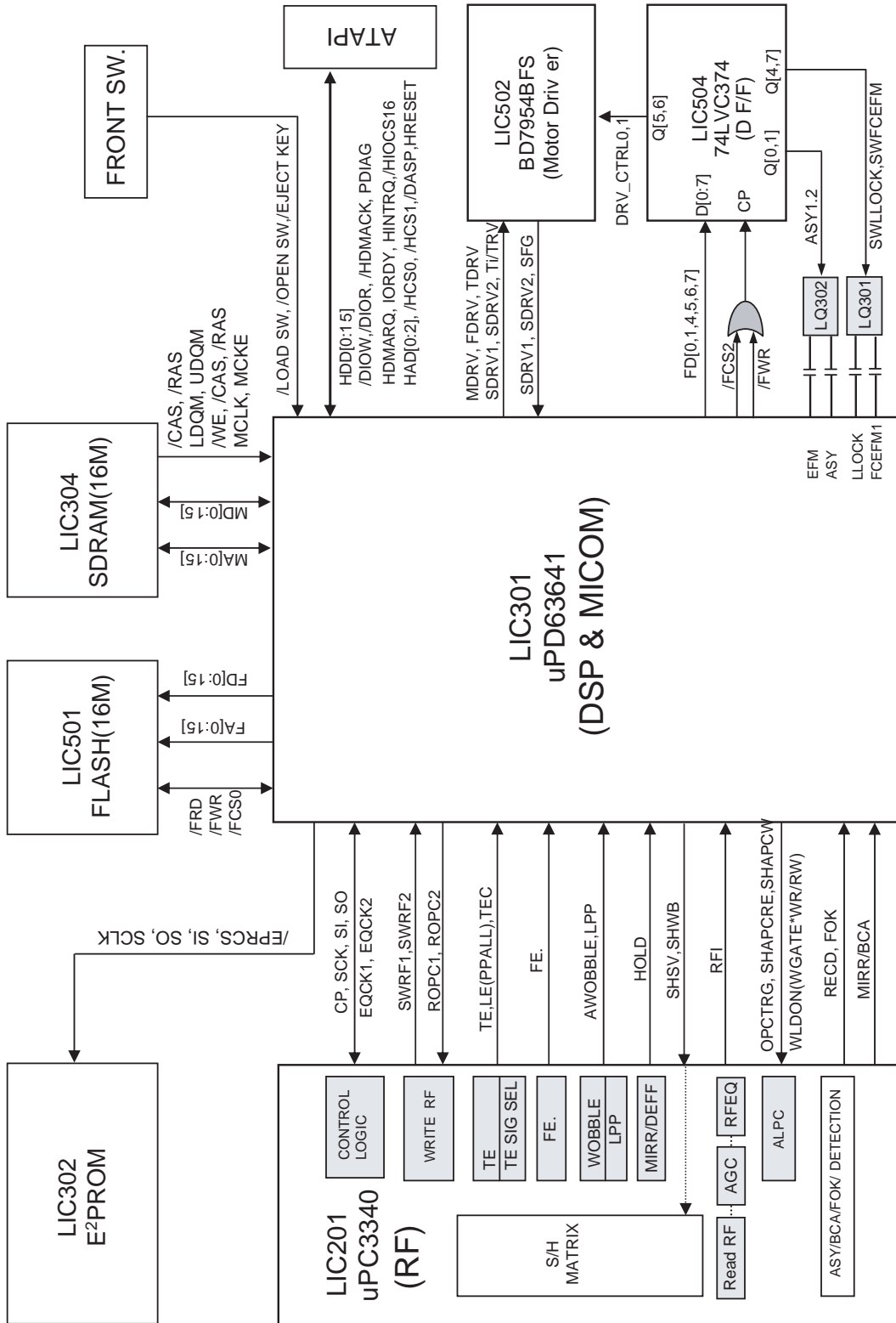
## 1. OVERALL BLOCK DIAGRAM



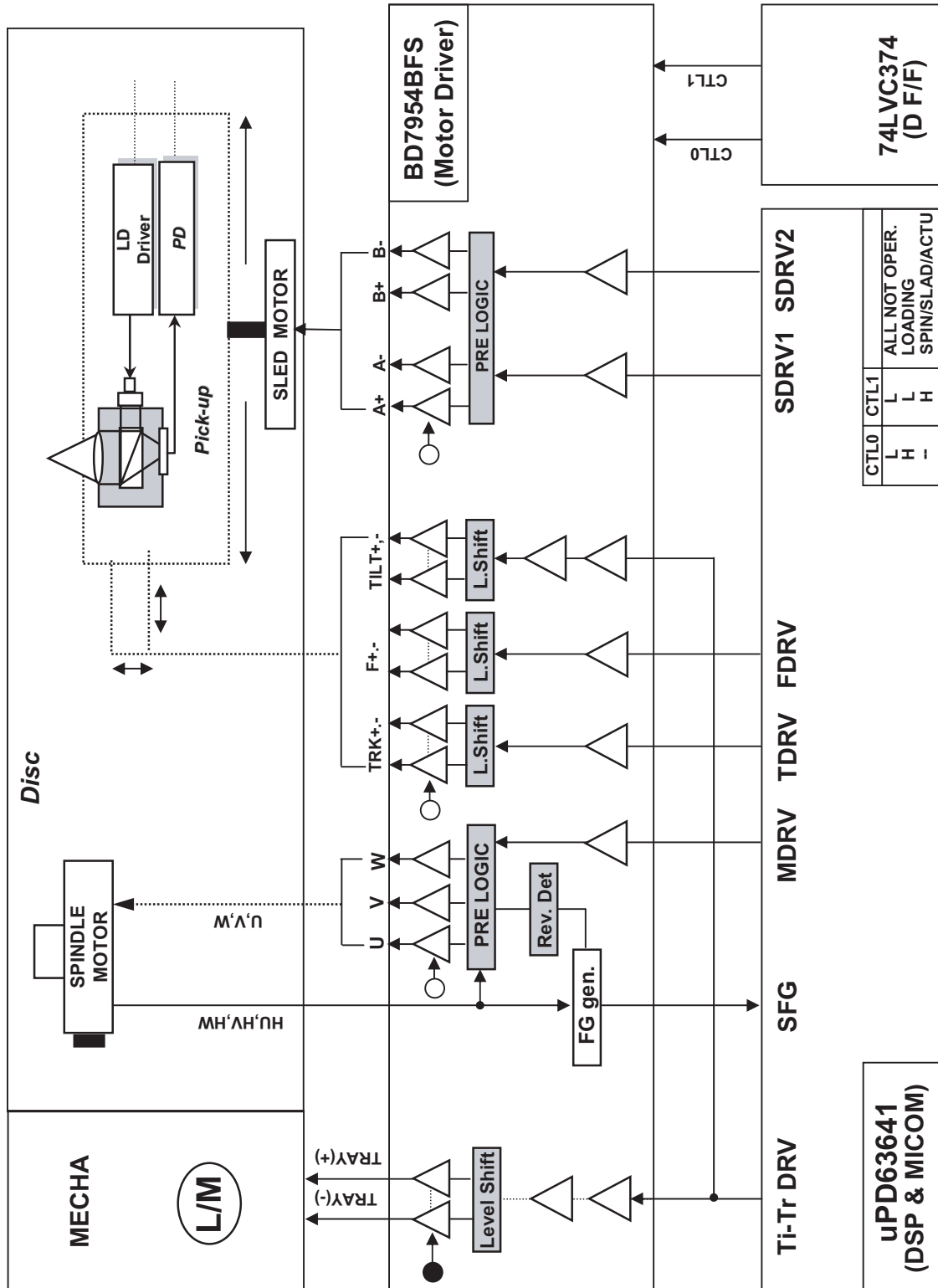
## 2. DSP BLOCK DIAGRAM



### 3. μ-COM BLOCK DIAGRAM

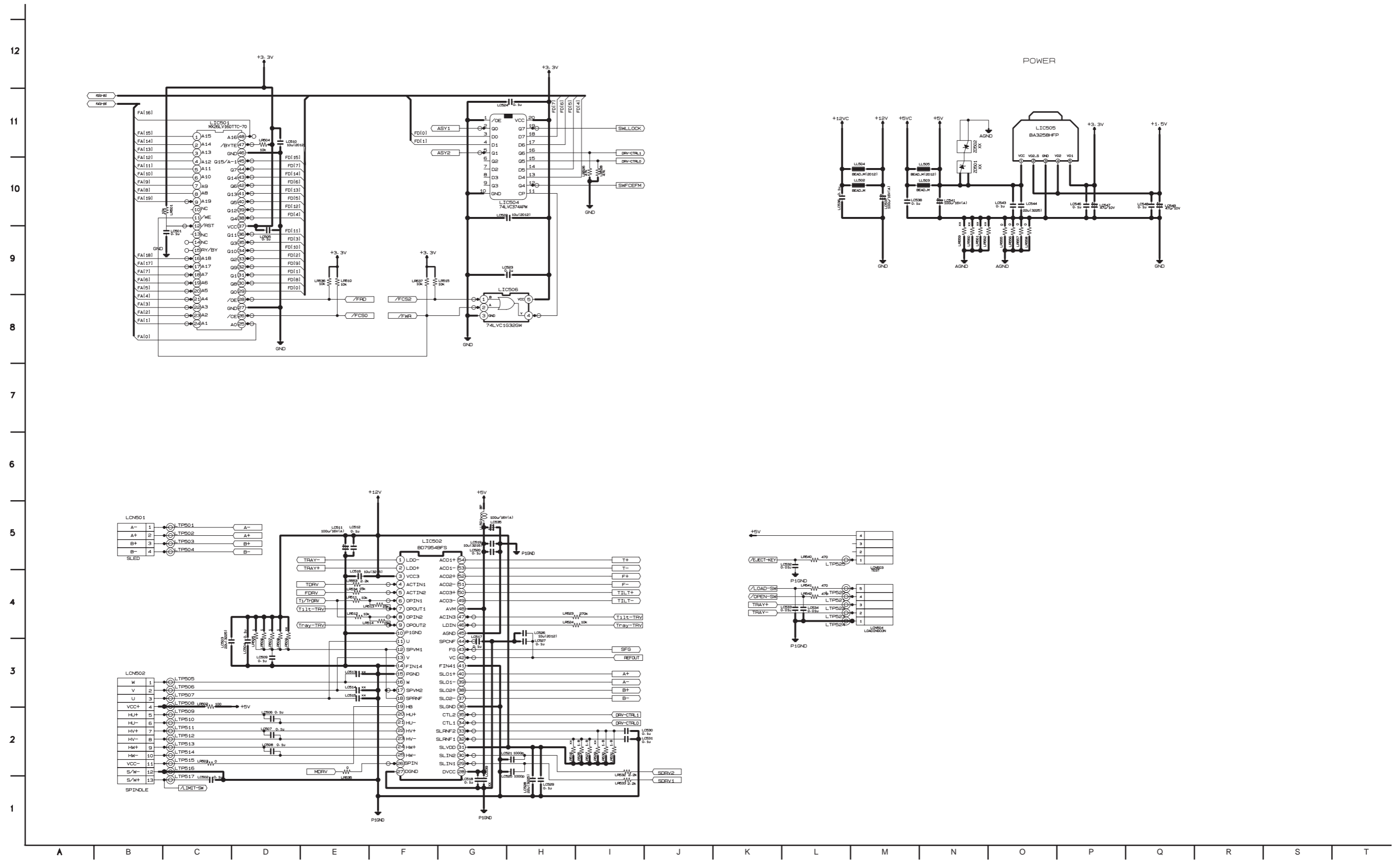


# 4. RF BLOCK DIAGRAM

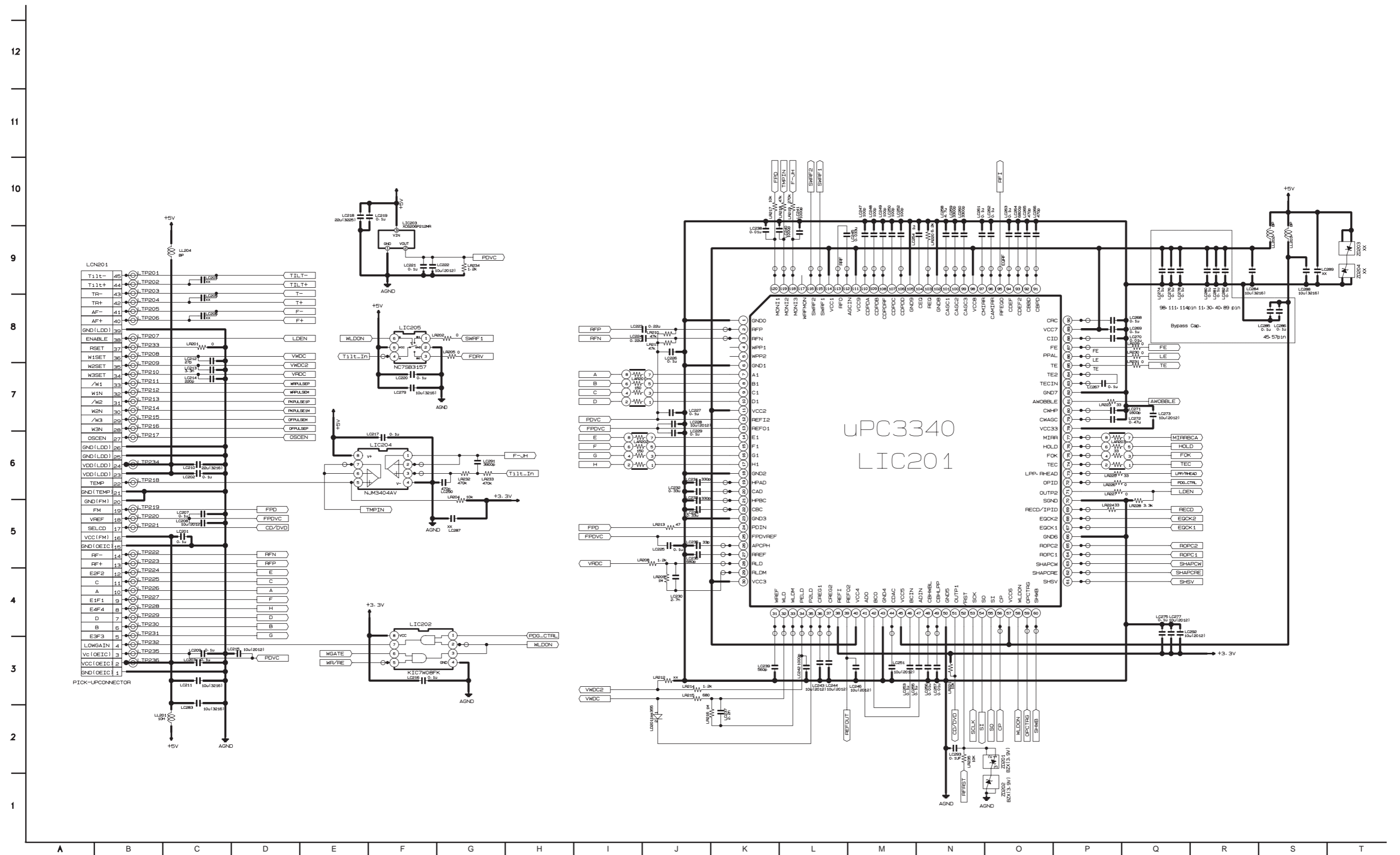


# CIRCUIT DIAGRAMS

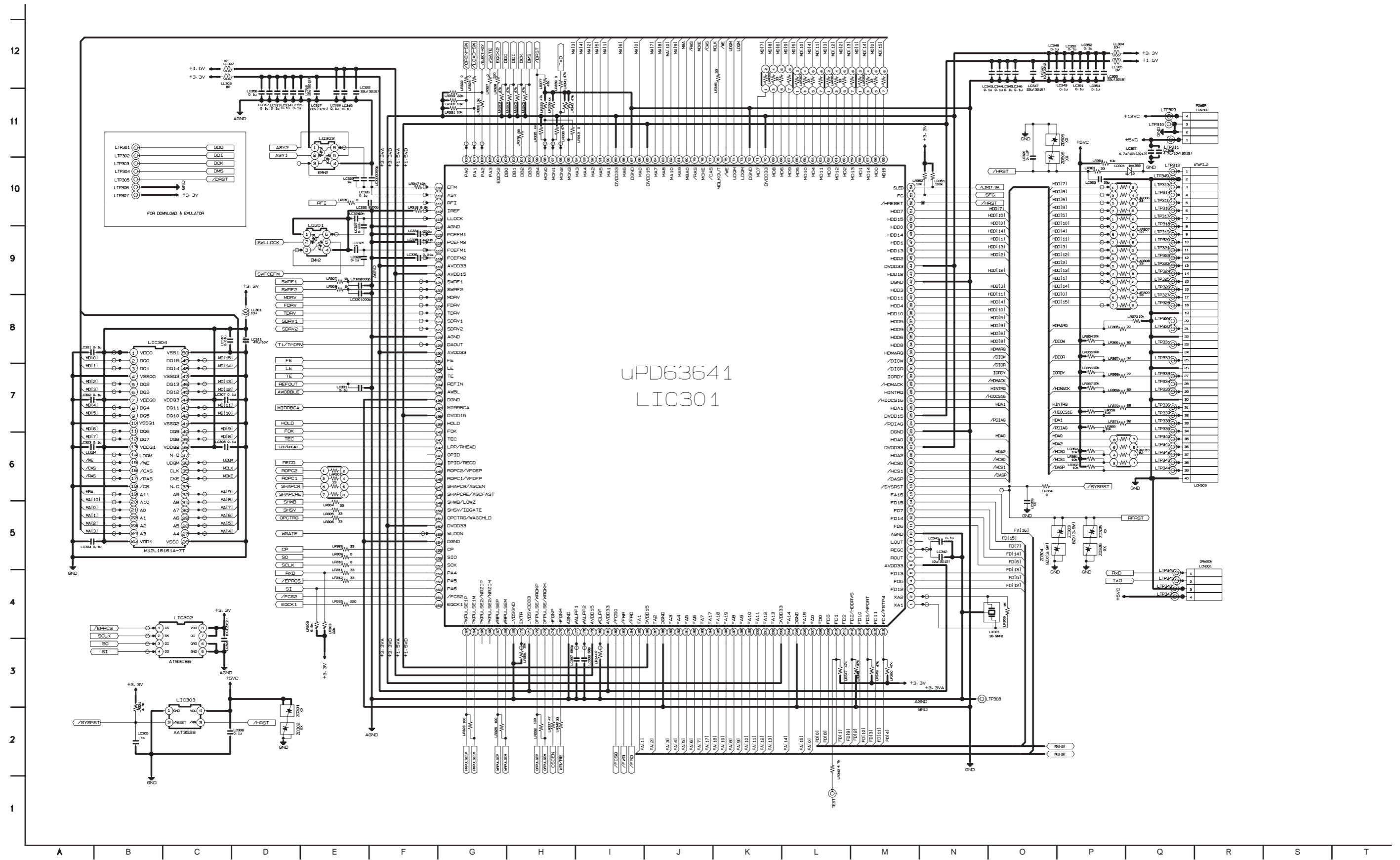
## 1. RF CIRCUIT DIAGRAM



## 2. DSP CIRCUIT DIAGRAM



### 3. $\mu$ -COM CIRCUIT DIAGRAM

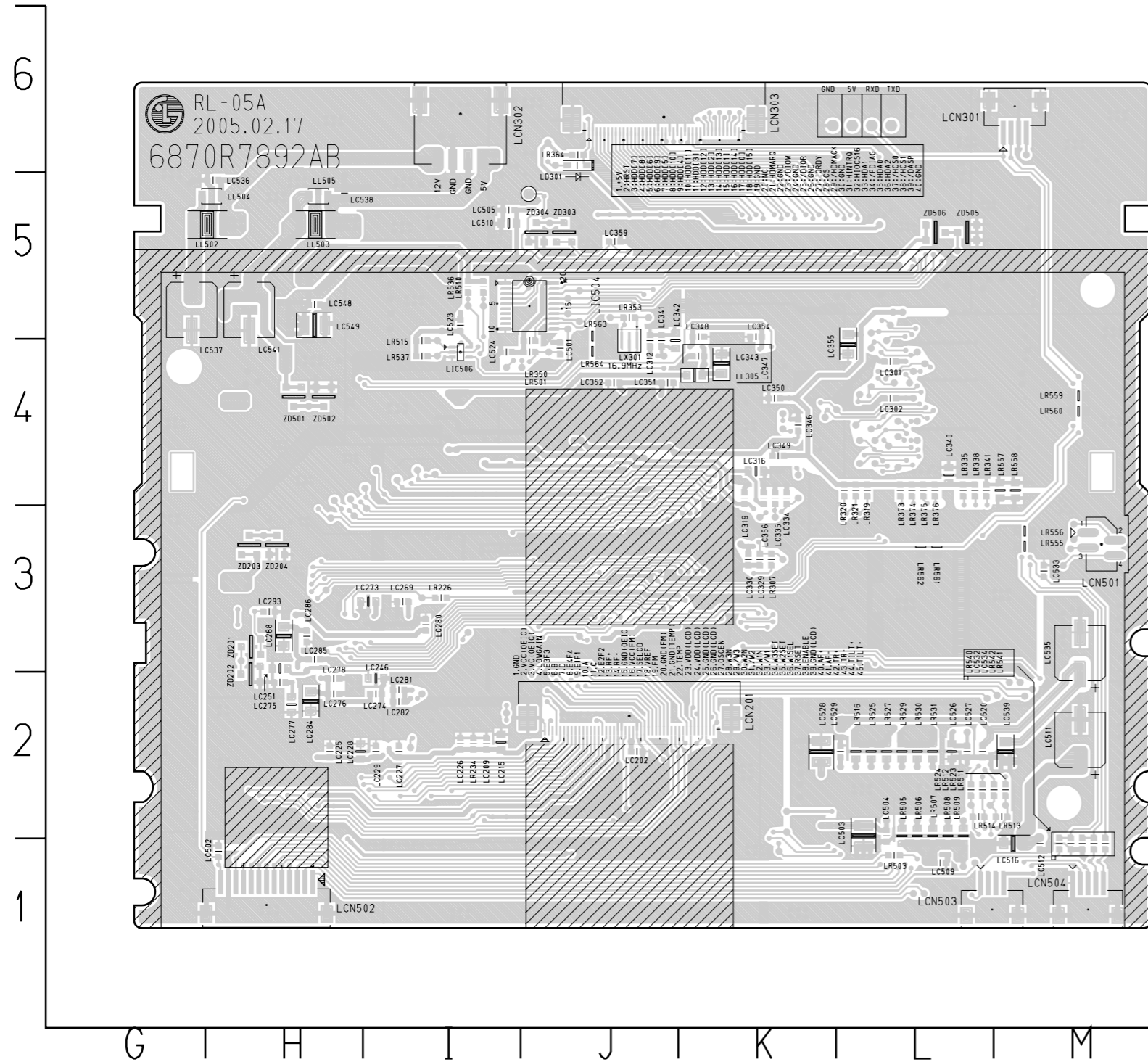






