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# COLOR MONITOR
# SERVICE MANUAL

**CHASSIS NO. : LM95A**

**MODEL: FLATRON W2486L W2486L-PFV**

**CAUTION**

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

P/NO : MFL61938704 (0904-REV00)

Printed in Korea

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# PRECAUTION

**WARNING FOR THE SAFETY-RELATED COMPONENT.**

- There are some special components used in LCD monitor that are important for safety. **These parts are marked ⚠ on the schematic diagram and the Exploded View.** It is essential that these critical parts should be replaced with the manufacturer's specified parts to prevent electric shock, fire or other hazard.
- Do not modify original design without obtaining written permission from manufacturer or you will void the original parts and labor guarantee.

**TAKE CARE DURING HANDLING THE LCD MODULE WITH BACKLIGHT UNIT.**

- Must mount the module using mounting holes arranged in four corners.
- Do not press on the panel, edge of the frame strongly or electric shock as this will result in damage to the screen.
- Do not scratch or press on the panel with any sharp objects, such as pencil or pen as this may result in damage to the panel.
- Protect the module from the ESD as it may damage the electronic circuit (C-MOS).
- Make certain that treatment person's body are grounded through wrist band.
- Do not leave the module in high temperature and in areas of high humidity for a long time.
- The module not be exposed to the direct sunlight.
- Avoid contact with water as it may a short circuit within the module.
- If the surface of panel become dirty, please wipe it off with a softmaterial. (Cleaning with a dirty or rough cloth may damage the panel.)

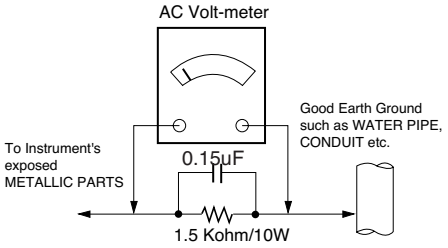
**⚠ CAUTION**
Please use only a plastic screwdriver to protect yourself from shock hazard during service operation.

**⚠ WARNING**

BE CAREFUL ELECTRIC SHOCK !

- If you want to replace with the new backlight (CCFL) or LIPS part, must disconnect the AC power because high voltage appears at inverter circuit about 650Vrms.
- Handle with care wires or connectors of the inverter circuit. If the wires are pressed cause short and may burn or take fire.

**Leakage Current Hot Check Circuit**




When 25A is impressed between Earth and 2nd Ground for 1 second, Resistance must be less than 0.1 Ω
*Base on Adjustment standard

- **Replaceable batteries**

  * CAUTION
  RISK OF EXPLOSION IF BATTERY IS REPLACED BY AN INCORRECT TYPE.
  DISPOSE OF USED BATTERIES ACCORDING TO THE INSTRUCTIONS

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# SERVICING PRECAUTIONS

**CAUTION:** Before servicing receivers covered by this service manual and its supplements and addenda, read and follow the **SAFETY PRECAUTIONS** on page 3 of this publication.

**NOTE:** If unforeseen circumstances create conflict between the following servicing precautions and any of the safety precautions on page 3 of this publication, always follow the safety precautions. Remember: Safety First.

**General Servicing Precautions**

1. Always unplug the receiver AC power cord from the AC power source before;
   a. Removing or reinstalling any component, circuit board module or any other receiver assembly.
   b. Disconnecting or re-connecting any receiver electrical plug or other electrical connection.
   c. Connecting a test substitute in parallel with an electrolytic capacitor in the receiver.
   **CAUTION:** A wrong part substitution or incorrect polarity installation of electrolytic capacitors may result in an explosion hazard.

2. Test high voltage only by measuring it with an appropriate high voltage meter or other voltage measuring device (DVM, FETVOM, etc) equipped with a suitable high voltage probe. Do not test high voltage by "drawing an arc".
3. Do not spray chemicals on or near this receiver or any of its assemblies.
4. Unless specified otherwise in this service manual, clean electrical contacts only by applying the following mixture to the contacts with a pipe cleaner, cotton-tipped stick or comparable non-abrasive applicator; 10% (by volume) Acetone and 90% (by volume) is opropyl alcohol (90%-99% strength)
   **CAUTION:** This is a flammable mixture.
   Unless specified otherwise in this service manual, lubrication of contacts in not required.
5. Do not defeat any plug/socket B+ voltage interlocks with which receivers covered by this service manual might be equipped.
6. Do not apply AC power to this instrument and/or any of its electrical assemblies unless all solid-state device heat sinks are correctly installed.
7. Always connect the test receiver ground lead to the receiver chassis ground before connecting the test receiver positive lead.
   Always remove the test receiver ground lead last.
8. Use with this receiver only the test fixtures specified in this service manual.
   **CAUTION:** Do not connect the test fixture ground strap to any heat sink in this receiver.

**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 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 to prevent 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 type 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 electrical charges 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. (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 ES device.)

General Soldering Guidelines

1. Use a grounded-tip, low-wattage soldering iron and appropriate tip size and shape that will maintain tip temperature within the range or 500°F to 600°F.
2. Use an appropriate gauge of RMA resin-core solder composed of 60 parts tin/40 parts lead.
3. Keep the soldering iron tip clean and well tinned.
4. Thoroughly clean the surfaces to be soldered. Use a mall wire-bristle (0.5 inch, or 1.25cm) brush with a metal handle.
   Do not use freon-propelled spray-on cleaners.
5. Use the following unsoldering technique
   a. Allow the soldering iron tip to reach normal temperature. (500°F to 600°F)
   b. Heat the component lead until the solder melts.
   c. Quickly draw the melted solder with an anti-static, suction-type solder removal device or with solder braid.
   CAUTION: Work quickly to avoid overheating the circuit board printed foil.
6. Use the following soldering technique.
   a. Allow the soldering iron tip to reach a normal temperature (500°F to 600°F)
   b. First, hold the soldering iron tip and solder the strand against the component lead until the solder melts.
   c. Quickly move the soldering iron tip to the junction of the component lead and the printed circuit foil, and hold it there only until the solder flows onto and around both the component lead and the foil.
   **CAUTION:** Work quickly to avoid overheating the circuit board printed foil.
   d. Closely inspect the solder area and remove any excess or splashed solder with a small wire-bristle brush.

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**IC Remove/Replacement**

Some chassis circuit boards have slotted holes (oblong) through which the IC leads are inserted and then bent flat against the circuit foil. When holes are the slotted type, the following technique should be used to remove and replace the IC. When working with boards using the familiar round hole, use the standard technique as outlined in paragraphs 5 and 6 above.

Removal

1. Desolder and straighten each IC lead in one operation by gently prying up on the lead with the soldering iron tip as the solder melts.
2. Draw away the melted solder with an anti-static suction-type solder removal device (or with solder braid) before removing the IC.

Replacement

1. Carefully insert the replacement IC in the circuit board.
2. Carefully bend each IC lead against the circuit foil pad and solder it.
3. Clean the soldered areas with a small wire-bristle brush. (It is not necessary to reapply acrylic coating to the areas).

**"Small-Signal" Discrete TransistorRemoval/Replacement**

1. Remove the defective transistor by clipping its leads as close as possible to the component body.
2. Bend into a "U" shape the end of each of three leads remaining on the circuit board.
3. Bend into a "U" shape the replacement transistor leads.
4. Connect the replacement transistor leads to the corresponding leads extending from the circuit board and crimp the "U" with long nose pliers to insure metal to metal contact then solder each connection.

**Power Output, Transistor Device Removal/Replacement**

1. Heat and remove all solder from around the transistor leads.
2. Remove the heat sink mounting screw (if so equipped).
3. Carefully remove the transistor from the heat sink of the circuit board.
4. Insert new transistor in the circuit board.
5. Solder each transistor lead, and clip off excess lead.
6. Replace heat sink.

**Diode Removal/Replacement**

1. Remove defective diode by clipping its leads as close as possible to diode body.
2. Bend the two remaining leads perpendicular y to the circuit board.
3. Observing diode polarity, wrap each lead of the new diode around the corresponding lead on the circuit board.
4. Securely crimp each connection and solder it.
5. Inspect (on the circuit board copper side) the solder joints of the two "original" leads. If they are not shiny, reheat them and if necessary, apply additional solder.

**Fuse and Conventional Resistor Removal/Replacement**

1. Clip each fuse or resistor lead at top of the circuit board hollow stake.
2. Securely crimp the leads of replacement component around notch at stake top.
3. Solder the connections.
   **CAUTION:** Maintain original spacing between the replaced component and adjacent components and the circuit board to prevent excessive component temperatures.

**Circuit Board Foil Repair**

Excessive heat applied to the copper foil of any printed circuit board will weaken the adhesive that bonds the foil to the circuit board causing the foil to separate from or "lift-off" the board. The following guidelines and procedures should be followed whenever this condition is encountered.

At IC Connections

To repair a defective copper pattern at IC connections use the following procedure to install a jumper wire on the copper pattern side of the circuit board. (Use this technique only on IC connections).

1. Carefully remove the damaged copper pattern with a sharp knife. (Remove only as much copper as absolutely necessary).
2. carefully scratch away the solder resist and acrylic coating (if used) from the end of the remaining copper pattern.
3. Bend a small "U" in one end of a small gauge jumper wire and carefully crimp it around the IC pin. Solder the IC connection.
4. Route the jumper wire along the path of the out-away copper pattern and let it overlap the previously scraped end of the good copper pattern. Solder the overlapped area and clip off any excess jumper wire.

At Other Connections

Use the following technique to repair the defective copper pattern at connections other than IC Pins. This technique involves the installation of a jumper wire on the component side of the circuit board.

1. Remove the defective copper pattern with a sharp knife. Remove at least 1/4 inch of copper, to ensure that a hazardous condition will not exist if the jumper wire opens.
2. Trace along the copper pattern from both sides of the pattern break and locate the nearest component that is directly connected to the affected copper pattern.
3. Connect insulated 20-gauge jumper wire from the lead of the nearest component on one side of the pattern break to the lead of the nearest component on the other side. Carefully crimp and solder the connections.
   **CAUTION:** Be sure the insulated jumper wire is dressed so the it does not touch components or sharp edges.

