



SERVICE MANUAL

MODEL: CM2760 (CM2760, CMS2760F)

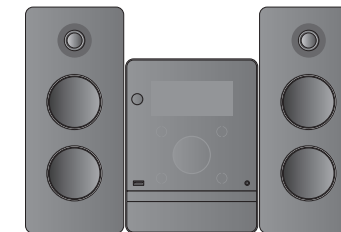


Micro Hi-Fi Audio **SERVICE MANUAL**

MODEL: CM2760
(CM2760, CMS2760F)

CAUTION

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



P/NO : AFN77360055

JANUARY, 2016

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SECTION 1

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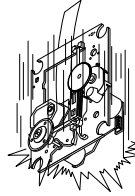
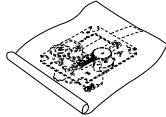
SERVICING PRECAUTIONS

NOTES REGARDING HANDLING OF THE PICK-UP

1. Notes for transport and storage

- 1) The pick-up should always be left in its conductive bag until immediately prior to use.
- 2) The pick-up should never be subjected to external pressure or impact.

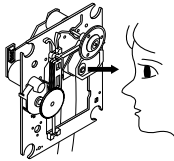
Storage in conductive bag



Drop impact

2. Repair notes

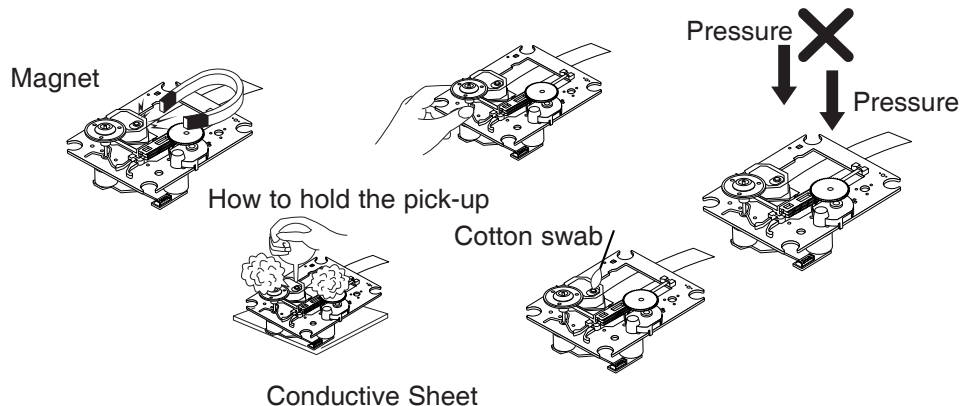
- 1) The pick-up incorporates a strong magnet, and so should never be brought close to magnetic materials.
- 2) The pick-up should always be handled correctly and carefully, taking care to avoid external pressure and impact. If it is subjected to strong pressure or impact, the result may be an operational malfunction and/or damage to the printed-circuit board.
- 3) Each and every pick-up is already individually adjusted to a high degree of precision, and for that reason the adjustment point and installation screws should absolutely never be touched.
- 4) Laser beams may damage the eyes!
Absolutely never permit laser beams to enter the eyes!
Also NEVER switch ON the power to the laser output part (lens, etc.) of the pick-up if it is damaged.



NEVER look directly at the laser beam, and don't allow contact with fingers or other exposed skin.

5) Cleaning the lens surface

If there is dust on the lens surface, the dust should be cleaned away by using an air bush (such as used for camera lens). The lens is held by a delicate spring. When cleaning the lens surface, therefore, a cotton swab should be used, taking care not to distort lens.



6) Never attempt to disassemble the pick-up.

Spring has excess pressure. If the lens is extremely dirty, apply isopropyl alcohol to the cotton swab. (Do not use any other liquid cleaners, because they will damage the lens.) Take care not to use too much of this alcohol on the swab, and do not allow the alcohol to get inside the pick-up.

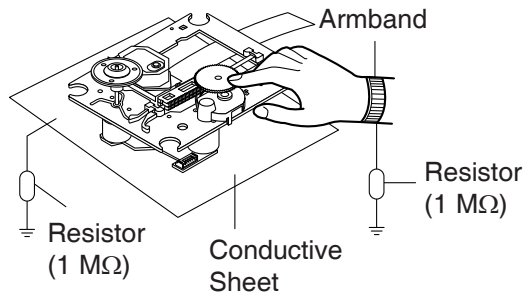
NOTES REGARDING COMPACT DISC PLAYER REPAIRS

1. Preparations

- 1) Compact disc players incorporate a great many ICs as well as the pick-up (laser diode). These components are sensitive to, and easily affected by, static electricity. If such static electricity is high voltage, components can be damaged, and for that reason components should be handled with care.
- 2) The pick-up is composed of many optical components and other high-precision components. Care must be taken, therefore, to avoid repair or storage where the temperature or humidity is high, where strong magnetism is present, or where there is excessive dust.

2. Notes for repair

- 1) Before replacing a component part, first disconnect the power supply lead wire from the unit
- 2) All equipment, measuring instruments and tools must be grounded.
- 3) The workbench should be covered with a conductive sheet and grounded.
When removing the laser pick-up from its conductive bag, do not place the pick-up on the bag. (This is because there is the possibility of damage by static electricity.)
- 4) To prevent AC leakage, the metal part of the soldering iron should be grounded.
- 5) Workers should be grounded by an armband (1 M Ω)
- 6) Care should be taken not to permit the laser pick-up to come in contact with clothing, in order to prevent static electricity changes in the clothing to escape from the armband.
- 7) The laser beam from the pick-up should NEVER be directly facing the eyes or bare skin.



ESD PRECAUTIONS

Electrostatically Sensitive Devices (ESD)

Some semiconductor (solid state) devices can be damaged easily by static electricity. Such components commonly are called Electrostatically Sensitive Devices (ESD). Examples of typical ESD 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 ESD 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 ESD 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 ESD devices.
5. Do not use freon-propelled chemicals. These can generate electrical charges sufficient to damage ESD devices.
6. Do not remove a replacement ESD device from its protective package until immediately before you are ready to install it. (Most replacement ESD devices are packaged with leads electrically shorted together by conductive foam, aluminum foil or comparable conductive materials).
7. Immediately before removing the protective material from the leads of a replacement ESD 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 ESD devices. (Otherwise 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 ESD device).

CAUTION. GRAPHIC SYMBOLS

	THE LIGHTNING FLASH WITH APOWHEAD SYMBOL. WITHIN AN EQUILATERAL TRIANGLE, IS INTENDED TO ALERT THE SERVICE PERSONNEL TO THE PRESENCE OF UNINSULATED "DANGEROUS VOLTAGE" THAT MAY BE OF SUFFICIENT MAGNITUDE TO CONSTITUTE A RISK OF ELECTRIC SHOCK.
	THE EXCLAMATION POINT WITHIN AN EQUILATERAL TRIANGLE IS INTENDED TO ALERT THE SERVICE PERSONNEL TO THE PRESENCE OF IMPORTANT SAFETY INFORMATION IN SERVICE LITERATURE.

HIDDEN KEY MODE

HIDDEN MODE	AVAILABLE STATUS	ENTRANCE KEY	EXIT KEY	DISPLAY
Version Check	POWER ON STATUS	Front Play + RMC 'Play' for 5s	RMC 'PLAY' for 1.5s	P1501290 OP0 FF Q1501290 EQCSFFFF
EEPROM INITIAL	POWER ON STATUS	Front Play + RMC '<<' for 5s	auto exit	"E2P CLR"
EEPROM EDIT	POWER ON STATUS	Front Play + RMC '>>' for 5s	Front Play + RMC '>> '	OPT0-9F (For Example)
APD Test Display	POWER ON STATUS	Front Play + RMC 'DELETE' for 5s	Front Play + RMC 'DE-LETE'	APD MM:SS (AUX mode→H:MM:SS)

B2B, Dealer HIDDEN MODE	AVAILABLE STATUS	ENTRANCE KEY	EXIT KEY	DISPLAY
Clip On/Off	POWER ON STATUS	Front Play + RMC 'Mute' for 5s	auto exit	CLIP OFF 00 130 00 CLIP ON
Disc Lock On/Off	POWER ON STATUS	Front Play + RMC 'Stop' for 5s	Front Play + RMC 'Stop' for 5s	'LOCKED'/'UNLOCKED'
Power Disc Lock On/Off	POWER ON STATUS	Front Play + RMC 'SOUND EFFECT' for 5s	Front Play + RMC 'SOUND EFFECT' for 5s	'LOCKED'/'UNLOCKED'
Demo ALL Key Lock	POWER ON STATUS Demo Function Only Active	Front Play + RMC 'INFO' for 5s	Front Play + RMC 'INFO' for 5s	'KEY LOCK'/'UNLOCKED'
BT Auto Power On/Off	POWER ON STATUS	Front/RMC 'Power' for 5s	Power normal Key SET Power off	OFF-AUTO POWER GOOD BY Scroll
Sound BYPASS	POWER ON STATUS	Front Play + RMC 'PROGRAM' for 5s	SOUND EFFECT key	display 'BYPASS' 3s

SOFTWARE UPDATE GUIDE

- 1) Prepare USB device without any files.
- 2) Copy software ("CM2760_FW_2015xxxxx.bin") into this USB device.
- 3) Power on the unit, switch to USB function.
- 4) Plug in USB device which contains software, no need other operations.
- 5) VFD display "SEARCH" ➡ "MCS UP" ➡ "FINISH", then unit auto power off.

SPECIFICATIONS

• GENERAL

Power requirements	Refer to the main label.
Power consumption	Refer to the main label.
	Networked standby : 0.5 W (If all network ports are activated.)
Dimensions (W x H x D)	Approx. 170 mm x 230 mm x 276 mm
Net Weight	Approx. 2.2 kg
Operating temperature	5 °C to 35 °C
Operating humidity	5 % to 90 %

• INPUTS

Portable in (PORT. IN)	0.45 Vrms (3.5 mm stereo jack) x 1
------------------------	------------------------------------

• TUNER

FM Tuning Range	87.5 to 108.0 MHz or 87.50 to 108.00 MHz
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• AMPLIFIER (RMS OUTPUT POWER)

Total	160 W
Front	80 W (4 Ω at 1 kHz, 10 % THD)

• SYSTEM

Frequency response	80 to 20,000 Hz
Signal-to-noise ratio	80 dB
Dynamic range	75 dB
Bus Power Supply (USB)	5 V $\pm$ 500 mA

• FRONT SPEAKERS

Type	3 Way 3 Speaker
Impedance	4 Ω
Rated Input Power	80 W
Max. Input Power	160 W
Dimensions (W x H x D)	Approx. 127 mm x 295 mm x 240 mm
Net Weight	Approx. 3.36 kg

- Design and specifications are subject to change without notice.

MEMO

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

SECTION 2

CABINET & MAIN CHASSIS

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 2. PACKING ACCESSORY SECTION 2-7

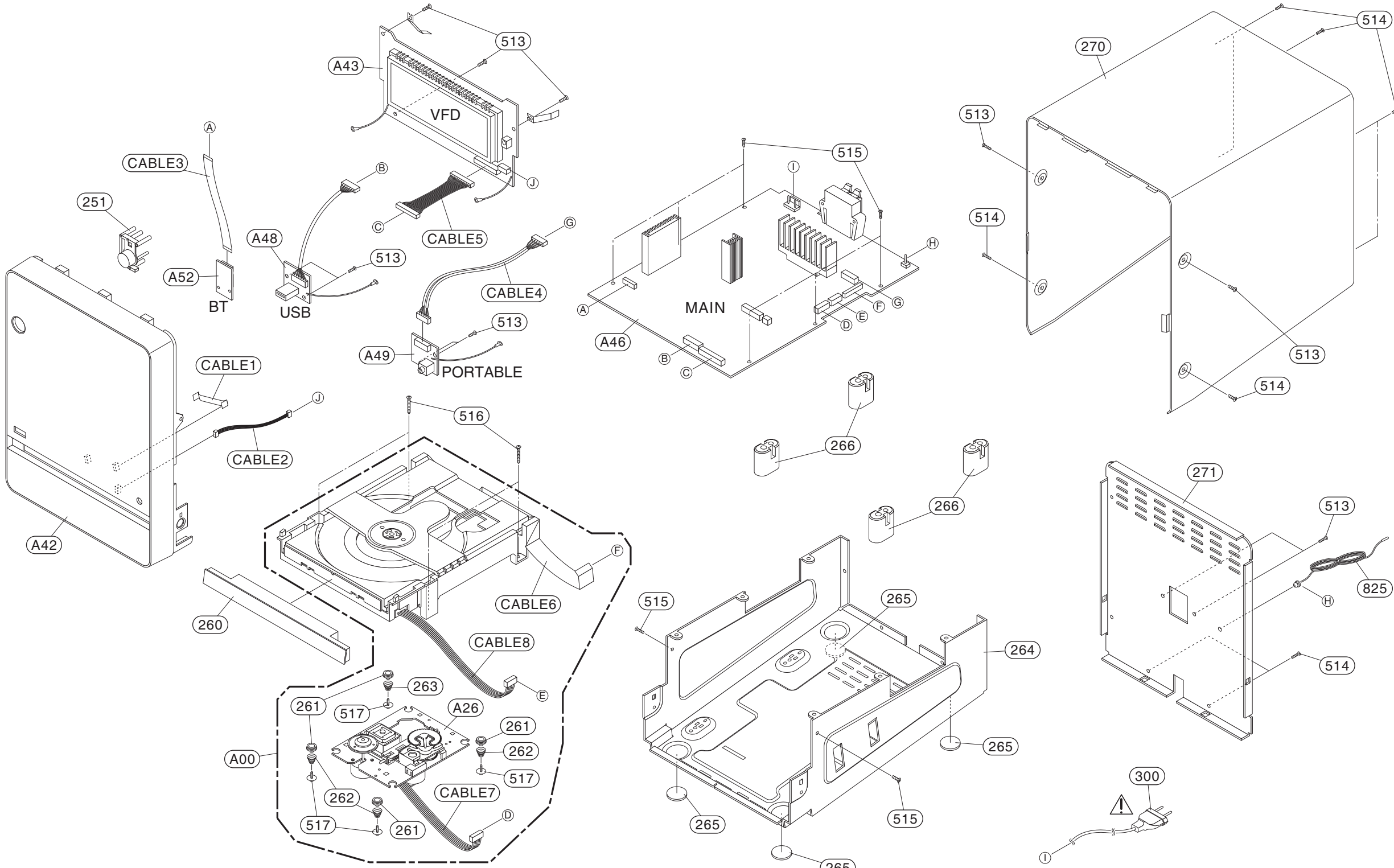
 3. SPEAKER SECTION 2-8

MEMO

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EXPLODED VIEWS

1. CABINET AND MAIN FRAME SECTION



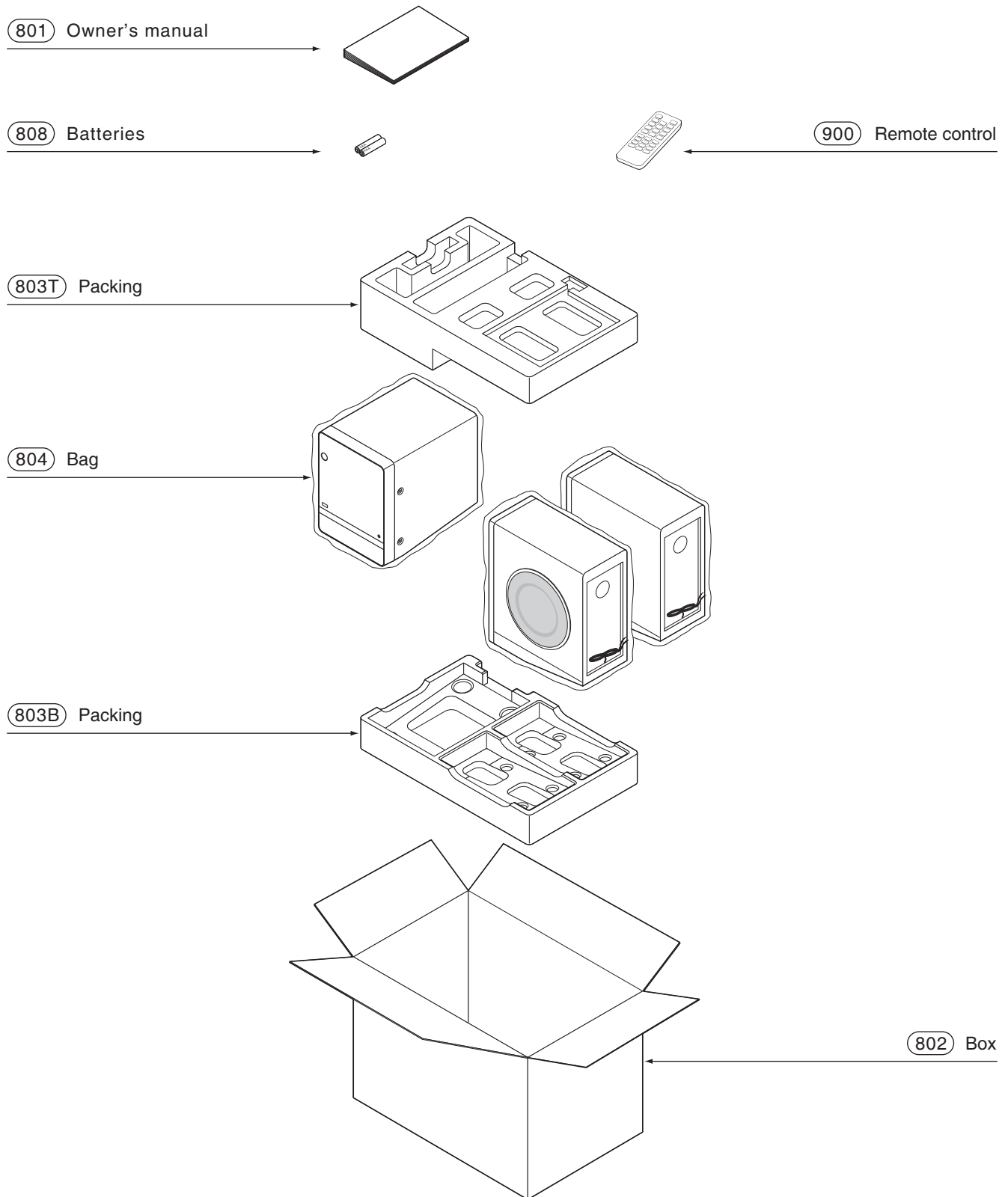
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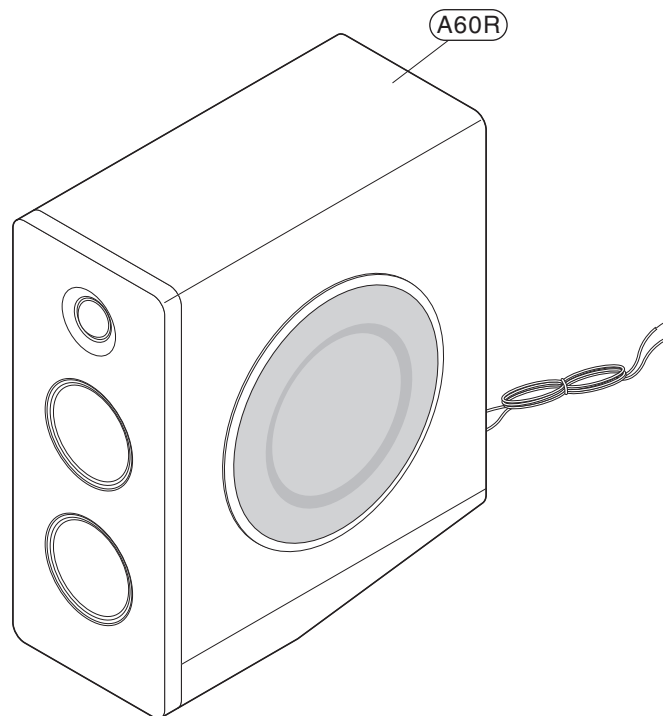
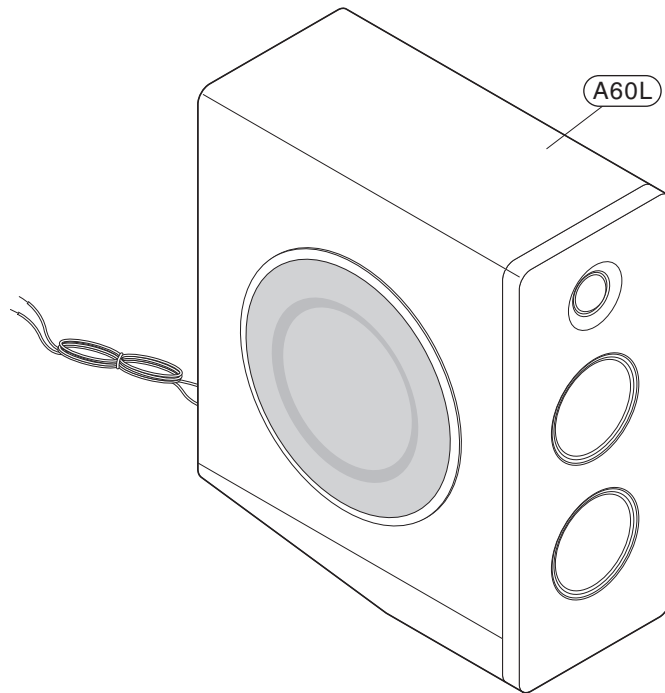
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2. PACKING ACCESSORY SECTION



3. SPEAKER SECTION



SECTION 3

ELECTRICAL

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ONE POINT REPAIR GUIDE

1. NO POWER PROBLEM

No power problem occurs when you power on the unit.

