

Service Service Service

LC13E
AA



Service Manual

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PHILIPS

1. Technical Specifications, Connections, and Chassis Overview

1.1 Technical Specifications

1.1.1 Reception

Tuning system	: PLL
Colour systems	: PAL B/G, : PAL D/K, : SECAM B/G, : SECAM D/K : SECAM L, : SECAM L1
Sound system	: 2CS BG, : NICAM B/G, : NICAM D/K, : NICAM I, : NICAM L
Built-in radio type	: FM
Speakers	: Full range
Frequency bands	: 13": 2 x 3 W_rms
IF Freq.	: 15": 2 x 3 W_rms
Channel selections	: 20": 2 x 5 W_rms
Aerial input	: UVSH
Pixel format	: 38.9 MHz
Viewing angle	: 100 channels
	: Full cable, UVSH
	: 75 ohm
	: Coax IEC-type
	: 13": 640 x 480 (VGA)
	: 15": 1024 x 768 (XGA)
	: 20": 640 x 480 (VGA)
	: 13": 120 x 90 degrees
	: 15": 176 x 170 degrees
	: 17": 176 x 170 degrees

1.1.2 Miscellaneous

Mains voltage 13"/15"	: External power Supply
	: Input: 100-240 Vac, : 1.5 A
	: Output: 12V dc, : +/- 0.6 V, 60 W
Mains voltage 20"	: External power Supply
	: Input: 100-240 V ac, : 1.5 A
	: Output: 24V dc, : +/- 1.2 V, 120 W
Mains frequency	: 50/60 Hz
Operating temperature	: + 5 to + 35 deg. C.
Storage temp.	: -20 to 60 deg. C.
Maximum humidity	: 90% R.H. max (< 40°C)
Power dissipation	: 13": 35 W : 15": 50 W : 20": 60 W
Standby Power dissipation	: 1 W
Weight	: 13": 4.5 kg : 15": 5.0 kg : 20": 8.5 kg
Dim. 13" model (WxHxD)	: 344x322x65 mm
Dim. 15" model (WxHxD)	: 377x361x70 mm
Dim. 20" model (WxHxD)	: 477x435x81 mm

1.2 Controls

1.2.1 Front + Top Controls

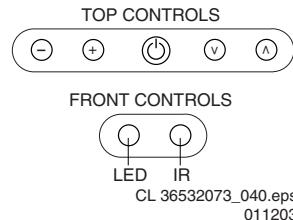


Figure 1-1 Front + Top Controls.

1.3 Connections

1.3.1 Left side Connections A/V

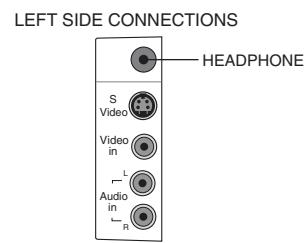


Figure 1-2 Left side connections.

Audio - Out

- Headphone, stereo 32 - 600 ohm/10 mW

3.5mm

S-VHS - In (Hosiden)

1 - Y	Ground	⊕
2 - C	Ground	⊖
3 - Y	1 Vpp/75 ohm	⊕
4 - C	0.3 Vpp/75 ohm	⊖

Video - In (Cinch)

- CVBS 1 Vpp/75 ohm

⊕ ⊖

Audio - In (Cinch)

- Audio - L	0.5 Vrms/10 kohm	⊕ ⊖
- Audio - R	0.5 Vrms/10 kohm	⊕ ⊖

1.3.2 Bottom Connections

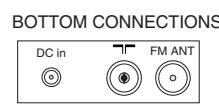


Figure 1-3 Bottom Connections

DC - In

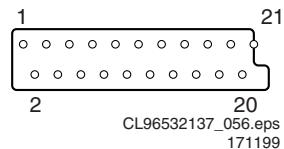
- 13"/15": 12 V_dc/5A/60 W
- 20": 24V_dc/5A/60 W

Aerial - In (IEC)

- IEC type 75 ohm, coax

FM Ant (IEC)

- IEC type 75 ohm, coax

1.3.3 Rear Connections**SCART EXT1 - In/Out (RGB/YUV and CVBS)****Figure 1-4 Rear connections**

1 - Audio - R	0.5 Vrms/1 kohm	
2 - Audio - R	0.5 Vrms/10 kohm	
3 - Audio - L	0.5 Vrms/1 kohm	
4 - Audio	Ground	
5 - Blue	Ground	
6 - Audio - L	0.5 Vrms/10 kohm	
7 - Blue	0.7 Vpp/75 ohm	
8 - CVBS-status	0 - 1.3 V: INT 4.5 - 7 V: EXT 16:9 9.5 - 12 V: EXT 4:3	
9 - Green	Ground	
10 - N.C.		
11 - Green	0.7 Vpp/75 ohm	
12 - N.C.		
13 - Red	Ground	
14 - Blanking	Ground	
15 - Red	0.7 Vpp/75 ohm	
16 - RGB-status/ FBL	0 - 0.4 V: INT 1 - 3 V: EXT/75 ohm	
17 - Video in/out	Ground	
18 - RGB sw. ctrl	Ground	
19 - CVBS-out	1 Vpp/75 ohm	
20 - CVBS-in	1 Vpp/75 ohm	
21 - Common	Ground	

1.4 Chassis Overview

1.4.1 13"/15" model

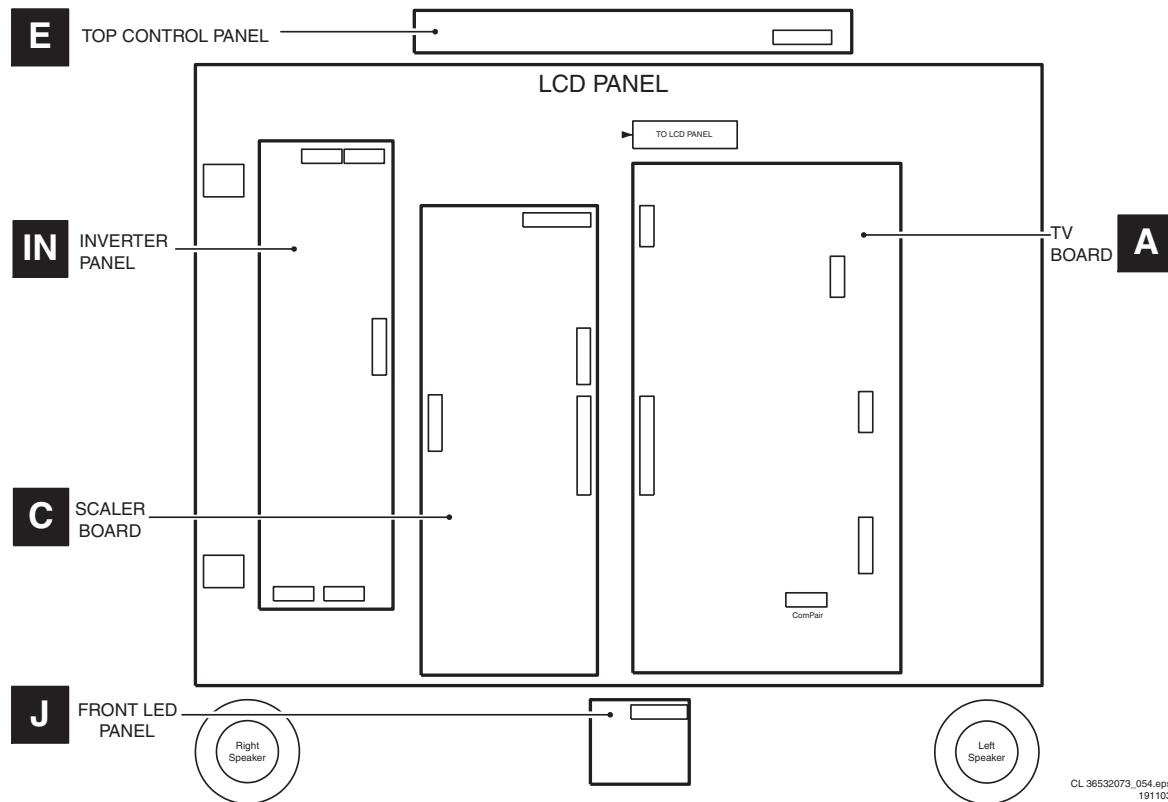


Figure 1-5 Chassis Overview 13"/15" model

1.4.2 20" model

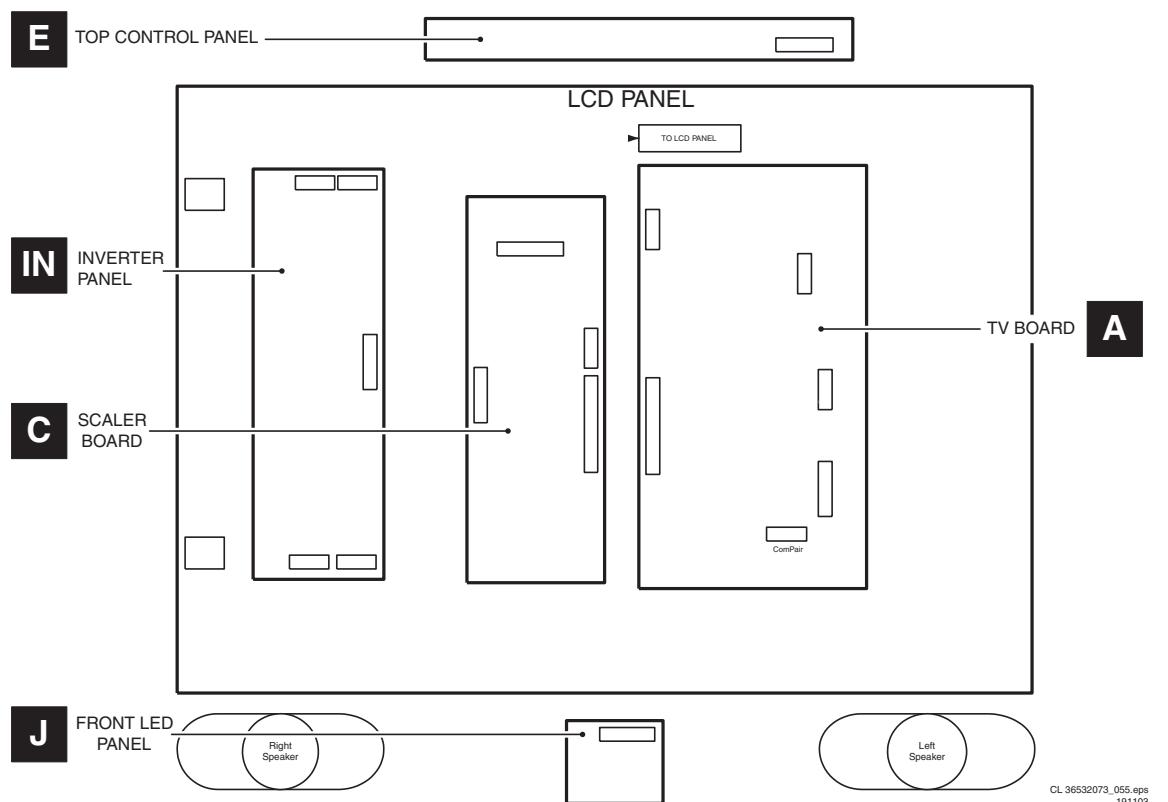


Figure 1-6 Chassis Overview 20" model

2. Safety Instructions, Warnings, and Notes

2.1 Safety Instructions

Safety regulations require that **during** a repair:

- Always connect the set to the mains via an isolation transformer (≥ 800 VA).
- Replace safety components, indicated by the symbol Δ , only by components identical to the original ones.

Safety regulations require that **after** a repair, the set must be returned in its original condition. Pay, in particular, attention to the following points:

- Route the wire trees and HT cables correctly and fix them with the mounted cable clamps.
- Check the insulation of the mains lead for external damage.
- Check the cabinet for defects, to avoid touching of any inner parts by the customer.

2.2 Warnings

- All ICs and many other semiconductors are susceptible to electrostatic discharges (ESD Δ). Careless handling during repair can reduce life drastically. Make sure that, during repair, you are connected with the same potential as the mass of the set by a wristband with resistance. Keep components and tools also at this same potential.

Available ESD protection equipment:

- Complete kit ESD3 (small tablemat, wristband, connection box, extension cable and earth cable) 4822 310 10671.
- Wristband tester 4822 344 13999.
- Be careful during measurements in the high voltage section (on the inverter panel).
- Never replace modules or other components while the unit is switched 'on'.
- When you align the set, use plastic rather than metal tools. This will prevent any short circuits and the danger of a circuit becoming unstable.

2.3 Notes

2.3.1 General

- Clean the LCD display with a slightly humid cloth.
- Measure the direct voltages and oscilloscopes with regard to the chassis ground (\ominus), or hot ground (\oplus) as this is called.
- The direct voltages and oscilloscopes shown in the diagrams are indicative. Measure them in the Service Default Mode (see section "Service Modes").
- Where necessary, measure the voltages in the power supply section both in normal operation (I) and in standby (S). These values are indicated by means of the appropriate symbols.
- The semiconductors indicated in the circuit diagram and in the parts lists, are interchangeable per position with the semiconductors in the unit, irrespective of the type indication on these semiconductors.

2.3.2 Schematic Notes

- All resistor values are in ohms and the value multiplier is often used to indicate the decimal point location (e.g. 2K2 indicates 2.2 kohm).
- Resistor values with no multiplier may be indicated with either an 'E' or an 'R' (e.g. 220E or 220R indicates 220 ohm).
- All Capacitor values are expressed in Micro-Farads ($\mu= \times 10^{-6}$), Nano-Farads ($n= \times 10^{-9}$), or Pico-Farads ($p= \times 10^{-12}$).

- Capacitor values may also use the value multiplier as the decimal point indication (e.g. 2p2 indicates 2.2 pF).
- An 'asterisk' (*) indicates component usage varies. Refer to the diversity tables for the correct values.
- The correct component values are listed in the Electrical Replacement Parts List. Therefore, always check this list when there is any doubt.

2.3.3 Rework on BGA ICs

General

Although (LF)BGA assembly yields are very high, there may still be a requirement for component rework. By rework, we mean the process of removing the component from the PWB and replacing it with a new component. If an (LF)BGA is removed from a PWB, the solder balls of the component are deformed drastically so the removed (LF) BGA has to be discarded.

Device Removal

As is the case with any component, it is essential when removing an (LF) BGA that the board, tracks, solder lands, or surrounding components are not damaged. To remove an (LF)BGA, the board must be uniformly heated to a temperature close to the reflow soldering temperature. A uniform temperature reduces the chance of warping the PWB. To do this, we recommend that the board is heated until it is certain that all the joints are molten. Then carefully pull the component off the board with a vacuum nozzle. For the appropriate temperature profiles, see the IC data sheet.

Area Preparation

When the component has been removed, the vacant IC area must be cleaned before replacing the (LF)BGA. Removing an IC often leaves varying amounts of solder on the mounting lands. This excessive solder can be removed with either a solder sucker or solder wick. The remaining flux can be removed with a brush and cleaning agent.

After the board is properly cleaned and inspected, apply flux on the solder lands and on the connection balls of the (LF) BGA.