# PRINTED CIRCUIT DIAGRAMS

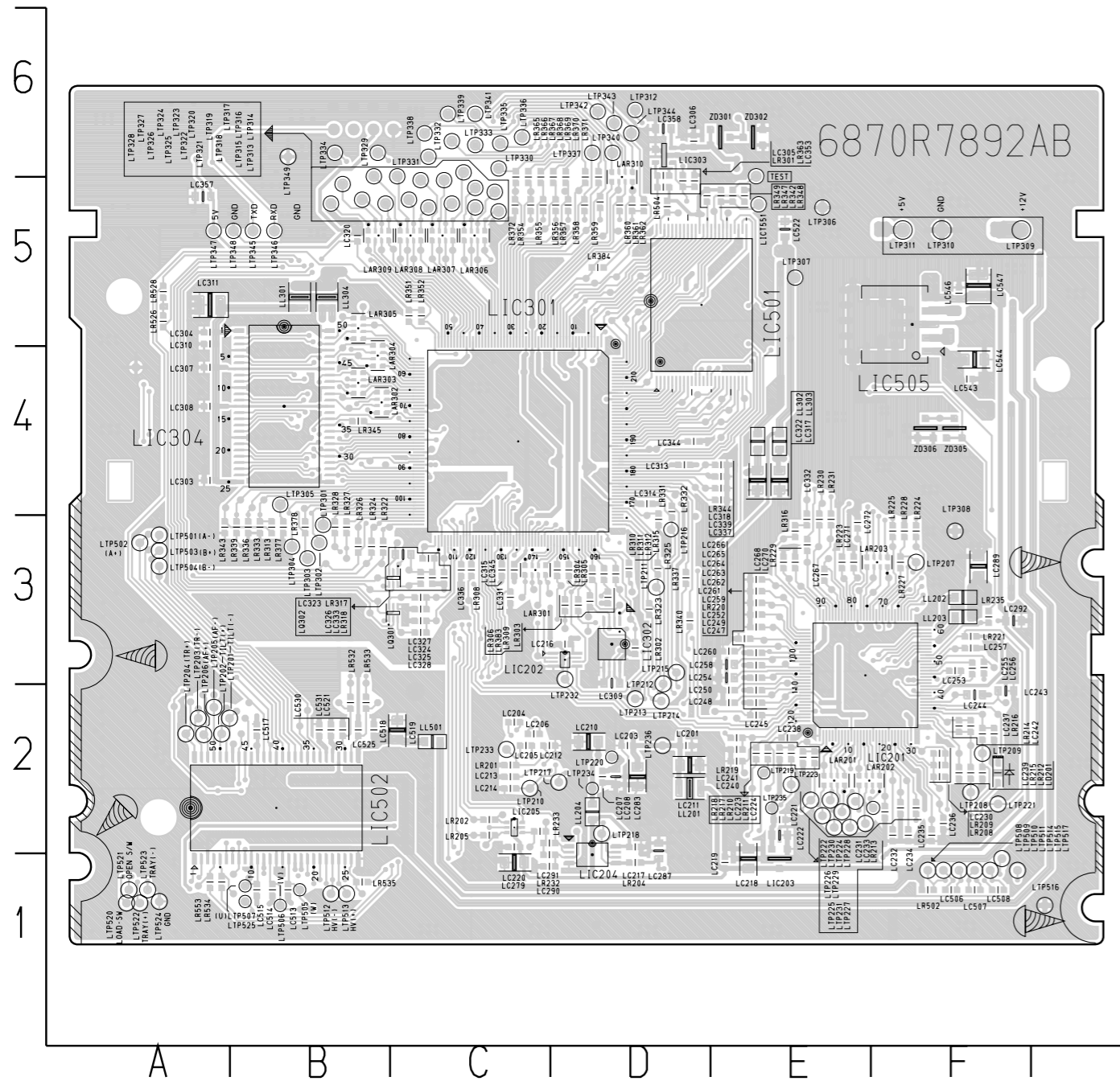
## 1. MAIN P.C.BOARD



### LOCATION GUIDE

LC202	J2	LC343	K4	LC541	H5	LICT318L4	LICT559L2	LR513	M2	
LC209	I2	LC346	K4	LC548	H5	LICT319L4	LICT561L2	LR514	L2	
LC215	I2	LC347	K4	LC549	H5	LICT321L4	LICT563L2	LR515	I4	
LC225	H2	LC348	K5	LCN201	J2	LICT324L4	LICT566L4	LR516	L2	
LC226	I2	LC349	K4	LCN301	M6	LICT325L4	LICT567L4	LR523	M2	