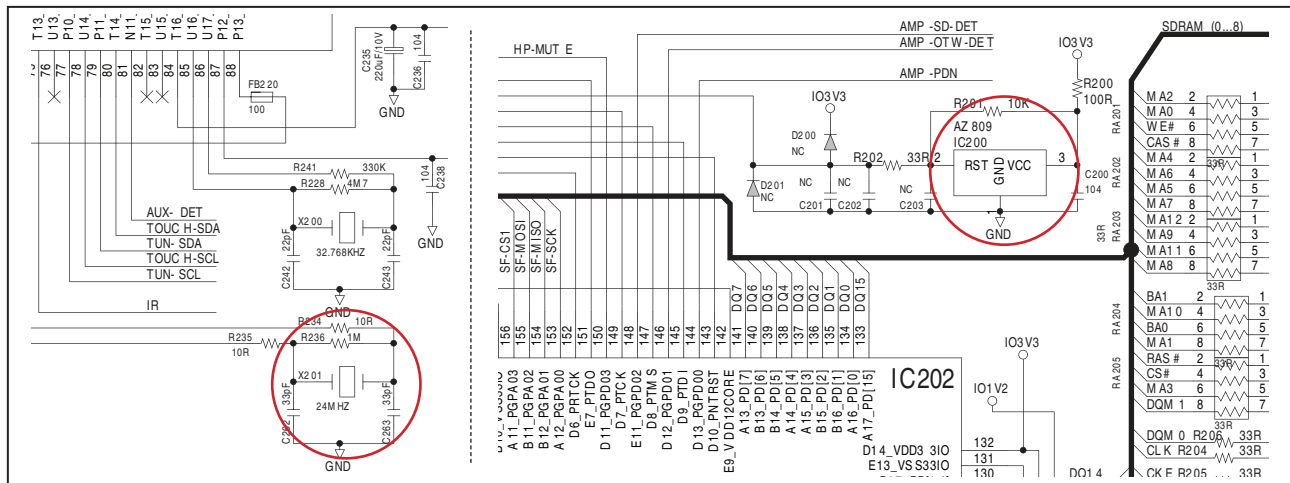
1-1. NO POWER

1-1-1. Solution

Replace X201, IC200, IC202.

1-1-2. How to troubleshoot (Countermeasure)

- 1) Check X201(Crystal).
 - ⇒ If it does not oscillate, replace X201.
 - 2) Check IC200(Reset IC).
 - ⇒ If its output voltage is not more than +2.7 V, replace IC200.
 - 3) Check IC202(DSP IC).
 - ⇒ After Power is ON if the pin48 of IC202 is not 'High', replace IC202.
- But, the new flash IC need to write program.



ONE POINT REPAIR GUIDE

2. SPEAKER NO AUDIO OUTPUT

No audio output problem occurs when you power on the unit.

2-1. NO SOUND

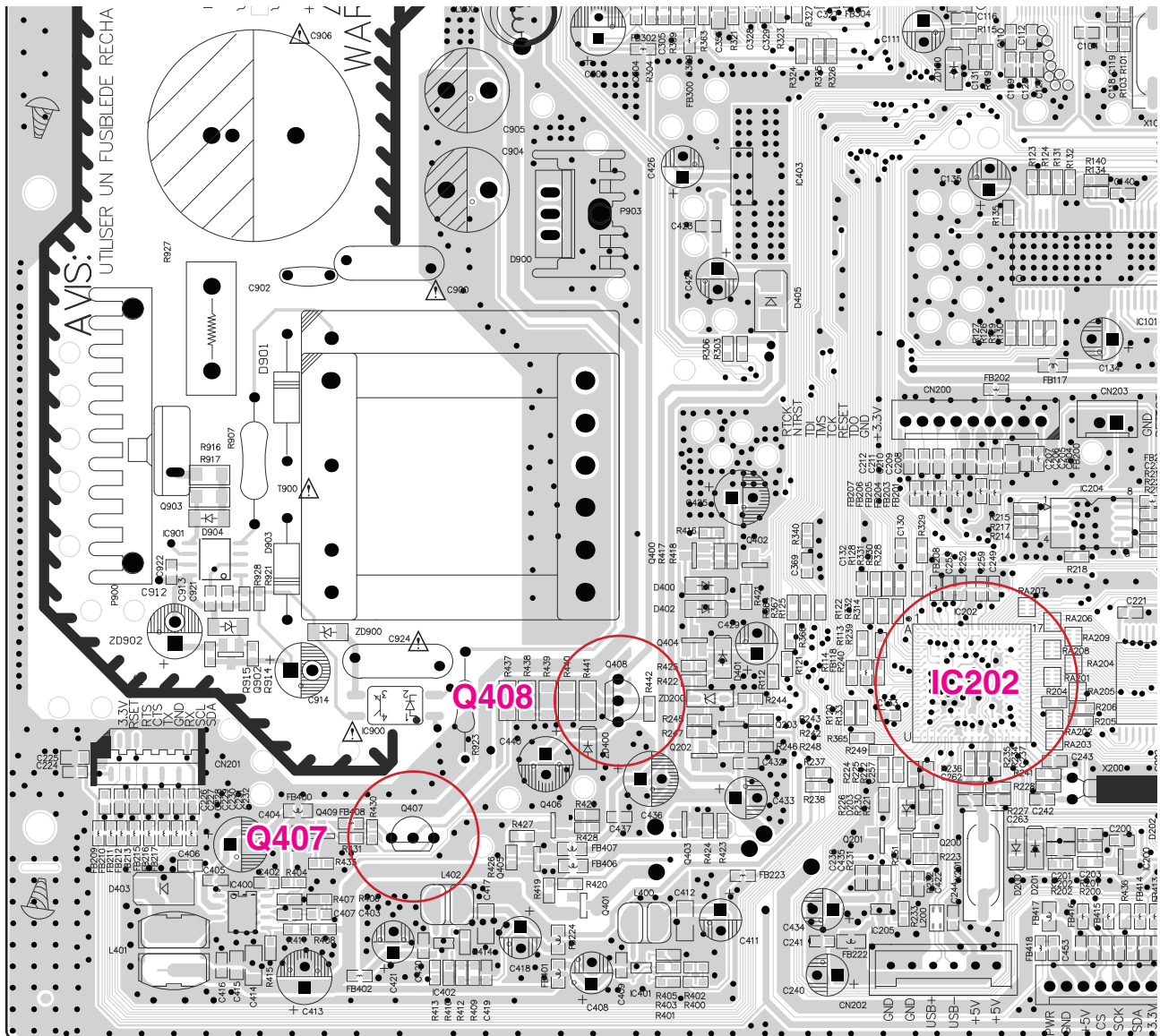
2-1-1. Solution

Reassemble AMP IC heat-sink, replace IC202.

2-1-2. How to troubleshoot (Countermeasure)

- 1) Reassemble AMP IC heat-sink (heat-sink screw must be assembled tightly).
- 2) Still NG, please check Q409, Q407, Q408 part out, if it is not appear 12 V.
- 3) If it is not appear 12 V, check IC202 pin48 output, is a high level.
- 4) If not high voltage, check whether IC202 damage, flash is lost.

2-1-3. Service hint (Any picture/ Remark)



ONE POINT REPAIR GUIDE

3. USB NO DETECT

When USB insert, USB no detect on the unit.

3-1. NO DETECT

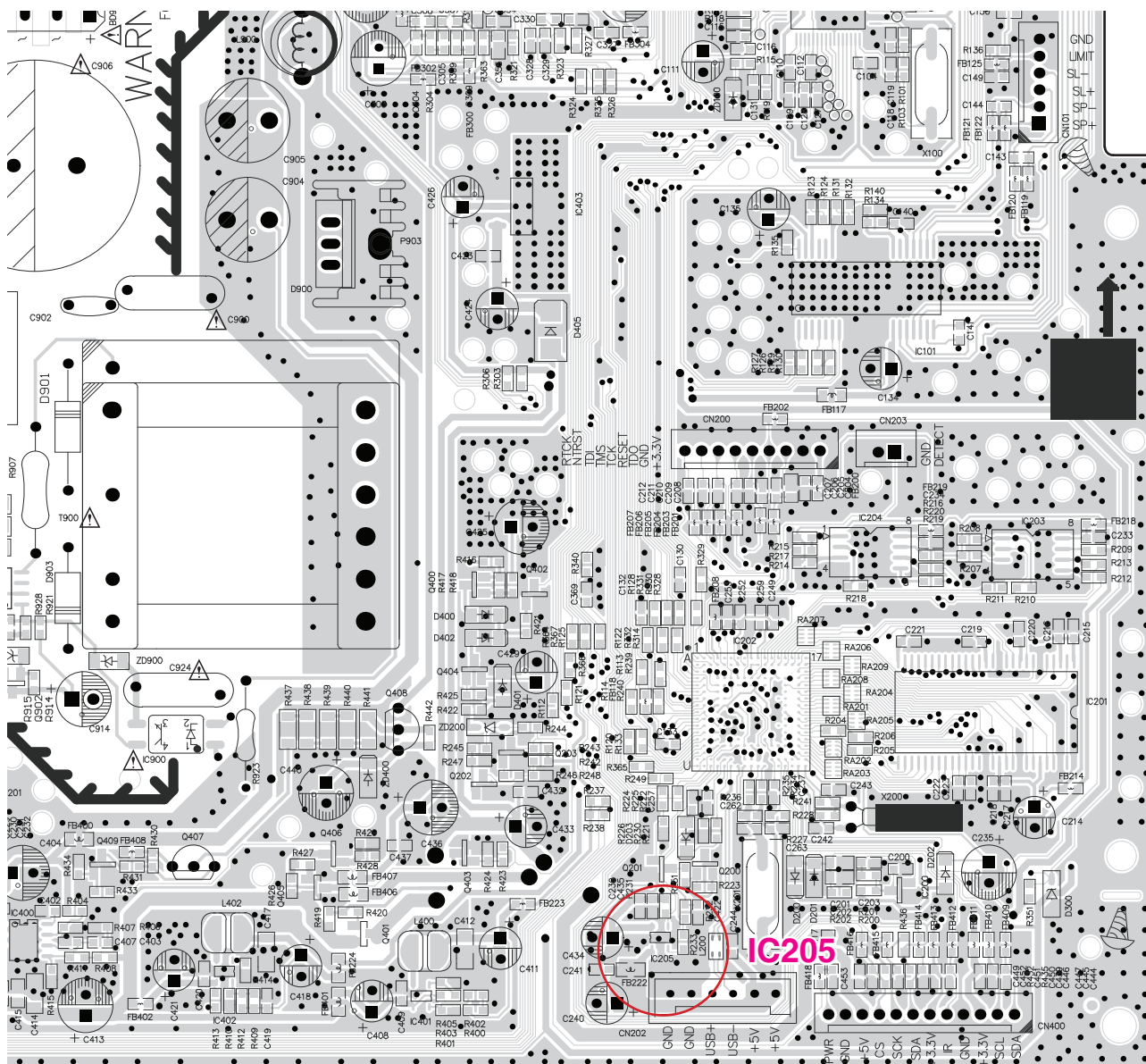
3-1-1. Solution

Replace IC205.

3-1-2. How to troubleshoot (Countermeasure)

- 1) Please check IC205.
⇒ pin1 : 5 V
- 2) If it is not OK, replace IC205.

3-1-3. Service hint (Any picture/ Remark)



ONE POINT REPAIR GUIDE

4. PROTECTION

4-1. D(DC) PROTECTION

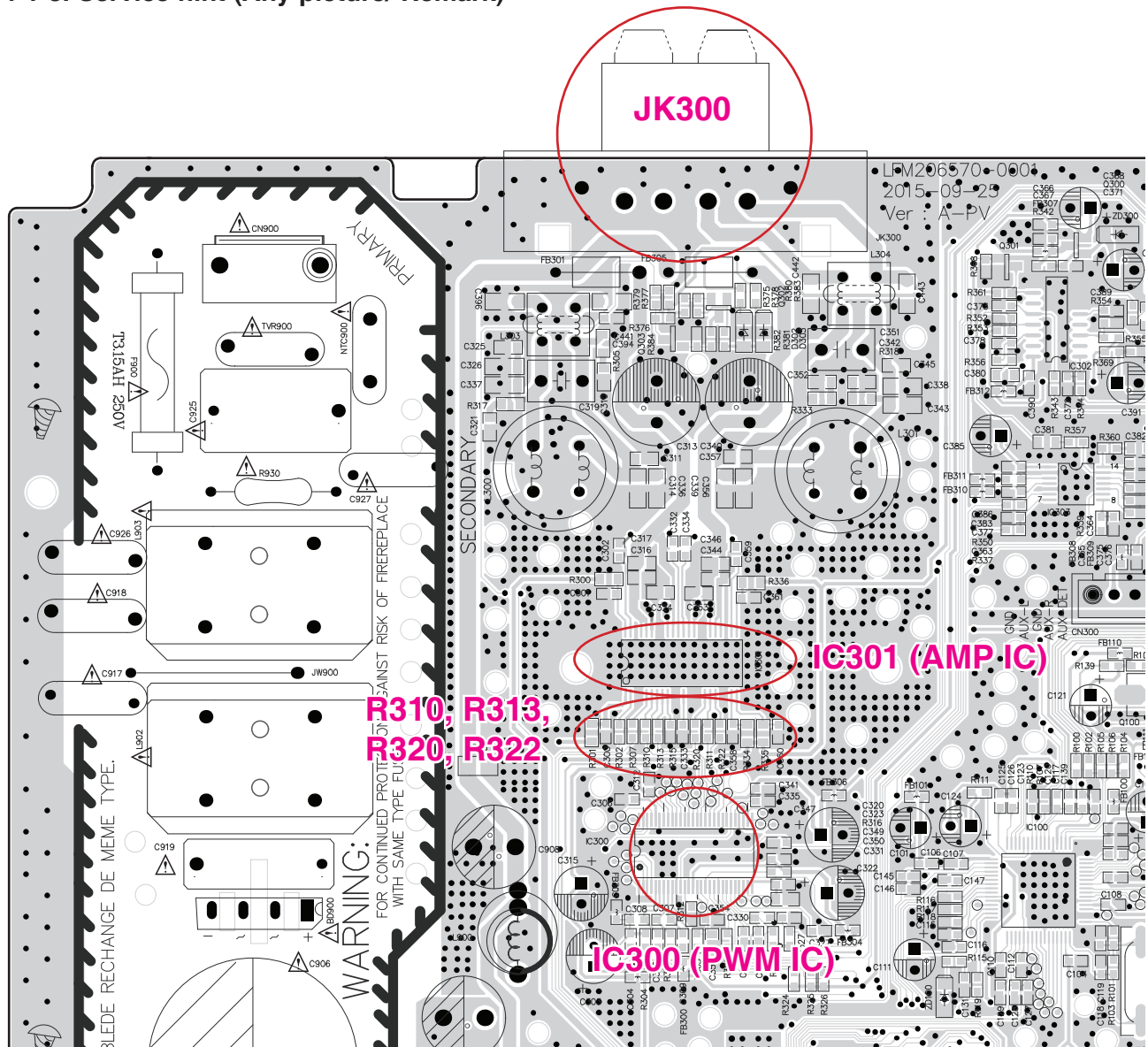
4-1-1. Solution

Replace IC301(AMP IC) on MAIN board.

4-1-2. How to troubleshoot (Countermeasure)

- 1) Press the power button, the display is normal, no sound output. (D Protection or S Protection)
- 2) Check DC Voltage of speaker out Front Left channel + & -(JK300 pin2, 1), Front Right channel + & - (JK300 pin4, 3).
- 3) Check resistor crack, cold solder of PWM IC out (R310, R313, R320, R322).
- 4) If PWM IC out is ok & speaker out(+/-) has DC Voltage, Replace IC301(AMP IC) on MAIN board.