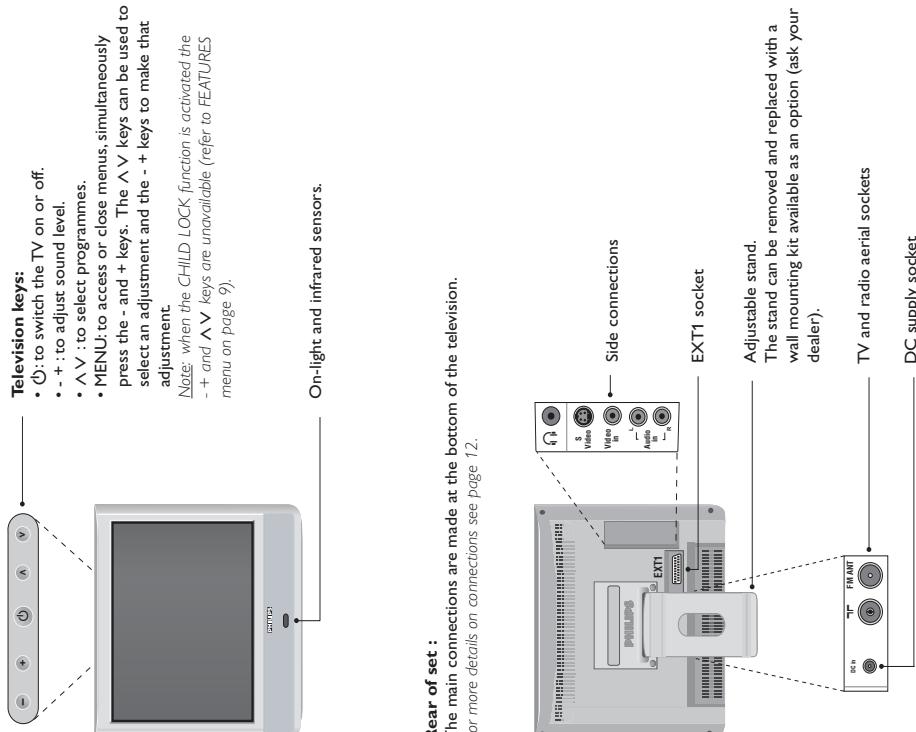
Note: Do not apply solder paste, as this has shown to result in problems during re-soldering.

Device Replacement

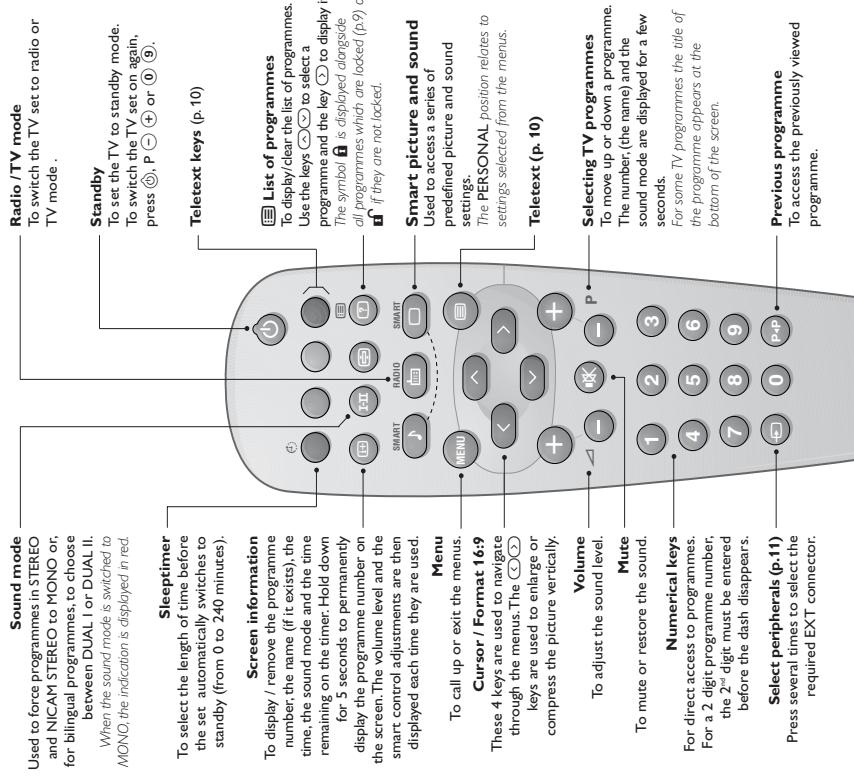
The last step in the repair process is to solder the new component on the board. Ideally, the (LF)BGA should be aligned under a microscope or magnifying glass. If this is not possible, try to align the (LF)BGA with any board markers. To reflow the solder, apply a temperature profile according to the IC data sheet. So as not to damage neighbouring components, it may be necessary to reduce some temperatures and times

3. Directions for Use

Presentation of the LCD Television

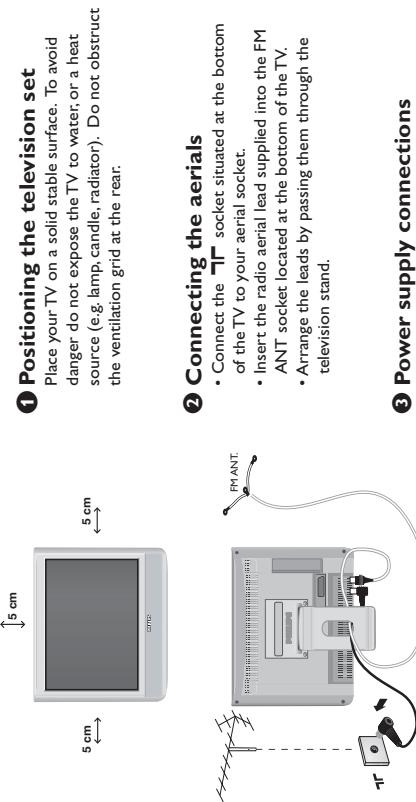


Remote control keys



Installing your television set

- 1 Positioning the television set**
- Place your TV on a solid stable surface. To avoid danger do not expose the TV to water or a heat source (e.g. lamp, candle, radiator). Do not obstruct the ventilation grid at the rear.



2 Connecting the aerials

- Connect the **FM** socket situated at the bottom of the TV to your aerial socket.
- Insert the radio aerial lead supplied into the FM ANT socket located at the bottom of the TV.
- Arrange the leads by passing them through the television stand.

3 Power supply connections

- The TV works with a DC supply (the voltage is indicated on the label). Only use the AC-DC adaptor supplied with the TV.
- Connect the DC plug of the adaptor to the TV DC socket. Leave a space round the adaptor for ventilation.
 - Insert the adaptor power lead and insert the mains plug into the wall socket.
- For connecting other appliances see page p.12.

4 Remote control

- Insert the two R6-type batteries supplied, making sure they are the right way round.
- The batteries supplied with the appliance do not contain mercury or nickel cadmium so as to protect the environment. Please do not discard your used batteries, but use the recycling methods available (consult your distributor).



5 Switching on

- To switch on the set, press the on/off key.
- green indicator comes on and the screen lights up. Go straight to the Quick Installation chapter on page 5. If the TV remains in standby mode (red indicator), press the P **+** key on the remote control.
 - The indicator will flash when you use the remote control.

Quick installation

Plug & Play

The first time you switch on the television, a menu appears on the screen. This menu asks you to choose the language of the menus :



If the menu does not appear, hold down the **-** and **+** keys on the set for 8 seconds to bring it up.

- Use the **(C) (V)** keys on the remote control to choose your language then confirm with **(C)**.
- Then select your country using the **(C) (V)** keys and confirm with **(C)**.

If your country does not appear in the list, select "...".

- 3 Tuning starts automatically.**

The operation takes several minutes. A display shows the search status and the number of programmes found. When it has finished the menu disappears.

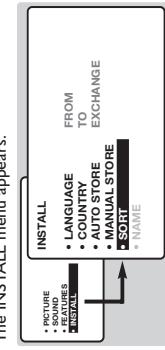
To exit or interrupt, press the **(H)** key.

If no programmes are found, refer to the chapter entitled Tips on p. 12.

- If the transmitter or the cable network broadcasts the automatic sort signal, the programmes will be correctly numbered.
- If not, the programmes found will be numbered in descending order starting at 99, 98, 97, etc. Use the **SORT** menu to renumber them. Some transmitters or cable networks broadcast their own sort parameters (region, language, etc.). Where this is the case, make your choice using the **(C) (V)** keys and confirm with **(C)**.

Sorting programmes

- 1 Press the **(H)** key. The main menu is displayed.**
- Select **INSTALL** **(C)**, then press **(C)**.
 - The **INSTALL** menu appears.



- Select the programme you wish to renumber using **(C) (V)** keys or **(1)** to **(9)**. Example: to renumber programme 78 as 2, press **7** **(8)**.

- Select **TO** (using **(C) (V)** key) and enter the new number with **(C) (V)** keys or **(0)** to **(9)** (for the example given, enter **(2)**).
- Select **EXCHANGE** (**C** key) and press **(C)**.

The message EXCHANGED appears, the exchange takes place. In our example, programme 78 is renumbered as 2 (and programme 2 as 78).

- Select the option **FROM** (**C** key) and repeat stages **4** to **6** as many times as there are programmes to renumber.
- To exit from the menus, press **(D)**.

- "TO"** (enter the new number).
- "EXCHANGE numbers"** (the operation is carried out).

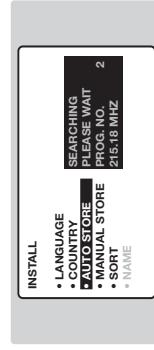
Choosing a language and country

- Press the **(INFO)** key to display the main menu.
- Select INSTALL (**(S)**), then press **(S)**.
The INSTALL menu appears.
- The LANGUAGE option is activated.
- Press **(S)** to go into the LANGUAGE menu.
- Select your language with the **(S)** keys.
The menus will appear in the chosen language.
- Press **(S)** to exit the LANGUAGE menu.
- Select the option COUNTRY and press **(S)**.
- Select your country with **(S)** keys.
If your country does not appear in the list, select OTHER.
- Press **(S)** to exit the COUNTRY menu.
- To exit from the menus, press **(B)**.



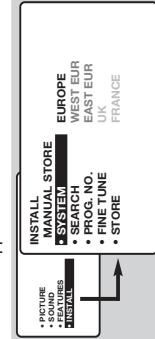
Automatic tuning

- This menu allows you to automatically search for all the programmes available in your region (or on your cable network).
- First carry out operations 1 to 8 above, then:
 - Press **(S)** once to select AUTO STORE then press **(S)**. The search begins.
 - After several minutes, the INSTALL menu reappears automatically.



Manual tuning

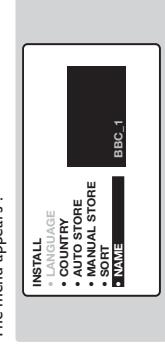
- This menu allows you to store the programmes one by one.
- Press **(INFO)**.
 - Select INSTALL (**(S)**), then press **(S)**.
The INSTALL menu appears.
 - Select the option MANUAL STORE (**(S)**) then press **(S)**.
The menu appears :
- | |
|----------------|
| INSTALL |
| • PICTURE |
| • SOUND |
| • FEATURES |
| • INSTALL |
| • LANGUAGE |
| • COUNTRY |
| • AUTO STORE |
| • MANUAL STORE |
| • SEARCH |
| • PROG. NO. |
| • FINE TUNE |
| • STORE |
- 4 Press **(S)** to go to the SYSTEM menu.



- This menu allows you to automatically search for all the programmes available in your region (or on your cable network).
- If the transmitter or the cable network broadcasts the automatic sort signal, the programmes will be correctly numbered.
 - If not, the programmes found will be numbered in descending order starting at 99, 98, 97, etc.
 - Use the SORT menu to renumber them.
Some transmitters or cable networks broadcast their own sort parameters (region, language, etc.). Where this is the case, make your choice using the **(S)** keys and confirm with **(S)**.
To exit or interrupt the search, press the **(INFO)** key.
If no picture is found, refer to the chapter entitled *Tips on p. 12*.
 - To exit from the menus, press **(B)**.

Programme name

- You may, if you wish, give a name to the first 40 programmes (from 1 to 40).
- Press **(INFO)**.
 - Select INSTALL (**(S)**), then press **(S)**.
The INSTALL menu appears.
 - Press **(S)** 5 times to select NAME (concealed at the bottom of the screen), then press **(S)**.
The menu appears :



- 5 Select SEARCH and press **(S)**.
The search begins. As soon as a programme is found, the search will stop. If you know the frequency of the programme required, enter its number directly using the **(1)** to **(9)** keys and go to step 7.

If no programme is found, refer to the Tips chapter on page 12.

6 If reception is un-satisfactory, select FINE TUNE and hold down **(S)** or **(S)** key
Select PROG. NO (programme number) and use the **(S)** or **(1)** to **(9)** keys to enter the desired number.

7 Select STORE and press **(S)**. The message STORED appears. The programme is stored.

8 Repeat steps 5 to 7 for each programme to be stored.

To exit: press the **(B)** key.

Using the radio

- Searching radio stations
- If you have used the quick installation all the available FM stations will be stored. To start a new search use the INSTALL menu :
AUTO STORE (for a complete search) or
MANUAL STORE (for a station by station search).
- The SORT and NAME menus let you classify or name the radio stations. These menus work in exactly the same way as the TV menus.
- Choosing radio mode
- Press the **(B)** key on the remote control to switch the TV to radio mode.
- In radio mode the number and name of the station (if available), its frequency and the sound mode are indicated on the screen.
- To enter the name of the stations use the NAME menu. (p. 7)

- Selecting programmes
- Use the **(1)** to **(9)** or **(-** P **+**) keys to select the FM stations (from 1 to 40).
- List of radio stations
- Press the **(B)** key to display / hide the list of radio stations. Then use the cursor to select a station.
- Using the radio menus
- Use the **(INFO)** key to access the specific radio settings.

Adjusting the picture

① Press  then .

The PICTURE menu appears :



② Use   keys to select a setting and   keys to adjust.

Note: the menu is a scroll-down menu.

Keep the key  held down to access the settings hidden at the bottom of the screen.

③ Once the necessary adjustments have been made, select the option STORE and press .

④ To exit from the menus, press .

⑤ MODE SELECT: to switch the TV in radio or TV.

⑥ To quit the menu, press .

⑦ To watch a programme which has been locked you will now need to enter the confidential

Timer function

① To exit from the menus, press .

Description of the settings:

- BRIGHTNESS: alters the brightness of the image.
- COLOUR: alters the colour intensity.
- CONTRAST+: alters the variation between light and dark tones.
- SHARPNESS: alters the crispness of the image.
- STORE: stores the picture settings.
- NR: attenuates picture noise (snow) in difficult reception conditions.
- CONTRAST+: To activate / de-activate the automatic contrast adjustment system (the dark areas are made darker whilst maintaining the detail).

② Use   keys to select a setting and   keys to adjust.

Note: the menu is a scroll-down menu. Keep the key  held down to access the settings hidden at the bottom of the screen.

③ Once the necessary adjustments have been made, select the option STORE and press .

④ To store them.

⑤ START TIME: enter the start time.

- ⑥ STOP TIME: enter the stop time.
- ⑦ PROG. NO.: enter the number of the programme for the wake-up alarm. For models equipped with a radio, you can select an FM station by using the   keys. These are only used to select TV programs.
- ⑧ ACTIVATE: you can set the alarm to be activated:
 - ONCE ONLY for a one-off alarm,
 - DAILY for a daily alarm or
 - OFF to cancel.
- ⑨ Press  to set the TV to standby. It will automatically switch on at the time programmed. If you leave the TV switched on, it will only change programme at the time indicated.