LC227	I2	LC350	K4	LCN302	I6	LICT328L4	LICT568J5	LR524	L2	
LC228	H2	LC351	J4	LCN303	J6	LICT329L4	LL305	K4	LR525	L2
LC229	I2	LC352	J4	LCN501	M3	LICT330K4	LL502	H5	LR527	L2
LC246	I2	LC354	K5	LCN502	H1	LICT331K4	LL503	H5	LR529	L2
LC251	H3	LC355	L4	LCN503	L1	LICT332L4	LL504	H5	LR530	L2
LC269	I3	LC356	K4	LCN504	M1	LICT333L4	LL505	H5	LR531	L2
LC273	I3	LC359	J5	LD301	J6	LICT335K4	LR226	I3	LR536	I5
LC274	I2	LC501	J4	LIC504	J5	LICT336L4	LR234	I2	LR537	I4
LC275	H2	LC502	H1	LIC506	I4	LICT337K1	LR307	K3	LR540	M1
LC276	H2	LC503	L2	LICT202J3		LICT339K2	LR319	L4	LR541	M1
LC277	H2	LC504	L2	LICT203I2		LICT353K3	LR320	L4	LR542	M1
LC278	H2	LC505	I5	LICT211 I2		LICT354K3	LR321	L4	LR555	M3
LC280	I3	LC509	L1	LICT238H3		LICT361K4	LR335	L4	LR556	M3
LC281	I2	LC510	I5	LICT247I3		LICT362K3	LR338	L4	LR557	M4
LC282	I2	LC511	M2	LICT265I3		LICT364K3	LR341	L4	LR558	M4
LC284	H2	LC512	M1	LICT277H3		LICT370J4	LR350	J4	LR559	M4