4-1-3. Service hint (Any picture/ Remark)



ONE POINT REPAIR GUIDE

PROTECTION

4-2. S(SHUT DOWN) PROTECTION

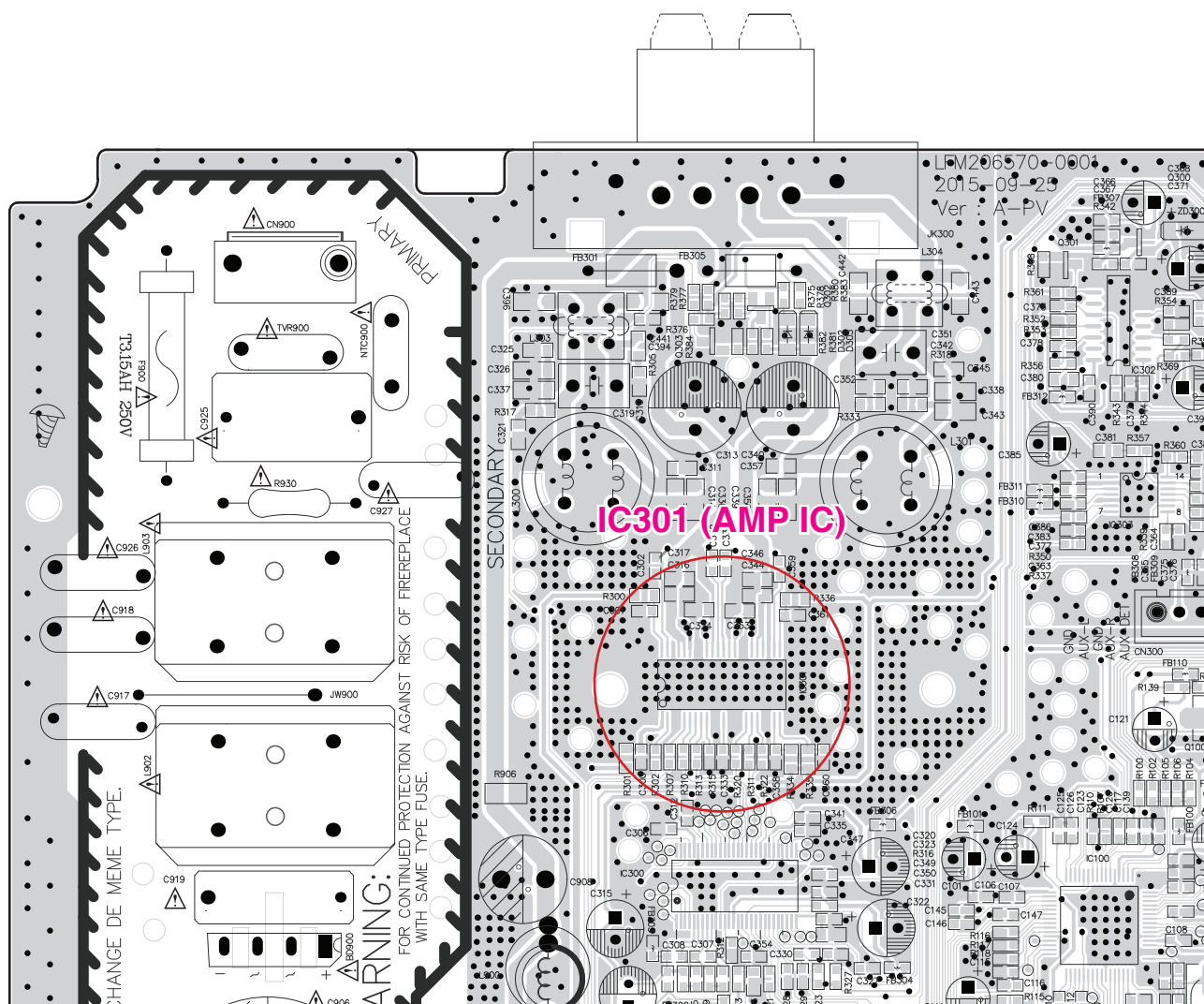
4-2-1. Solution

Replace IC301(AMP IC) on MAIN board.

4-2-2. How to troubleshoot (Countermeasure)

- 1) Press the power button, the display is normal, no sound output. (D Protection or S Protection)
- 2) Check PVDD Voltage. (27 V)
 - If PVDD abnormal Voltage, Refer to SMPS Board repair guide.
- 3) Check GVDD, VDD Voltage(12 V) of IC301 pin1, 22, 23, 44.
 - If 12 V system abnormal Voltage, Refer to 12 V no power repair guide.
- 4) Check impedance (4 Ω) of speaker unit .
 - If Impedance of speaker unit has 1 Ω under, replace speaker unit .
- 5) If check point 2, 3, 4 is ok, replace IC301(AMP IC) on MAIN board.

4-2-3. Service hint (Any picture/ Remark)



< MAIN board top view >

ONE POINT REPAIR GUIDE

PROTECTION

4-3. B(BURNT) PROTECTION

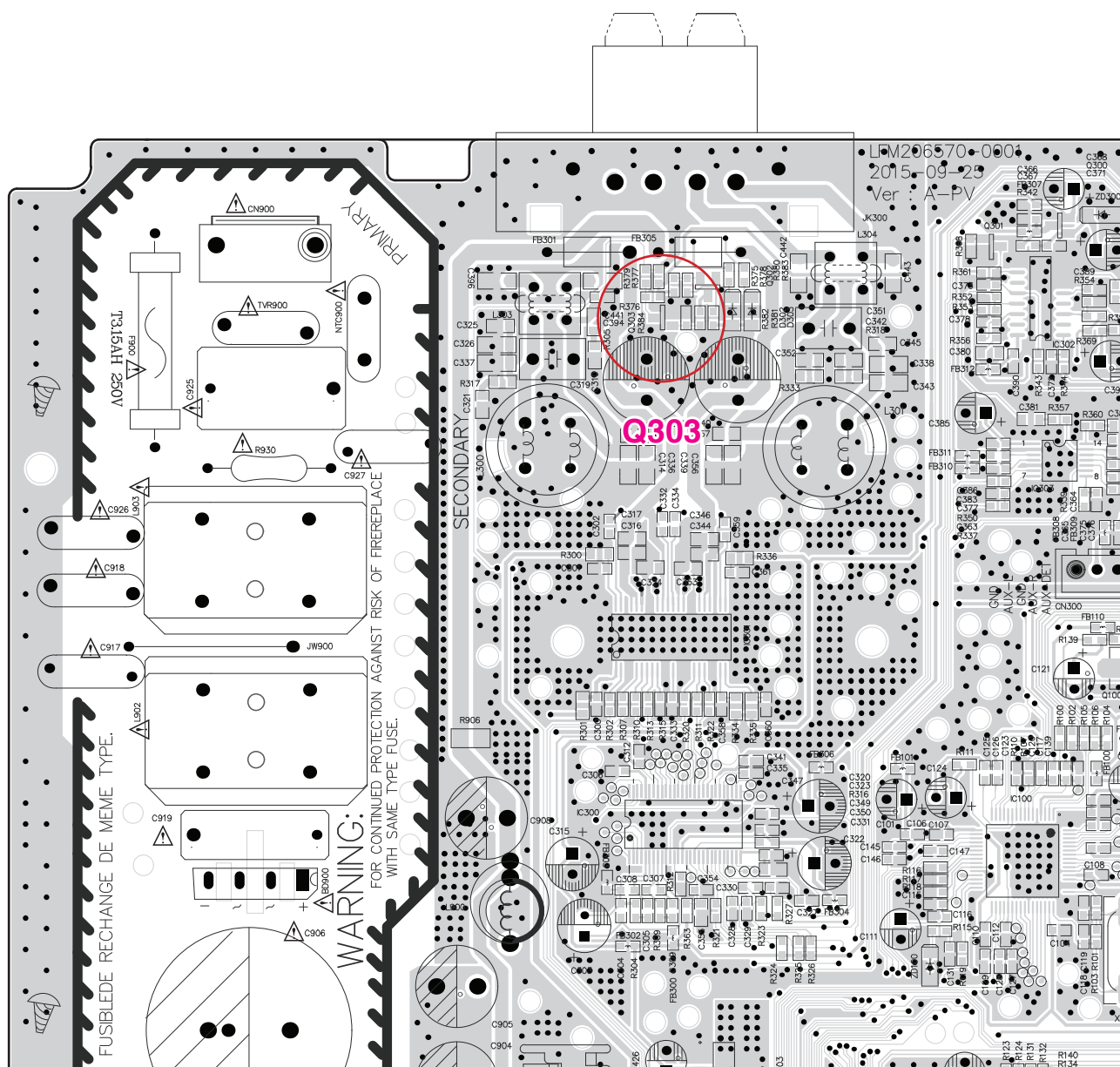
4-3-1. Solution

Replace IC301(AMP IC) on MAIN board.

4-3-2. How to troubleshoot (Countermeasure)

- 1) Press the power button, the display is normal, no sound output. (B Protection)
- 2) Check Voltage 3.3 V of AMP_Protect signal. (collector Q303)
- 3) If collector Q303 is low(0 V), Replace IC301(AMP IC) on MAIN board.

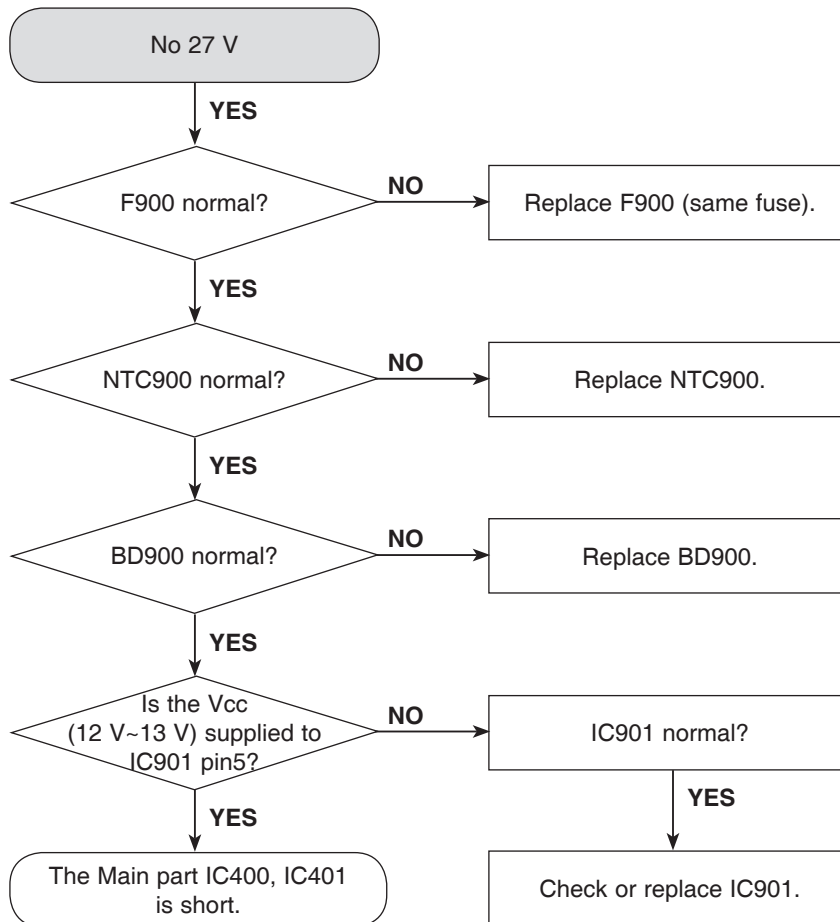
4-3-3. Service hint (Any picture/ Remark)



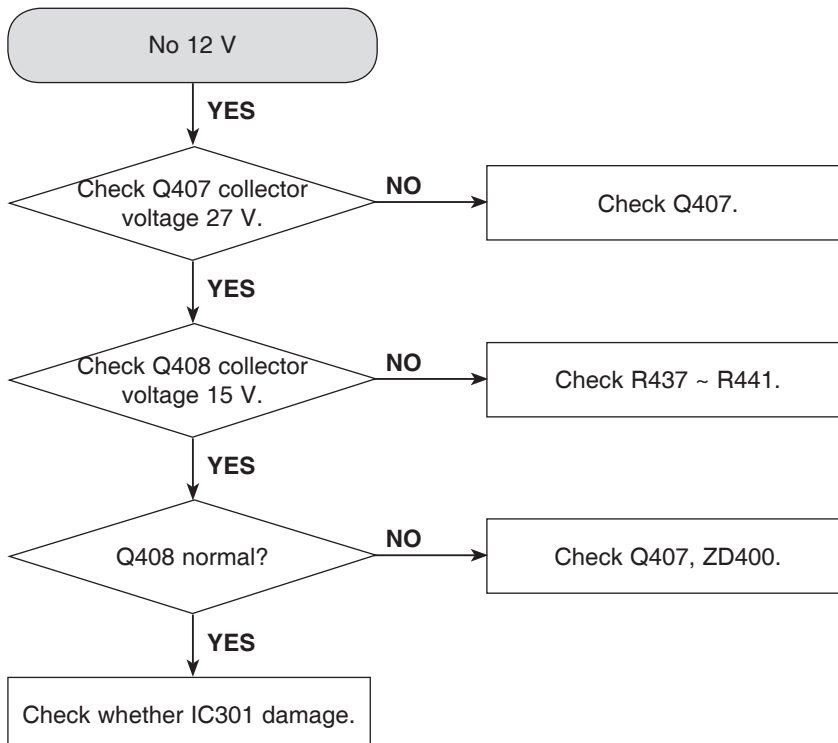
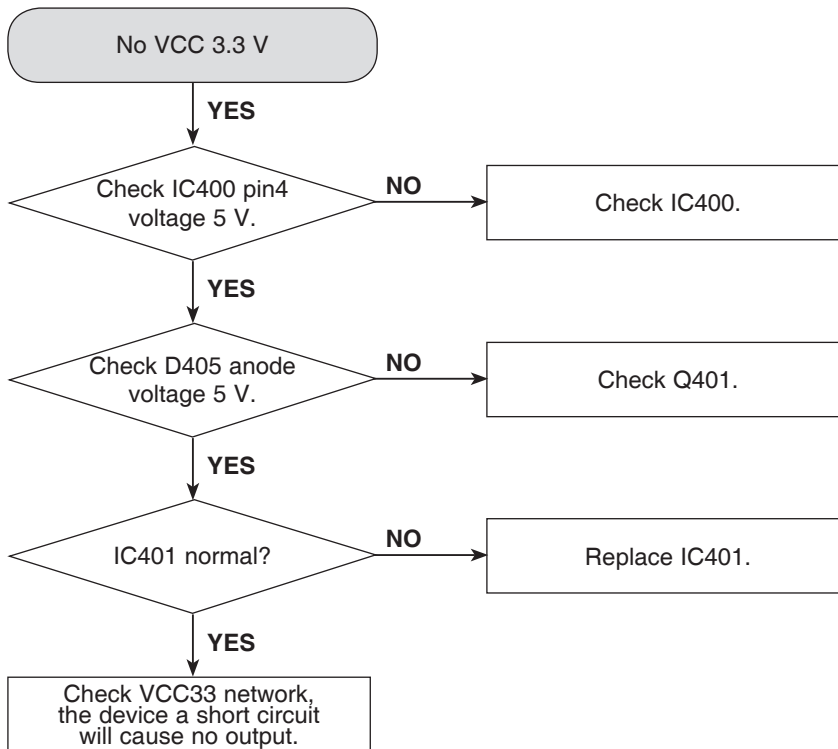
< MAIN board top view >

ELECTRICAL TROUBLESHOOTING GUIDE OF AUDIO PART

1. SMPS POWER CIRCUIT

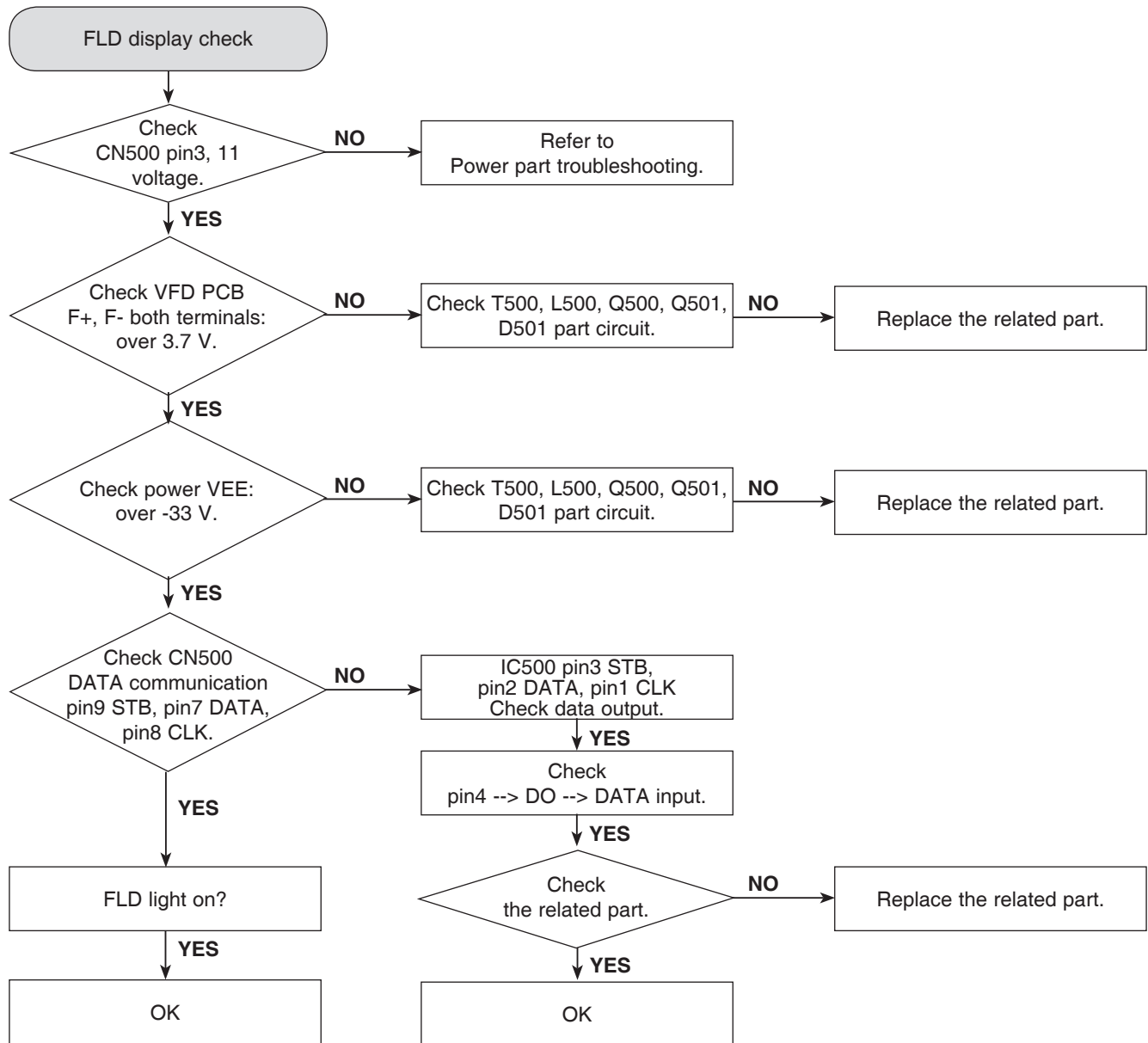


ELECTRICAL TROUBLESHOOTING GUIDE OF AUDIO PART



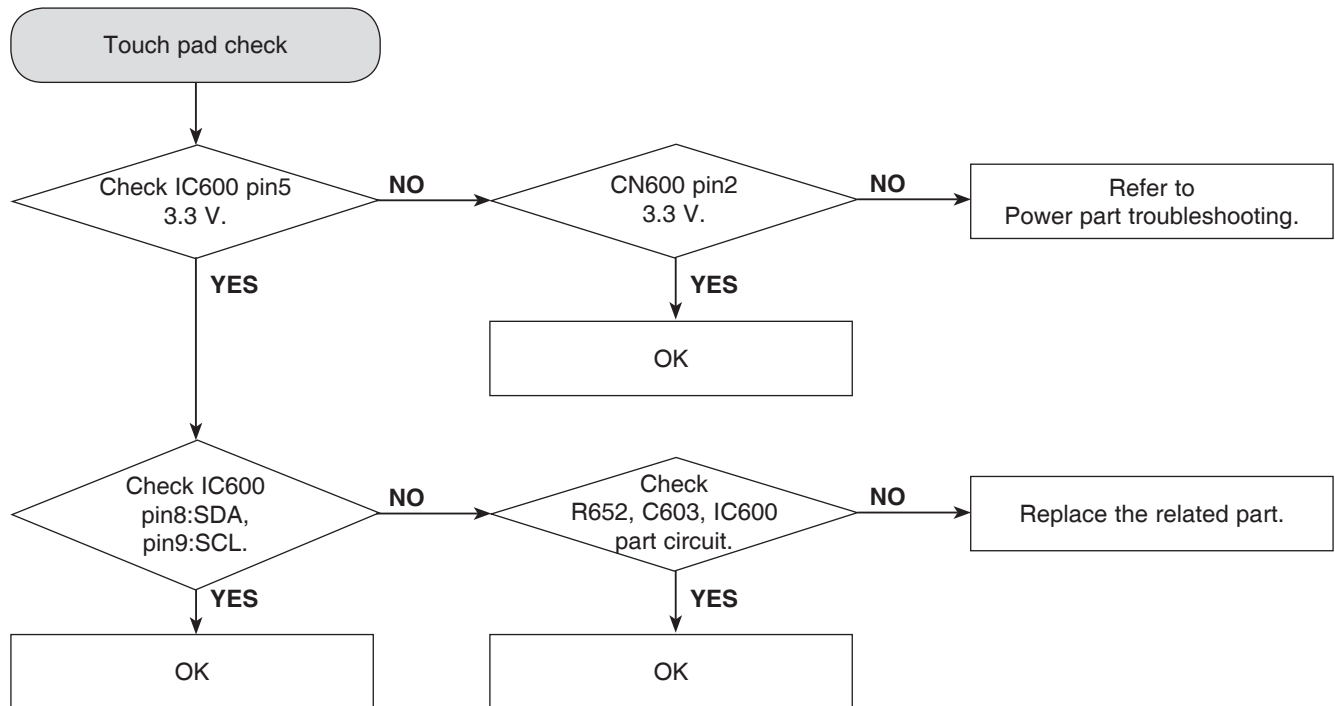
ELECTRICAL TROUBLESHOOTING GUIDE OF AUDIO PART