This menu allows you to use your TV as an alarm clock.

① Press .

② Select FEATURES () and press  twice.

The TIMER menu appears :

- ③ Press  to enter and exit the sub-menus and use keys   to adjust:
- ④ TIME: enter current time.

Note: the time is updated automatically each time the set is switched on using teletext information taken from programme 1. If programme 1 does not have teletext, the update will not take place.

⑤ START TIME: enter the start time.

⑥ STOP TIME: enter the stop time.

⑦ PROG. NO.: enter the number of the programme for the wake-up alarm. For models equipped with a radio, you can select an FM station by using the   keys. These are only used to select TV programs.

⑧ ACTIVATE: you can set the alarm to be activated:

- ONCE ONLY for a one-off alarm,
- DAILY for a daily alarm or
- OFF to cancel.

⑨ Press  to set the TV to standby. It will automatically switch on at the time programmed. If you leave the TV switched on, it will only change programme at the time indicated.

The combination of the CHILD LOCK and TIMER functions may be used to limit the length of time your television is in use, for example, by your children.

To unlock all programmes

Repeat stages ① to ④ above, then select CLEAR ALL, and press .

To change the confidential code

Repeat stages ① to ④ above, then:

- ⑤ Select CHANGE CODE and enter your own 4-digit number.
- ⑥ Confirm by entering it again.
- ⑦ Your new code will be stored.

If you have forgotten your confidential code, enter the universal code 0711 twice.

Feature settings

- ① Press , select FEATURES () and press .
- ③ MODE SELECT: to switch the TV in radio or TV.
- ④ To quit the menu, press .

⑤ MODE SELECT: to switch the TV in radio or TV.

⑥ To quit the menu, press .

⑦ To watch a programme which has been locked you will now need to enter the confidential

① Locking the keys

- ① Press  select FEATURES () and press .
- ② Select CHILD LOCK () and press  to set the lock to ON.
- ③ Switch off the set and put the remote control out of sight. The set cannot be used (it can only be switched on using the remote control).
- ④ To cancel: switch CHILD LOCK to OFF.

Teletext

Teletext is an information system broadcast by certain channels which can be consulted like a newspaper. It also offers access to subtitles for viewers with hearing problems or who are not familiar with the transmission language (cable networks, satellite channels, etc.).



- Press :**
- ①** **Teletext on/off**
- This is used to call teletext, change to transparent mode and then exit. The summary appears with a list of items that can be accessed. Each item has a corresponding 3 digit page number. If the channel selected does not broadcast teletext, the indication '100' will be displayed and the screen will remain blank (in this case, exit teletext and select another channel).

- ①/⑨
- P +** **Selecting a page**
- Enter the number of the page required using the **①** to **⑨** or **(-) P (+)** keys. Example: page 120, enter **①** **②** **⑩**. The number is displayed top left, the counter turns and then the page is displayed. Repeat this operation to view another page. If the counter continues to search, this means that the page is not transmitted. Select another number.

- ③
④
⑤
⑥
⑦
⑧
⑨
⑩
⑪
⑫
⑬
⑭
⑮
⑯
⑰
⑱
⑲
⑳
⑳
⑳
⑳** **Direct access to the items**
- Coloured areas are displayed at the bottom of the screen. The coloured keys are used to access the items or corresponding pages. The coloured areas flash when the item or the page is not yet available.

- ⑪
⑫
⑬
⑭
⑮
⑯
⑰
⑱
⑲
⑳
⑳
⑳
⑳** **Contents**
- This returns you to the contents page (usually page 100). This allows you to display the top or bottom part of the page and then return to normal size.

- ⑪
⑫
⑬
⑭
⑮
⑯
⑰
⑱
⑲
⑳
⑳
⑳
⑳** **Stop sub-page acquisition**
- Certain pages contain sub-pages which are automatically displayed successively. This key is used to stop or resume sub-page acquisition. The indication **⑳** appears top left.

- ⑪
⑫
⑬
⑭
⑮
⑯
⑰
⑱
⑲
⑳
⑳
⑳
⑳** **Hidden information**
- To display or hide the concealed information (games solutions).

- ⑪
⑫
⑬
⑭
⑮
⑯
⑰
⑱
⑲
⑳
⑳
⑳
⑳** **Favourite pages**
- Instead of the standard coloured areas displayed at the bottom of the screen, you can store 4 favourite pages on the first 40 channels which can then be accessed using the colour red keys (red, green, yellow, blue). Once set, these favourite pages will become the default every time teletext is selected.

- ① Press the **(INFO)** key to change to favourite pages mode.
- ② Display the teletext page that you want to store.
- ③ Press **⑳** then the coloured key of your choice.
- The page is stored.
- ④ Repeat steps **②** and **③** for the other coloured keys.
- ⑤ Now when you consult teletext, your favourite pages will appear in colour at the bottom of the screen.
- ⑥ To temporarily retrieve the standard items, press **(INFO)**.
- To clear everything and return the standard items as the default, press **⑳** for 5 seconds.

Connecting peripheral equipment

The EXT1 socket has audio, C/B/S/RGB inputs and audio, C/B/S outputs.

Video recorder

Video recorder (or DVD recorder)
Carry out the connections shown opposite, using a good quality euroconnector cable.

If your video recorder does not have a euroconnector socket, the only connection possible is via the aerial cable. You will therefore need to tune in your video recorder's test signal and assign it programme number 0 (refer to manual store, p.7). To reproduce the video recorder picture, press **⑩**.

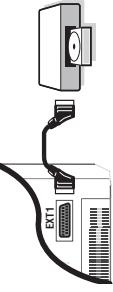
Video recorder with decoder

Connect the decoder to the second euroconnector socket of the video recorder. You will then be able to record scrambled transmissions.

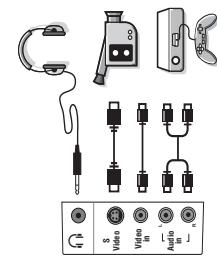
Satellite receiver; decoder; DVD, games, etc.

Make the connections as shown opposite.

Other equipment



Side connections



Make the connections as shown opposite. With the **⑩** key select EXT3.
For a monophonic device, connect the audio signal to the AUDIO L input. The sound automatically comes out of the left and right speakers of the set.

Headphones

When headphones are connected, the sound on the TV set will be cut. The **(-) P (+)** keys are used to adjust the volume level. The headphone impedance must be between 32 and 600 Ohms.

To select connected equipment

Press the **⑩** key to select EXT1 and EXT3.
Most equipment (decoder, video recorder) carries out the switching itself.



4. Mechanical Instructions

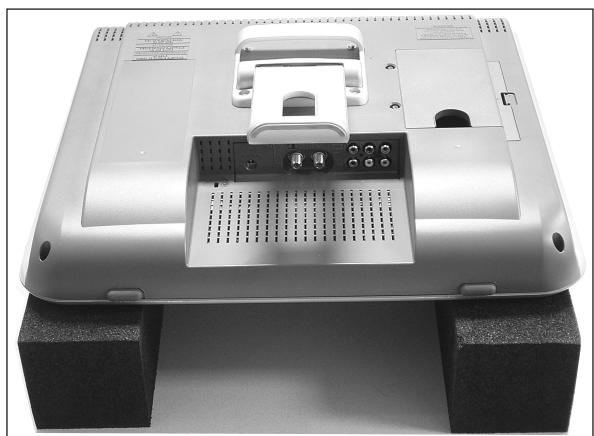
Index of this chapter:

1. Service Position
2. Rear Cover Removal
3. I/O Cover Removal
4. LED/Remote Control Board Removal
5. TV Board Removal
6. Scaler Board Removal
7. Inverter Board Removal
8. Top Control Assy Removal
9. LCD Panel Removal
10. Re-assembly

Note: Figures below can deviate from the actual situation, due to different set executions and screen sizes.

4.1 Service Position

First, put the TV in its service position. Therefore, place it upside down on a tabletop, use a protection sheet or a foam cushion. Take care that this is flat and free from obstacles like screws, to prevent damaging the fragile LCD screen. ESD protective service buffers, as shown below, can be used (3122 785 90580).



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Figure 4-1 Service position with ESD protective service buffers

4.2 Rear Cover Removal

1. Use a Torx (T10) screwdriver to remove the rear cover by unscrewing and removing the screws as indicated by the figures: Rear cover removal 13-inch and 20-inch.
2. Make sure all power-, audio-, video-, coax-, cinch- and SCART cables are unplugged.
3. The number of Torx screws to be removed are: six for the 13- and 15-inch version and seven for the 20-inch.
4. Carefully remove the rear cover and store it on a safe place.



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Figure 4-2 Rear cover removal 13- and 15-inch



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Figure 4-3 Rear cover removal 20-inch



Figure 4-4 Rear cover removal hidden screw EU version

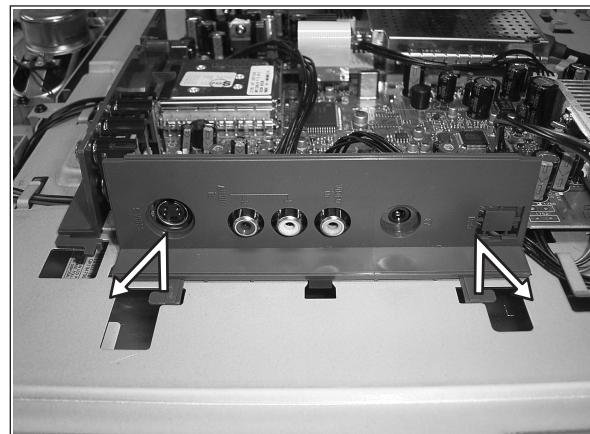


Figure 4-7 IO cover side

1. Lift up both tags (securing clips) and at the same time pull it away from the TV board.



Figure 4-5 Rear cover removal hidden screws US version

4.3 I/O Cover Removal

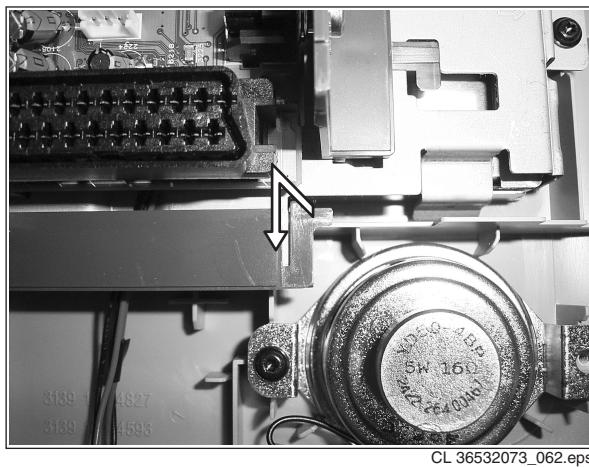


Figure 4-6 IO cover bottom

1. Lift up the tag (securing clip) at the right side of the IO cover and at the same time pull it away from the TV board.



Figure 4-8 TV board

Note: Sometimes it is necessary to place the Scaler board in a service position. In this case, it is necessary to use the specific "Repair kit scaler board" including two extra long cables (order nr. 3122 785 90490).

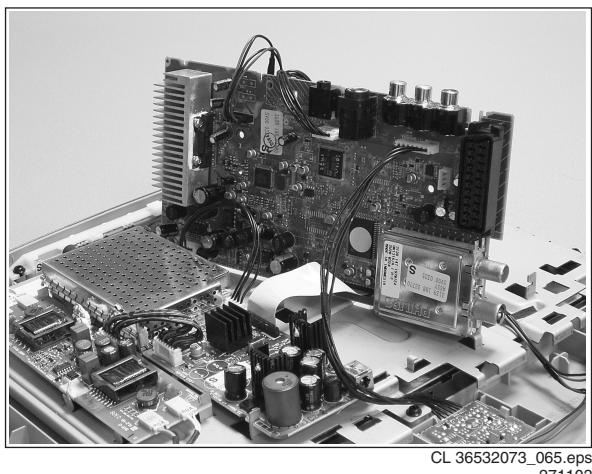


Figure 4-9 Service position TV board

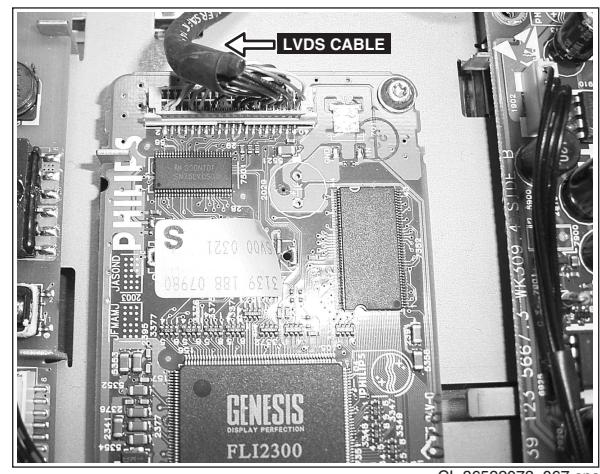


Figure 4-11 Scaler PWB

4.6 Scaler Board Removal

4.6.1 13 and 20 inch versions

1. Carefully remove the shielding covering the top part of the Scaler board.
2. Carefully disconnect the TTL cable connector in the centre of the board (1501). Take care not to damage the fragile cables.
3. Disconnect the cable connectors at the edge of the board (1342 and 1003).
4. Pull the thin flat cable out of its special shaped connector (1681).
5. Unscrew and remove both PWB mounting screws.
6. Take out the Scaler PWB.



Figure 4-10 Scaler PWB

4.6.2 15 inch version

1. Carefully disconnect the LVSD cable connector at the top of the board (1506). Take care not to damage the fragile cables.
2. Disconnect the cable connectors at the edge of the board (1342 and 1003).
3. Pull the thin flat cable out of its special shaped connector (1681).
4. Unscrew and remove both PWB mounting screws.
5. Take out the Scaler PWB.

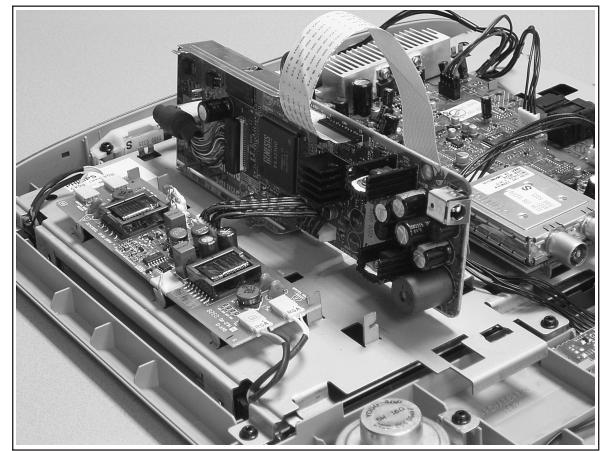


Figure 4-12 Service position Scaler Board

Important: Video converter chip heat sink.