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# SPECIFICATIONS

## 1. General Specification

| No | Item | | Content | | Remark |
|---|---|---|---|---|---|
| 1 | Customer | | BRAND | | |
| 2 | User Model Name | | W2486L-PFV | | |
| 3 | Sale region | | World Wide | | |
| 4 | Feature | | 24” LCD MONITOR | | |
| 5 | Chassis Name | | LM95A | | |
| 6 | General Scope | External SW &Adj. | Smart, Fun, Menu, F-engine( ▼ ),Source( ▲ ) Auto/Select, Power | | |
| | | Function | OSD, DDC2B, DDC-CI, HDCP, Control Lock, sRGB, f-Engine, ARC, RTC, Auto bright, Over scan, ez zooming, photo effect, 4:3 in wide, headphone out, black level, | | |
| 7 | Power Cord | | Length : 1.87±0.05 M | | |
| | | | Shape : Wall-out | | |
| | | | Color : Black | | |
| 8 | Cable | Signal Cable (D-SUB) | Length : 1.8±0.03M | | |
| | | | Shape : Detachable Type | | |
| | | | Color : Black | | |
| | | | Pin : Triple Row, 15-Position Sub-miniature D | | |
| | | Signal Cable (DVI) | Length : 2.0±0.03 M | | |
| | | | Shape : Detachable Type | | |
| | | | Color : Black | | |
| | | | Pin : Triple Row, 18-Position DVI-D | | |
| 9 | Adqpter | | Input: AC100~240V 50~60Hz, 1.0A Max | | |
| 10 | Applying module list | | Model P/No | Specification | |
| | | | EAJ60678401 | M240HW01 v1 | |

## 2. Mechanical specification

| No | Item | | Content | | | | Remark |
|---|---|---|---|---|---|---|---|
| 1 | Product Dimension | | Width (W) | Length (D) | Height (H) | | |
| | | Before Packing | 577.4 | 198.4 | 440.5 | | With stand |
| | | | 577.4 | 84.1 | 430 | | Without stand |
| | | After Packing | 654 | 492 | 126 | | |
| 2 | Product Weight | Only SET | 4.7 Kg | | | | |
| | | With BOX | 7.2 Kg | | | | |
| 3 | Container Loading Quantity | Individual or Palletizing | 20ft | | 40ft | | |
| | | | Indi. | Pallet | Indi. | Pallet | |
| | | | 684 | 576 | 1512 | 1344 | |
| 4 | Stand Assy | Type | Attachable(Tilt Only) | | | | |
| | | Size (W x D x H) | 256.1 * 198.4 * 26.6 | | | | |
| | | Tilt Degree | -2°(±2) ~ 15°(±3) | | | | |
| | | Tilt force | 0.8~2.5 kgf | | | | |
| | | Swivel Degree | N/A | | | | |
| | | Swivel Force | N/A | | | | |
| 5 | Appearance | General | Refer to Standard of LG(56)G2-1011 | | | | |

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## 3. Optical Character

| No | Item | Criteria | | Remark |
|---|---|---|---|---|
| 1 | Viewing Angle <CR ≥10> | Horizontal(R/L) : +75º/-75º(min), +85º/-85º(Typ.) | | |
| | | Vertical(Top/Bottom) : +70º/-70º(min), +80º/-80º (Typ.) | | |
| 2 | Luminance | Minimum Luminance(cd/m 2 ) | 180(min) (Full white pattern, 0.70V) | 6500K |
| | | Brightness Uniformity | 75%(min) | |
| 3 | Contrast Ratio | 600(Min), 1000(Min) DFC-> 1,000,000:1(Min) | | |
| 4 | Response Time | On/off:5ms(TYP), Gray to Gray: 2ms(TYP) | | |
| 5 | Light Leakage | Condition: Do not visible at 300 Lux | | |

## 4. Engineering Specification

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Supported Sync. Type | Separate Sync., SOG, Digital | | | | | Remarks |
| 2 | Operating Frequency | Analog/ Digital | Horizontal | 30 ~ 83kHz | | | |
| | | | Vertical | 56 ~ 75 Hz | | | |
| | | HDMI | Horizontal | 28 ~ 83kHz | | | |
| | | | Vertical | 48 ~ 61 Hz | | | |
| 3 | Resolution | Analog/ Digital | Max. | 1920x1080 @ 60Hz | | | |
| | | | Recommend | 1920x1080 @ 60Hz | | | |
| | | HDMI | Max. | 1920x1080 @ 60Hz | | | |
| | | | Recommend | 1920x1080 @ 60Hz | | | |
| 4 | Input Voltage | Voltage : 100 – 240 Vac, 50 or 60Hz | | | | | |
| 5 | Inrush Current | Cold Start : 50 A Hot : 120 A | | | | | |
| 6 | Operating Condition | Sync(H/V) | Video | LED | Wattage | | |
| | On Mode | On/On | Active | RED | 32W (Max) 28W (typ) | | Test condition 1. 1920x1080 @ 60Hz 2. burst pattern 3. 100~240V 4. After aging 30min |
| | Sleep Mode | Off/On On/Off Off/Off | Off | blinking | 1W | | |
| | Off Mode (Power switch off) | - | - | Off | 1W | | |
| 7 | MTBF | 50,000 HRS with 90% Confidence level | | Lamp Life : 50,000 Hours(Min) | | | |
| 8 | Using Altitude | 5,000 m (for Reliability) 3,000m(for FOS) | | | | | |
| 9 | Environment Condition | 0perating | Temperature 10 °C ~ 35 °C | | | | |
| | | | Humidity 10% ~ 80% | | | | |
| | | Storage | Temperature -20 °C ~ 60 °C | | | | |
| | | | Humidity 5% ~ 90% non-condensing | | | | |

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## 5. LCD Panel Characteristic

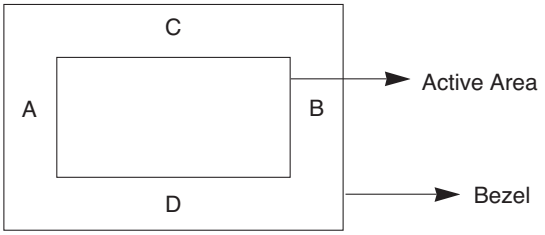
| No | Item | | | Content | | | Remark |
|---|---|---|---|---|---|---|---|
| 1 | LCD Module Feature | Maker | | AUO | | | |
| | | Type | | TFT Color LCD Module | | | |
| | | Active Display Area | | 24 inches (609.7mm)<br>diagonal (Aspect ratio 16:10) | | | |
| | | Pixel Pitch [mm] | | 0.2767mm x 0.2767mm | | | |
| | | Electrical Interface | | 2ch-LVDS | | | |
| | | Color Depth | | 16.7M colors<br>(RGB 6-bit + Hi_FRC) | | | |
| | | Size (Outline) [mm] | | 556.0(H) x 323.2(V) x 14.55(D) mm | | | |
| | | Surface Treatment | | Anti-Glare, Hard Coating (3H) | | | |
| | | Operating Mode | | Transmissive mode<br>Normally White | | | |
| | | Back light Unit | | White LED | | | |
| | | R/T | Typical | Rise Time: 3.4 , Fall Time: 1.6 | | | |
| | | | Max. | Rise Time: 7.4 , Fall Time: 2.6 | | | |
| 2 | CIE Color Coordinates | | | Minimum | Normal | Maximum | |
| | | White | Wx | Typ-0.015 | 0.283 | Typ+0.015 | 9300K |
| | | | Wy | | 0.298 | | |
| | | White | u’ | Typ-0.015 | 0.313 | Typ+0.015 | 6500K |
| | | | v’ | | 0.329 | | |
| | | Red | Rx | Typ-0.03 | 0.635 | Typ+0.03 | |
| | | | Ry | | 0.349 | | |
| | | Green | Gx | | 0.335 | | |
| | | | Gy | | 0.607 | | |
| | | Blue | Bx | | 0.146 | | |
| | | | By | | 0.058 | | |

(1) Standard Measurement Condition
- Ambient Luminance Level : dark ( < 10 lux)
- Ambient Temperature : Normal Temperature(10 ~ 25ºC)
- warm-up Time : More than 30min (at Full White Pattern)
- Input Signal : VESA 1920X1080+ 60Hz
- Contrast : 70 (But, the contrast is 100 when we check response time)
- Brightness : Max. 100
- 6500K : Color Temperature Setting is 6500 K( if it’s not special specification)
- Clock/Clock Phase : The Best Setting

(2) Another Spec.: Product Specification Standard( LG(55)G1-1034 )
(3) Cosmetic Spec. : LCD Module IIS Spec.

### 5.1 Display Area

1) Active Display Area of the LCD Monitor Should be within Cabinet’s Bezel.
2) Distance Difference between Active Area and Bezel
   I A-BI<1.0 mm , I C-DI<1.0 mm
   A: The Distance from The Left of Active Area to the Bezel
   B: The Distance from The Right of Active Area to the Bezel
   C: The Distance from The Top of Active Area to the Bezel
   D: The Distance from The Bottom of Active Area to the Bezel

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# 6. EDID

## 6.1 EDID

| No | Item | Content | Hexadecimal Data |
|---|---|---|---|
| 1 | Manufacturer ID | GSM | 1E 6D |
| 2 | Product ID | 22306(Analog)<br>22307(Digital)<br>22313(HDMI1) | 5722<br>5723<br>5729 |
| 3 | Year | 2009 | 13 |
| 4 | Version | Analog : 1<br>Digital : 1<br>HDMI : 1 | 01 |
| 5 | Revision | Analog : 3<br>Digital : 3<br>HDMI: 3 | 03 |
| 6 | Model Name | W2486 | -- |
| 7 | Special Item | White LED module | |

## 6.2 Data (128 Bytes)

### 6.2.1 EDID Ver. 1.3 For ANALOG

| Addr | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0000 | 00 | FF | FF | FF | FF | FF | FF | 00 | 1E | 6D | 22 | 57 | 01 | 01 | 01 | 01 |
| 0010 | 01 | 13 | 01 | 03 | 6A | 35 | 1E | 78 | EA | 3F | 35 | A2 | 59 | 55 | 9B | 25 |
| 0020 | 0E | 50 | 54 | A7 | 6B | 80 | B3 | 00 | 81 | 80 | 81 | 40 | 71 | 4F | 01 | 01 |
| 0030 | 01 | 01 | 01 | 01 | 01 | 01 | 02 | 3A | 80 | 18 | 71 | 38 | 2D | 40 | 58 | 2C |
| 0040 | 45 | 00 | 13 | 2B | 21 | 00 | 00 | 1E | 21 | 39 | 90 | 30 | 62 | 1A | 27 | 40 |
| 0050 | 68 | B0 | 36 | 00 | 13 | 2B | 21 | 00 | 00 | 1C | 00 | 00 | 00 | FD | 00 | 38 |
| 0060 | 4B | 1E | 53 | 0F | 00 | 0A | 20 | 20 | 20 | 20 | 20 | 20 | 00 | 00 | 00 | FC |
| 0070 | 00 | 57 | 32 | 34 | 38 | 36 | 0A | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 00 | F1 |

### 6.2.2 EDID Ver. 1.3 For DIGITAL

| Addr | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0000 | 00 | FF | FF | FF | FF | FF | FF | 00 | 1E | 6D | 23 | 57 | 01 | 01 | 01 | 01 |
| 0010 | 01 | 13 | 01 | 03 | 80 | 35 | 1E | 78 | EA | 3F | 35 | A2 | 59 | 55 | 9B | 25 |
| 0020 | 0E | 50 | 54 | A7 | 6B | 80 | B3 | 00 | 81 | 80 | 81 | 40 | 71 | 4F | 01 | 01 |
| 0030 | 01 | 01 | 01 | 01 | 01 | 01 | 1A | 36 | 80 | A0 | 70 | 38 | 1F | 40 | 30 | 20 |
| 0040 | 35 | 00 | 13 | 2B | 21 | 00 | 00 | 1A | 02 | 3A | 80 | 18 | 71 | 38 | 2D | 40 |
| 0050 | 58 | 2C | 45 | 00 | 13 | 2B | 21 | 00 | 00 | 1E | 00 | 00 | 00 | FD | 00 | 38 |
| 0060 | 4B | 1E | 53 | 0F | 00 | 0A | 20 | 20 | 20 | 20 | 20 | 20 | 00 | 00 | 00 | FC |
| 0070 | 00 | 57 | 32 | 34 | 38 | 36 | 0A | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 00 | 2B |