2. FLD DISPLAY CHECK



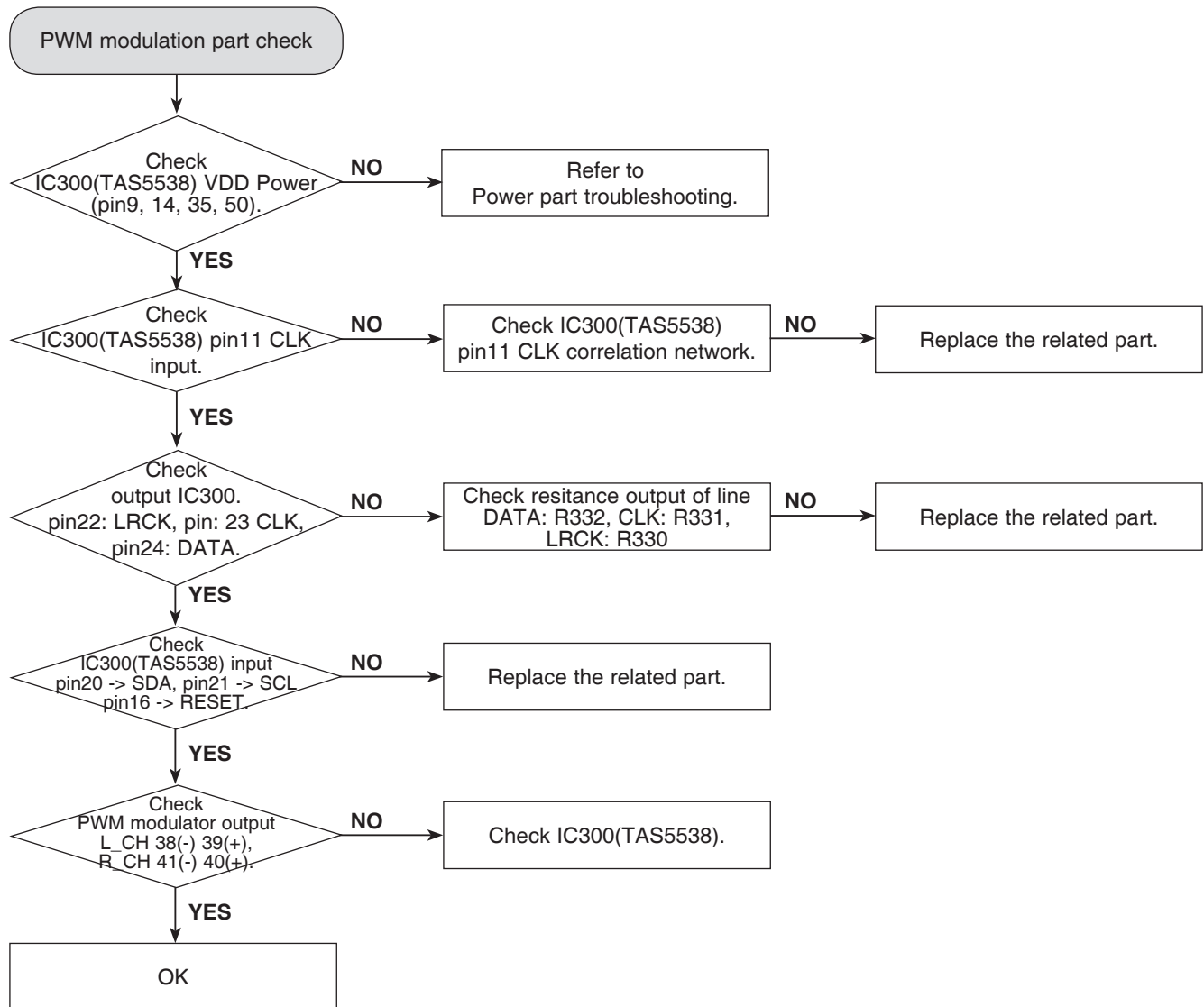
ELECTRICAL TROUBLESHOOTING GUIDE OF AUDIO PART

3. TOUCH PAD CHECK



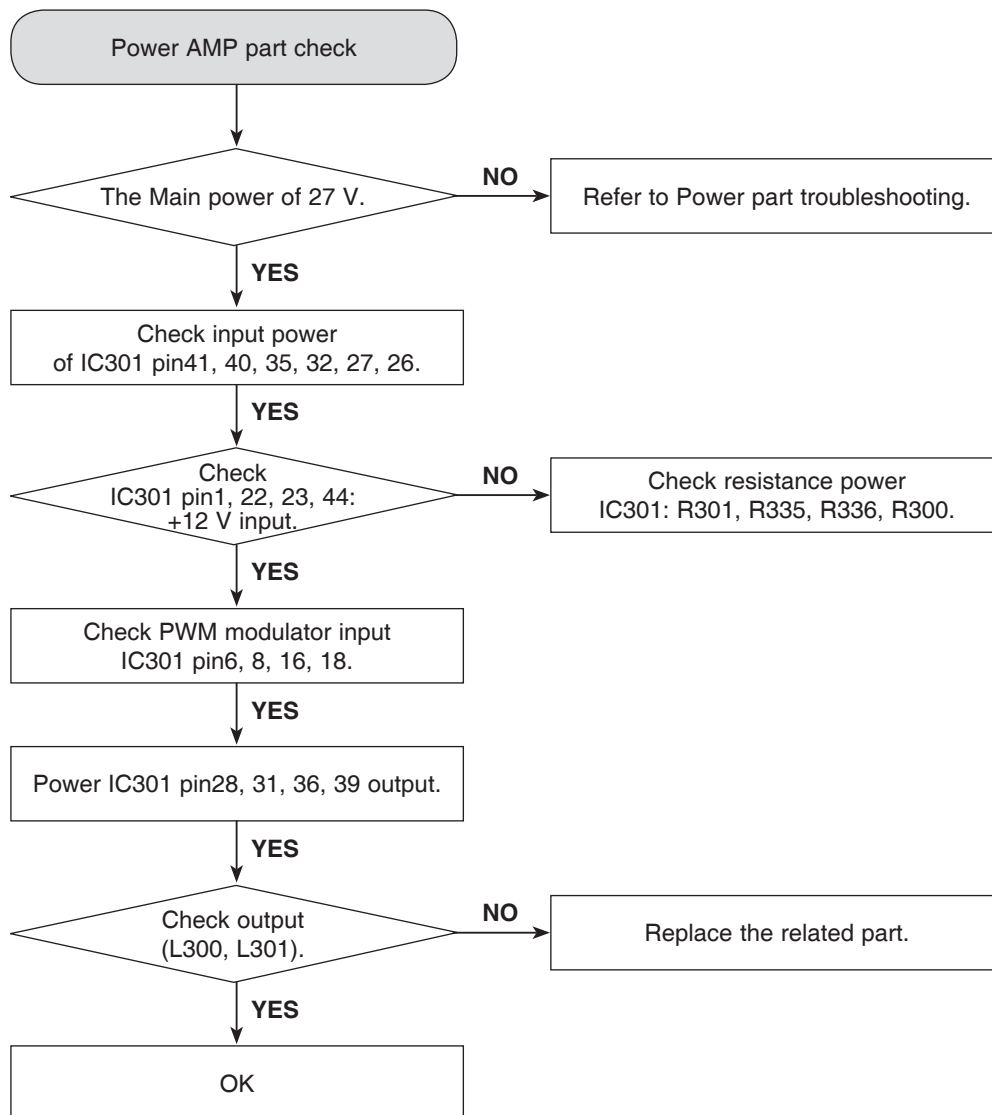
ELECTRICAL TROUBLESHOOTING GUIDE OF AUDIO PART

4. PWM MODULATION PART



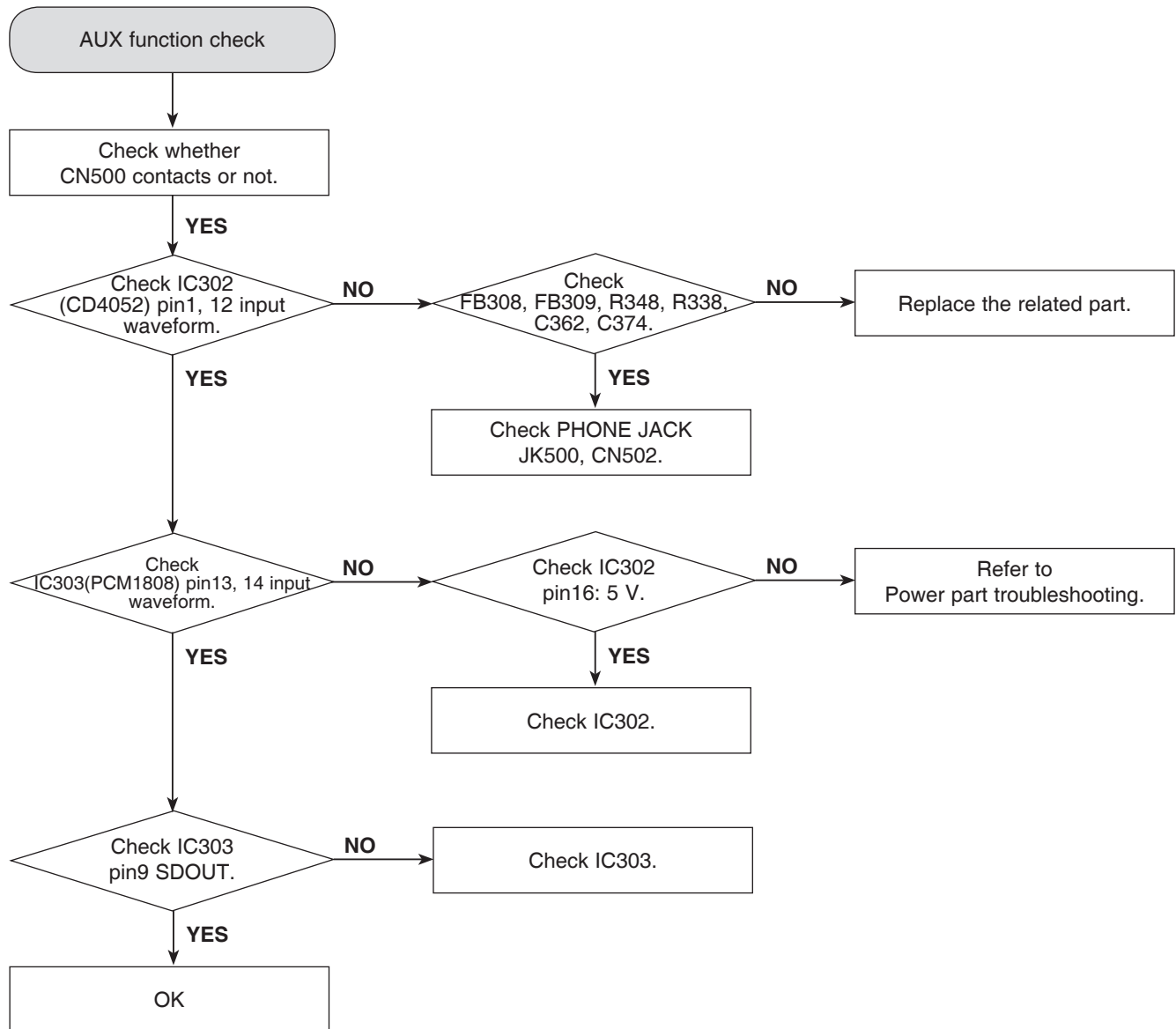
ELECTRICAL TROUBLESHOOTING GUIDE OF AUDIO PART

5. POWER AMP PART CHECK



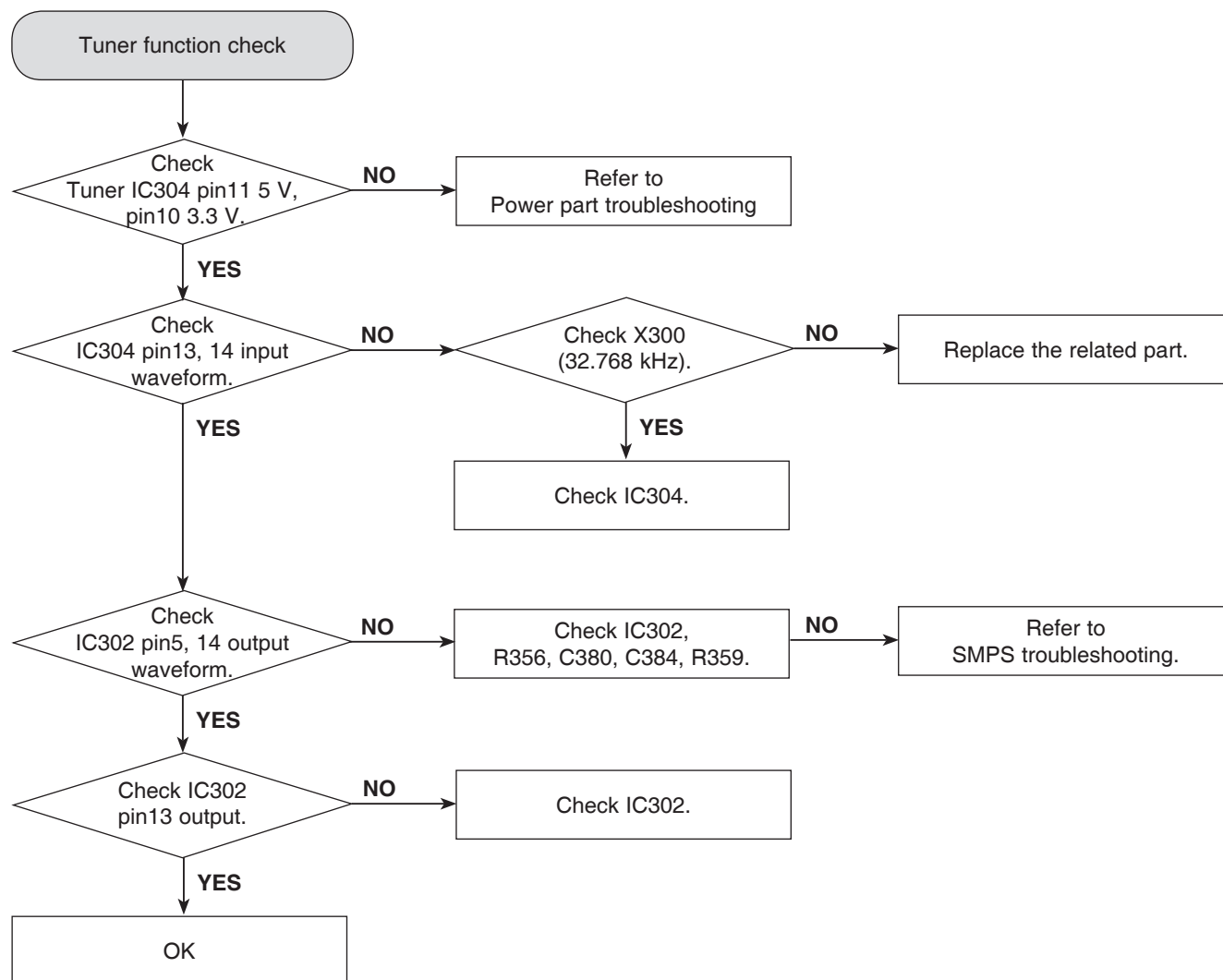
ELECTRICAL TROUBLESHOOTING GUIDE OF AUDIO PART

6. AUX FUNCTION CHECK



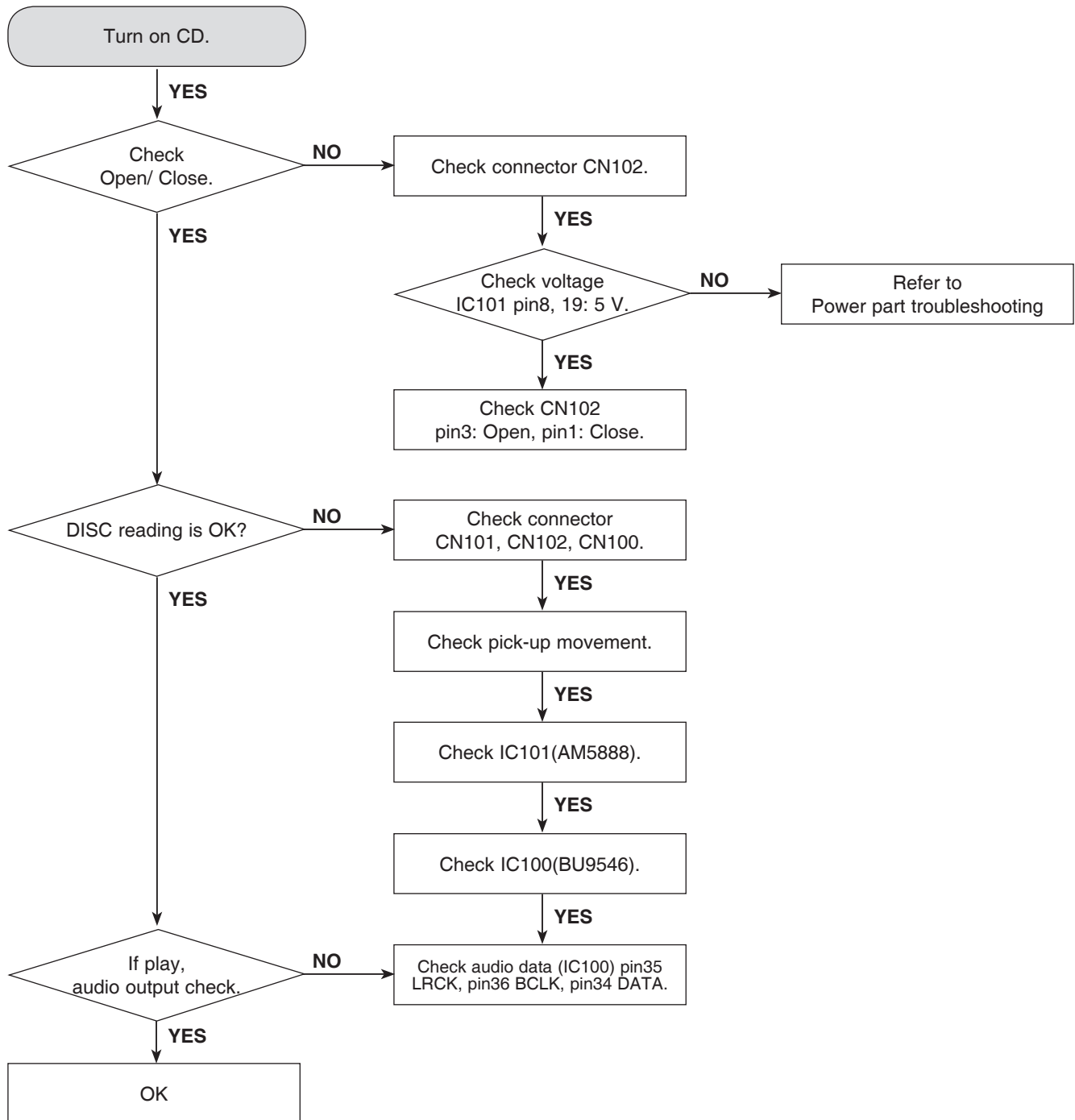
ELECTRICAL TROUBLESHOOTING GUIDE OF AUDIO PART

7. TUNER FUNCTION CHECK



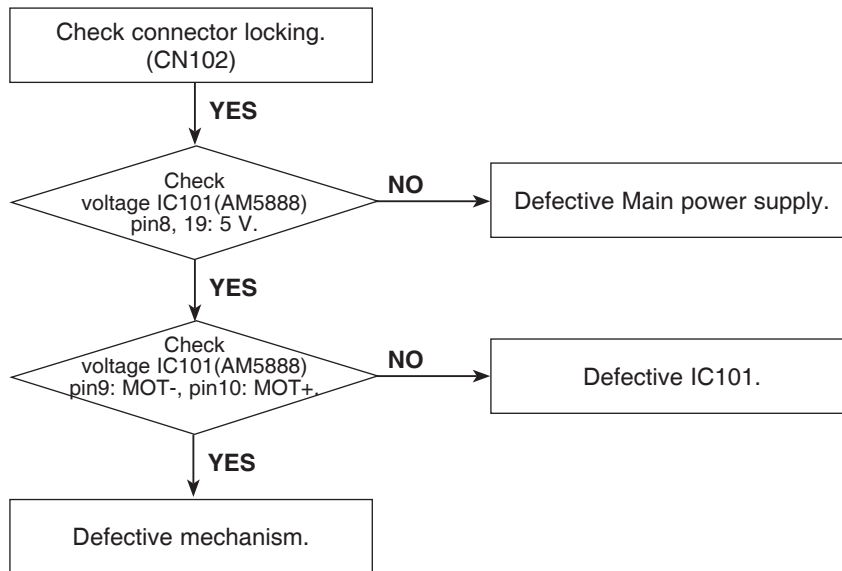
ELECTRICAL TROUBLESHOOTING GUIDE OF CD PART