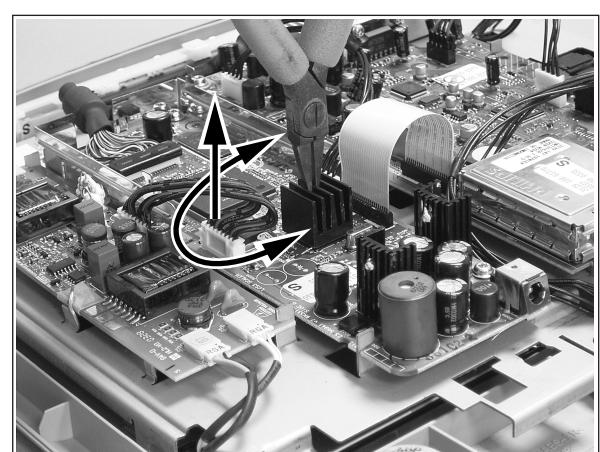


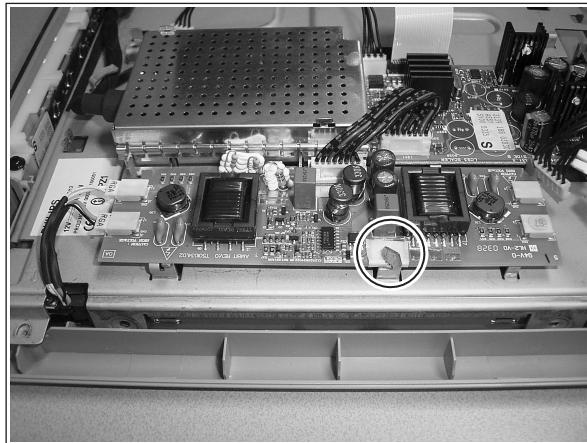
Figure 4-13 Heat sink removal

Note: Sometimes it is necessary to place the Scaler board in a service position. In this case, it is necessary to use the specific "Repair kit scaler board" including two extra long cables (order nr. 3122 785 90490).

1. Use a pair of pliers to take off the heat sink by means of a twist- and pull movement (see figure), before you de-solder the video converter chip SAA7118 from the board. Store the heat sink on a safe place, adhesive side up!
2. Place the self-adhesive heat sink back in place after the chip exchange action has been finished.

4.7 Inverter Panel Removal

1. Disconnect the 8-pole cable from the PWB.
2. Disconnect at top and bottom side all cable connectors.
3. Use a pair of pliers to bend the metal securing clamp in such a way that the PWB can be taken out.
4. Remove the Inverter PWB and store it on a safe place.

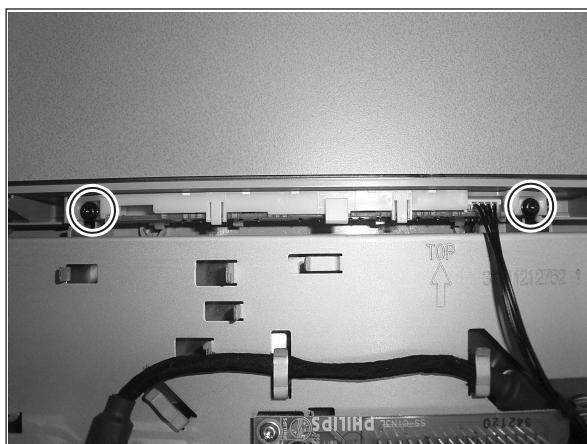


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Figure 4-14 Inverter PWB

4.8 Top Control Assy Removal

1. Remove the cable from the Top control assy (1500).
2. Remove both mounting screws that secure the unit to the monitor frame.
3. Take out the Top control assy.



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Figure 4-15 Top control assy

4.9 LCD Panel Removal

In order to remove the LCD panel make sure that the TV board is removed. See previous paragraph(s).

1. Carefully disconnect the LVDS or TTL cable connector, which is revealed now, from LCD panel (CN1). Take care not to damage the fragile cables.
2. Unscrew and remove all five screws of the panel frame, which secure the frame to the monitor front.
3. Take care that the tape securing the speaker cable assy is removed, or loosened.
4. Remove the LCD panel metal cover frame, the LCD panel can be removed now.



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Figure 4-16 LCD panel frame screws

4.10 Re-Assembly

To re-assemble the whole set, do all processes in reverse order.

Notes:

- Take extra care when reconnecting the inverter PWB backlight connectors (black/white/pink). Connect them properly to avoid "high voltage sparking".

5. Service Modes, Error Messages, and Repair Tips

Index of this chapter:

1. Test Points
2. Service Modes
3. Errors
4. The "Blinking LED" Procedure
5. ComPair
6. Trouble Shooting Tips

5.1 Test Points

This chassis is equipped with test points in the service printing. In the schematics test points are identified with a rectangle box around Fxxx or Ixxx. On the PCB, test points are specifically mentioned in the service manual as "half moons" with a dot in the centre.

Measurements are performed under the following conditions:

- Video: colour bar signal.
- Audio: 3kHz left, 1kHz right.

5.2 Service Modes

5.2.1 Limited DST Support

This chassis does still have some limited Dealer Service Tool (DST) support. The set can be put in two service modes via the DST (RC7150, this remote is not available anymore). These are the Service Default Mode (SDM) and the Service Alignment Mode (SAM).

Installation Features Dealer

For easy installation and diagnosis, the DTS can be used. When there is no picture (to access the error code buffer via the OSD), DST can enable the functionality of displaying the contents of the entire error code buffer via the blinking LED procedure.

The dealer can use the RC7150 for programming the TV-set with presets. Ten different program tables can be programmed into the DST via a GFL or MG TV-set (downloading from the GFL or MG to the DST; see GFL or MG service manuals) or by the DST-I. For explanation of the installation features of the DST, the directions for use of the DST are recommended.

5.2.2 Service Default Mode (SDM)

Purpose of SDM:

- To provide a situation with predefined settings to get the same measurements as in this manual.
- To start the "Blinking LED" procedure.
- To have the possibility to override the 5V protection

Activating SDM:

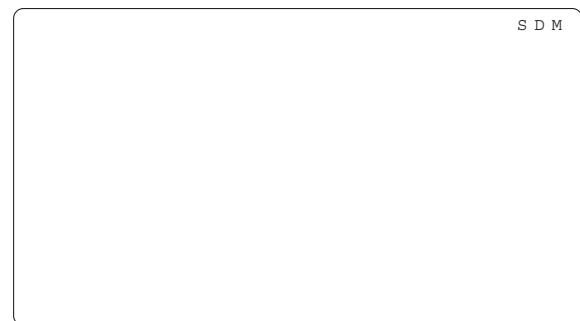
- By transmitting the "DEFAULT" command with the RC7150 Dealer Service Tool (this works both while the set is in normal operation mode or in the SAM).
- Standard RC sequence **0-6-2-5-9-6** followed by pressing the "MENU"-button (this works both while the set is in normal operation mode or in the SAM).
- By shorting pins 5 and 6 of connector 1170 of LED/RC panel. Then apply DC supply from the AC-DC adaptor (not required to remove the metal shielding).

Note: By temporarily shorting pins 5 and 6 of connector 1170 and then applying DC supply from the AC-DC adaptor, the 5V protection is disabled.

Caution: Overriding the 5V protection should only be used for a short period of time. In case of S/W protections (error 4) the set will shutdown after 15 sec.

For recognition, "SDM" is displayed at the upper right corner of the screen.

SDM Menu



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Figure 5-1 SDM Menu

Deactivating SDM:

- Press the "EXIT"-button on the DST, or
- Press 0-0 on the standard RC, or
- Switch the set to Standby (the error buffer is NOT cleared).

Note: When the mains power is switched off while the set is in SDM, the set will switch to SDM immediately when the mains is switched on again.

The SDM sets the following pre-defined conditions:

- PAL/SECAM sets: tuning at 475.25 MHz PAL.
- Volume level is set to 25% (of the maximum volume level). Other picture and sound settings are set to 50%.

The following functions are switched off in SDM (and after leaving SDM):

- Timer.
- Sleep timer.

The following functions are disabled during SDM (and enabled after leaving SDM)

- Parental lock.
- Blue mute.
- Hospitality Mode.
- No-ident Timer (normally the set is automatically switched off when no video signal (IDENT) was received for 15 minutes).

All other controls operate normally.

Special Functions SDM

Access to normal user menu

Pressing the "MENU" button on the remote control switches between the SDM and the normal user menus (with the SDM mode still active in the background).

Channel search

Pressing the "P+" button of the remote control will select the next available channel in the preset list.

Type nr, Error buffer, etc

Pressing the "OSD" or "info+" button of the remote control shows/hides the type nr, error buffer, SW ID, Hours and option codes. OSD can be hidden to prevent interference with waveform measurements.

Access to SAM

By pressing **0-6-2-5-9-6 "info+"** (or OSD) in sequence on the standard RC will switch from SDM to SAM.

5.2.3 Service Alignment Mode (SAM)**Purpose of SAM:**

- To do alignments.
- To change option settings.
- To display/clear the error code buffer values.
- To store data in NVM

Note: to store the data in SAM mode main menu.

Activating SAM:

- By transmitting the "ALIGN" command with the RC7150 Dealer Service Tool (this works both while the set is in normal operation mode or in the SDM).
- Standard RC sequence **0-6-2-5-9-6** followed by pressing the "info+"-button (this works both while the set is in normal operation mode or in the SDM).

Deactivating SAM:

- Press the "EXIT"-button on the DST, or
- Press 0-0 on the standard RC, or
- Switch the set to Standby (the error buffer is NOT cleared).

Note: When the AC-DC adaptor power is switched off while the set is in SAM, the set will go back to normal mode of operation when the AC-DC adaptor is switched on again.

In SAM the following information is displayed on the screen:

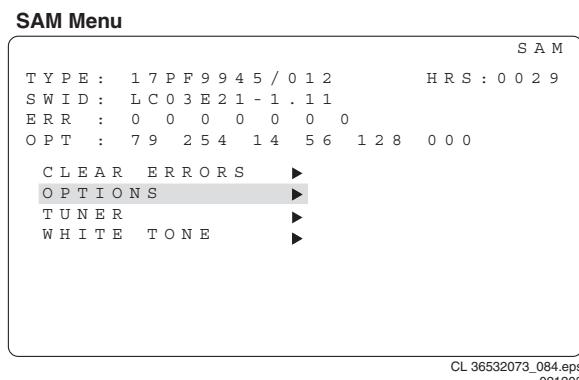


Figure 5-2 SAM Menu

- Operation hours timer (hexadecimal).
- Software identification of the main micro controller of TV-board (LC03BBC-X.YY).
 - LC13 is the chassis name for 4 x 3 format LCD-TV.
 - BBC is 1 letter and 2-digit combination to indicate the regional software type and the supported languages.
 - X = main version number.
 - YY= subversion number.
- Error buffer (7 errors possible).
- Option bytes (8 codes possible), summary of options are explained below.
- Sub menus are listed in a scroll-menu.

SAM Menu Control

All Menu items are:

- CLEAR ERRORS
- OPTIONS
- TUNER
- WHITE TONE
- GEOMETRY
- SOUND
- SMART SETTING

Menu items can be selected with the cursor UP/DOWN key. The selected item will be highlighted. When not all menu items fit on the screen, moving the cursor UP/DOWN will display the next/previous menu items.

With the cursor LEFT "<" / RIGHT ">" keys, it is possible to:

- Activate the selected menu item (e.g. GEOMETRY).
- Change the value of the selected menu item (e.g. HOR.SHIFT).
- Activate the selected submenu (e.g. ASBY ON/OFF).
- To return to the main menu / previous menu, press "MENU" keys on the remote control

Access to Normal User Menu

Pressing the "MENU" button on the remote control switches between the SAM and the normal user menus (with the SAM mode still active in the background). Pressing the "MENU" key in a submenu will go to the previous menu.

Menus and Submenus

CLEAR ERRORS: Erasing the contents of the error buffer. Select the CLEAR ERRORS menu item and press the MENU RIGHT key. The content of the error buffer is cleared.

The functionality of the OPTIONS and ALIGNMENTS (TUNER, WHITE TONE, GEOMETRY, SOUND and SMART SETTING) sub menus are described in chapter 8.

5.2.4 Customer Service Mode (CSM)

This chassis is equipped with the "Customer Service Mode". CSM is a special service mode that can be activated and deactivated by the customer, upon request of the service technician/dealer during a telephone conversation in order to identify the status of the set. This CSM is a 'read only' mode therefore modifications in this mode are not possible.

Activating Customer Service Mode.

The Customer Service Mode can be switched on:

- By pressing RC button in sequence "**1-2-3-6-5-4**" or,
- By pressing simultaneously the MUTE button on the remote control and any key on the TV control buttons (P+, P-, VOL +, VOL -) for at least 4 seconds.

When the CSM is activated:

- Picture and sound settings are set to nominal levels.
- Modes that interfere with the behaviour of the set are switched off (sleep timer, auto standby, etc.).
- Pressing cursor DOWN "v" on the RC will switch to CSM2 screen if it is in CSM1 screen. Likewise pressing cursor UP "^" will switch to previous CSM1 screen.
- Pressing "P+" or "P-" on RC will select next available channel to be displayed.
- Pressing channel numeric keys on RC will select the desired channel to be displayed.

Deactivating Customer Service Mode.

The Customer Service Mode will be switched off after:

- Pressing any key on the remote control handset (except numeric keys, "P+", "P-", and cursor up/down)
- Switching off the TV set with the mains switch.

All settings that were changed during activation of CSM are restored to the initial values.

Customer Service Mode Information Screen

After activating the Customer Service Mode the following screen will appear.

```

1 TYPE : 17PF9945 / 012 HRS : 0029 CSM1
2 SWID : LC03E21-1.11
3 ERR : 0 0 0 0 0 0
4 OPT : 79 254 14 56 128 000
5
6 SYSTEM: WEST EUR 11 SOURCE : 5
7 NO SIGNAL 12 SOUND : MONO
8 13 VOLUME : 26
9 14 BALANCE: 1
10 15 COLOUR : 50

```

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Figure 5-3 CSM 1

The Customer Service Menu (CSM1) shows the following information:

- **Line 1:** "TYPE: 99XX9999/99XHRS: nnnn". TYPE: type-version/model of the set (i.e. 17PF9945/12). HRS: Hexadecimal counter of operating hours. (Standby hours are counted as operating hours).
- **Line 2:** "SWID: AAAABBC-X.YY": (Software identification of the main micro controller on TV-Board) See paragraph "Service Alignment Mode (SAM)". Details on available software versions can be found in the chapter "Software Survey" of the publication "Product Survey - Colour Television".
- **Line 3:** "CODES: xx xx xx xx xx xx xx". Error code buffer (see paragraph "Errors"). Displays the last 7 errors of the error code buffer.
- **Line 4:** "OPT xxx xxx xxx xxx xxx xxx xxx xxx". Option bytes. Option bits control the software and hardware functionality of the chassis. An option byte or option number represents 8 of those bits. Each option number is displayed as a decimal number between 0 and 255. The set may not work correctly when an incorrect option code is set. See chapter 8 for more information on correct option settings
- **Line 6:** "SYSTEM: EUROPE/WEST EUR/EAST EUR/UK/FRANCE". Indicates which colour and sound system is installed for this preset as defined in the Manual INSTALL menu:
 - PAL BG
 - PAL I
 - PAL DK
 - SECAM BG
 - SECAM DK
 - SECAM LL'
- **Line 7:** "NO SIGNAL". Indicates that the set is not receiving an "ident" signal on the selected source.
 - No or bad antenna signal; connect a proper antenna signal
 - Antenna not connected; connect the antenna
 - No channel / preset is stored at this program number; go to the INSTALL menu and store a proper channel at this program number
 - The tuner is faulty (in this case the CODES line will contain number 13); check the tuner and replace/repair if necessary

Note: On some models, BLUE MUTE is displayed (if the BM option is ON) when no signal is received.