### 6.2.3 EDID Ver. 1.3 For HDMI1

| Addr | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0000 | 00 | FF | FF | FF | FF | FF | FF | 00 | 1E | 6D | 29 | 57 | 01 | 01 | 01 | 01 |
| 0010 | 01 | 13 | 01 | 03 | 80 | 35 | 1E | 78 | 0A | 3F | 35 | A2 | 59 | 55 | 9B | 25 |
| 0020 | 0E | 50 | 54 | 21 | 08 | 00 | E3 | 00 | 81 | 80 | 81 | 40 | 71 | 40 | 01 | 01 |
| 0030 | 01 | 01 | 01 | 01 | 01 | 01 | 1A | 36 | 80 | A0 | 70 | 38 | 1F | 40 | 30 | 20 |
| 0040 | 35 | 00 | 13 | 2B | 21 | 00 | 00 | 1A | 02 | 3A | 80 | 18 | 71 | 38 | 2D | 40 |
| 0050 | 58 | 2C | 45 | 00 | 13 | 2B | 21 | 00 | 00 | 1E | 00 | 00 | 00 | FD | 00 | 30 |
| 0060 | 3D | 1C | 53 | 0F | 00 | 0A | 20 | 20 | 20 | 20 | 20 | 20 | 00 | 00 | 00 | FC |
| 0070 | 00 | 57 | 32 | 34 | 38 | 36 | 0A | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 01 | 94 |
| 0080 | 02 | 03 | 21 | F1 | 4E | 90 | 04 | 03 | 01 | 14 | 12 | 05 | 1F | 10 | 13 | 00 |
| 0090 | 00 | 00 | 00 | 23 | 09 | 07 | 07 | 83 | 01 | 00 | 00 | 65 | 03 | 0C | 00 | 10 |
| 00A0 | 00 | 02 | 3A | 80 | 18 | 71 | 38 | 2D | 40 | 58 | 2C | 45 | 00 | 13 | 2B | 21 |
| 00B0 | 00 | 00 | 1E | 01 | 1D | 80 | 18 | 71 | 1C | 16 | 20 | 58 | 2C | 25 | 00 | 13 |
| 00C0 | 2B | 21 | 00 | 00 | 9E | 01 | 1D | 00 | 72 | 51 | D0 | 1E | 20 | 6E | 28 | 55 |
| 00D0 | 00 | 13 | 2B | 21 | 00 | 00 | 1E | 8C | 0A | D0 | 8A | 20 | E0 | 2D | 10 | 10 |
| 00E0 | 3E | 96 | 00 | 13 | 2B | 21 | 00 | 00 | 18 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00F0 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 26 |

### 6.2.4 EDID Ver. 1.3 For HDMI2

| Addr | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0000 | 00 | FF | FF | FF | FF | FF | FF | 00 | 1E | 6D | 29 | 57 | 01 | 01 | 01 | 01 |
| 0010 | 01 | 13 | 01 | 03 | 80 | 35 | 1E | 78 | 0A | 3F | 35 | A2 | 59 | 55 | 9B | 25 |
| 0020 | 0E | 50 | 54 | 21 | 08 | 00 | B3 | 00 | 81 | 80 | 81 | 40 | 71 | 40 | 01 | 01 |
| 0030 | 01 | 01 | 01 | 01 | 01 | 01 | 1A | 36 | 80 | A0 | 70 | 38 | 1F | 40 | 30 | 20 |
| 0040 | 35 | 00 | 13 | 2B | 21 | 00 | 00 | 1A | 02 | 3A | 80 | 18 | 71 | 38 | 2D | 40 |
| 0050 | 58 | 2C | 45 | 00 | 13 | 2B | 21 | 00 | 00 | 1E | 00 | 00 | 00 | FD | 00 | 30 |
| 0060 | 3D | 1C | 53 | 0F | 00 | 0A | 20 | 20 | 20 | 20 | 20 | 20 | 00 | 00 | 00 | FC |
| 0070 | 00 | 57 | 32 | 34 | 38 | 36 | 0A | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 01 | 94 |
| 0080 | 02 | 03 | 21 | F1 | 4E | 90 | 04 | 03 | 01 | 14 | 12 | 05 | 1F | 10 | 13 | 00 |
| 0090 | 00 | 00 | 00 | 23 | 09 | 07 | 07 | 83 | 01 | 00 | 00 | 65 | 03 | 0C | 00 | 20 |
| 00A0 | 00 | 02 | 3A | 80 | 18 | 71 | 38 | 2D | 40 | 58 | 2C | 45 | 00 | 13 | 2B | 21 |
| 00B0 | 00 | 00 | 1E | 01 | 1D | 80 | 18 | 71 | 1C | 16 | 20 | 58 | 2C | 25 | 00 | 13 |
| 00C0 | 2B | 21 | 00 | 00 | 9E | 01 | 1D | 00 | 72 | 51 | D0 | 1E | 20 | 6E | 28 | 55 |
| 00D0 | 00 | 13 | 2B | 21 | 00 | 00 | 1E | 8C | 0A | D0 | 8A | 20 | E0 | 2D | 10 | 10 |
| 00E0 | 3E | 96 | 00 | 13 | 2B | 21 | 00 | 00 | 18 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00F0 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 16 |

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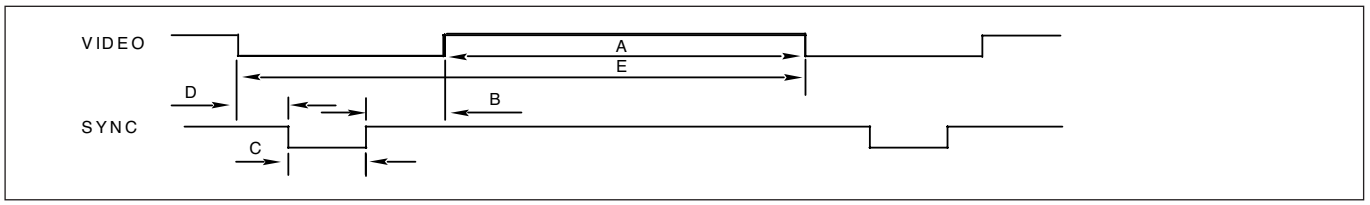
# TIMING CHART

### (1) Signal(Video & Sync)




### (2) H/V Timing

| Mode | Classification | Sync Polarity | Dot Clock | Frequency | Total Period ( E ) | Disply ( A ) | Front Porch ( D ) | Sync. ( C ) | Back porch( B ) | Resolution |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | H(Pixels) | - | 28.321 | 31.468 | 900 | 720 | 18 | 108 | 54 | 720 X400 |
| | V(Lines) | + | | 70.08 | 449 | 400 | 12 | 2 | 35 | |
| 2 | H(Pixels) | - | 25.175 | 31.469 | 800 | 640 | 16 | 96 | 48 | 640 x480 |
| | V(Lines) | - | | 59.94 | 525 | 480 | 10 | 2 | 33 | |
| 3 | H(Pixels) | - | 31.5 | 37.5 | 840 | 640 | 16 | 64 | 120 | 640 x480 |
| | V(Lines) | - | | 75 | 500 | 480 | 1 | 3 | 16 | |
| 4 | H(Pixels) | + | 40.0 | 37.879 | 1056 | 800 | 40 | 128 | 88 | 800 x600 |
| | V(Lines) | + | | 60.317 | 628 | 600 | 1 | 4 | 23 | |
| 5 | H(Pixels) | + | 49.5 | 46.875 | 1056 | 800 | 16 | 80 | 160 | 800 x600 |
| | V(Lines) | + | | 75.0 | 625 | 600 | 1 | 3 | 21 | |
| 6 | H(Pixels) | - | 65.0 | 48.363 | 1344 | 1024 | 24 | 136 | 160 | 1024 x768 |
| | V(Lines) | - | | 60.0 | 806 | 768 | 3 | 6 | 29 | |
| 7 | H(Pixels) | - | 78.75 | 60.123 | 1312 | 1024 | 16 | 96 | 176 | 1024x768 |
| | V(Lines) | - | | 75.029 | 800 | 768 | 1 | 3 | 28 | |
| 8 | H(Pixels) | +/- | 108.0 | 67.500 | 1600 | 1152 | 64 | 128 | 256 | 1152x 864 |
| | V(Lines) | +/- | | 75.000 | 900 | 864 | 1 | 3 | 32 | |
| 9 | H(Pixels) | + | 108.0 | 63.981 | 1688 | 1280 | 48 | 112 | 248 | 1280 x1024 |
| | V(Lines) | + | | 60.02 | 1066 | 1024 | 1 | 3 | 38 | |
| 10 | H(Pixels) | + | 135.0 | 79.976 | 1688 | 1280 | 16 | 144 | 248 | 1280 X1024 |
| | V(Lines) | + | | 75.035 | 1066 | 1024 | 1 | 3 | 38 | |
| 11 | H(Pixels) | + | 119 | 64.674 | 1840 | 1680 | 48 | 32 | 80 | 1680 X1050 |
| | V(Lines) | - | | 59.883 | 1080 | 1050 | 3 | 6 | 21 | |
| 12 | H(Pixels) | - | 146.25 | 65.290 | 2240 | 1680 | 104 | 176 | 280 | 1680 X1050 |
| | V(Lines) | + | | 59.954 | 1089 | 1050 | 3 | 6 | 30 | |
| 13 | H(Pixels) | + | 148.50 | 67.50 | 2200 | 1920 | 88 | 44 | 148 | 1920 X1080 |
| | V(Lines) | + | | 60 | 1125 | 1080 | 4 | 5 | 36 | |

• D-SUB/DVI DTV Mode is not supported (interlace mode)

### (3) HDMI Video input

| | Factory support mode (Preset Mode) | Horizontal freq. (KHz) | Vertical freq. (Hz) |
|---|---|---|---|
| 1 | 480P | 31.5 | 60 |
| 2 | 576P | 31.25 | 50 |
| 3 | 720P | 37.5 | 50 |
| 4 | 720P | 45 | 60 |
| 5 | 1080i | 28.12 | 50 |
| 6 | 1080i | 33.75 | 60 |
| 7 | 1080P | 56.25 | 50 |
| 8 | 1080P | 67.5 | 60 |

• HDMI jack is for AV(video signal)

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# ADJUSTMENT

## 1. Coverage

Apply to 24" Wide monitor made in Monitor Factory(Kumi Korea) or made in accordance with the standard of Kumi Factory process.

## 2. Appointment

2.1 Adjustment must be done as fixed sequence, and adjustment sequence can be modified after agreement withthe responsible R&D engineer considering mass-production condition.