1. CD PART

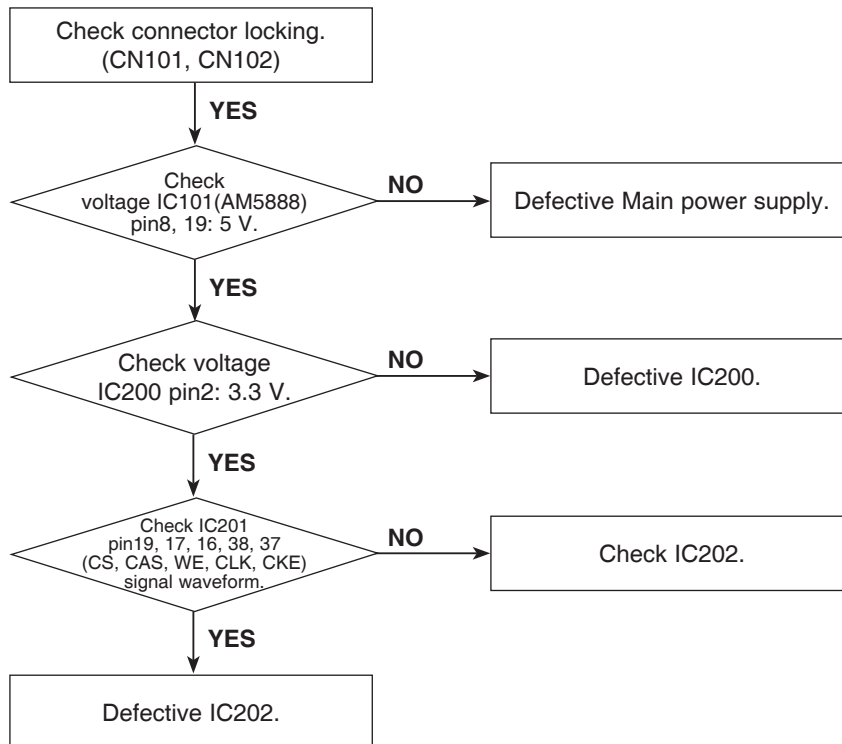


ELECTRICAL TROUBLESHOOTING GUIDE OF CD PART

2. OPEN/ CLOSE NG

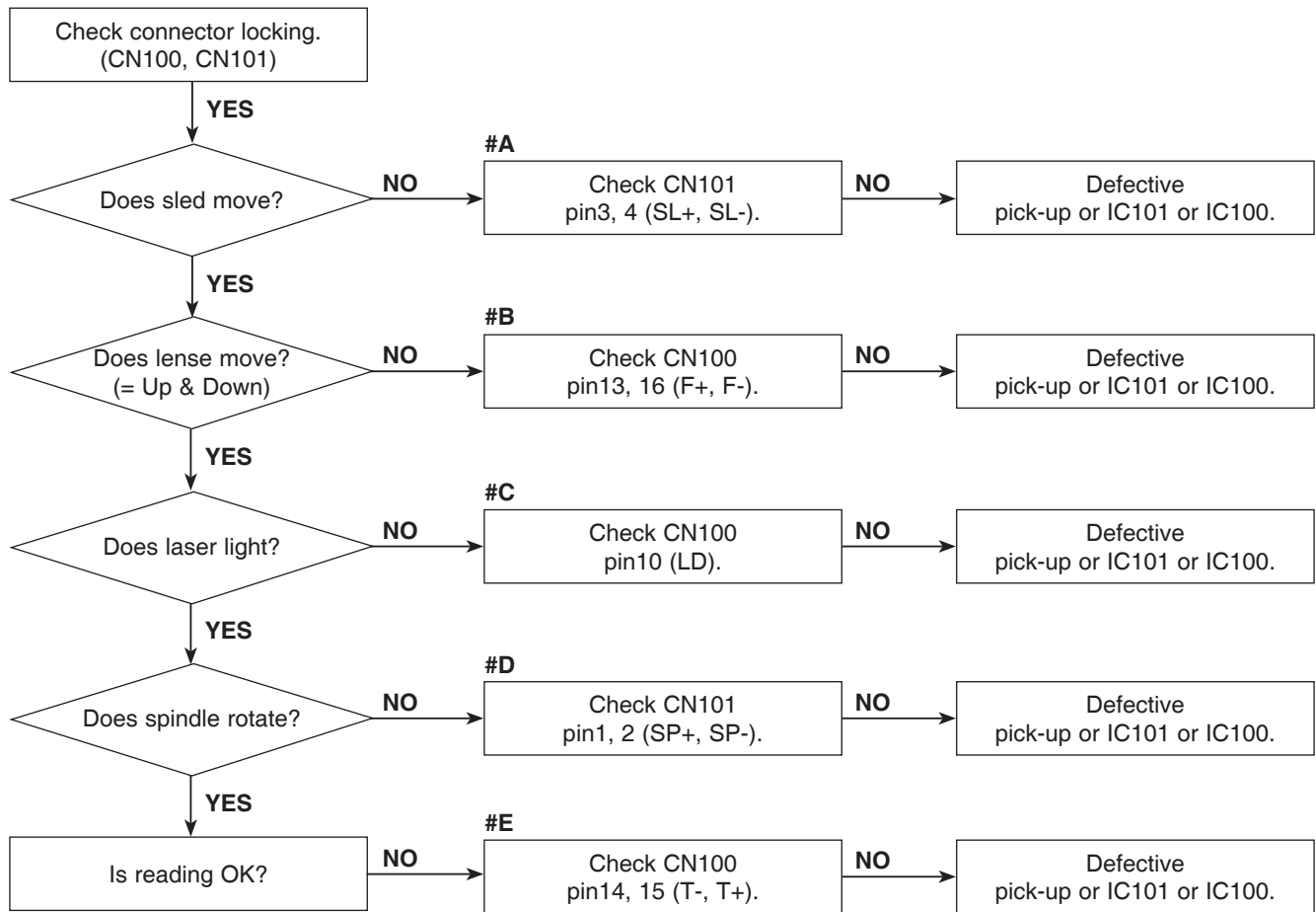


3. “ READING ” DISPLAY CHECK (= ONLY “CD” DISPLAY)



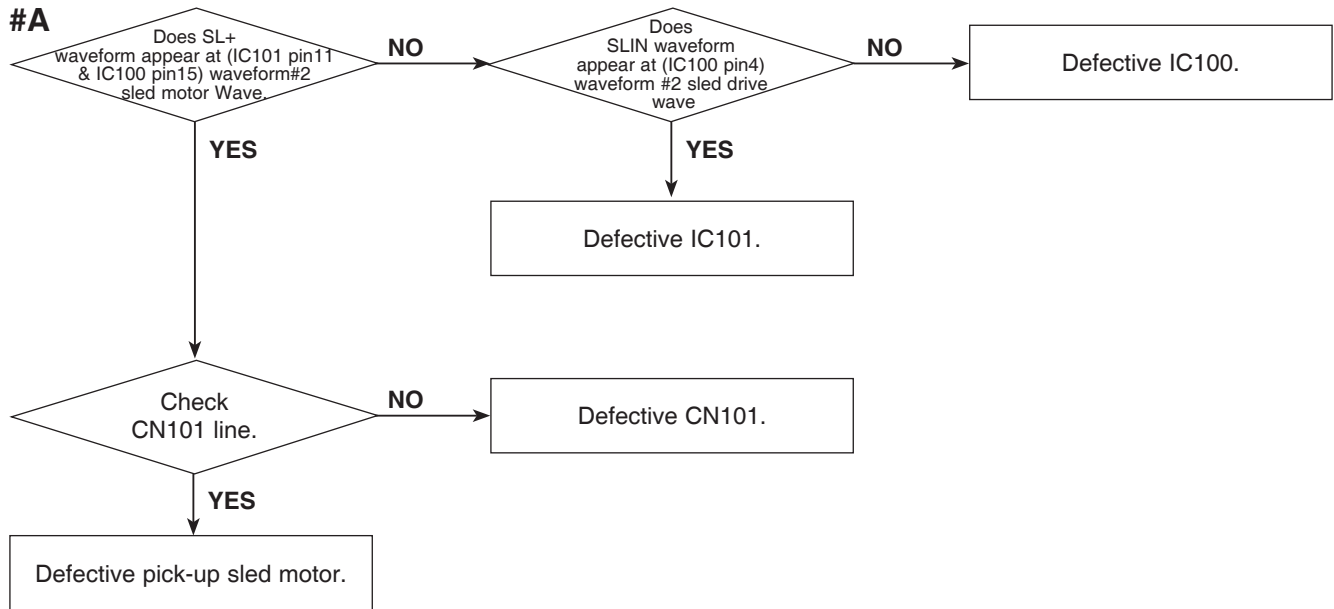
ELECTRICAL TROUBLESHOOTING GUIDE OF CD PART

4. READING OK CHECK (= “NO DISC” DISPLAY)

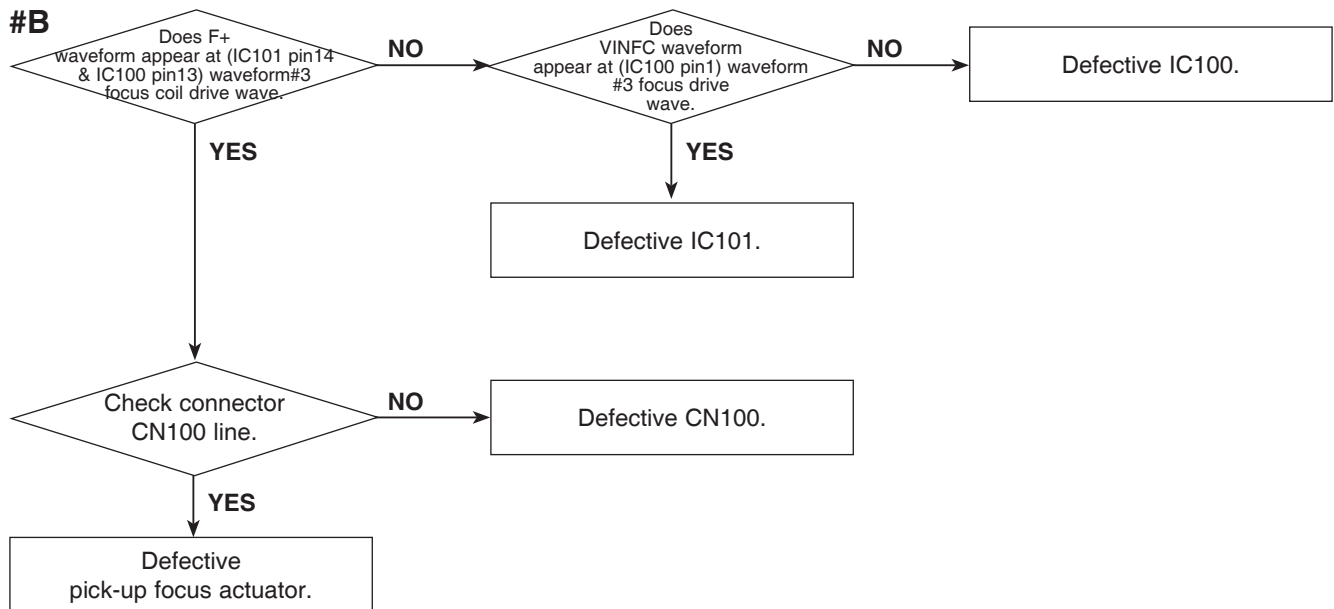


ELECTRICAL TROUBLESHOOTING GUIDE OF CD PART

4-1. READING OK CHECK #A (= “NO DISC” DISPLAY)

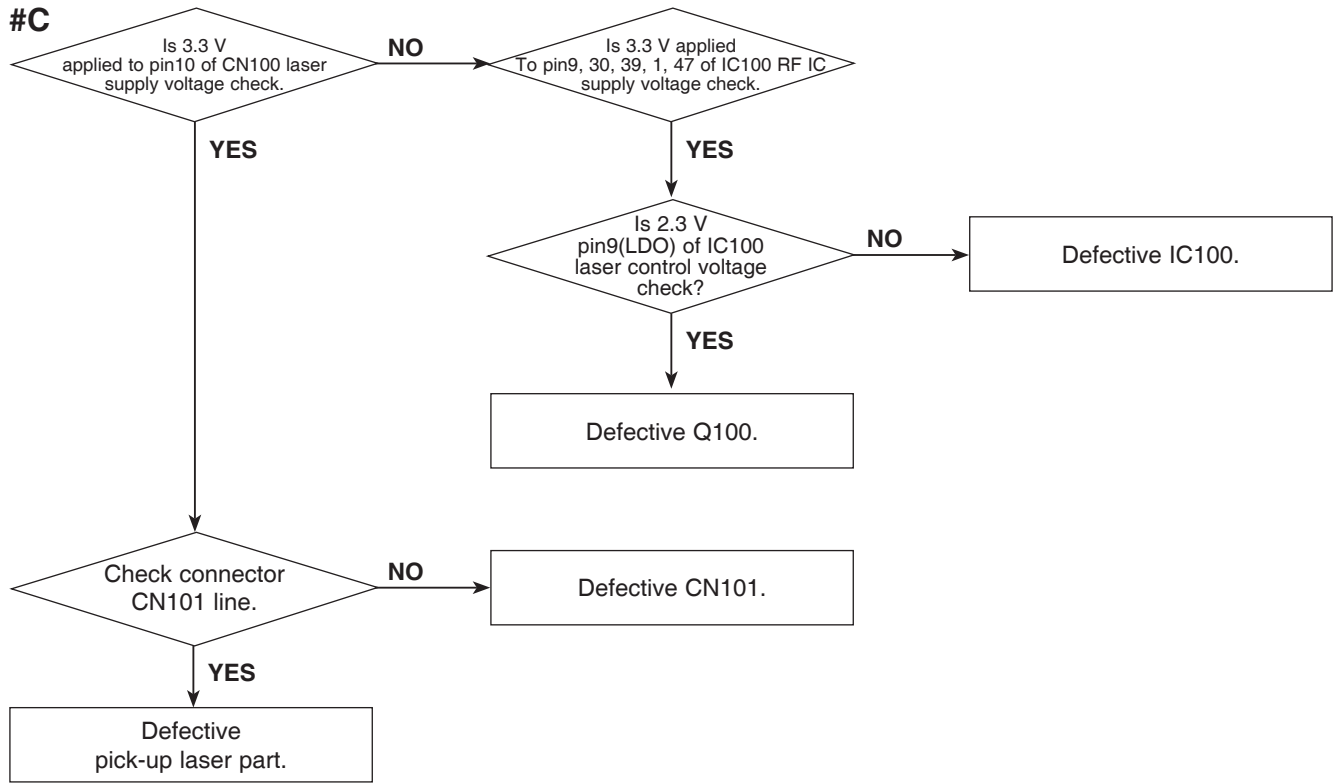


4-2. READING OK CHECK #B (= “NO DISC” DISPLAY)

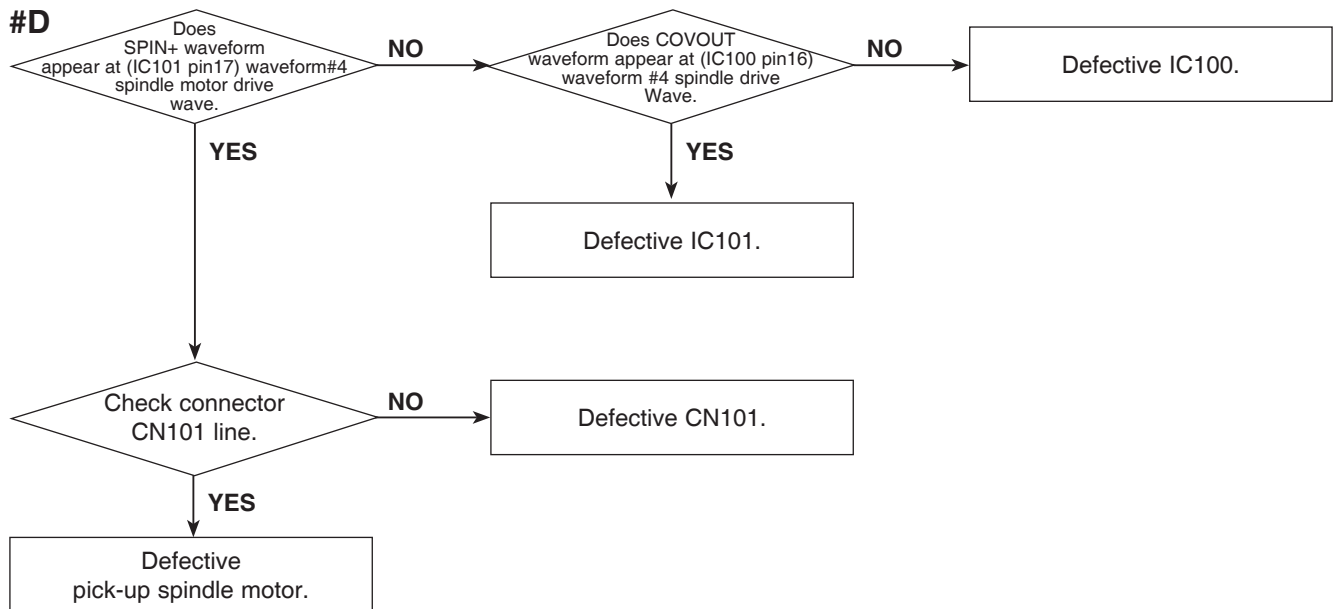


ELECTRICAL TROUBLESHOOTING GUIDE OF CD PART

4-3. READING OK CHECK #C (= “NO DISC” DISPLAY)