- **Line 11:** "SOURCE". Indicates which SOURCE is installed for this preset: EXT1, SVHS2, EXT2, or Tuner.
- **Line 12:** "SOUND": Indicates which sound mode is installed for this preset: Mono, NICAM, Stereo, L1, L2, SAP, Virtual, or Digital.
- **Line 13:** "VOLUME": Value indicates level at entry CSM.
- **Line 14:** "BALANCE": Value indicates level at entry CSM.
- **Line 15:** "COLOUR": Value indicates level at entry CSM.

```

1 TYPE : 17PF9945 / 012 HRS : 0029 CSM2
2 SWID : LC03E21-1.11
3 ERR : 0 0 0 0 0 0
4 OPT : 79 254 14 56 128 000
5
6 BRIGHTNESS : 50 11
7 CONTRAST : 56 12
8 HUE : 50 13
9 14
10 15

```

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021203

Figure 5-4 CSM 2

The next Customer Service Menu (CSM2) shows the following information:

- Line 6: "**BRIGHTNESS**": Value indicates level at entry CSM.
- Line 7: "**CONTRAST**": Value indicates level at entry CSM.
- Line 8: "**HUE**": Value indicates level at entry CSM.

5.3 Errors

5.3.1 Error code buffer

The error code buffer contains all errors detected since the last time the buffer was erased. The buffer is written from left to right. When an error occurs that is not yet in the error code buffer, the error is written at the left side and all other errors shift one position to the right.

The error code buffer will be cleared in the following cases:

- By activating the CLEAR ERRORS function in SAM menu.
- By transmitting 0-6-2-5-9-9 with the normal RC.
- By transmitting the commands "DIAGNOSE 99 OK" with the DST (RC7150) or with ComPair.
- Automatically reset if its contents has not changed for 50 hours.

By leaving SDM or SAM with the mains switch, the error buffer is not reset.

Examples:

ERROR: 0 0 0 0 0 0 : No errors detected

ERROR: 6 0 0 0 0 0 : Error code 6 is the last and only detected error

ERROR: 9 6 0 0 0 0 : Error code 6 was first detected and error code 9 is the last detected (newest) error

The contents of the error buffer can also be made visible through the "blinking LED" procedure. This is especially useful when there is no picture. See paragraph 5.4 "The blinking LED procedure".

5.3.2 Error codes

In case of non-intermittent faults, clear the error buffer before starting the repair, to prevent that "old" error codes are present (it is wise to write down the content of the error buffer before you clear it). If possible check the entire content of the error buffers. In some situations an error code is only the result of another error code (and not the actual cause).

Note: a fault in the protection detection circuitry can also lead to a protection.

Table 5-1 Error Codes

Error code	Error description	Possible defective components	Diagram
0	No error detected	-	----
1	Reserved		
2	Reserved		
3	Reserved		
4	5V protection active	IC7620 & 1100 I2C devices(MSP34XX & Tuner)	A3, A8, A10
5	Reserved		
6	General I2C bus error	I2C bus s/c or o/c	
7	Reserved		
8	BOCMA I2C error	IC 7301 (IF Video TDA888XX)	A4
9	BOCMA 8V supply failure	IC 7910 or IC7301(MC34063A or TDA888XX)	A4, A10
10	NVM I2C error	IC 7066 (NVM M24CXX)	A1
11	NVM identification failure	IC 7066 (NVM M24CXX)	A1
12	uProcessor internal RAM test failure	IC 7064 (uP SAA56XX)	A1
13	Tuner I2C error	1100 - UR13XX (Tuner)	A3
14	Sound processor I2C error	IC 7620 (MSP34XX)	A8
15	SRAM error	IC 7070 (RAM 128 x 8)	A2
16	Video Formatter/Scaler I2C error	IC 7351 (Farouja_s2300)(Video Converter)	C5
17	Multi-Video Decoder I2C error	IC 7302 (Video Decoder SAA7118)	C3
18*	Reserved		
19*	Reserved		
20*	Reserved		
21	SDRAM protection active	IC 7352 (SDRAM 2M x 32)	C5

*= Not application

TV-Board**Errors**

- **Error 0** = No error
- **Error 4** = +5V protection. 5V protection active; set is switched to protection; error code 4 is placed in the error buffer; the LED will blink 4 times (repeatedly). A 5V failure can be caused by a drop in the 5V supply output, resulting in an undefined behaviour of the set. Therefore, all I2C devices connected to the 5V supply are constantly monitored. When none of these devices responds to the micro controller for a prolonged time, the micro controller assumes that there is a failure in the 5V supply. By starting up the set with the service jumpers shorted, the 5V protection is disabled and it is easier to determine the cause. +5V protection will be activated when these I2C devices fail (no I2C communication):
 - Main Tuner 1100 (diagram A3)
 - ITT sound processor MSP34xx IC-7620 (diagram A8)

Service tips: To isolate the problem area after overriding the +5V protection, determine whether:

1. The +5V source is working properly IC7930 (diagram A10)
2. ITT sound processor circuit is loading the +5V; isolate coil 5620 (diagram A8)
3. The audio delay IC 7601 - IC7605 is loading the +5V source; isolate coil 5601 (diagram A7)
4. Main tuner circuit is loading the +5V source; isolate coil 5122 (diagram A3)

Caution: Overriding the 5V protection when there is a 5V failure can increase the temperature in the set and may cause permanent damage to components. Do not override the 5V protection for a prolonged time.

- **Error 6** = General I2C error. This will occur in the following cases:
 - SCL or SDA is shorted to ground
 - SCL is shorted to SDA
 - SDA or SCL connection at the micro controller is open circuit.

- **Error 8** = BOCMA IC TDA888xx (diagram A4) I2C communication failure. BOCMA (IC7301 on TV board) is corrupted or the I2C line to the BOCMA is low or no supply voltage present at pin 14 (3V3) or no supply voltage at pin 23.
- **Error 9** = BOCMA IC TDA888xx 8V failure (SUP bit). No supply voltage at pin 53. Check coil 5302.
- **Error 10** = NVM I2C error (diagram A1). NVM (EEPROM - IC7066) does not respond to the micro controller.
- **Error 11** = Micro controller / NV Memory identification error. During the last start-up the NVM and the micro controller did not recognize each other (e.g. one of them was replaced or the NVM memory has been changed/adapted or lost), therefore the NVM was loaded with default values.
- **Error 12** = Microprocessor (Painter - IC 7064) internal RAM test failure.
- **Error 13** =Main Tuner I2C failure UR13xx. Tuner (item 1100, diagram A3) is corrupted or the I2C line to the tuner is low or no supply voltage at pin 3, pin 6 or 7 of the tuner.
- **Error 14** =Sound processor I2C error IC7620 (MSP34xx, diagram A8). Sound controller does not respond to the micro controller.
- **Error 15** =SRAM IC CY7C1019 test failure (IC7070, diagram A2).

Note: Only for Europe and AP-PAL execution.

Scaler Board

When the TV detects critical errors from the Scaler board, it will shutdown into protection mode. After a short period of time, the LED will blink according to the respective error codes.

Protection errors:

- **Error 16** = Video formatter/converter I2C error IC7351 (GENESIS FLI2300, diagram C5).
- **Error 17** = Video decoder I2C error IC7302 (Philips SAA7118E, diagram C3).

Note: BGA IC fixed with a heat sink (see chapter 4 how to remove).

5.4 The “Blinking LED” procedure

The contents of the error buffer can also be made visible through the “Blinking LED” procedure. This is especially useful when there is no picture.

When the SDM is entered, the LED will blink the contents of the error-buffer. Error-codes ≥ 10 are shown by a long blink of 750msec, which is an indication of the decimal digit, followed by a pause of 1500msec. followed by n short blinks. When all the error-codes are displayed, the sequence is finished with a LED display of 3 seconds. The sequence starts again.

Example:

Error code position 1 2 3 4 5
Error buffer: 12 9 6 0 0

This gives after activating SDM: 1 long blink of 750msec + pause of 1500msec + 2 short blinks - pause of 3 s - 9 short blinks - pause of 3 s - 6 short blinks - pause of 3 s - long blink of 3 s - etc.

Note: If errors 1, 2 or 4 occur, the LED **always** blinks the last occurred error, even if the set is **not** in service mode.

Another method of reading out a single error code is to use a standard RC or a DST.

- Standard RC - Press “0-6-2-5-0-x” in sequence, to read (blinking LED) out a respective error code in the error buffer, where x = 1, 2, 3, 4, 5, 6, or 7.
- DST: Press “Diagnose” “x” “OK” to read (blinking LED) out a respective error code in the error buffer, where x = 1, 2, 3, 4, 5, 6, or 7.

5.5 ComPair

5.5.1 Introduction

ComPair (Computer Aided Repair) is a service tool for Philips Consumer Electronics products. ComPair is a further development on the European DST (service remote control), which allows faster and more accurate diagnostics. ComPair has three big advantages:

ComPair helps you to quickly get an understanding on how to repair the chassis in a short time by guiding you systematically through the repair procedures.

ComPair allows very detailed diagnostics (on I2C level) and is therefore capable of accurately indicating problem areas. You do not have to know anything about I2C commands yourself because ComPair takes care of this.

ComPair speeds up the repair time since it can automatically communicate with the chassis (when the microprocessor is working) and all repair information is directly available. When ComPair is installed together with the SearchMan electronic manual of the defective chassis, schematics and PWBs are only a mouse click away.

5.5.2 Specifications

ComPair consists of a Windows based faultfinding program and an interface box between PC and the (defective) product. The ComPair interface box is connected to the PC via a serial or RS232 cable.

The ComPair faultfinding program is able to determine the problem of the defective television. ComPair can gather diagnostic information in two ways:

- **Automatic** (by communication with the television):
ComPair can automatically read out the contents of the entire error buffer. Diagnosis is done on I2C level. ComPair can access the I2C bus of the television. ComPair can send and receive I2C commands to the micro controller of the television. In this way, it is possible for ComPair to communicate (read and write) to devices on the I2C busses of the TV-set.

- **Manually** (by asking questions to you): Automatic diagnosis is only possible if the micro controller of the television is working correctly and only to a certain extend. When this is not the case, ComPair will guide you through the faultfinding tree by asking you questions (e.g. *Does the screen give a picture? Click on the correct answer: YES / NO*) and showing you examples (e.g. *Measure test-point I7 and click on the correct waveform you see on the oscilloscope*). You can answer by clicking on a link (e.g. text or a waveform picture) that will bring you to the next step in the faultfinding process.

By a combination of automatic diagnostics and an interactive question / answer procedure, ComPair will enable you to find most problems in a fast and effective way.

Beside fault finding, ComPair provides some **additional features** like:

- Up- or downloading of pre-sets.
- Managing of pre-set lists.
- Emulation of the Dealer Service Tool (DST).
- If both ComPair and SearchMan (Electronic Service Manual) are installed, all the schematics and the PWBs of the set are available by clicking on the appropriate hyperlink.

Example: *Measure the DC-voltage on capacitor C2568 (Schematic/Panel) at the Mono-carrier.*

- Click on the ‘Panel’ hyperlink to automatically show the PWB with a highlighted capacitor C2568.
- Click on the ‘Schematic’ hyperlink to automatically show the position of the highlighted capacitor.

5.5.3 How To Connect

1. First, install the ComPair Browser software (see the Quick Reference Card for installation instructions).
2. Connect the RS232 interface cable between a free serial (COM) port of your PC and the PC connector (marked with ‘PC’) of the ComPair interface.
3. Connect the mains adapter to the supply connector (marked with ‘POWER 9V DC’) of the ComPair interface.
4. Switch the ComPair interface “off”.
5. Switch the television set “off” with the mains switch.
6. Connect the ComPair interface cable between the connector on the rear side of the ComPair interface (marked with ‘I2C’) and the ComPair connector at the rear side of the TV (situated just below the tuner input, see also chapter 4).
7. Plug the mains adapter in a mains outlet, and switch the interface “on”. The green and red LEDs light up together. The red LED extinguishes after approx. 1 second while the green LED remains lit.
8. Start the ComPair program and read the ‘Introduction’ chapter.

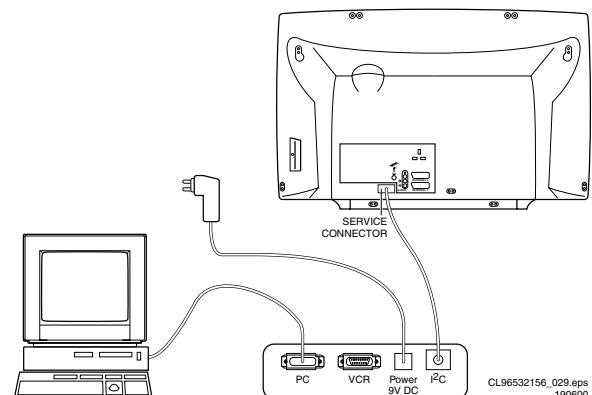


Figure 5-5 ComPair Interface connection

5.5.4 How To Order

ComPair order codes (EU/AP/LATAM):

- Starter kit ComPair32/SearchMan32 software and ComPair interface (excl. transformer): 3122 785 90450.
- ComPair interface (excluding transformer): 4822 727 21631.
- Starter kit ComPair32 software (registration version): 3122 785 60040.
- Starter kit SearchMan32 software: 3122 785 60050.
- ComPair32 CD (update): 3122 785 60070 (year 2002, 3122 785 60110 (year 2003).
- SearchMan32 CD (update): 3122 785 60080 (year 2002), 3122 785 60120 (year 2003).
- ComPair interface cable: 3122 785 90004.
- ComPair firmware upgrade IC: 3122 785 90510 (only for sets with software upgrade facilities).
- Transformer (non-UK): 4822 727 21632.
- Transformer UK: 4822 727 21633.

Note: If you encounter any problems, contact your local support desk.

5.6 Trouble Shooting Tips

5.6.1 Scaler/TV Board Power Supply Problems

In this paragraph some troubleshooting steps for checking the power supply of the Scaler-board and TV-board circuitry are described.

- Measure across pin-1 and pin-4 of connector 1003 (diagram C1). +12V (13" and 15") or +24V (20") should be present. If the voltage is not present, probably is caused by:
 - AC to DC adaptor is defect.
 - Short circuit in TV-board (can be isolated by connector 1003).
 - Fuse 1002 is open circuit.
- Measure across C2923 (diagram A10). +3V3 should be present. If not present, probably this is caused by:
 - IC7920 is defective.
 - R3925 is defective.
 - The power supply circuit (diagram C1) is defective (see Scaler-board circuit trouble shooting tips).
- Measure across C2913/C2933 (diagram A10). +8V3/+5V4 should be present respectively. If not present, probably this is caused by:
 - IC 7910/7930 regulator is defective.
 - Fuse 1903 is defective.
 - Switching FET 7900 is defective.
 - Transistor T7901 is defective.
- Measure across C2007 (diagram C1). +5V should be present. If not present, probably this is caused by:
 - +5V grounded by the load.
 - Regulator IC 7001 is defective.
 - Control transistor T7003/T7002 is defective.
 - Scaler power control signal line (POW-CON-SCALER coming from TV-board) is defective.
- Measure pin-4 or pin-5 of connector 1341 (diagram C5). Pin-4 should be high (+4V7) and pin-5 also should be high (+3V4). If one/both of the voltage is not present, probably this is caused by:
 - IC 7351 (Farouja_s2300) is defective.
 - Inverter board is defective.