2.2 Power : AC100~240 Voltage (Free)

2.3 Input signal : As Product Standard ( Signal ROM: W2286l V0.1)

2.4 Warm-up Time : Over than 5 minutes

2.5 Adjustment equipment : White balance equipment (CA-110/210), Display adjust equipment, VG-819(or VG828), Oscilloscope, PC (More than 486 computer ) & White balance adjust program.,HDCP Adjusting Jig equipment.

## 3. Adjustment

### 3.1 Overview

Use factory automation equipment and adjust automatic movement. But, do via passivity adjust in erroroccurrence.

### 3.2 Adjustment order

(refer to the Adjustment standard and adjustment command table)

#### 3.2.1 Board Assembly Line

· Connect input signal to 15pin D-sub.
· Ready for adjustment : check whether adjustment command works normally or not and the operating state of each mode. Check the display state of gray color when 256 gray scale pattern is embodied.
· Read by EEPROM Read Command to check whether initial value is correct or not.

#### 3.2.2 Total Assembly Line

· Input analog signal. (1920x 1080@60Hz)
· Write HDCP Key to EEPROM(24C16) by using DDC2AB protocol&HDCP Adjusting equipment [Address 0xAC 80, 289 btes]
· If error is occurred, write and check again.
· Ready : Heat-run during 5 minutes in the state with signal
· Connect input signal to D-sub.
· Default value before adjustment : Contrast "70" , Brightness "100(Max)"

#### 3.2.3 Adjustment of Horizontal/Verticality screen position, Clock and Clock Phase at each Mode.

· There is no special factory mode adjustment.
Writing initial value of EEPROM in Board Assembly line is adjusting Preset Mode and Reset mode. (EEPROM is initialized when AC Power is ON first.)
· If the change of FOS data is needed after M.P, it is possible by writing Mode Data with EEPROM write command or modifying the Mode Data in MICOM itself.

# Caution) Must keep power-on more than 3 seconds after AC Power-on first time.

#### 3.2.4 Color coordinates adjustment and Luminance adjustment.

3.2.4.1 Color coordinates adjustment

· Monitor Contrast / Brightness
- Contrast : 70
- Brightness : 100(Max)
· CA-110/210: Set "Channel 7" ->
CA-110: channel8. CA-210: channel5
· Signal Generator : At cut-off and drive ->
16 step pattern for ADC
- Output Voltage : 700 mVp-p
- Output Mode : Mode 13( WSXGA+ 60Hz )mode Setting.

3.2.4.2.Adjustment : Board Assembly Line

· Input 16 step pattern for ADC (Mode13, pattern 11). (Video level : 700 mVp-p)
· Adjust by commanding AUTO_COLOR_ADJUST Confirm "Success" message in Screen or Check the data of 0xFE, 0xFF address of EEPROM(0XA6) is 0xAA after waiting 5 seconds
· If there is "FAULT" message or the data of 0xFE, 0xFF address of EEPROM(0xAA) is not 0xAA, do adjust again
· If all Adjustment is completed, the values of 6500K, User Color and 9300K are saved automatically.

3.2.4.3. Confirm at Total Assembly Line: adjustment

· Check the data of 0xFE, 0xFF address of EEPROM(0xA6) is 0xAA.
· If the data of 0xFE, 0xFF address of EEPROM(0xA6) is not 0xAA, do adjust again by 3.2.4.2.

3.2.4.4. Confirm PRESET 6500K Color coordinates and Adjust PRESET 9300K Color coordinates .

· Set as Aging mode ON, by commanding AGING_ON/OFF command code.
· Select Module that is being used in present production by commanding MODULE SELECT.
· Send SYSTEM RESET command to set Module data.
· Input Full White Pattern (Video level : 700 mVp-p)
· Set as 9300K by commanding COLOR_MODE_CHANGE Command code.
· Adjust to meet x = 0.283 ± 0.004, y=0.298±0.004, and confirm.
· Save 9300K Color by commanding COLOR SAVE Command code.
· Input Full White Pattern (Video level : 700 mVp-p)
· Set as 6500K by commanding COLOR_MODE_CHANGE Command code.
· 6500K color adjustment
It's not TCO model.
Don't need to adjust 6500K color.
If this TCO 03 spec should be satisfied later, refer to below method.
Adjust to meet x = 0.313 ± 0.007, y=0.329±0.007, and confirm.

* (Option)
It's another method for 6500K color adjustment at Gumi & NT
At first, check ΔUV. If that is under 0.0065, the set is not adjusted.
If not. It is adjust to meet u'= 0.198±0.0065, v'=0.469±0.0065

· Set as sRGB by commanding COLOR_MODE_CHANGE Command code.
· Adjust to meet Y = 180 ± 10, and confirm.

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3.2.4.5. Confirm User color coordinates .
· Confirm Whether User color is saved same as 6500K.
· After confirming Color coordinates, **Must return to 6500K**
· Confirm whether user color is 50. If the value of user color(R/G/B) is 30, do adjust again by 3.2.4.2.

## 3.2.5 Confirm Operation state.

3.2.5.1 Operation mode : Confirm whether each appointed mode operate correctly or not.

3.2.5.2 Confirmation of Adjustment condition and operation : Confirm whether it meet Auto/Manual equipement Adjustment standard or not.

For W2086T
· Confirm Analog screen state : Confirm screen state at below mode.
Appointment mode : 640*480 @60Hz (Mode 2),
800*600@75Hz(Mode 5), 1024*768@60Hz(Mode 6),
1280*1024@60Hz(Mode 9), 1680*1050@60HZ(Mode 11),
1920*1080@60HZ(Mode 12)
SMPTE pattern(Check 0%,5%,95%,100%) –Mode can be added.
· Check HDCP signal screen by using Video generator that generate HDCP signal

3.2.5.3. Confirm Auto adjustment operation.
· Input Analog 1 Dot on/off & Rectangle Pattern at Mode12(1920*1080@60Hz)
· Confirm adjustment operation by changing Clock, Phase,H/V Position.
· Check Clock, Phase by pressing AUTO Key.
· Confirm first set of new lot by periods

3.2.5.4 Other quality
· Confirm that each items satisfy under standard condition that was written product spec.
· Confirm Applying Module & MICOM Setting -> Confirm with Service OSD
-> Confirm at Service OSD by “Menu + Power key” on .(from Power off)
-> Confirm first set of new lot by periods, and confirm periodically when there is Process change or Adjustment setting change.

3.2.5.5. OSD & Adjustment device Confirmation : Confirm operation mentioned as product spec.
· Vary Brightness and Contrast and confirm the variation of Luminance and display status.
· Operate the f-engine function and confirm variation of Luminance.
· Make sure to do FACTORY RESET after confirmation of OSD function.

3.2.5.6. Confirm the display state by inputting 8 color Bar Pattern & 256 Gray Scale pattern.

3.2.5.7. DPM operation confirmation : Check if Power LED Color and Power Consumption operates as standard.

· Measurement Condition : 230V@ 50Hz (Analog)
· Confirm DPM operation at the state of screen without Video Signal.

3.2.5.8. DDC EDID Write
- HDMI part EDID data
· Confirm whether module selection is correct or not on the self-diagnostics OSD with signal cable disconnected.
· Connect HDMI Signal Cable to DVI-D wafer.
· Write EDID DATA to EEPROM(24C02) by using DDC2B protocol.
· Check whether written EDID data is correct or not.

- DVI part EDID data
· Confirm whether module selection is correct or not on the self-diagnostics OSD with signal cable disconnected.
· Connect Digital Signal Cable to DVI-D wafer.
· Write EDID DATA to EEPROM(24C02) by using DDC2B protocol.
· Check whether written EDID data is correct or not.

- Analog part EDID data
· Connect analog Signal Cable to D-sub wafer.
· Write EDID DATA to EEPROM(24C016) by using DDC2AB protocol. [ Address 0xA6 00]
· Check whether written EDID data is correct or not.
(refer to Product spec).

=> After writing EDID, send Elapsed Time Clear command.
(Elapsed time should not be displayed, after EDID writing)
: Confirm periodically (in the first set of new lot, process change) whether module name and aging time disappeared on the self-diagnostics OSD with signal cable disconnected.

-> If Elapsed Time Clear command isn’t executed, module name, aging time and TCO word appear on the self-diagnostics OSD.(Module name and aging time should not appear after writing EDID)
-> Make sure to do FACTORY RESET at the final process.

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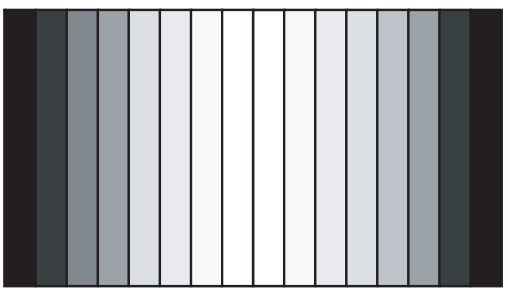
## 5.Standard of Auto/Manual equipment adjustment

| No . | Item | | | Adjustment & measurement standard | Operation mode | Operation Pattern | Measurement Position |
|---|---|---|---|---|---|---|---|
| 1 | Voltage(V) | | | 5V± 0.3V / 3.3V±0.25V, 1.8V± 0.07 | MODE 12 | Pattern4 | TP of Each power |
| 2 | Color coordinates (9300/6500K) | Black Level | | Auto Adjustment | MODE 13 | Pattern 0 | Center of Screen |
| 3 | Color coordinates (6500K) | DRIVE1 | X | 0.313±0.004 | MODE 13 | Pattern1 | Centerof Screen |
| | | | Y | 0.329±0.004 | | | |
| | | | u' | 0.198±0.02 | | | |
| | | | v' | 0.468±0.02 | | | |
| | Color coordinates (9300K) | DRIVE2 | X | 0.283±0.004 | | | |
| | | | Y | 0.298±0.004 | | | |
| | Luminance | 6500K | | More than 210cd/m2 | MODE 13 (700mVp-p) | Pattern1 | Center of Screen |
| 4 | Screen Position | | | FULL SIZE | MODE 1–13 | Pattern4 | Full Screen |
| 5 | Screen Compensation | Clock phase | | FULL SIZE | MODE 13 | Pattern 4 | Full screen |
| | | AUTO | | FULL SIZE | MODE 13 | Pattern 4 | Full screen |
| 6 | DPM Confirmation | On Mode | | 32W(Max) | MODE 13 | note1 | RED |
| | | | | 29W(typ) | | | |
| | | Sleep Mode | | ≤1W | | Pattern 6/7/8 | Blinking |
| | | Off Mode | | ≤1W | | | Off |
| 7 | SOG signal Confirmation | | | Input SOG signal | MODE 13 | Pattern 9 | Full screen |
| 8 | Gray scale Confirmation | | | Linear gray Scale | MODE 13 | Pattern 9 | Full screen |
| 9 | Withstanding Voltage | | | When 1500Vac or 2131Vdc is impressed between the first of power (Live/Neutral) and ground (Earth) for 1 second, check whether something wrong happens or not. | | | |
| 10 | Ground Confirmation | | | When 25A is impressed between Earth and 2 nd Ground for 1 second, Resistance must be less than 0.1 Ω | | | |
| 11 | Cutoff/ADC Adjustment Pattern | | | 16 step pattern for ADC 1600 * 900 (700mVp-p) W2086T | MODE 13 | Patten11 | |