LC285	H3	LC516	M1	LICT301L4		LICT374J5	LR353	J5	LR560	M4
LC286	H3	LC520	L2	LICT302L5		LICT378J5	LR364	J6	LR561	L3
LC288	H3	LC523	I5	LICT303L5		LICT383J5	LR373	L4	LR562	L3
LC293	H3	LC524	I4	LICT304L4		LICT501J4	LR374	L4	LR563	J5
LC301	L4	LC526	L2	LICT305L4		LICT502I4	LR375	L4	LR564	J4
LC302	L4	LC527	L2	LICT306L4		LICT505L1	LR376	L4	LX301	J4
LC312	J4	LC528	K2	LICT307L4		LICT516L2	LR501	J4	ZD201	H3
LC316	K4	LC529	L2	LICT308L4		LICT517L2	LR503	L1	ZD202	H2
LC319	K4	LC532	M1	LICT309L4		LICT526J4	LR505	L2	ZD203	H3
LC329	K3	LC533	M3	LICT310L4		LICT539J5	LR506	L2	ZD204	H3
LC330	K3	LC534	M1	LICT311 K4		LICT541J5	LR507	L2	ZD303	J5
LC334	K4	LC535	M3	LICT312 L4		LICT543J5	LR508	L2	ZD304	J5
LC335	K4	LC536	H5	LICT313L4		LICT545J5	LR509	L2	ZD501	H4
LC340	L4	LC537	G5	LICT314 L4		LICT554I5	LR510	I5	ZD502	H4
LC341	J4	LC538	H5	LICT315L4		LICT555I5	LR511	M2	ZD505	L5
LC342	J4	LC539	M2	LICT316L4		LICT558M2	LR512	L2	ZD506	L5