5.6.2 General Problems

TV switched "off" or changed channel without any user action

Set switches off after "TV SWITCHING OFF" was displayed.

"Auto Standby" switched the set "off" because:

- There was no ident signal for more than 15 minutes.

- There was no remote control signal received or local key pressed for > 2 hours.

See chapter 8 for a description on the options to enable/disable "Auto Standby".

5.6.3 Picture problems

Picture too dark or too bright

- Press "Smart Picture" button on the remote control. In case the picture improves, increase / decrease the brightness value or increase / decrease the contrast value. The new "Personal Preference" value is automatically stored after 3 minutes.
- After switching on the Customer Service Mode the picture is OK. Increase / decrease the brightness value or increase / decrease the contrast value. The new "Personal Preference" value is automatically stored after 3 minutes.

Snowy picture

Check the "NOT TUNED" section of the Customer Service Mode screen.

Snowy picture and/or unstable picture

A scrambled or decoded signal is received.

Black and white picture

- Press "Smart Picture" button on the remote control. In case picture improves, increase the colour value. The new "Personal Preference" value is automatically stored after 3 minutes.
- After switching on the Customer Service Mode the picture is OK. Increase the colour value. The new "Personal Preference" value is automatically stored after 3 minutes.

Menu text not sharp enough

- Press "Smart Picture" button on the remote control. In case the picture improves, decrease the contrast value. The new "Personal Preference" value is automatically stored after 3 minutes.
- After switching on the Customer Service Mode the picture is OK. Decrease the contrast value. The new "Personal Preference" value is automatically stored after 3 minutes.

5.6.4 Sound problems

No sound or sound too loud (after channel change / switching on)

After switching on the Customer Service Mode the volume is OK. Increase / decrease the volume level. The new "Personal Preference" value is automatically stored after 3 minutes.

5.6.5 Extra information/tips:

- Complaints that may be caused by an incorrect system setting:
 - No colours
 - Colours not correct
 - Unstable picture
 - Noise in picture To change the system setting of a preset:
 1. Press the "MENU" button on the remote control
 2. Select the INSTALL sub menu
 3. Select the MANUAL STORE sub menu
 4. Select and change the SYSTEM setting until picture and sound are correct
 5. Select the STORE menu item
- The Scaler is the driving engine of the LCD panel. When there is no display and OSD on screen, check whether sound is producible on TV channel. If sound is audible, most likely the defective lies in Scaler board or inverter board.

- To know fast whether inverter is functioning, visually check if the backlights are “on” by looking at the back of the LCD panel. Some bright spots can be seen on the side. Other way to tell whether the backlight is working is to switch the set to AV mode. The front of the screen had some kind of “fogged” effect.

Note: when one of the backlight connectors has loosened, the inverter circuit will be shut down.

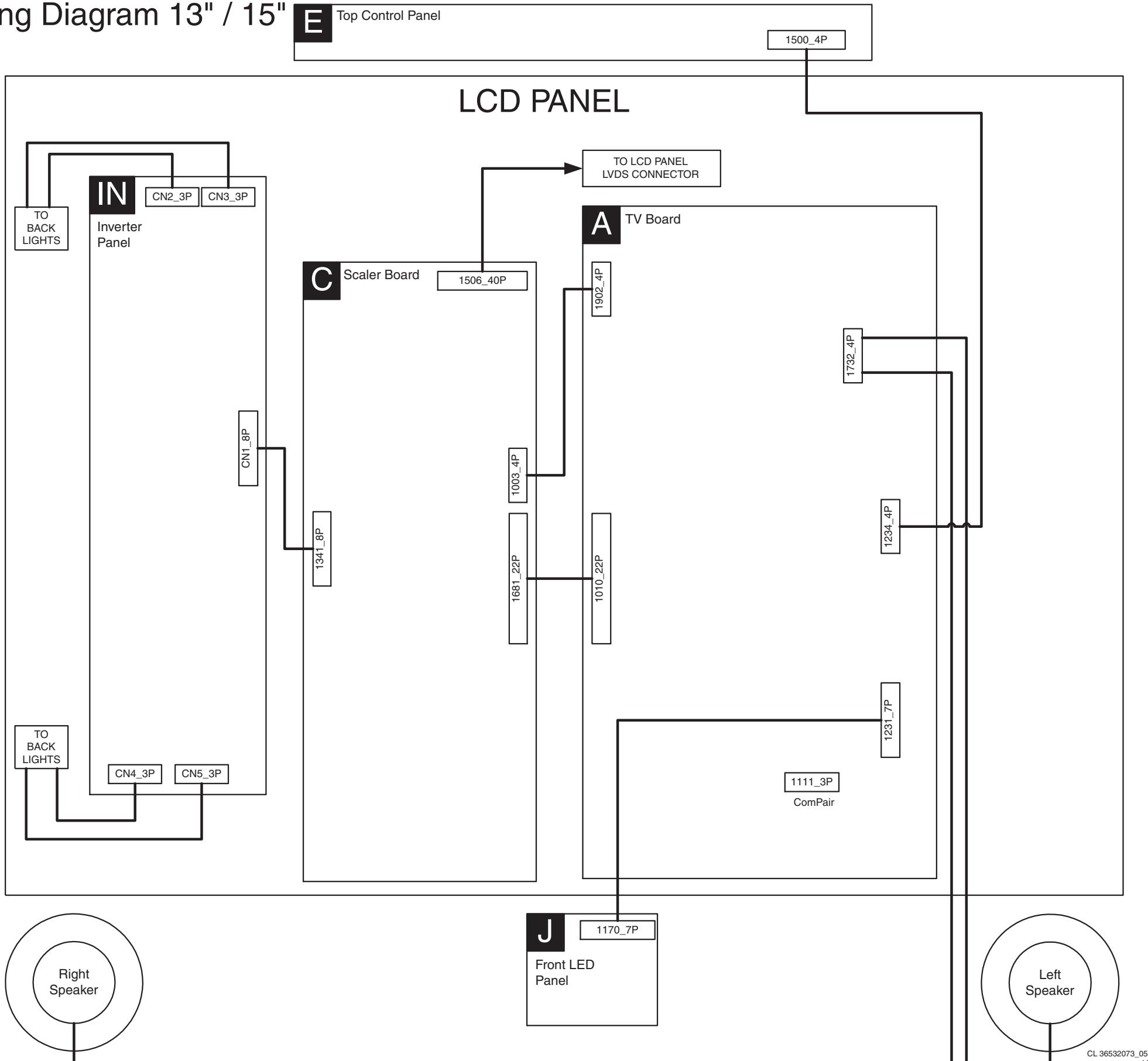
- If the supply to the LCD panel is OK (likewise for backlight supply), but no data signals (example: signals on connector 1506) supplied from Scaler to LCD panel, you will notice that the LCD screen will shown full screen in sequential of BLUE, GREEN, RED, BLANK, dark-GREY, light-GREY and WHITE repeatedly. It means LCD panel is in good condition. The fault lies in the Scaler board

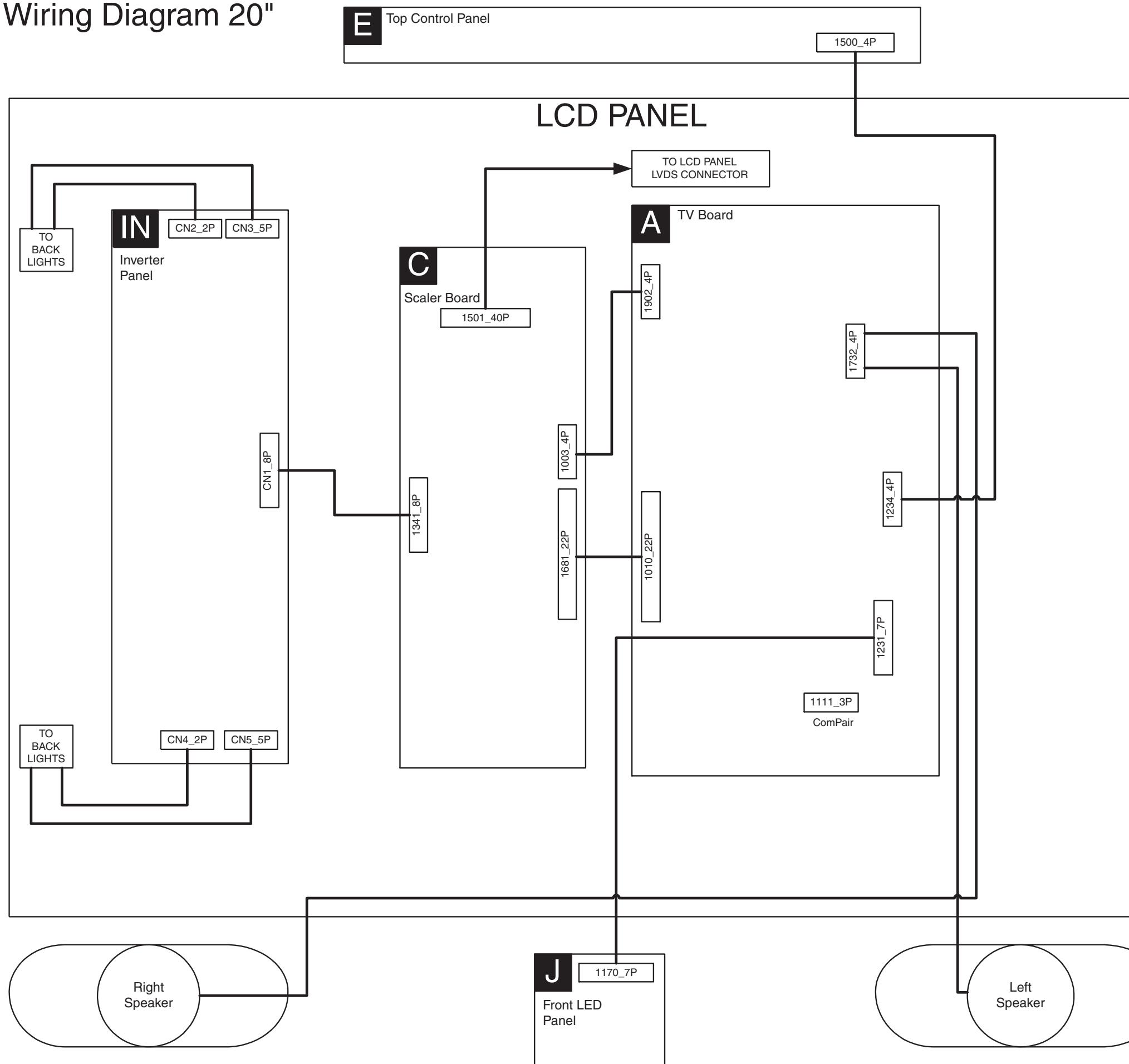
Personal Notes:

6. Block Diagrams, Testpoint Overviews, and Waveforms

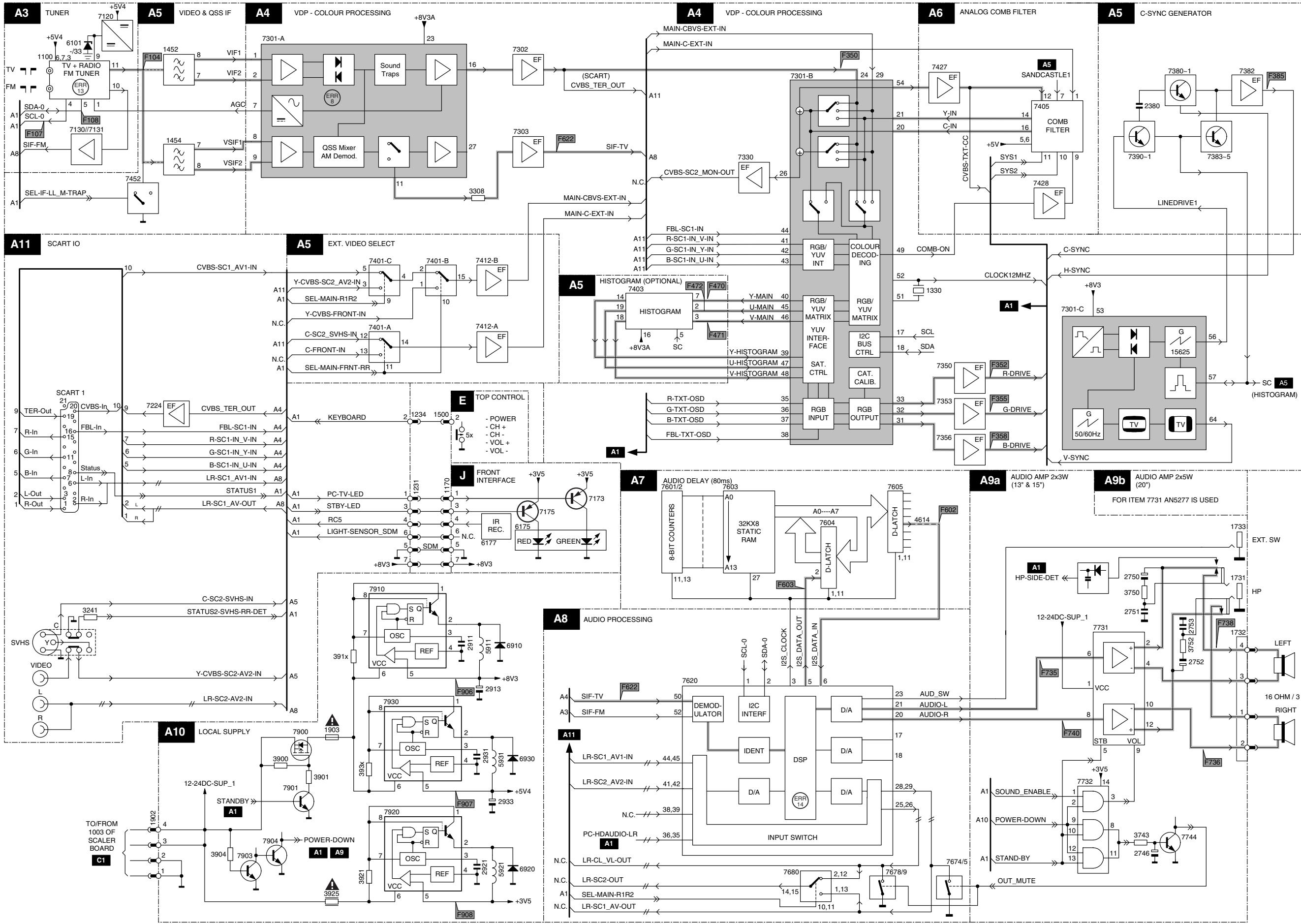
Wiring Diagram (13"/15")

Wiring Diagram 13" / 15"