*Note 1 (Test condition):
- mode12(1920x1080 @60Hz)
- Burst pattern
- 100V ~ 240Vac
- Analog & Digital
- After aging 30min

## 4. Pattern for Adjustment

Pattern 0 : FULL BLACK (State of without video signal )
Pattern 1 : FULL WHITE (Don display other Character except for White Pattern)
Pattern 3 : FULL WHITE
Pattern 4 : Cross hatch pattern (Horizontal 10Line, Vertcial 8Line) & Rectangle Pattern
Pattern 5 : 1 Dot on, 1 Dot off & Rectangle Pattern
Pattern 6 : Vertical Sync only input (Use signal cable of which Pin #5 is GND)
Pattern 7 : Horizontal Sync only input (Use signal cable of which Pin #5 is GND)
Pattern 8 : State of without Vertical/Horizontal Sync and Video Signal. (Use signal cable of which Pin #5 is GND)
Pattern 9 : 8 Color Bar Pattern + 16 Gray Level Pattern
Pattern 10 : SMPTE Pattern
Pattern 11 : 16 Gray Step Pattern (700mV)



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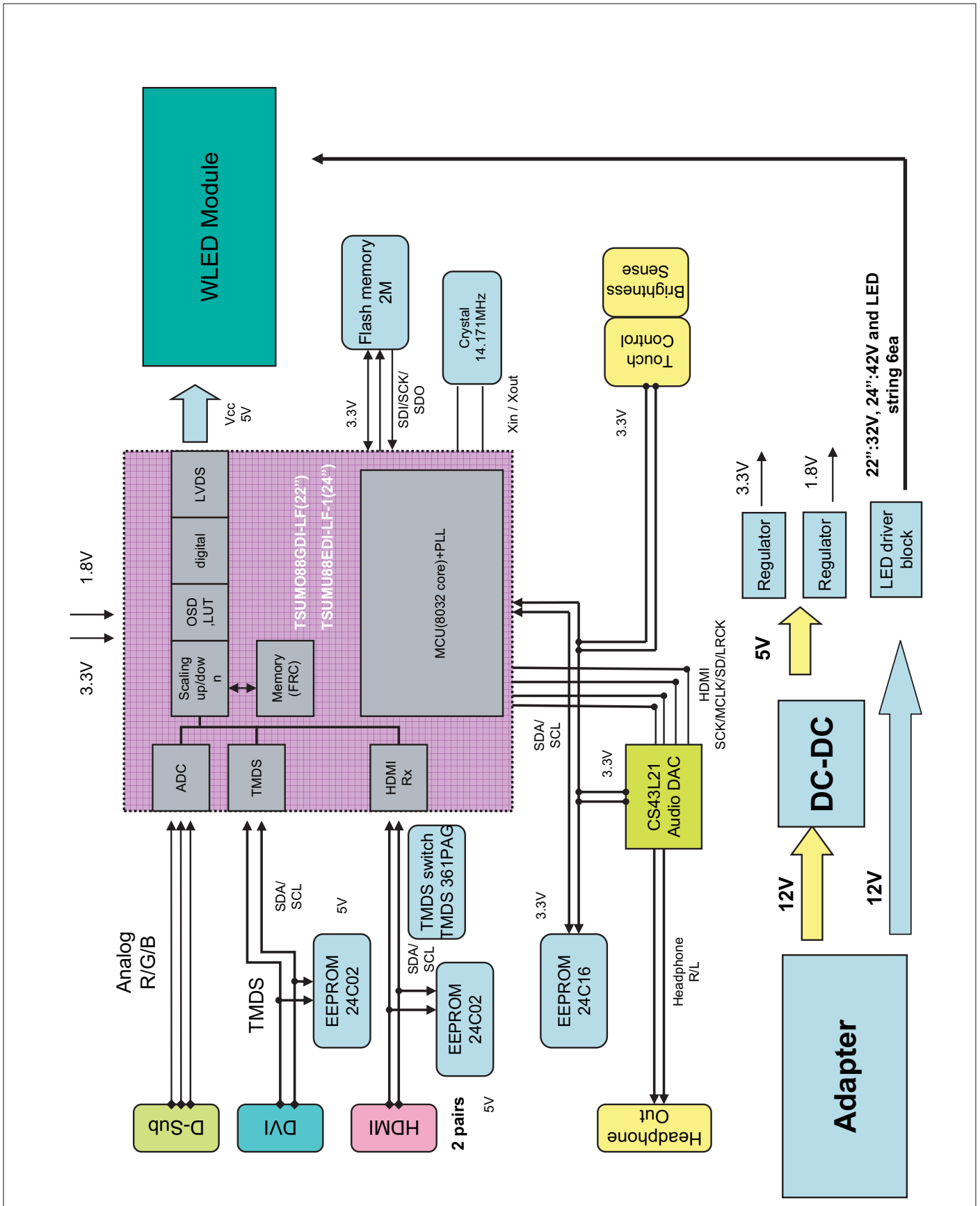
# BLOCK DIAGRAM

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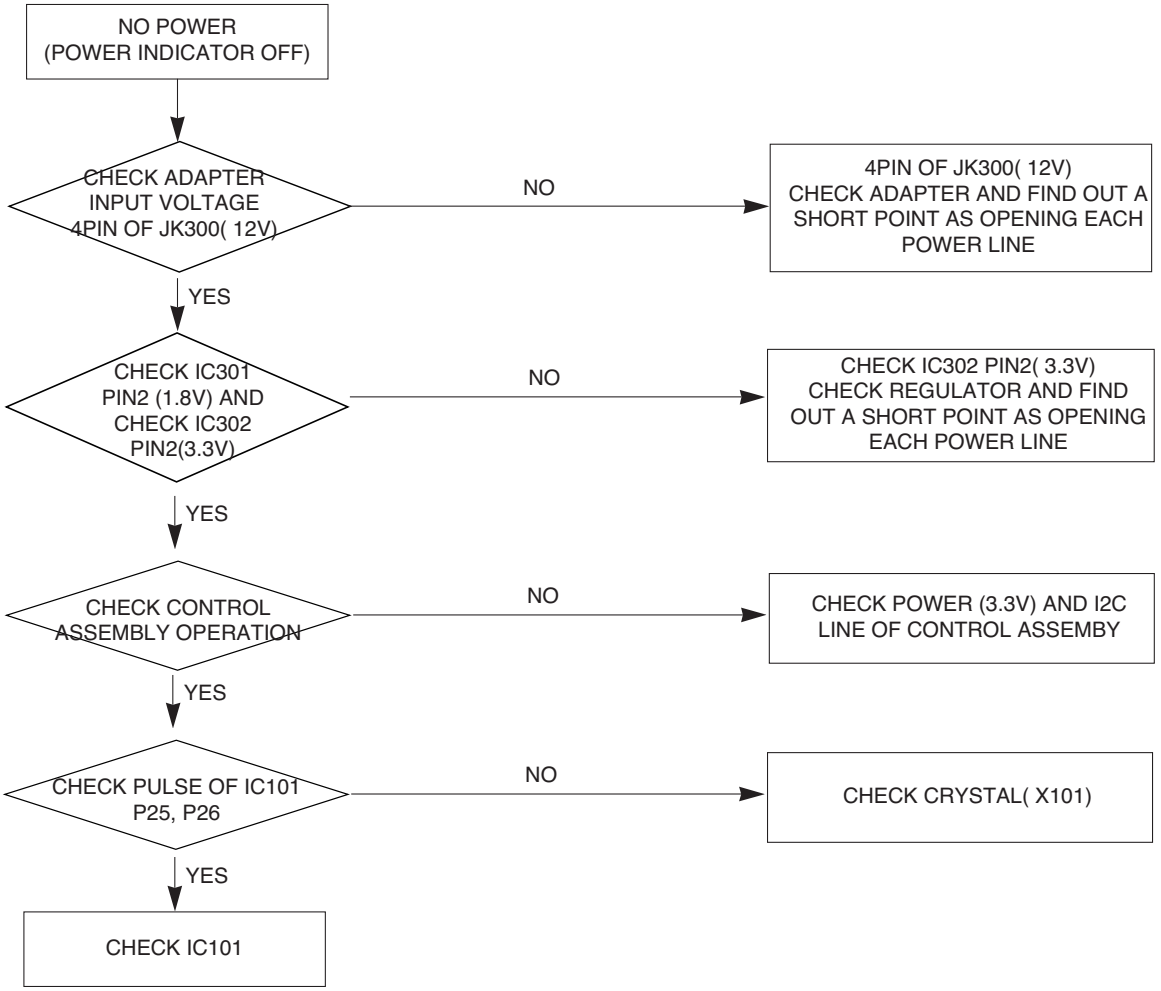
# TROUBLESHOOTING GUIDE

## 1. NO POWER

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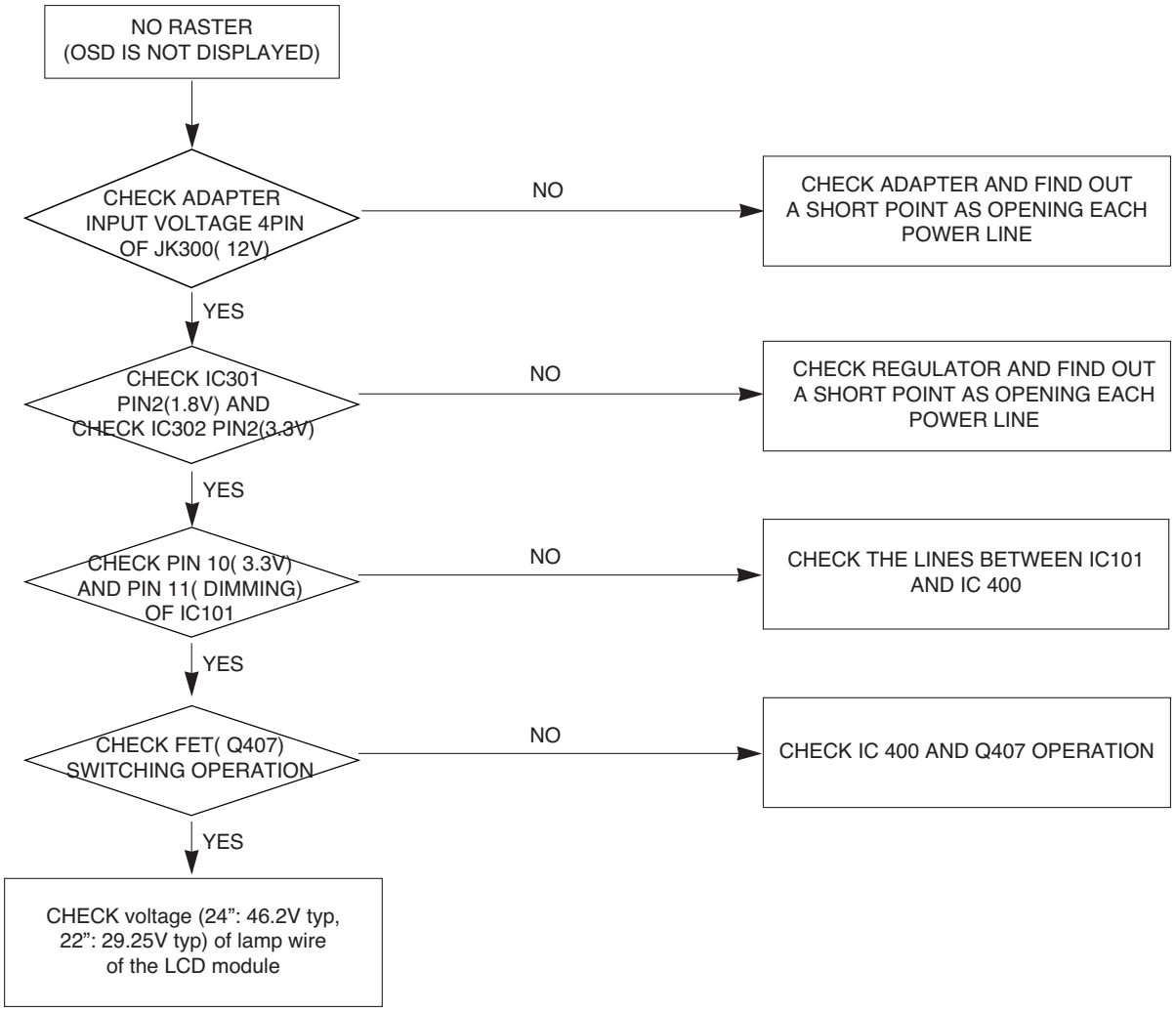
## 2. NO RASTER (OSD IS NOT DISPLAYED) – INVERTER