## 2. MAIN P.C.BOARD



### LOCATION GUIDE

EQRF	E3	LC235	F2	LC292	F3	LC518	B2	LICT220E2	LICT272D3	LICT377D4	LICT544D5	LR220	E3	LR339	B3	LR553	A1	LTP305	B4	LTP346	B5	
FF	E3	LC236	F2	LC303	A4	LC519	C2	LICT221F2	LICT273C3	LICT384B5	LICT546D5	LR221	F3	LR340	D3	LR221	F3	LTP201	A2	LTP306	E5	
LAR201	F2	LC237	F2	LC304	A5	LC521	B2	LICT222E3	LICT274C3	LICT385C5	LICT547D5	LR223	E3	LR342	E5	LTP202	A2	LTP307	E5	LTP347	A5	
LAR202	F2	LC238	F2	LC305	D6	LC522	E5	LICT223F2	LICT275C3	LICT386C5	LICT548D5	LR224	F3	LR343	A3	LTP203	A2	LTP308	F3	LTP348	B6	
LAR203	F3	LC239	F2	LC306	D6	LC525	B2	LICT224C3	LICT276C3	LICT387C5	LICT549E5	LR225	F3	LR344	E4	LTP204	A2	LTP309	F5	LTP501	A3	
LAR301	C3	LC240	E2	LC307	A4	LC530	B2	LICT225F2	LICT317B4	LICT388C5	LICT550D5	LR227	F3	LR345	B4	LTP205	A2	LTP310	F5	LTP502	A3	
LAR302	B4	LC241	F2	LC308	A4	LC531	B2	LICT226C2	LICT320B5	LICT389C5	LICT551E5	LR228	F3	LR347	E5	LTP206	A2	LTP311	F5	LTP503	A3	
LAR303	B4	LC242	F2	LC309	D3	LC543	F4	LICT227F2	LICT322B4	LICT390C5	LICT552E5	LR229	E3	LR348	E5	LTP207	F3	LTP312	D6	LTP504	A3	
LAR304	B4	LC243	F2	LC310	A5	LC544	F4	LICT228F2	LICT323B4	LICT391C5	LICT556D4	LR230	E3	LR349	D5	LTP208	F2	LTP313	C5	LTP505	B1	
LAR305	B5	LC244	F2	LC311	A5	LC546	F5	LICT230E2	LICT326B4	LICT392C5	LICT557D5	LR231	E3	LR351	C5	LTP209	F2	LTP314	C5	LTP506	B1	
LAR306	C5	LC245	E2	LC313	D4	LC547	F5	LICT232E2	LICT327B4	LICT393C5	LICT560B1	LR232	C1	LR352	C5	LTP210	C2	LTP315	C5	LTP507	B1	
LAR307	C5	LC247	E2	LC314	D4	LD201	F2	LICT234E2	LICT334B4	LICT394C5	LICT562B2	LR233	C2	LR354	C5	LTP211	D3	LTP316	C5	LTP508	F1	
LAR308	C5	LC248	E2	LC315	C3	LE	E3	LICT236E3	LICT336C2	LICT395C5	LICT564B2	LR235	F3	LR355	C5	LTP212	D2	LTP317	C6	LTP509	F1	
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LC203	D2	LC253	F3	LC322	E4	LIC204	D1	LICT245F3	LICT343D5	LICT504B1	LL203	F3	LR304	D3	LR359	D5	LTP216	D3	LTP321	C5	LTP513	B1
LC204	C2	LC254	F3	LC323	C3	LIC205	C2	LICT246E3	LICT344D3	LICT506B1	LL204	D2	LR305	D3	LR360	D5	LTP217	D2	LTP322	C5	LTP514	F1
LC205	C2	LC255	F3	LC324	C3	LIC201	C4	LICT248E3	LICT345D3	LICT513B2	LL301	B5	LR306	D3	LR361	D5	LTP218	D2	LTP323	C5	LTP515	F1
LC206	C2	LC256	F3	LC325	C3	LIC302	D3	LICT249E3	LICT346D3	LICT514B2	LL302	E4	LR308	C3	LR362	D5	LTP219	E2	LTP324	B5	LTP516	G1