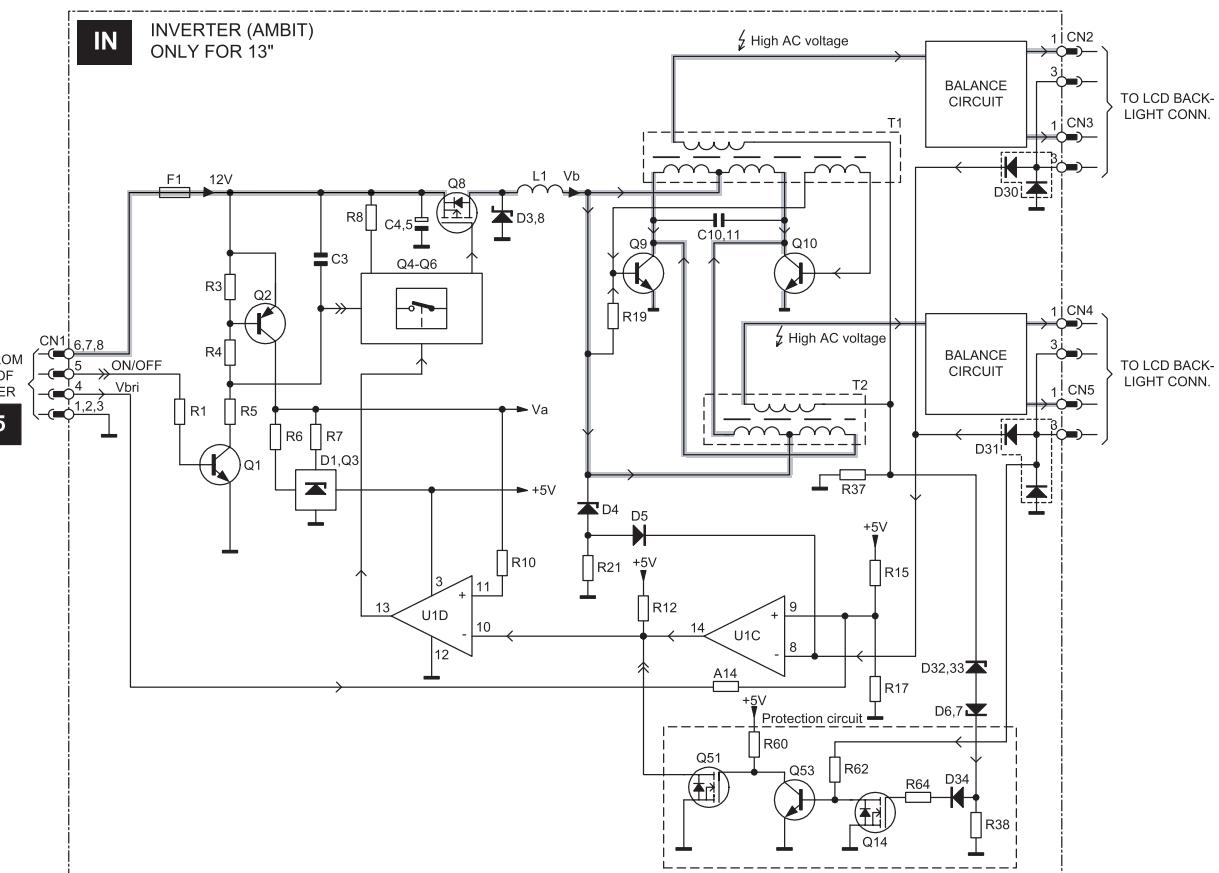
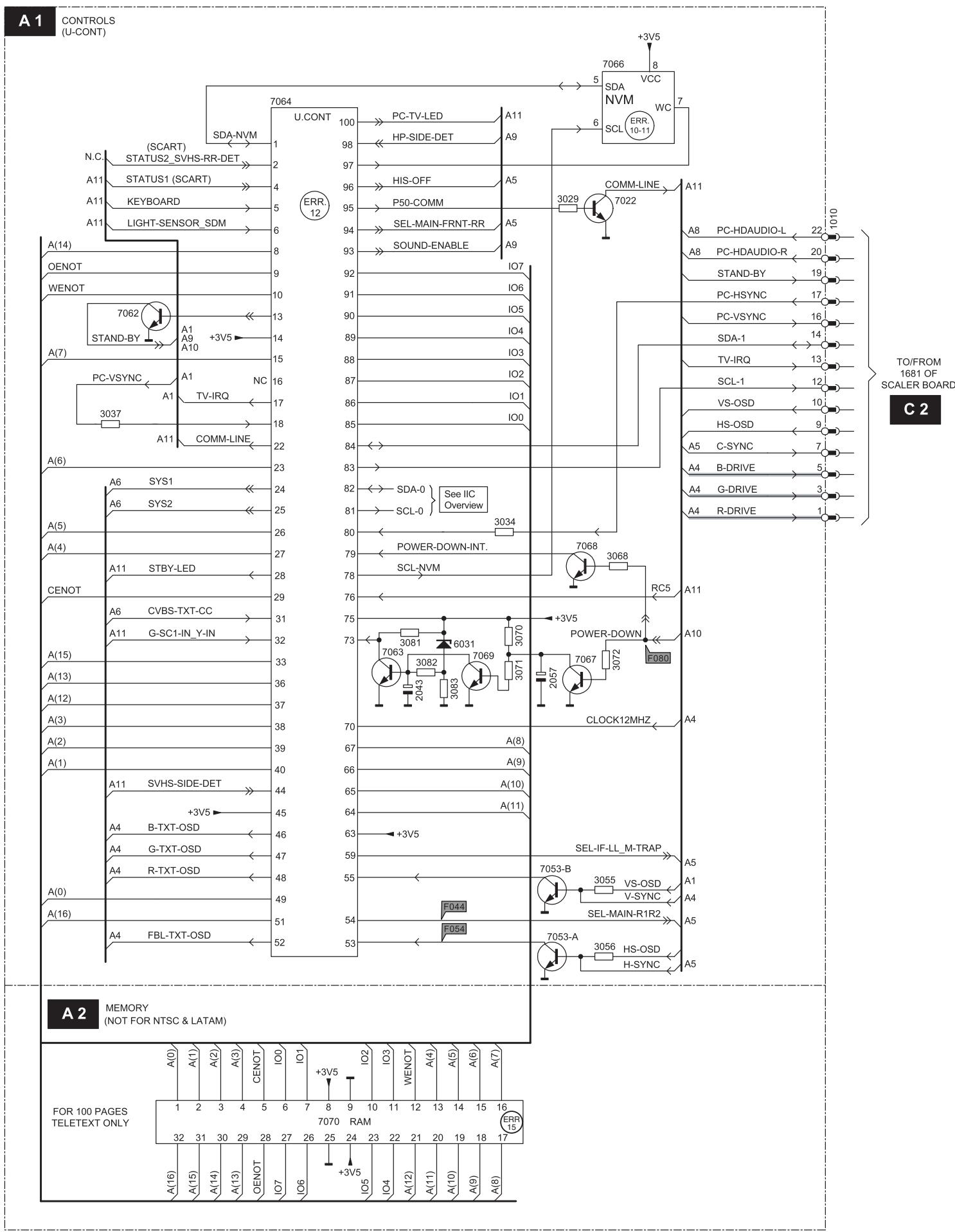


Wiring Diagram 20"**Wiring Diagram 20"**

Block Diagram (Tuner-IF-Video)



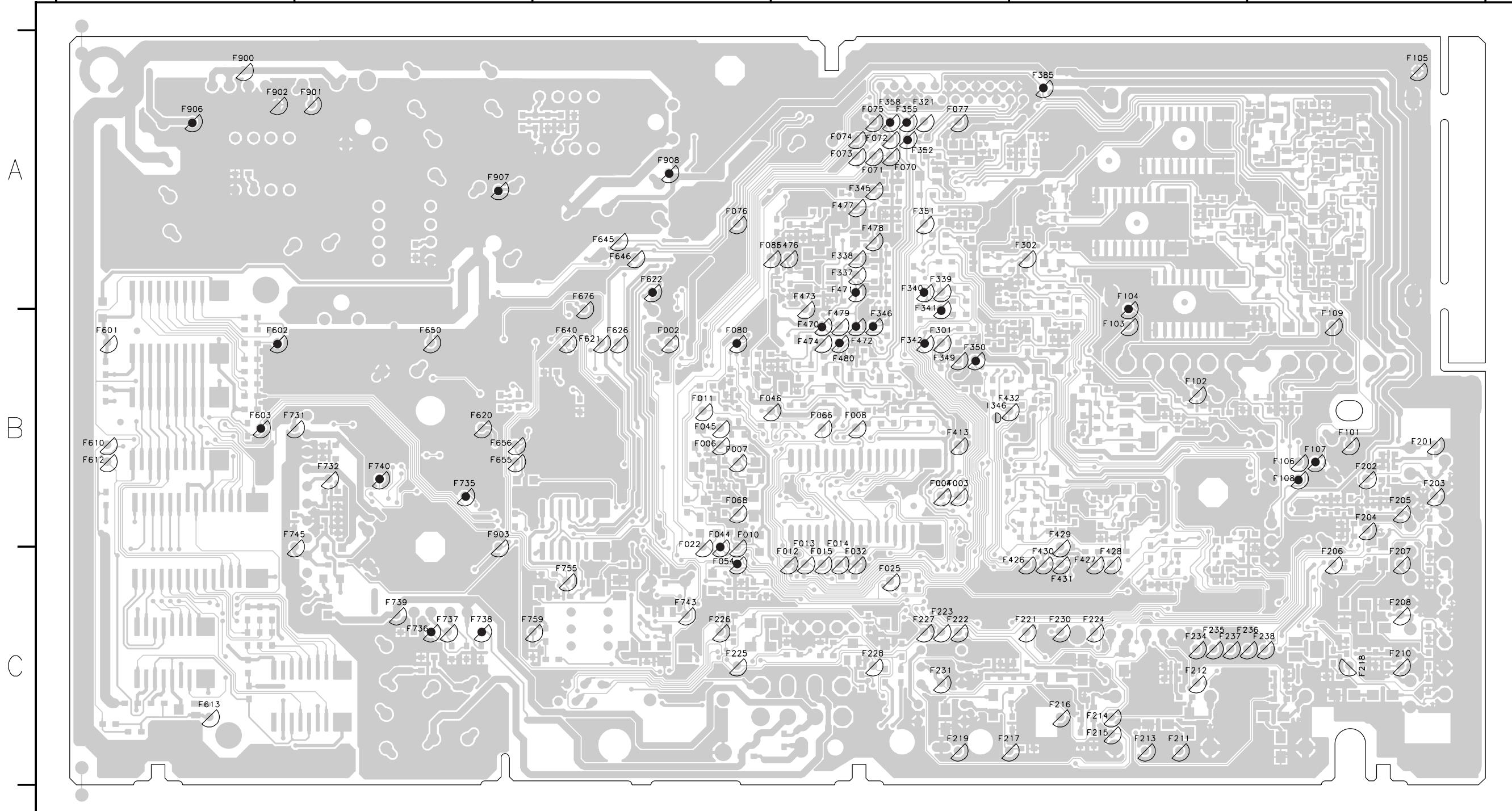
Block Diagram (TV Control and Inverter Panel)

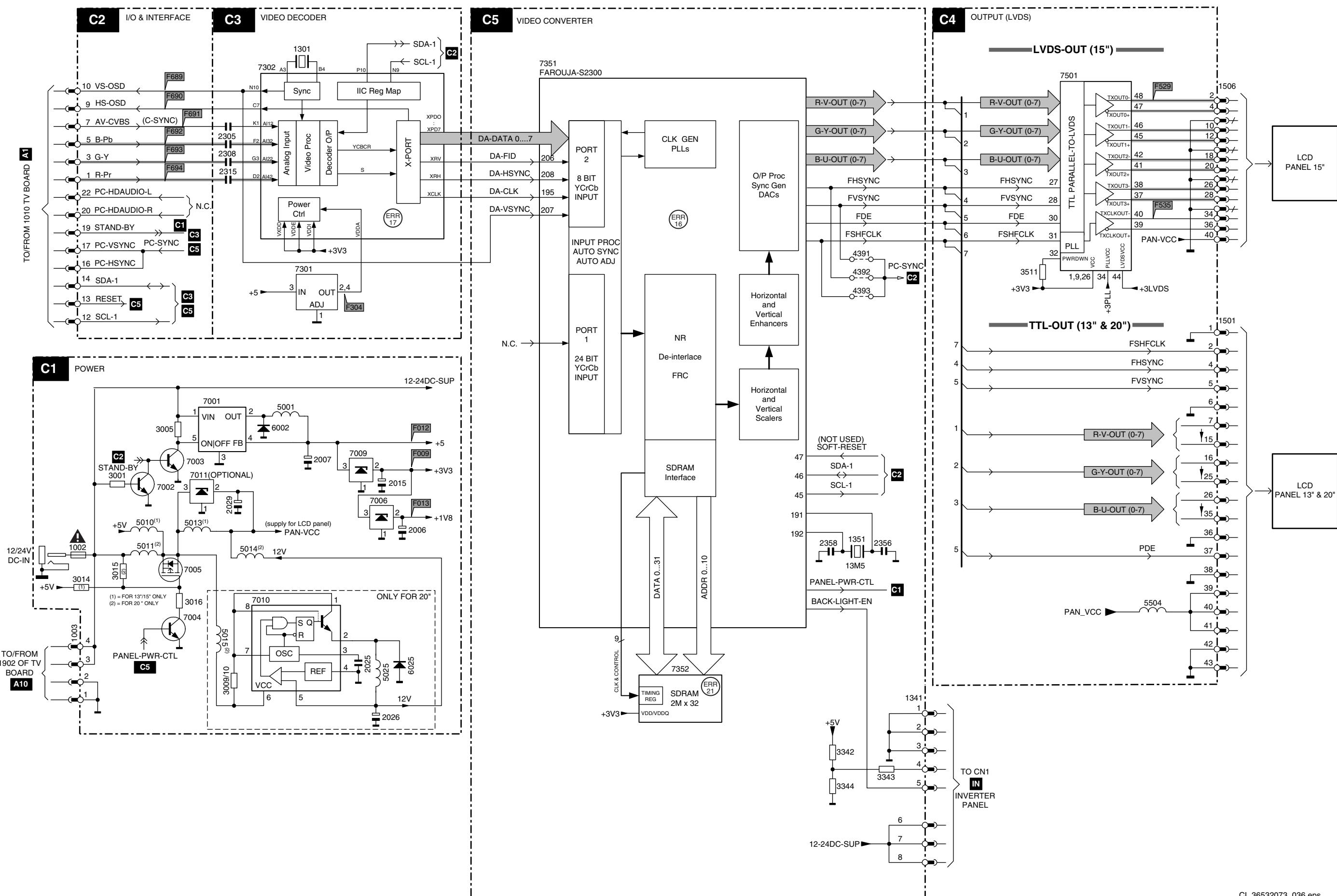


Testpoint Overview TV Board

F002 B3	F010 B3	F022 B3	F054 C3	F073 A4	F085 A3	F106 B6	F203 B6	F210 C6	F216 C5	F223 C4	F230 C5	F238 C6	F339 A4	F349 B4	F385 A5	F430 C5	F473 A4	F480 B4	F613 C1	F645 A3	F731 B1	F739 C2	F900 A1	F908 A3
F003 B4	F011 B3	F025 C4	F066 B4	F074 A4	F101 B6	F107 B6	F204 B6	F211 C5	F217 C4	F223 C5	F231 C4	F301 B4	F340 A4	F350 B4	F413 B4	F431 C5	F474 B4	F601 B1	F620 B2	F646 A3	F732 B2	F740 B2	F901 A2	I346 B4
F004 B4	F012 C4	F032 C4	F068 B3	F075 A4	F102 B5	F108 B6	F205 B6	F212 C5	F218 C6	F225 C3	F234 C5	F302 A5	F341 A4	F351 A4	F426 C5	F432 B4	F476 A4	F602 B1	F621 B3	F650 B2	F735 C2	F743 C3	F902 A1	
F006 B3	F013 B4	F044 B3	F070 A4	F076 A3	F103 B5	F109 B6	F206 C6	F213 C5	F219 C4	F226 C3	F235 C5	F321 A4	F342 B4	F352 A4	F427 C5	F470 B4	F477 A4	F603 B1	F622 A3	F655 B2	F736 C2	F745 B1	F903 B2	
F007 B3	F014 B4	F045 B3	F071 A4	F077 A4	F104 A5	F201 B6	F207 C6	F214 C5	F221 C5	F227 C5	F236 C5	F337 A4	F345 A4	F355 A4	F428 C5	F471 A4	F478 A4	F610 B1	F626 B3	F656 B2	F737 C2	F755 C3	F906 A1	
F008 B4	F015 C4	F046 B3	F072 A4	F080 B3	F105 A6	F202 B6	F208 C6	F215 C5	F222 C4	F228 C4	F237 C5	F338 A4	F346 B4	F358 A4	F429 B5	F472 B4	F479 B4	F612 B1	F640 B3	F676 A3	F738 C2	F759 C2	F907 A2	