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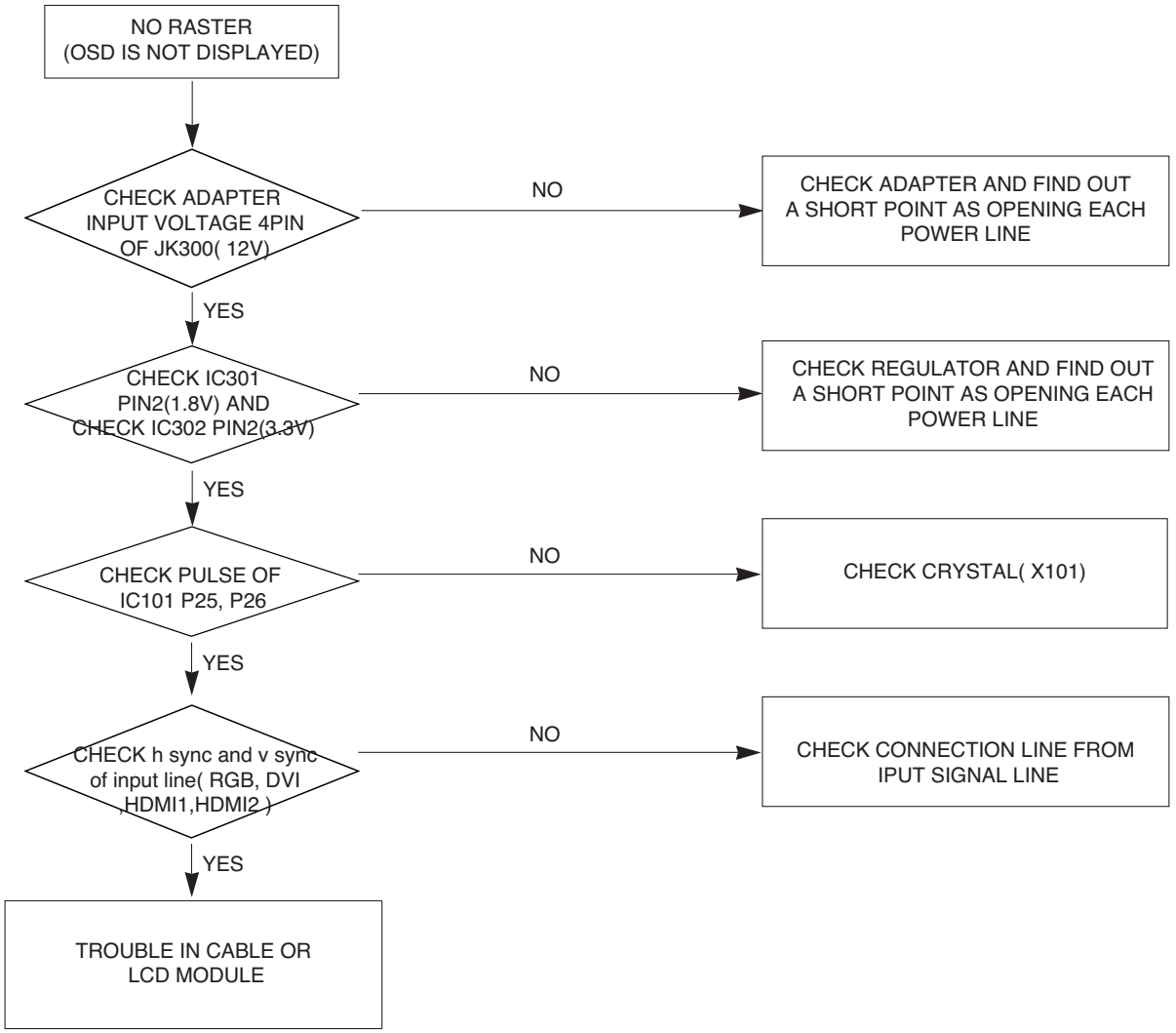
## 3. NO RASTER (OSD IS NOT DISPLAYED) – Mstar

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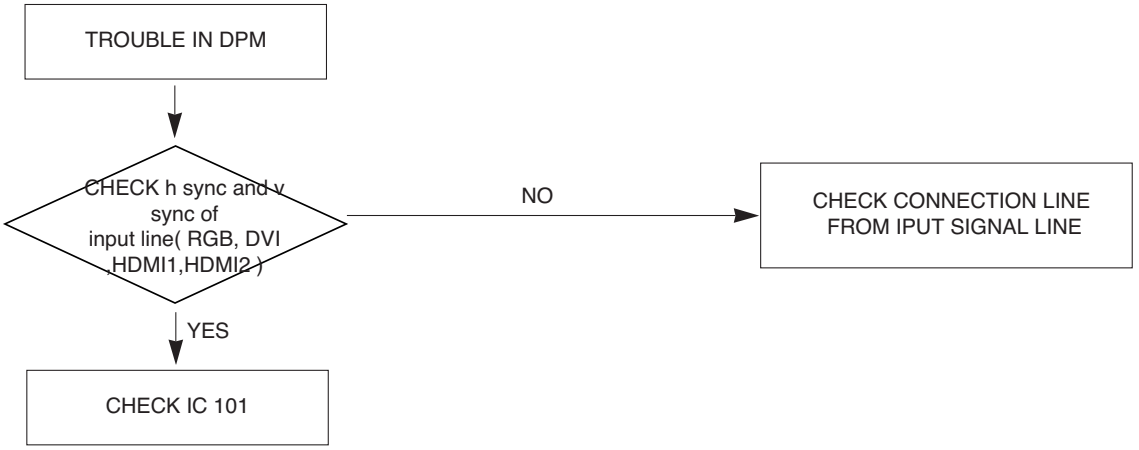
## 4. TROUBLE IN DPM

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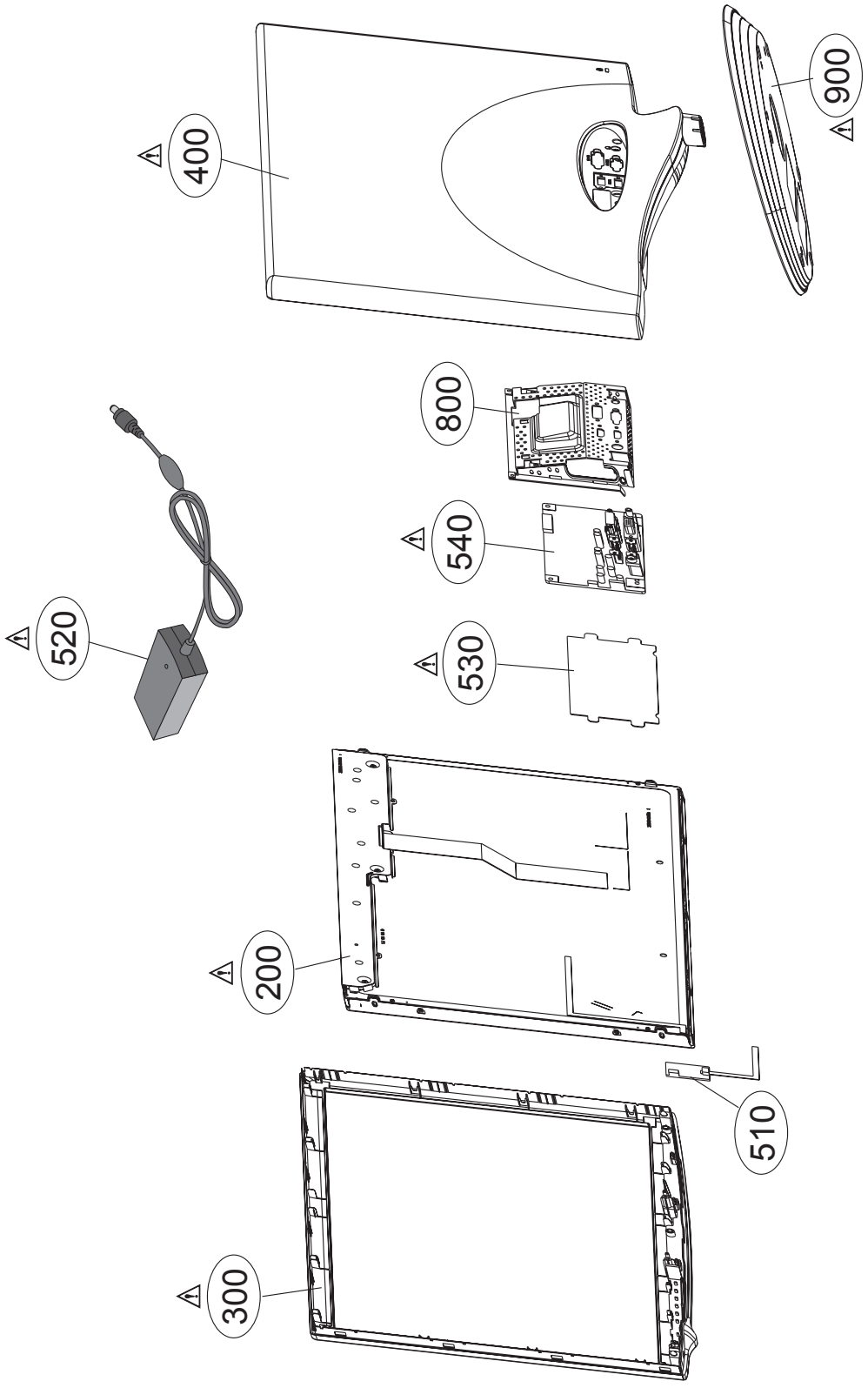
# EXPLODED VIEW

**IMPORTANT SAFETY NOTICE**

Many electrical and mechanical parts in this chassis have special safety-related characteristics. These parts are identified by ⚠ in the Schematic Diagram and EXPLODED VIEW.
It is essential that these special safety parts should be replaced with the same components as recommended in this manual to prevent X-RADIATION, Shock, Fire, or other Hazards.
Do not modify the original design without permission of manufacturer.