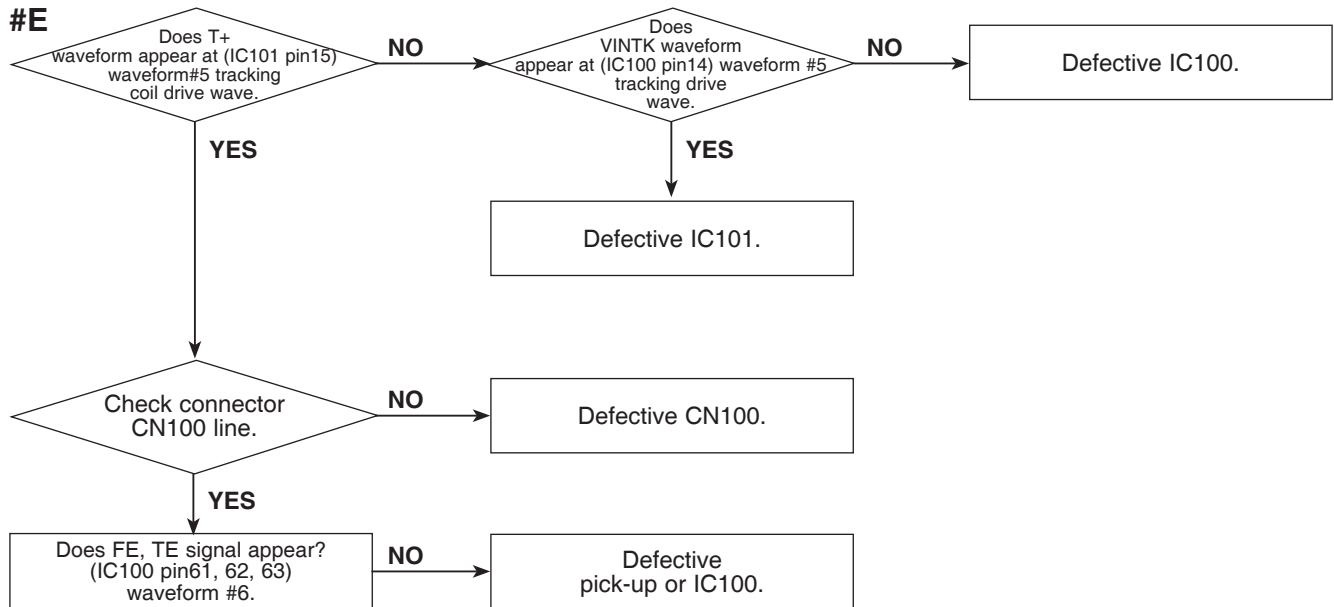


4-4. READING OK CHECK #D (= “NO DISC” DISPLAY)



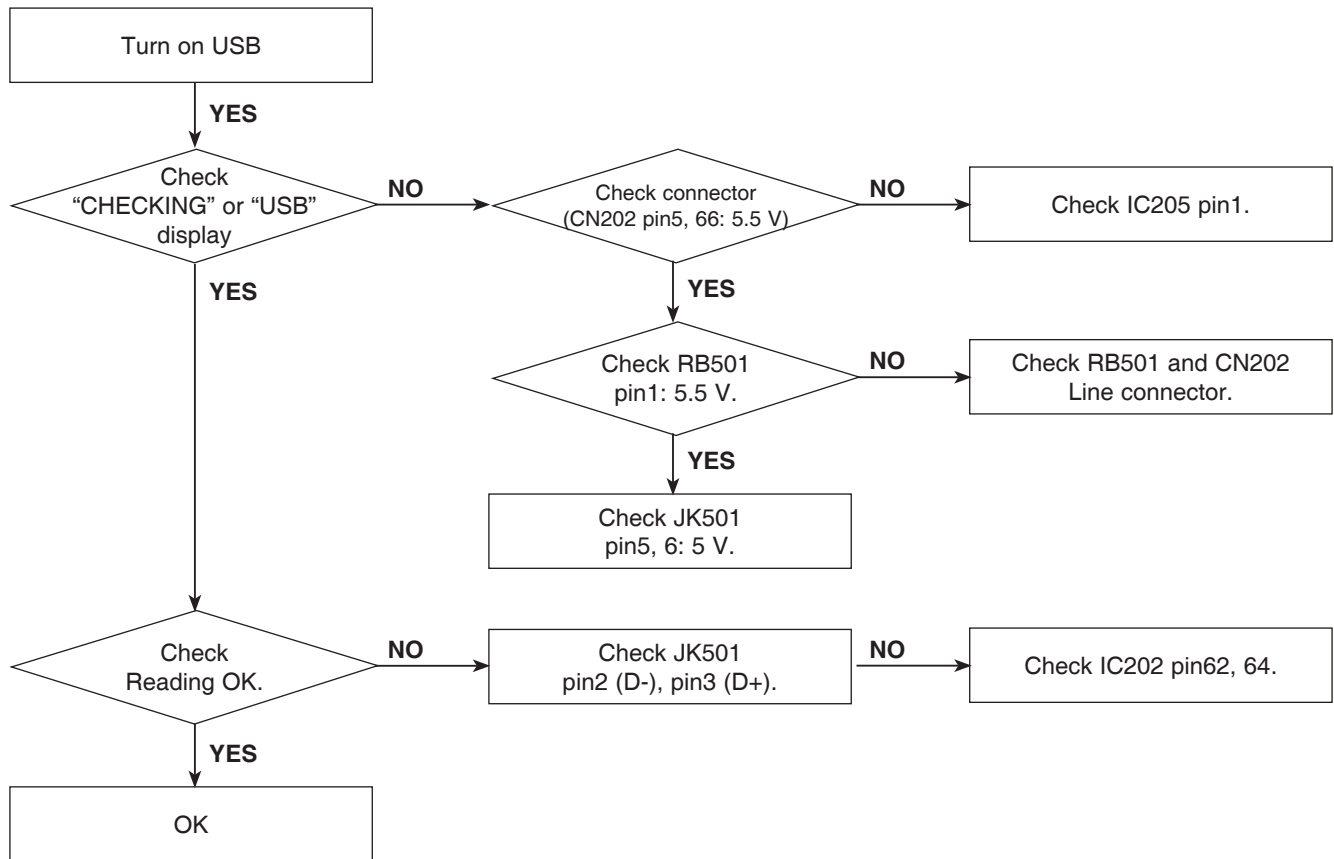
ELECTRICAL TROUBLESHOOTING GUIDE OF CD PART

4-5. READING OK CHECK #E (= “NO DISC” DISPLAY)



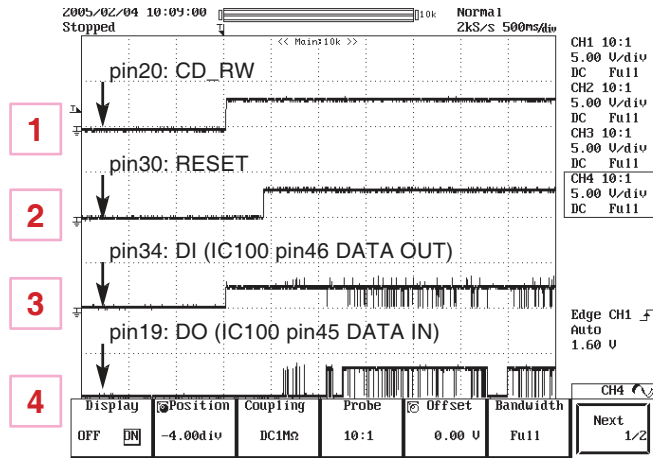
ELECTRICAL TROUBLESHOOTING GUIDE OF CD PART

5. USB PART

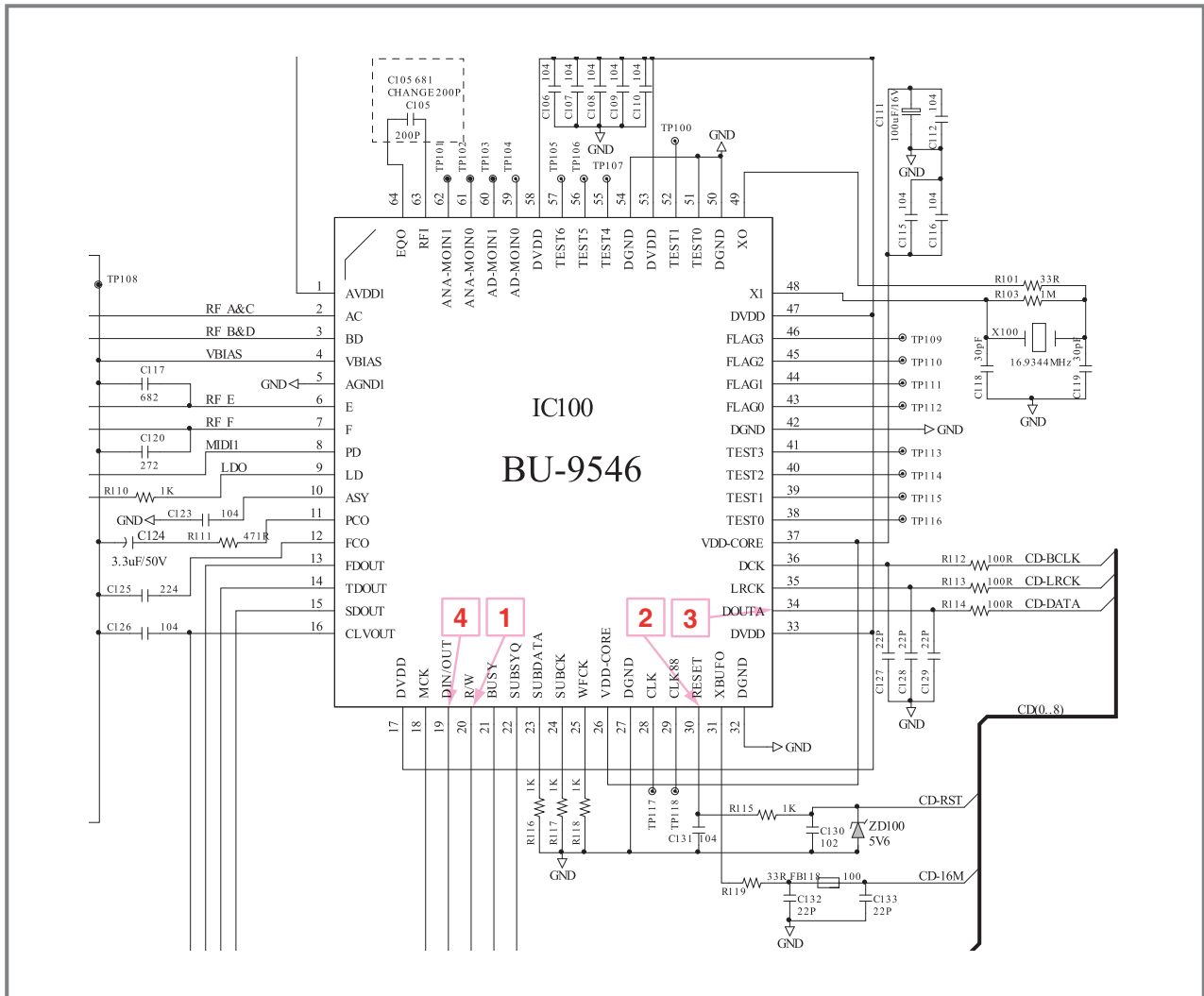
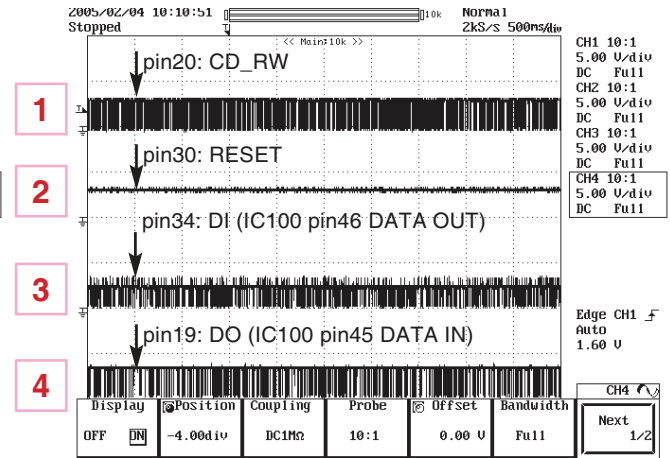


WAVEFORMS OF MAJOR CHECK POINT

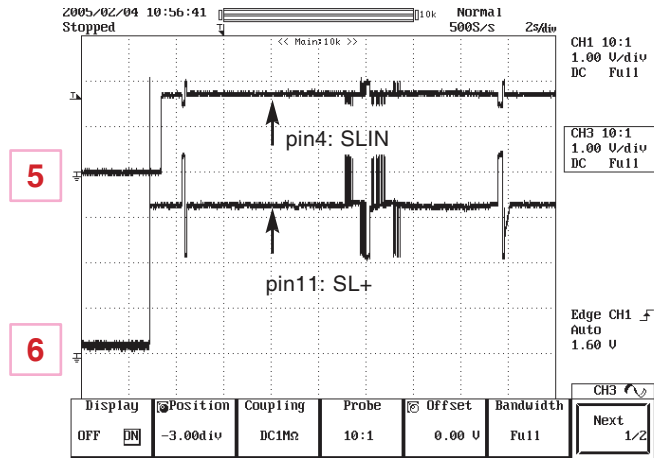
#1. MICOM INTERFACE WAVEFORM (IC100 pin19, 20, 30, 34) DURING POWER ON



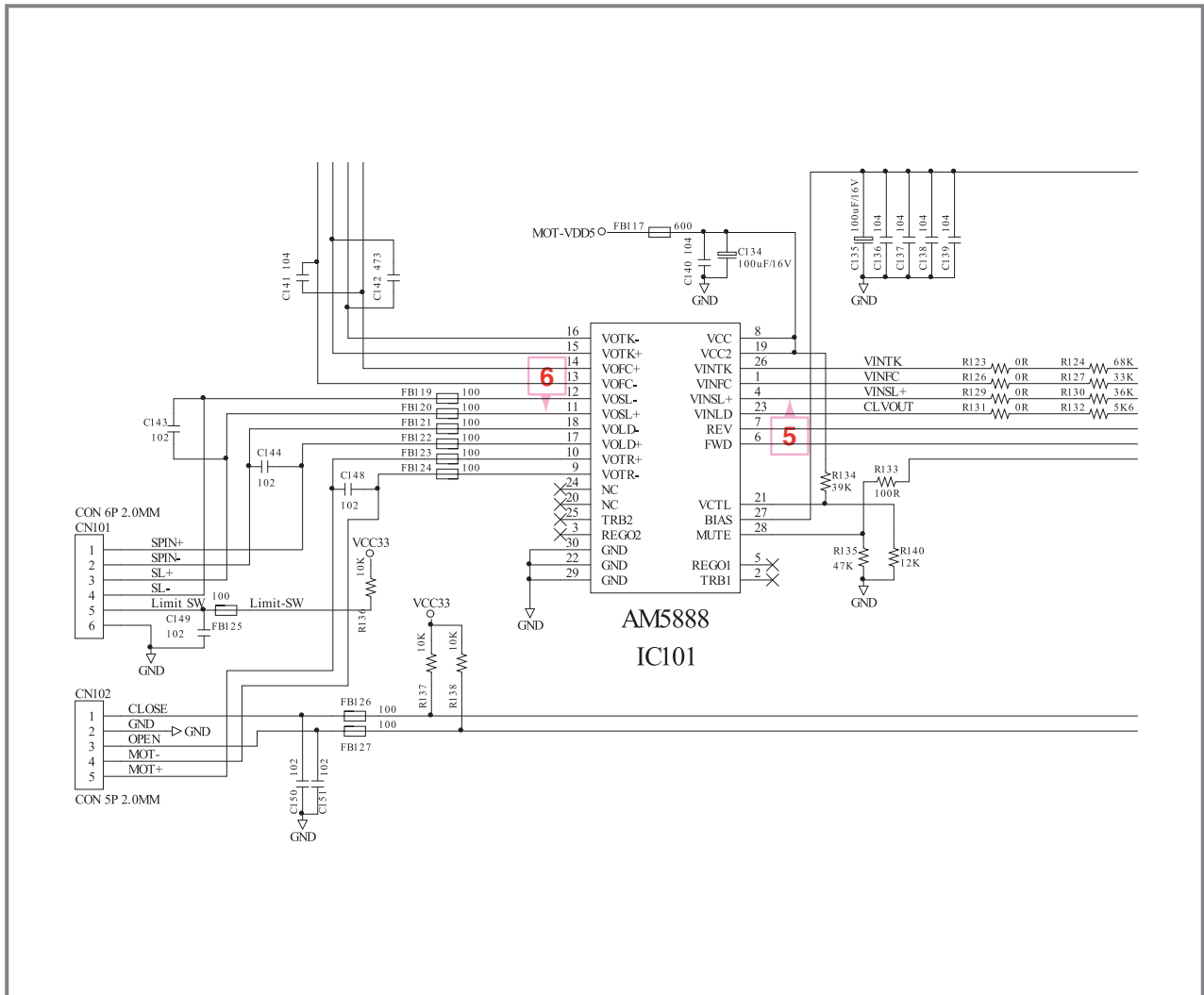
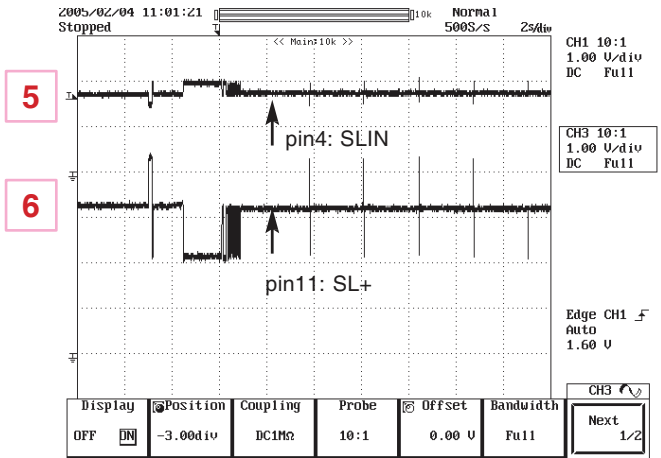
#1. MICOM INTERFACE WAVEFORM (IC100 pin19, 20, 30, 34) DURING NORMAL PLAY