LC207	D2	LC257	F3	LC326	C3	LIC303	D6	LICT250E3	LICT347D3	LICT515B2	LL303	E4	LR309	D3	LR363	D5	LTP220	F2	LTP325	B5	LTP517	F1
LC208	D2	LC258	F3	LC327	C3	LIC304	B4	LICT251E3	LICT349C3	LICT518B2	LL304	B5	LR310	D3	LR365	C5	LTP221	F2	LTP326	B5	LTP520	A1
LC210	D2	LC259	F3	LC328	C3	LIC501	D5	LICT252E3	LICT350C3	LICT519B2	LL501	C2	LR311	D3	LR366	C5	LTP222	E2	LTP327	B5	LTP521	A1
LC211	D2	LC260	F3	LC331	C3	LIC502	B2	LICT253E3	LICT351C3	LICT520B3	LL501	C3	LR312	D3	LR367	C5	LTP223	E2	LTP328	B5	LTP521	A1
LC212	C2	LC261	F3	LC332	E3	LIC505	F5	LICT254E3	LICT352C3	LICT521B3	LQ302	C3	LR313	D3	LR368	D5	LTP224	E2	LTP329	B6	LTP523	A1
LC213	C2	LC262	F3	LC333	C3	LICT201E2		LICT255E3	LICT355B3	LICT524B3	LR201	C2	LR315	B3	LR369	D5	LTP225	E2	LTP330	C6	LTP524	A1
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LC217	D2	LC265	F3	LC339	E4	LICT206F2		LICT258E3	LICT358C3	LICT528D4	LR205	C2	LR318	C3	LR372	C5	LTP228	F2	LTP333	C6	TE	E3
LC218	E1	LC266	F3	LC344	D4	LICT207F2		LICT259E3	LICT359E4	LICT529D4	LR208	F2	LR322	B3	LR377	B3	LTP229	F2	LTP334	B6	TEST	E5
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LC220	C2	LC268	F3	LC353	D5	LICT209F2		LICT261F3	LICT363C3	LICT531E4	LR210	E2	LR324	B3	LR383	D3	LTP231	E2	LTP336	C6	ZD302	E6
LC221	E2	LC270	F3	LC357	A5	LICT210E2		LICT262F3	LICT365B3	LICT532D4	LR211	E2	LR325	D3	LR384	D5	LTP232	D3	LTP337	D6	ZD305	F4
LC222	E2	LC271	F3	LC358	D6	LICT212F2		LICT263F3	LICT366B3	LICT533E4	LR212	F2	LR326	B3	LR502	F1	LTP233	C2	LTP338	C6	ZD306	F4
LC223	E2	LC272	F3	LC506	F1	LICT213F2		LICT264F3	LICT367B3	LICT534E4	LR213	F2	LR327	B3	LR504	D5	LTP234	D2	LTP339	C6		
LC224	E2	LC279	C1	LC507	F1	LICT214F2		LICT266D3	LICT368D3	LICT535E4	LR214	F2	LR328	B3	LR526	A5	LTP235	E2	LTP340	D6		
LC230	F2	LC283	D2	LC508	F1	LICT215F2		LICT267F3	LICT369D4	LICT536E4	LR215	F2	LR331	D3	LR528	A5	LTP236	D2	LTP341	C6		
LC231	F2	LC287	D2	LC513	B1	LICT216E2		LICT268C2	LICT371B4	LICT537D5	LR216	F2	LR332	D4	LR532	B2	LTP237	B3	LTP342	D6		
LC232	F2	LC289	F3	LC514	B1	LICT217F2		LICT269D3	LICT372B4	LICT538D5	LR217	E2	LR333	B3	LR533	B2	LTP238	B3	LTP343	D6		
LC233	F2	LC290	C1	LC515	B1	LICT218E2		LICT270D3	LICT373B4	LICT540D5	LR218	E2	LR336	B3	LR534	A1	LTP239	B3	LTP344	D6		
LC234	F2	LC291	C2	LC517	B2	LICT219F2		LICT271B3	LICT376D4	LICT542D5	LR219	E2	LR337	D3	LR535	B1	LTP240	B3	LTP345	B5		