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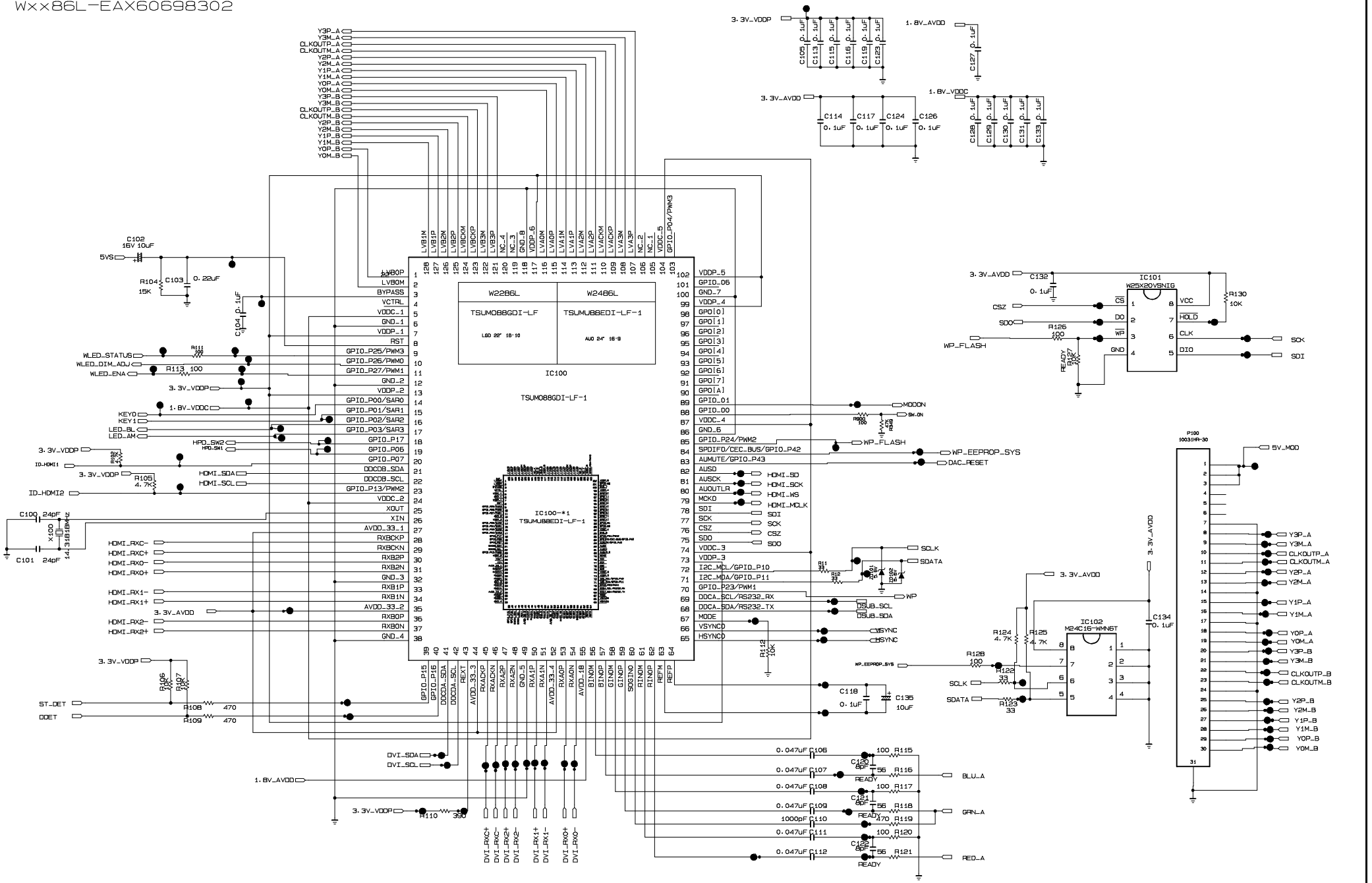


THE ⚠ SYMBOL MARK OF THIS SCHEMETIC DIAGRAM INCORPORATES SPECIAL FEATURES IMPORTANT FOR PROTECTION FROM X-RADIATION. FILRE AND ELECTRICAL SHOCK HAZARDS. WHEN SERVICING IF IS ESSENTIAL THAT ONLY MANUFATURES SPECFIED PARTS BE USED FOR THE CRITICAL COMPONENTS IN THE ⚠ SYMBOL MARK OF THE SCHEMETIC.

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| MODEL | Wxx86 HDMI | DATE | 2009. 3. 21 |
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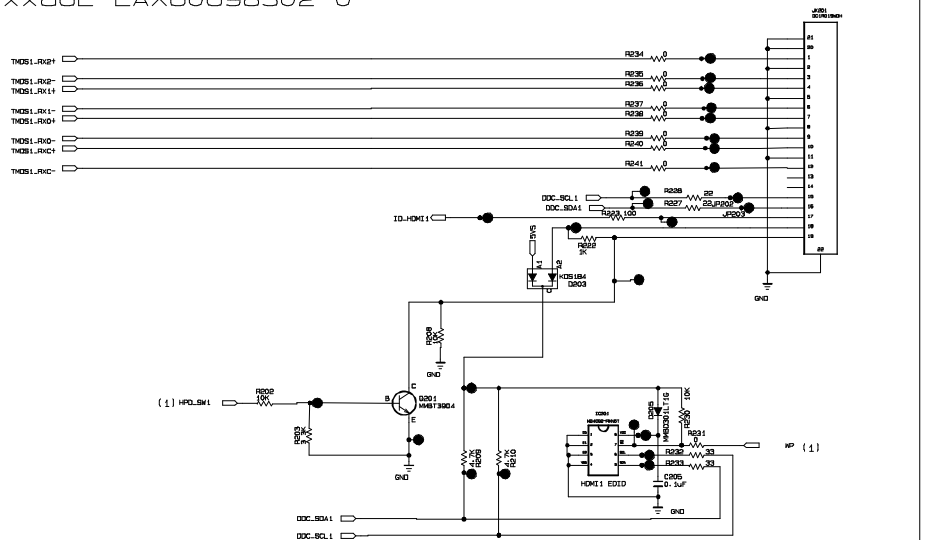