#2. SLED DRIVE AND MOTOR WAVEFORM (IC101 pin4, 11) WHEN FOCUS SEARCH



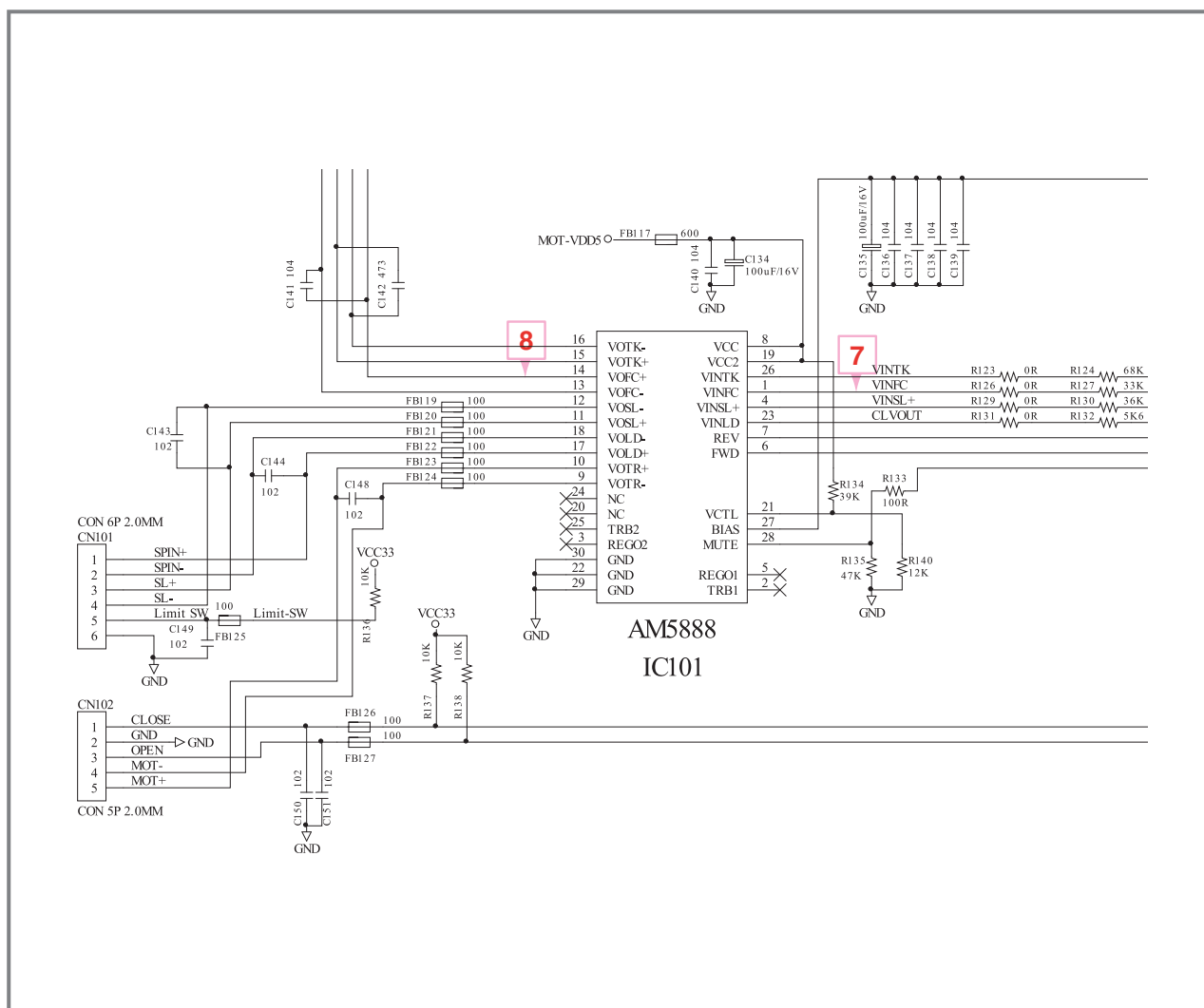
#2. SLED DRIVE AND MOTOR WAVEFORM (IC101 pin4, 11) DURING NORMAL PLAY



- WHEN FOCUS SEARCH FAILED OR THERE IS NO DISC ON TRAY



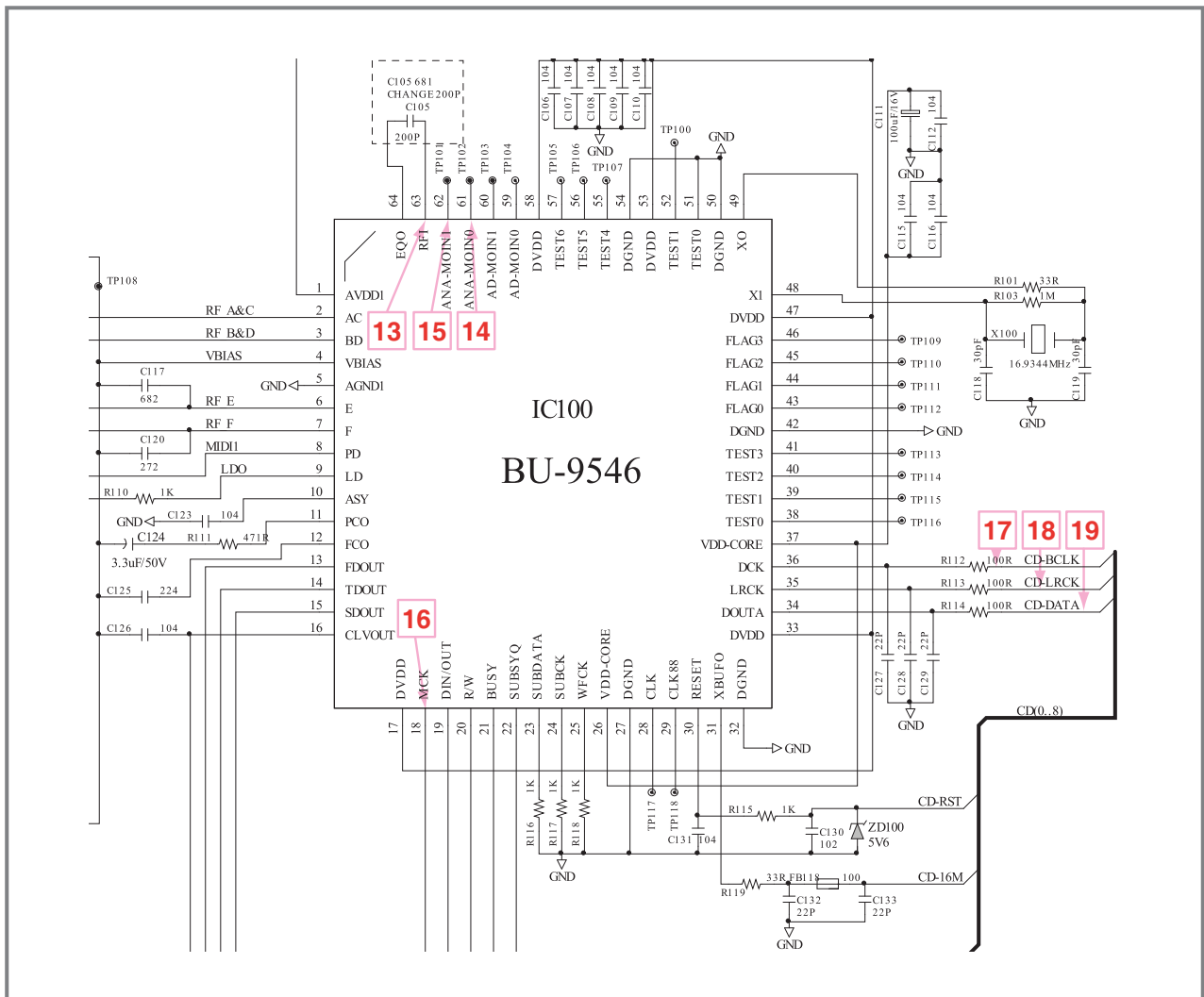
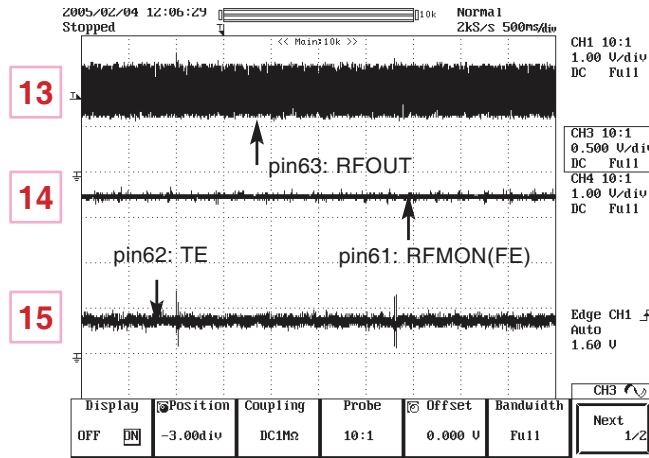
- THERE IS DISC ON TRAY AND FOCUS SEARCH SUCCESS



#5. TRACK DRIVE AND MOTOR WAVEFORM (IC101 pin16, 26) DURING NORMAL PLAY



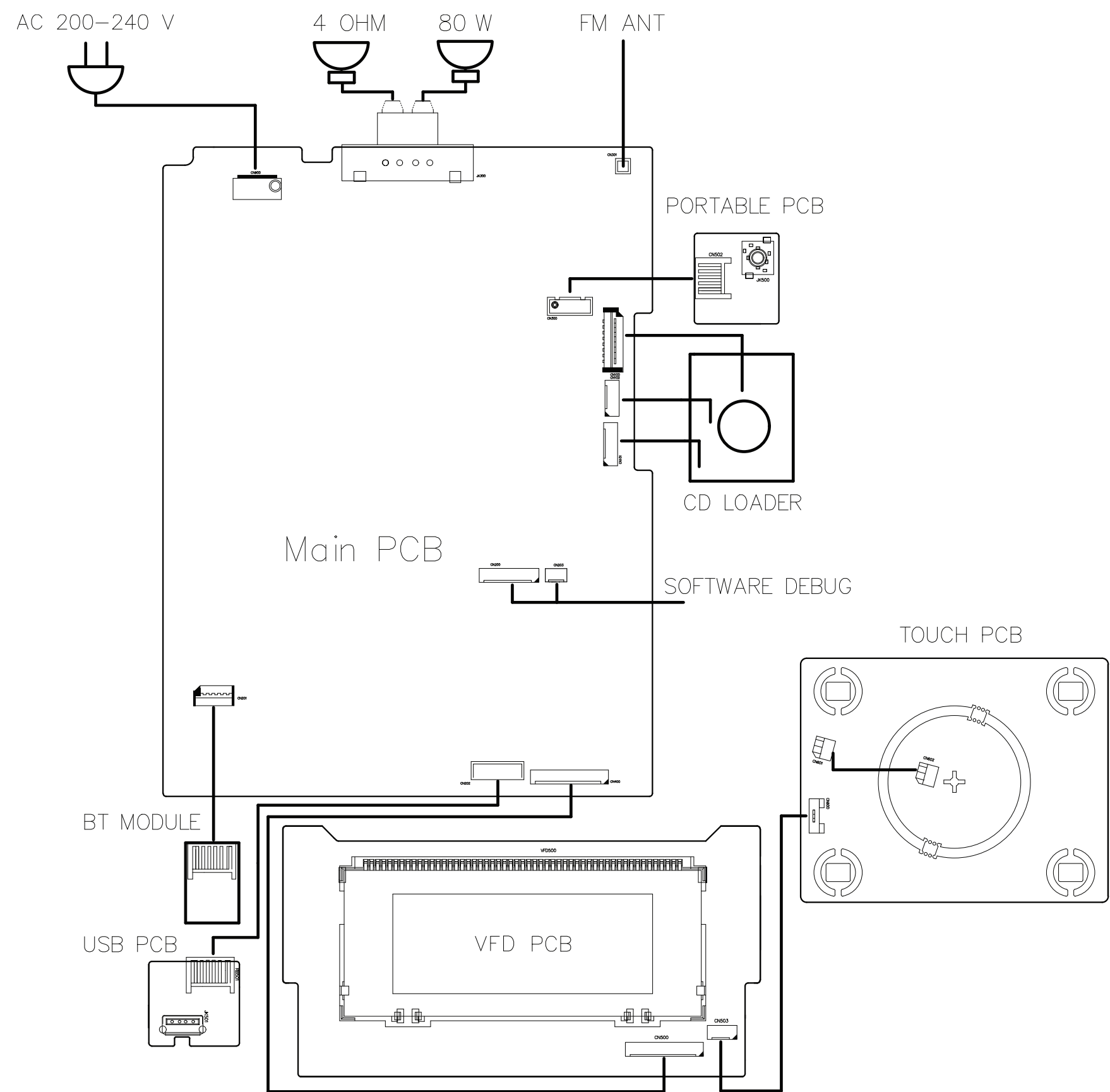
#6. RF, FOCUS AND TRACKING ERROR WAVEFORM #7. AUDIO PART (I2S) WAVEFORM (IC100 pin61, 62, 63) DURING NORMAL PLAY