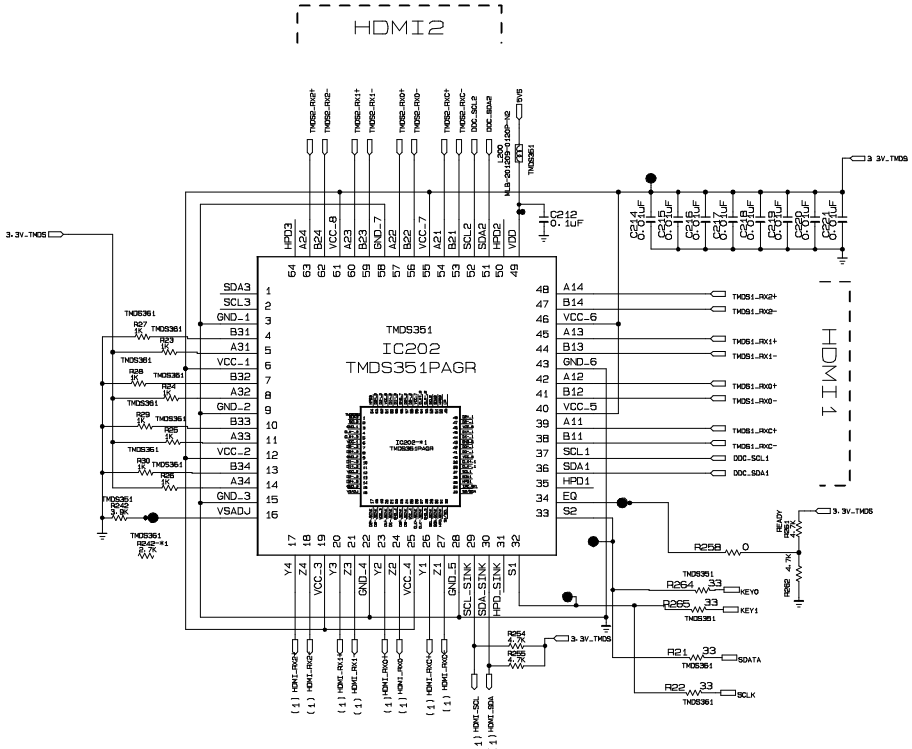


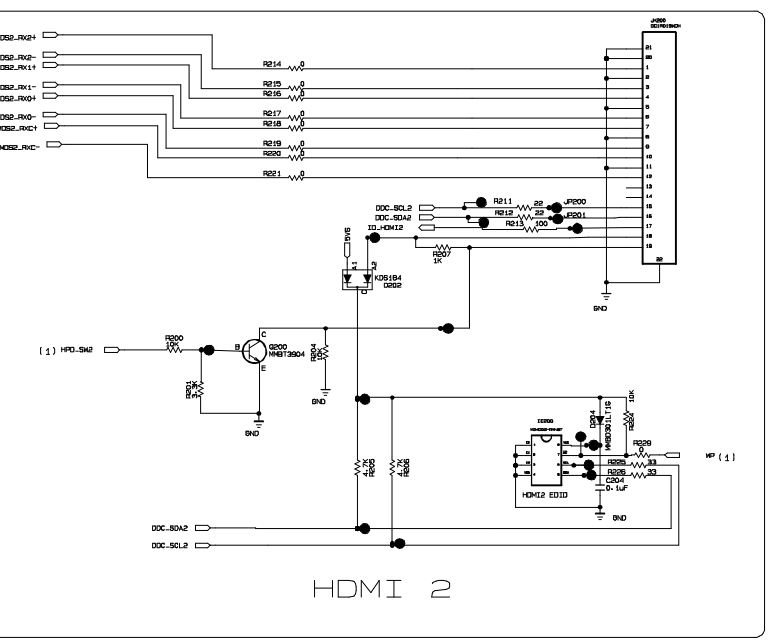


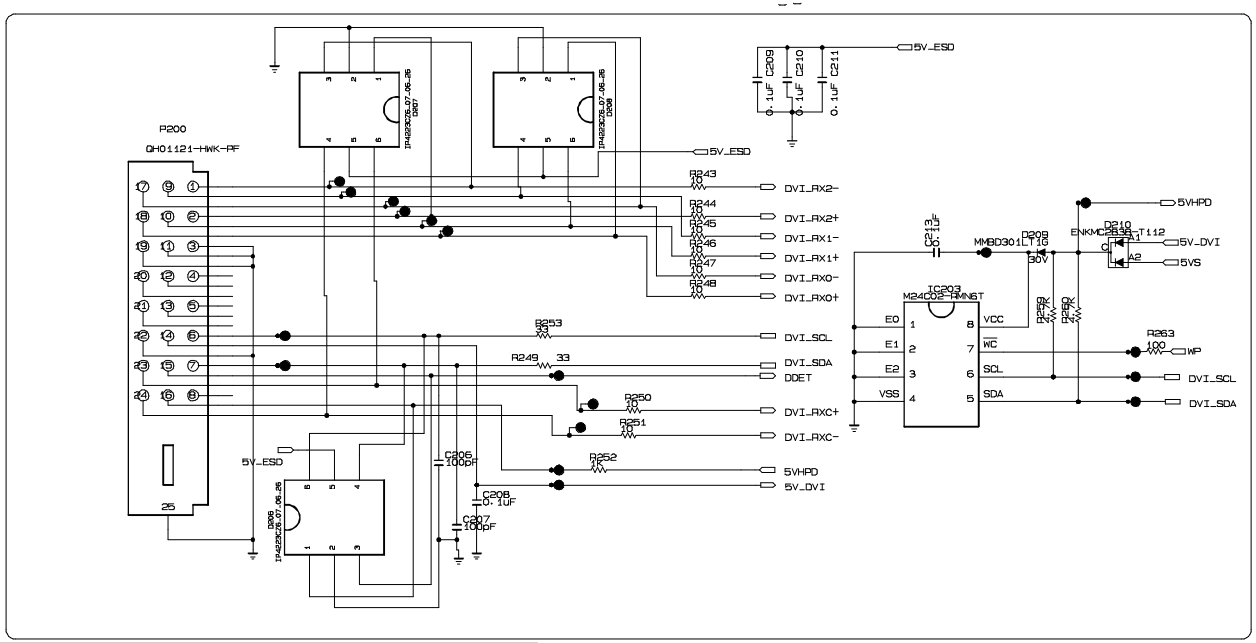


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| MODEL | Wxx86V HDMI | DATE | 2009.3.21 |
|---|---|---|---|
| BLOCK | TMDS switch | SHEET | 2 / 4 |

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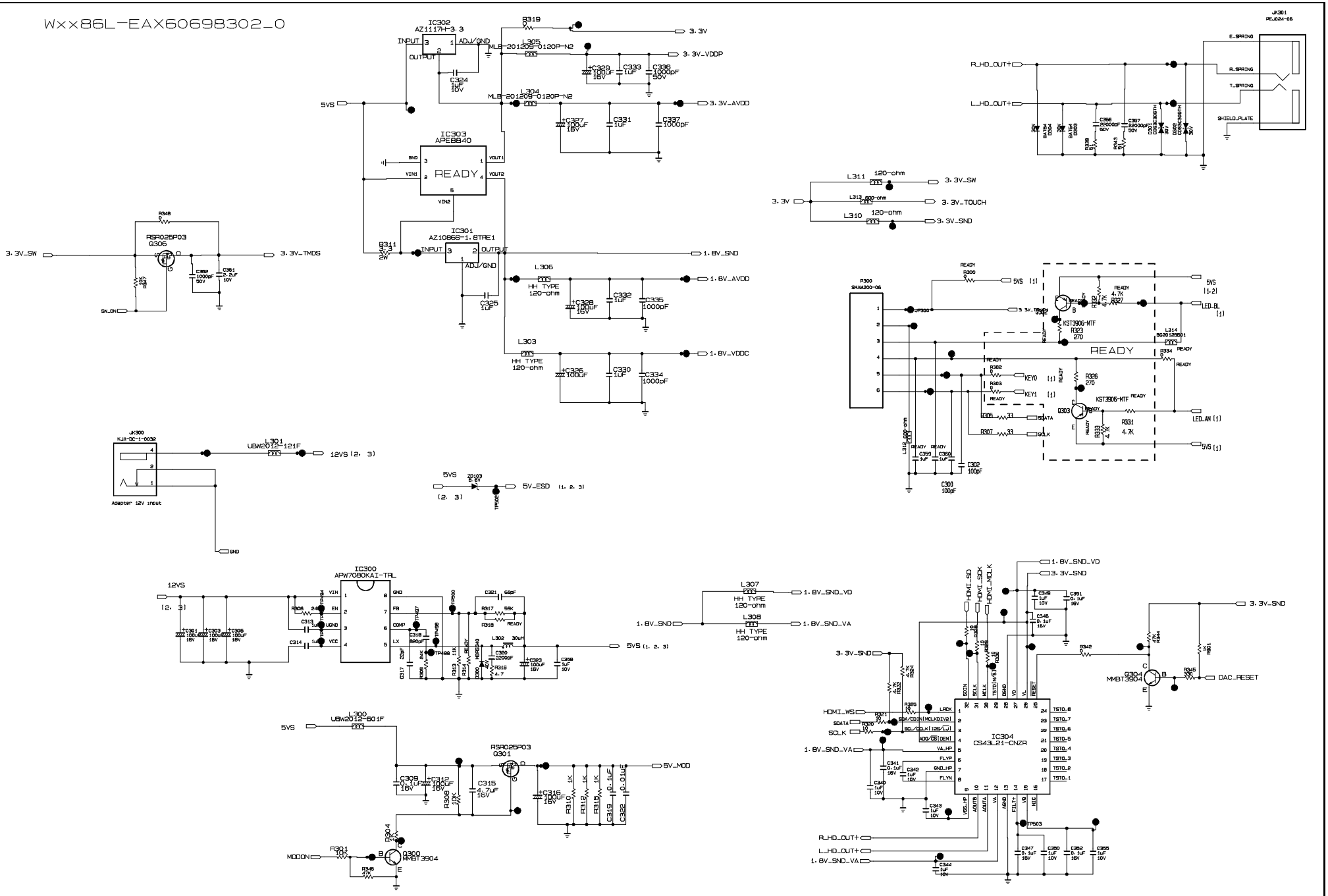


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LG ELECTRONICS

| MODEL | Wxx86L_HDMI | DATE | 2009.3.21 |
|---|---|---|---|
| BLOCK | Audio/DC-DC/POWER | SHEET | 3 / 4 |

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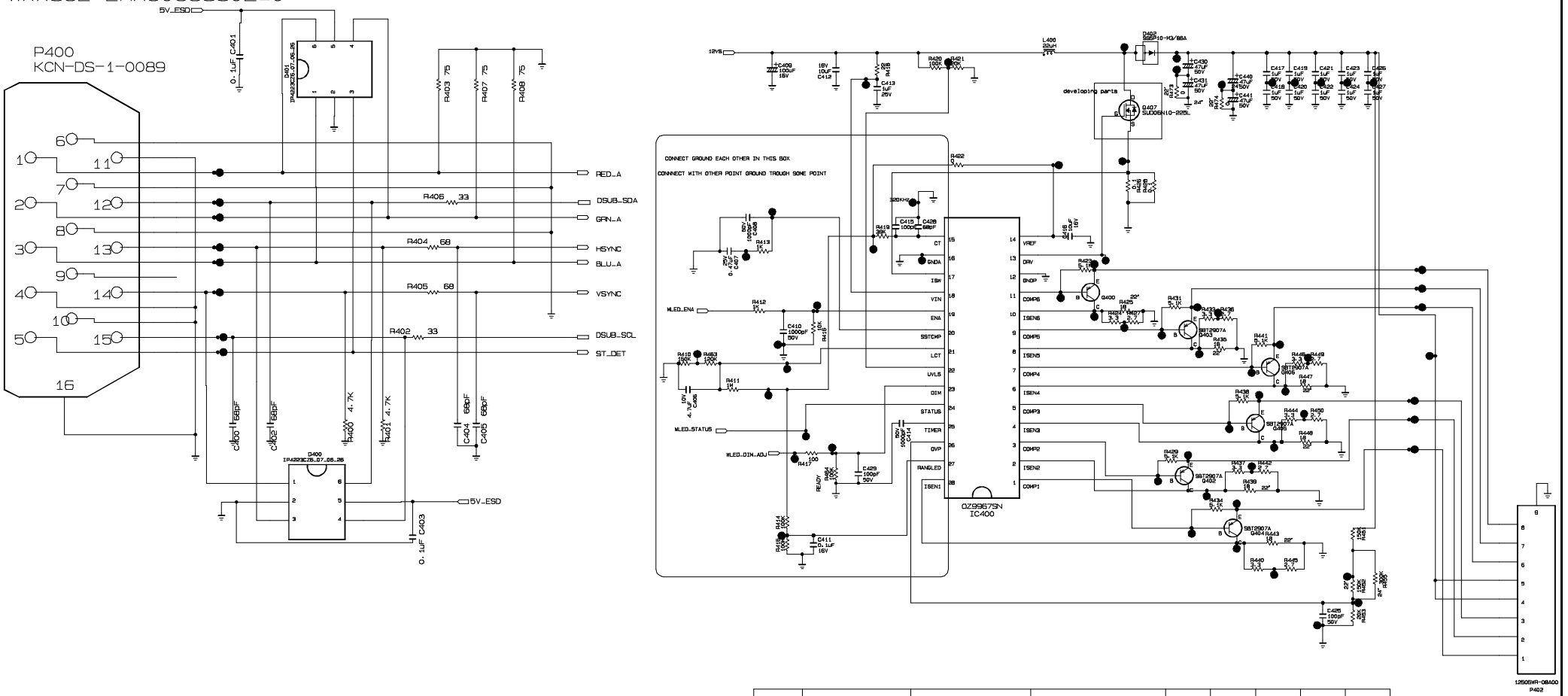
Wxx86L-EAX60698302_0




| | R425, R435, R447<br>R448, R439, R443(18ohm) | R424, R433, R446<br>R444, R437, R440(3.3ohm) | R427, R436, R449<br>R450, R442, R445(2.7ohm) | R452<br>(150K) | R454<br>(300k) | R473<br>(0) | C431<br>(47UF) | C441<br>(47UF) |
|---|---|---|---|---|---|---|---|---|
| W2286L | ○ | ○ | ○ | ○ | X | ○ | X | X |
| W2486L | X | ○ | ○ | X | ○ | X | ○ | ○ |

THE ⚠ SYMBOL MARK OF THIS SCHEMETIC DIAGRAM INCORPORATES SPECIAL FEATURES IMPORTANT FOR PROTECTION FROM X-RADIATION. FILRE AND ELECTRICAL SHOCK HAZARDS. WHEN SERVICING IF IS ESSENTIAL THAT ONLY MANUFATURES SPECFIED PARTS BE USED FOR THE CRITICAL COMPONENTS IN THE ⚠ SYMBOL MARK OF THE SCHEMETIC.

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| MODEL | Wxx86L | DATE | 2009. 3. 21 |
|---|---|---|---|
| BLOCK | LED driver/analog | SHEET | 4 / 4 |

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