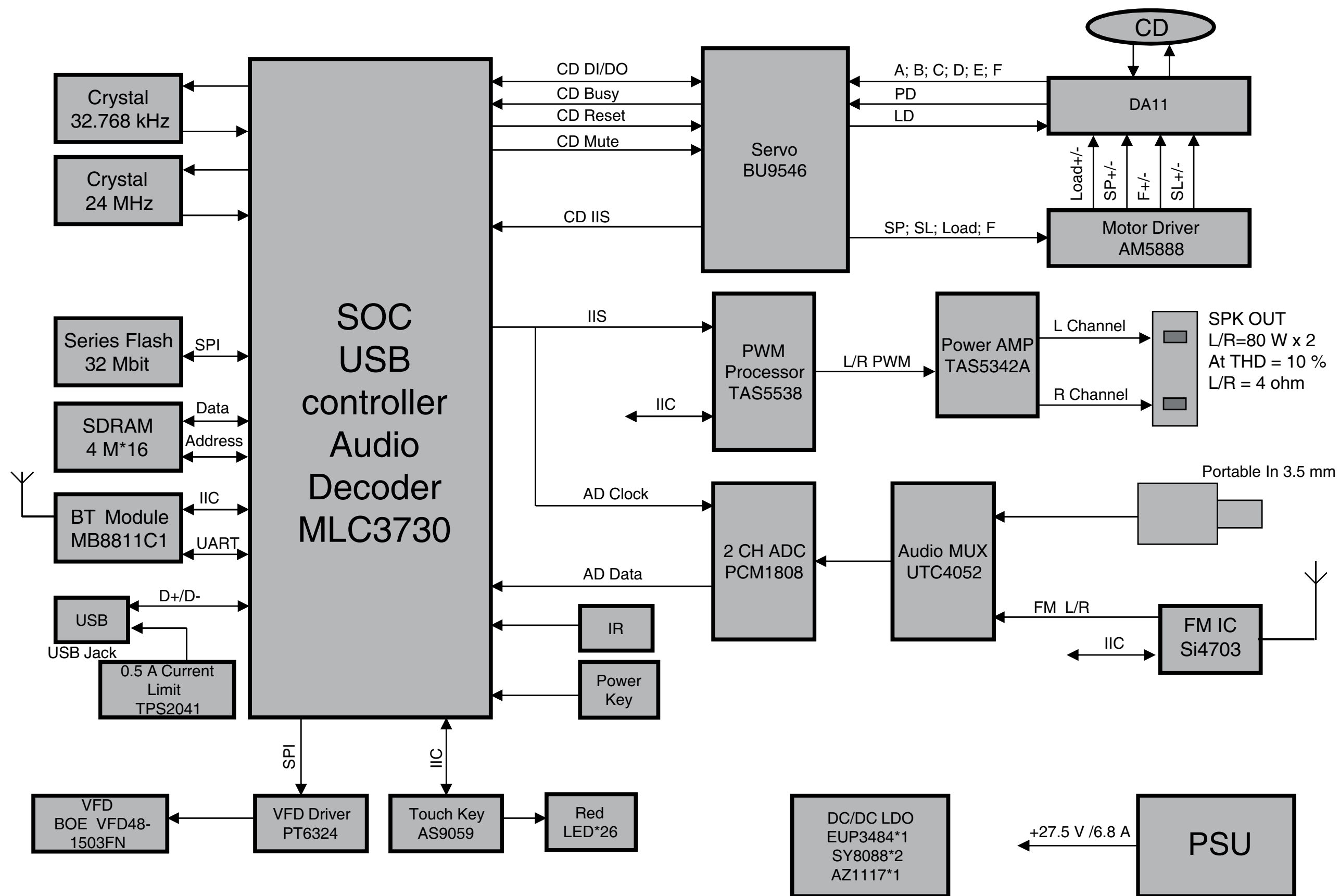
MEMO

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

WIRING DIAGRAM



BLOCK DIAGRAM



CIRCUIT VOLTAGE CHART

1. CONNECTORS VOLTAGE

INPUT VOLTAGE: 200-264 V / 50-60 Hz

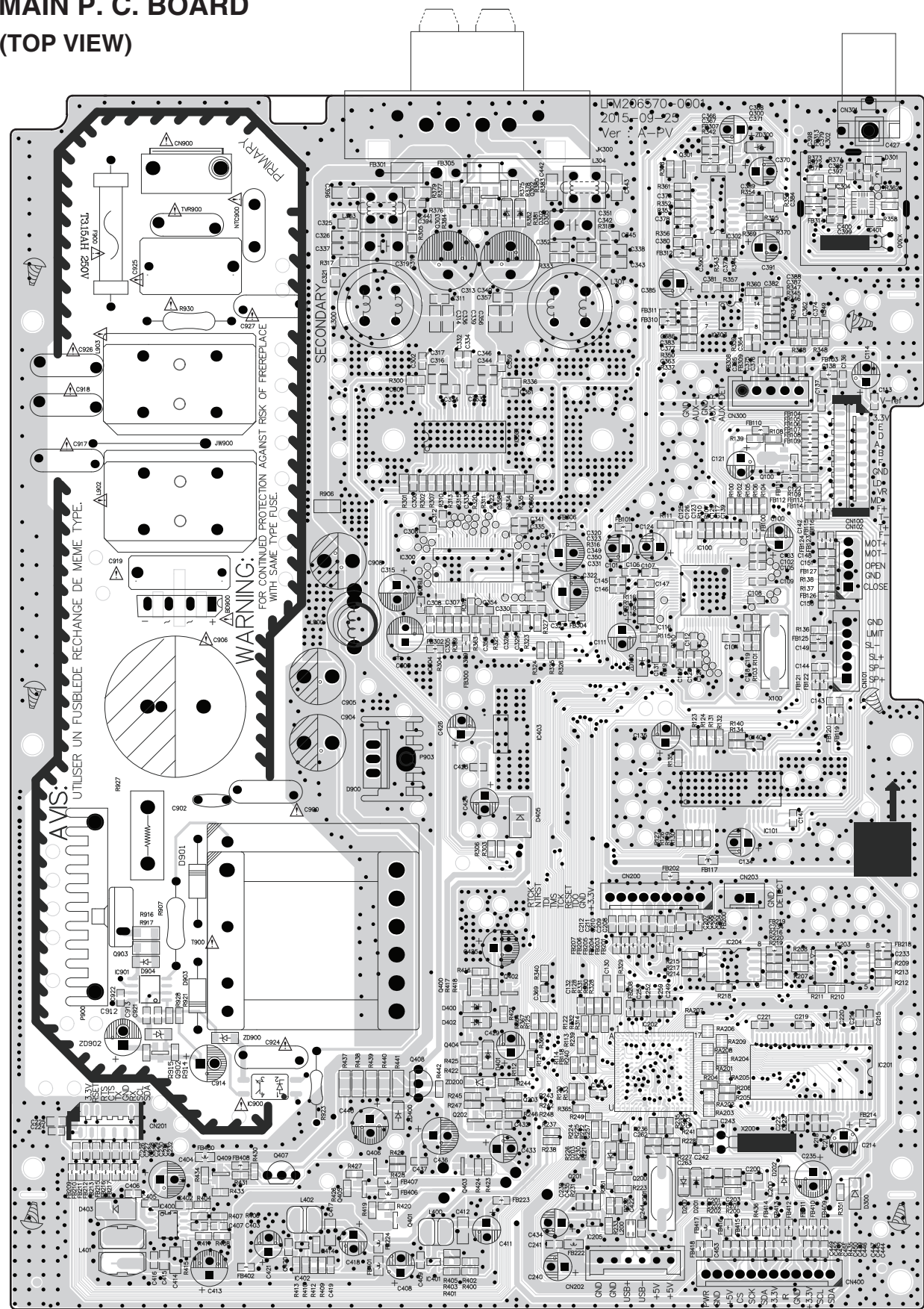
Connector No.	Pin No.	Pin Name	Voltage	Voltage
			Spec.	Stress V
Main Board				
CN100	1	Vref	1.5~1.8 V	1.625 V
	2	VCC	2.4~5.5 V	3.28 V
	3	E	0.9~1.6 V	1.625 V
	4	D	1~1.8 V	1.625 V
	5	A	1~1.8 V	1.625 V
	6	B	1~1.8 V	1.625 V
	7	C	1~1.8 V	1.625 V
	8	F	0.9~1.6 V	1.625 V
	9	GND	0 V	0 V
	10	LD	0~3 V	1.95 V
	11	VR	0~3.3 V	1.3 V
	12	MD	0~3.3 V	1.3 V
	13	F+	0~3.3 V	1.3 V
	14	T-	0~3.3 V	1.3 V
	15	T+	0~3.3 V	1.3 V
	16	F-	0~3.3 V	1.3 V
CN101	1	SPIND+	1~6 V	4 V
	2	SPIND-	1~5 V	4 V
	3	SL+	1~6 V	4 V
	4	SL-	1~6 V	4 V
	5	LIMIT SW	0~3.3 V	0~3.25 V
	6	GND	0 V	0 V
CN102	1	MOT+	3.8~5 V	4 V
	2	MOT-	3.8~5 V	4 V
	3	OPEN	0~3.3 V	0~3.3 V
	4	GND	0 V	0 V
	5	CLOSE	0~3.3 V	0 V
CN200	1	3.3V	3.3 V	3.3 V
	2	GND	0 V	0 V
	3	TDO	0~3.3 V	0.3 V
	4	MCS-RST	0~3.3 V	3.3 V
	5	TCK	0~3.3 V	3.3 V
	6	TMS	0~3.3 V	3.3 V
	7	TDI	0~3.3 V	3.29 V
	8	NTRST	0~3.3 V	3.21 V
CN201	9	RTCK	0~3.3 V	3.3 V
	1	3.3V	0~3.6 V	3.3 V
	2	BT-RESET	0~3.6 V	0~3.3 V
	3	RTS	0~3.6 V	0~3.3 V
	4	CTS	0~3.6 V	0~3.3 V
	5	TX	0~3.6 V	0~3.3 V
	6	GND	0 V	0 V
	7	RX	0~3.6 V	0~3.3 V
	8	GND	0 V	0 V
	9	SCL	0~3.6 V	0~3.3 V
10	SDA	0~3.6 V	0~3.3 V	
CN202	1	GND	0 V	0 V
	2	GND	0 V	0 V
	3	USB+	0~3.3 V	0.2 V
	4	USB-	0~3.3 V	0 V
	5	5V	0~5.5 V	5.14 V
	6	5V	0~5.5 V	5.14 V

Connector No.	Pin No.	Pin Name	Voltage	Voltage
			Spec.	Stress V
CN203	1	DEBUG	0~3.3 V	3.3 V
	2	GND	0 V	0 V
CN300	1	GND	0 V	0 V
	2	AUDIO IN	0 V	0 V
	3	GND	0 V	0 V
	4	AUDIO IN	0 V	0 V
	5	AUDIO DETECT	0~3.3 V	0~3.25 V
CN400	1	T-SDA	0~3.6 V	3 V
	2	T-SCL	0~3.6 V	3.1 V
	3	3.3V	0~3.6 V	3.28 V
	4	GND	0 V	0 V
	5	IR	0~5 V	3.3 V
	6	3.3V	0~3.6 V	3.3 V
	7	VFD-SDA	0~3.6 V	3.3 V
	8	VFD-SCK	0~3.6 V	3.3 V
	9	VFD-CS	0~3.6 V	3.3 V
	10	5V	0~6 V	4.99 V
	11	GND	0 V	0 V
	12	POWER-KEY	0~3.6 V	0~3.3 V
JK300	1	L-	13~14 V	13.6 V
	2	L+	13~14 V	13.6 V
	3	R-	13~14 V	13.6 V
	4	R+	13~14 V	13.6 V
VFD Board				
CN500	1	T-SDA	0~3.6 V	3 V
	2	T-SCL	0~3.6 V	3.1 V
	3	3.3V	0~3.6 V	3.28 V
	4	GND	0 V	0 V
	5	IR	0~5 V	3.3 V
	6	3.3V	0~3.6 V	3.3 V
	7	VFD-SDA	0~3.6 V	3.3 V
	8	VFD-SCK	0~3.6 V	3.3 V
	9	VFD-CS	0~3.6 V	3.3 V
	10	5V	0~6 V	4.99 V
	11	GND	0 V	0 V
	12	POWER-KEY	0~3.6 V	0~3.3 V
CN503	1	T-SDA	0~3.6 V	3 V
	2	T-SCL	0~3.6 V	3.1 V
	3	3.3V	0~3.6 V	3.28 V
	4	GND	0 V	0 V
Portable Board				
CN502	1	GND	0 V	0 V
	2	AUDIO IN	0 V	0 V
	3	GND	0 V	0 V
	4	AUDIO IN	0 V	0 V
	5	AUDIO DETECT	0~3.3 V	0~3.25 V
USB Board				
RB501	1	GND	0 V	0 V
	2	GND	0 V	0 V
	3	USB+	0~3.3 V	0.2 V
	4	USB-	0~3.3 V	0 V
	5	5V	0~5.5 V	5.14 V
	6	5V	0~5.5 V	5.14 V

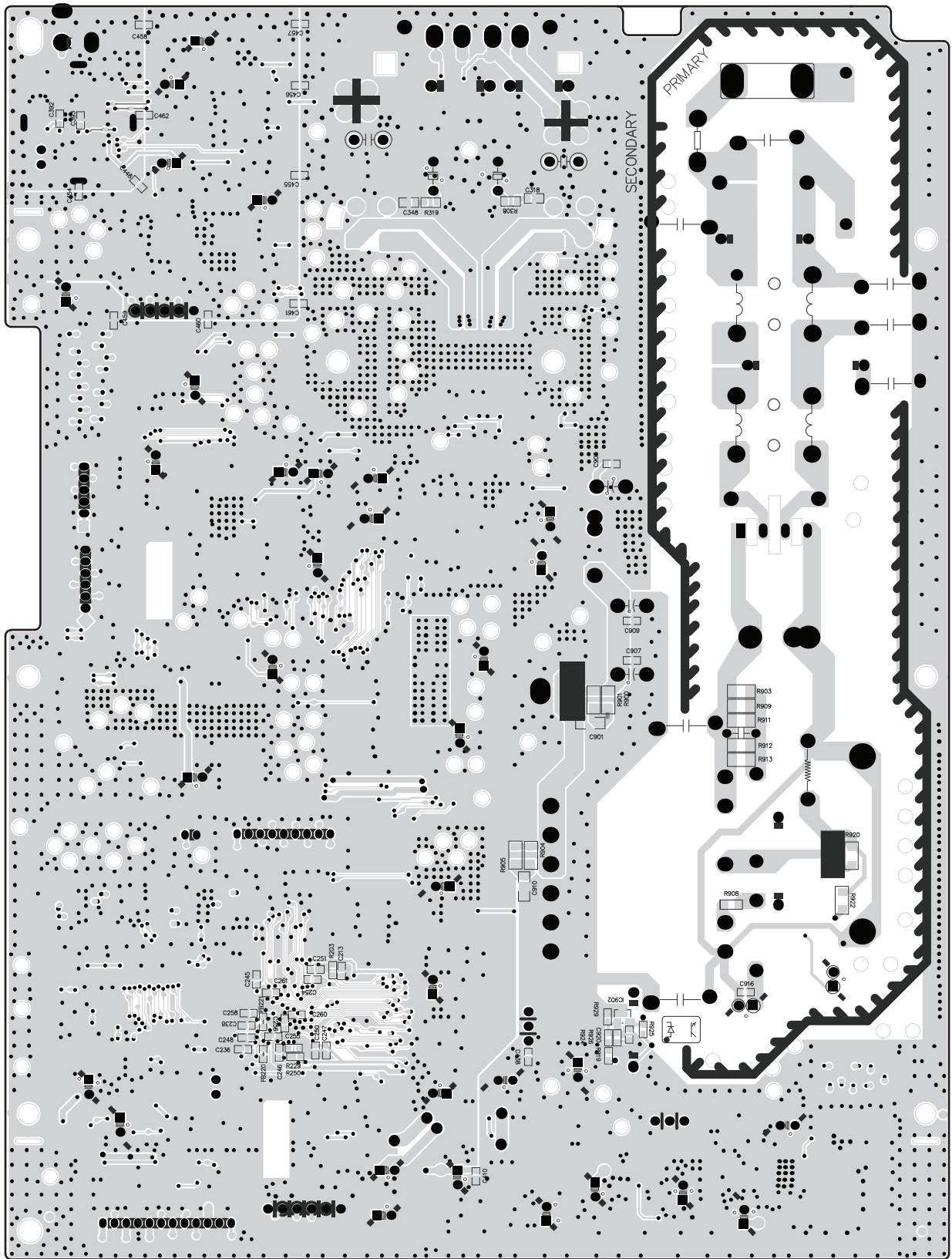
PRINTED CIRCUIT BOARD DIAGRAMS

1. MAIN P. C. BOARD

(TOP VIEW)

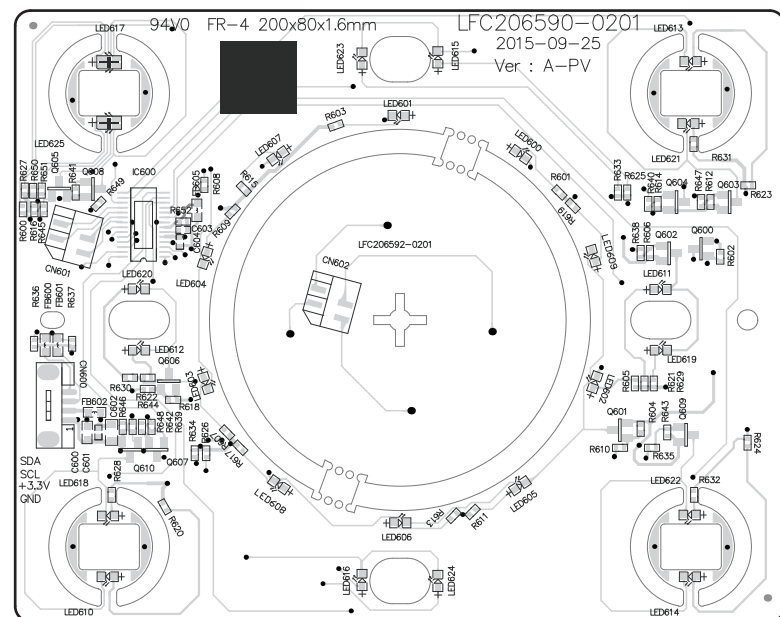


(BOTTOM VIEW)

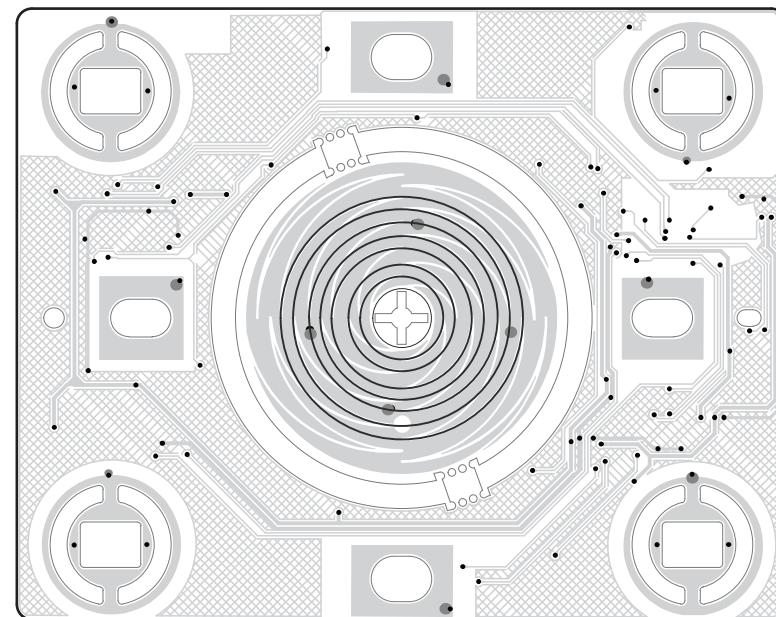


NOTE) Warning
Parts that are critical with respect to risk of fire or electrical shock.

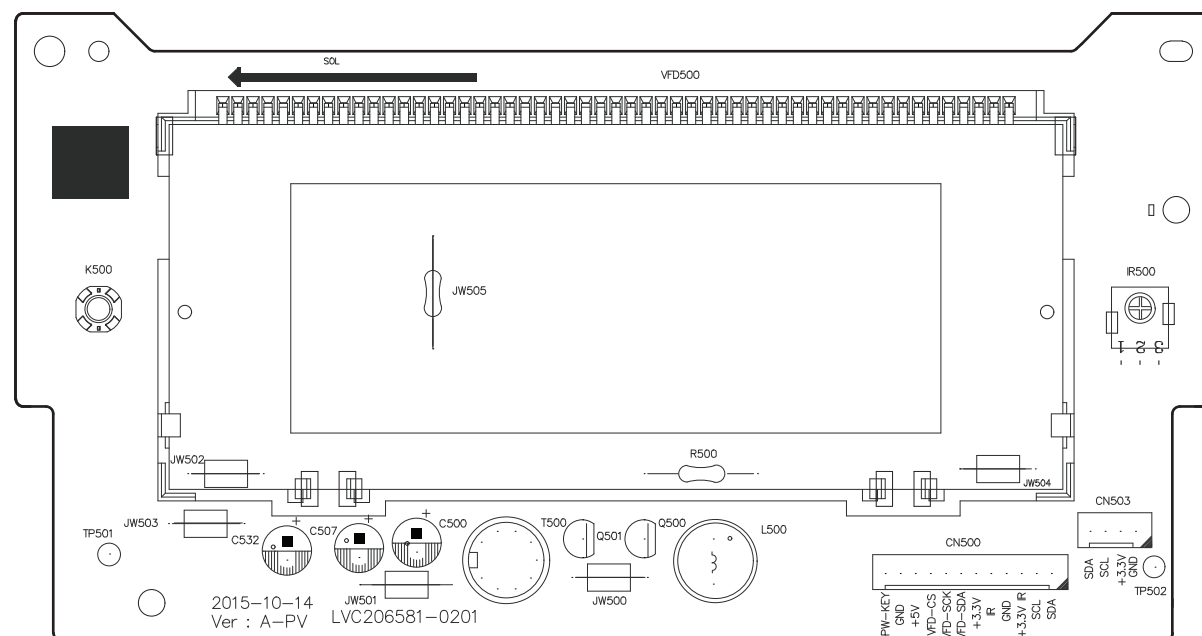
2. TOUCH P. C. BOARD (TOP VIEW)



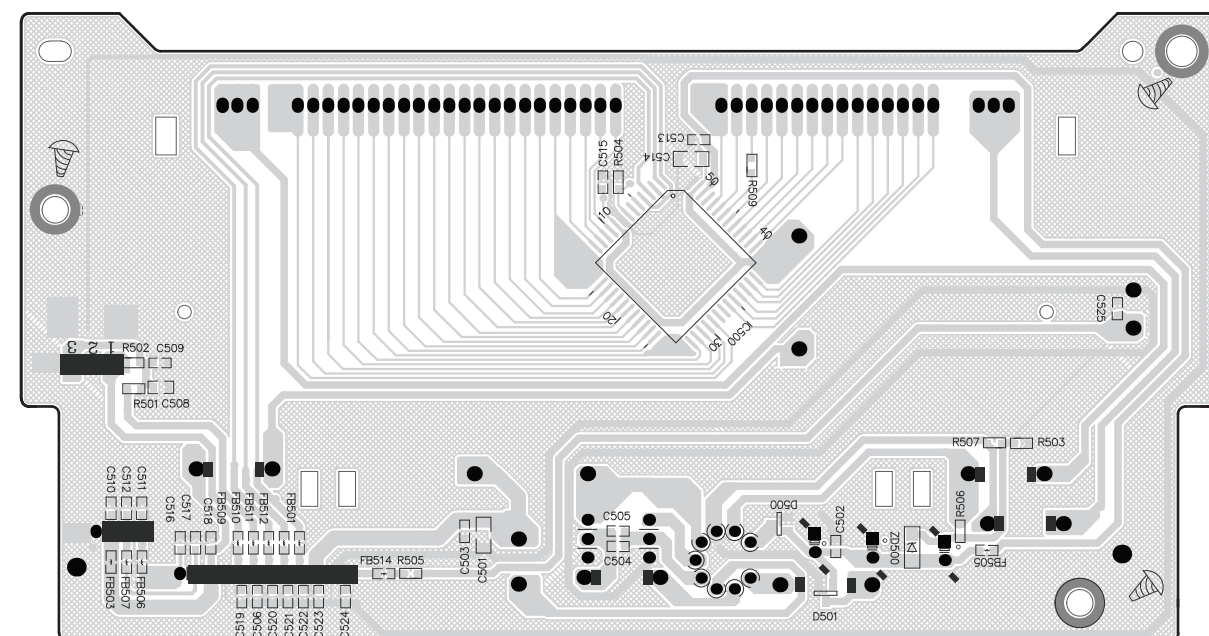
(BOTTOM VIEW)



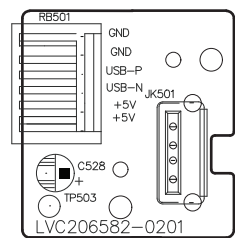
3. VFD P. C. BOARD (TOP VIEW)



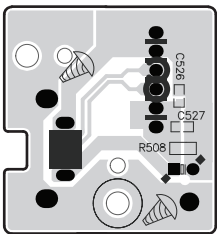
(BOTTOM VIEW)



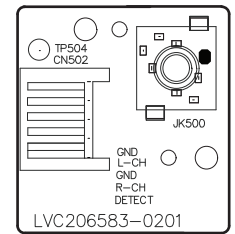
4. USB P. C. BOARD
(TOP VIEW)



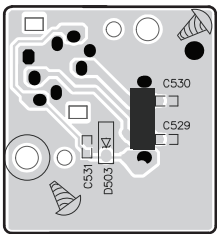
(BOTTOM VIEW)



5. PORTABLE P. C. BOARD
(TOP VIEW)



(BOTTOM VIEW)



MEMO

Handwriting practice area for page 3-55, featuring 25 horizontal dotted lines.

MEMO

Handwriting practice area for page 3-56, featuring 25 horizontal dotted lines.