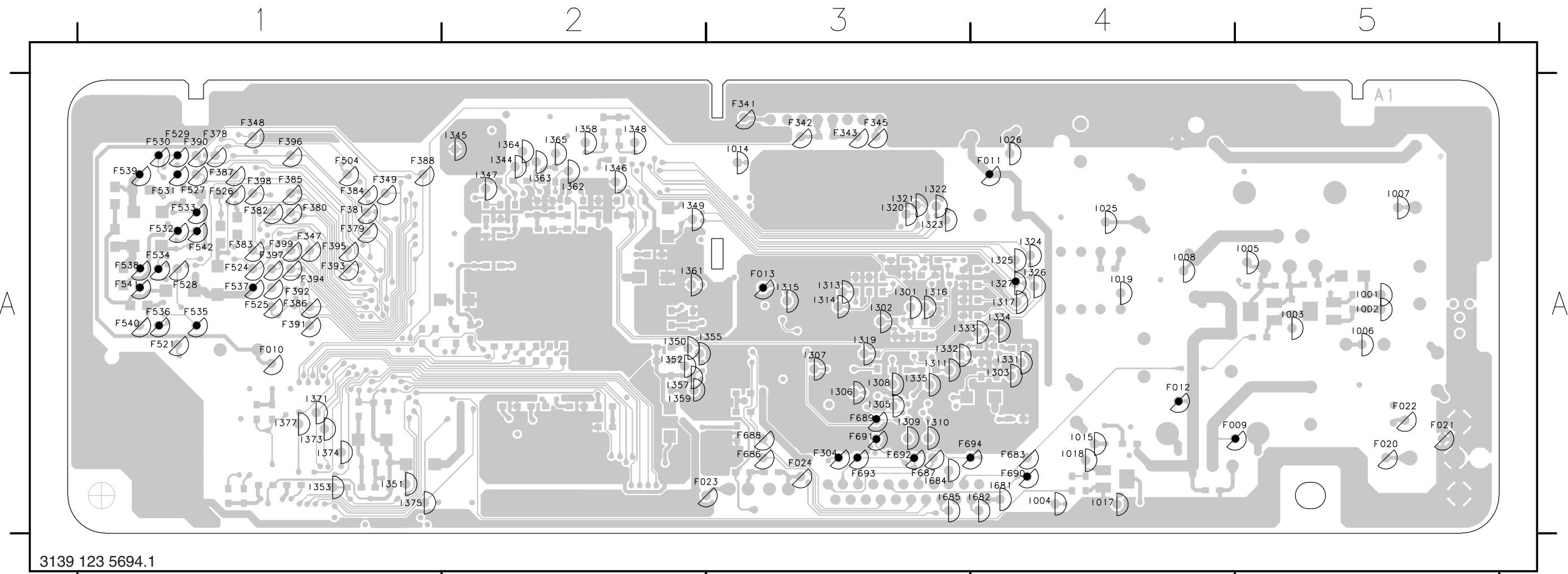
1 2 3 4 5 6



Block Diagram (Scaler Board)

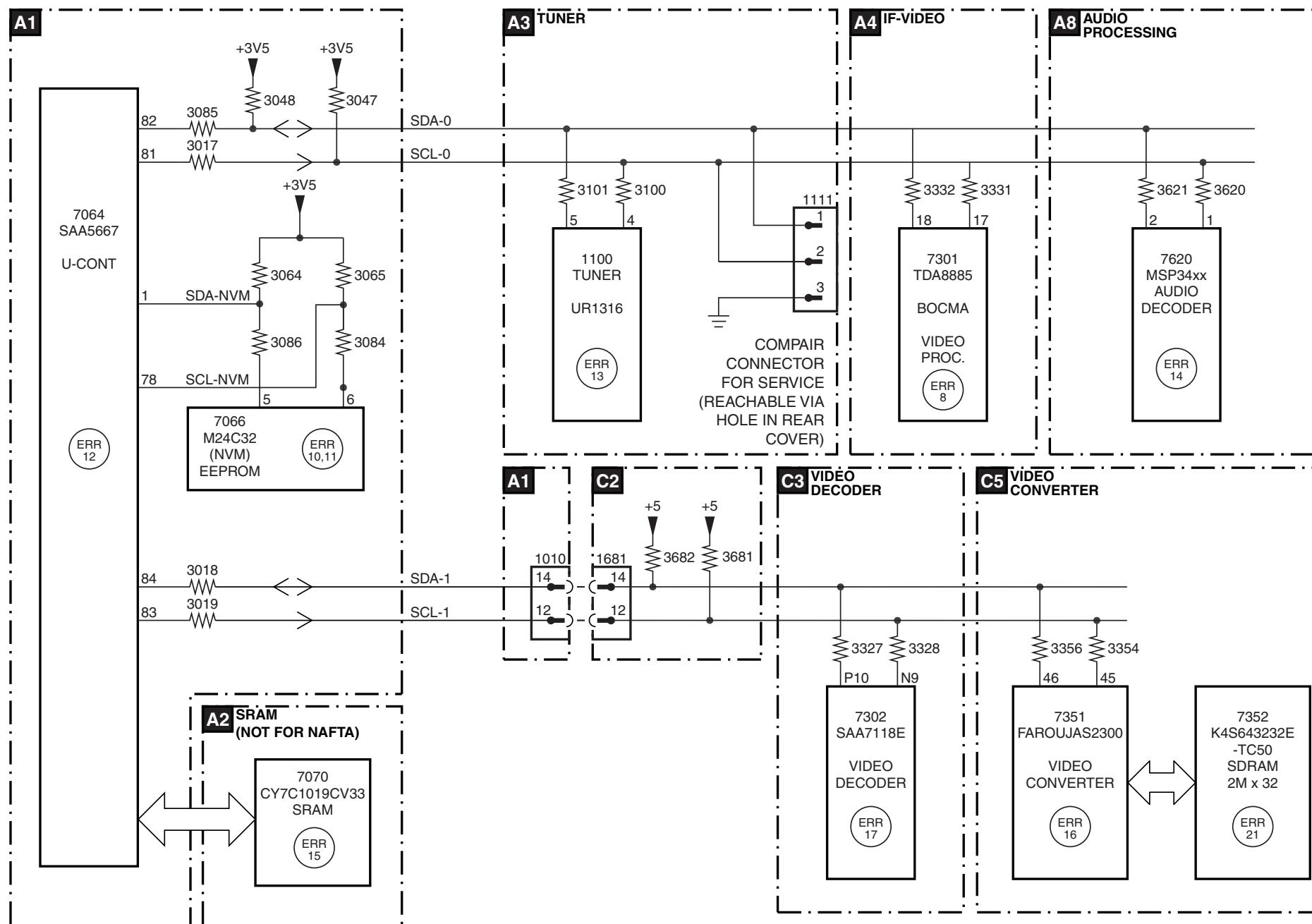
Testpoint Overview Scaler Board

F009 A4	F021 A5	F342 A3	F378 A1	F384 A1	F391 A1	F397 A1	F525 A1	F531 A1	F537 A1	F683 A4	F691 A3	I003 A5	I014 A3	I026 A4	I307 A3	I314 A3	I321 A3	I327 A4	I344 A2	I350 A2	I358 A2	I365 A2	I681 A4
F010 A1	F022 A5	F343 A3	F379 A1	F385 A1	F392 A1	F398 A1	F526 A1	F532 A1	F538 A1	F686 A3	F692 A3	I004 A4	I015 A4	I301 A3	I308 A3	I315 A3	I322 A3	I331 A4	I345 A2	I351 A1	I359 A2	I371 A1	I682 A4
F011 A4	F023 A2	F345 A3	F380 A1	F386 A1	F393 A1	F399 A1	F527 A1	F533 A1	F539 A1	F687 A3	F693 A3	I005 A5	I017 A4	I302 A3	I309 A3	I316 A3	I323 A3	I332 A3	I346 A2	I352 A2	I361 A2	I373 A1	I684 A3
F012 A4	F024 A3	F347 A1	F381 A1	F387 A1	F394 A1	F504 A1	F528 A1	F534 A1	F540 A1	F688 A3	F694 A3	I006 A5	I018 A4	I303 A4	I310 A3	I317 A4	I324 A4	I333 A3	I347 A2	I353 A1	I362 A2	I374 A1	I685 A3
F013 A3	F304 A3	F348 A1	F382 A1	F388 A1	F395 A1	F521 A1	F529 A1	F535 A1	F541 A1	F689 A3	I001 A5	I007 A5	I305 A3	I311 A3	I319 A3	I325 A4	I334 A4	I348 A2	I355 A3	I363 A2	I375 A1		
F020 A5	F341 A3	F349 A1	F383 A1	F390 A1	F396 A1	F399 A1	F524 A1	F530 A1	F536 A1	F542 A1	F690 A4	I002 A5	I008 A4	I302 A4	I306 A3	I313 A3	I320 A3	I326 A4	I349 A2	I357 A2	I364 A2	I377 A1	



I2C-IC's and Error Codes Overview

IIC

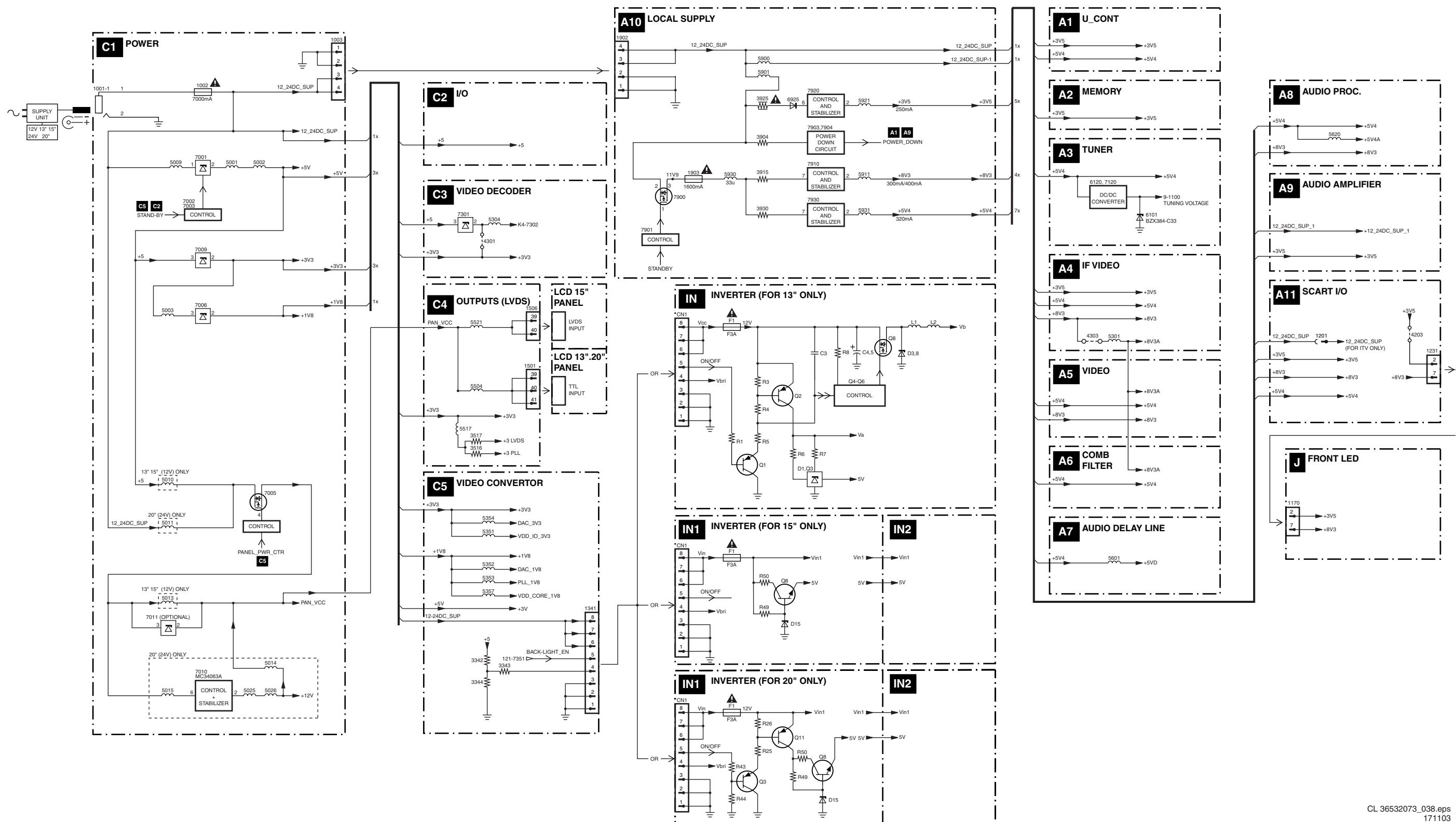


Error codes

Error code	Error description	Possible defective components	Diagram
0	No error detected	—	---
1	Reserved		
2	Reserved		
3	Reserved		
4	5V protection active	IC7620 & 1100 I2C devices (MSP34XX & Tuner)	A3, A8, A10
5	Reserved		
6	General I2C bus error	I2C bus s/c or o/c	
7	Reserved		
8	BOCMA I2C error	IC 7301 (IF Video TDA888XX)	A4
9	BOCMA 8V supply failure	IC 7910 or IC7301 (MC34063A or TDA888XX)	A4, A10
10	NVM I2C error	IC 7066 (NVM M24CXX)	A1
11	NVM identification failure	IC 7066 (NVM M24CXX)	A1
12	uProcessor internal RAM test failure	IC 7064 (up SAA56XX)	A1
13	Tuner I2C error	1100 – UR13XX (Tuner)	A3
14	Sound processor I2C error	IC 7620 (MSP34XX)	A8
15	SRAM error	IC 7070 (RAM 128 x 8)	A2
16	Video Formatter/Scaler I2C error	IC 7351 (Farouja_s2300) (Video Converter)	C5
17	Multi-Video Decoder I2C error	IC 7302 (Video Decoder SAA7118)	C3
18*	Reserved		
19*	Reserved		
20*	Reserved		
21	SDRAM protection active	IC 7352 (SDRAM 2M x 32)	C5

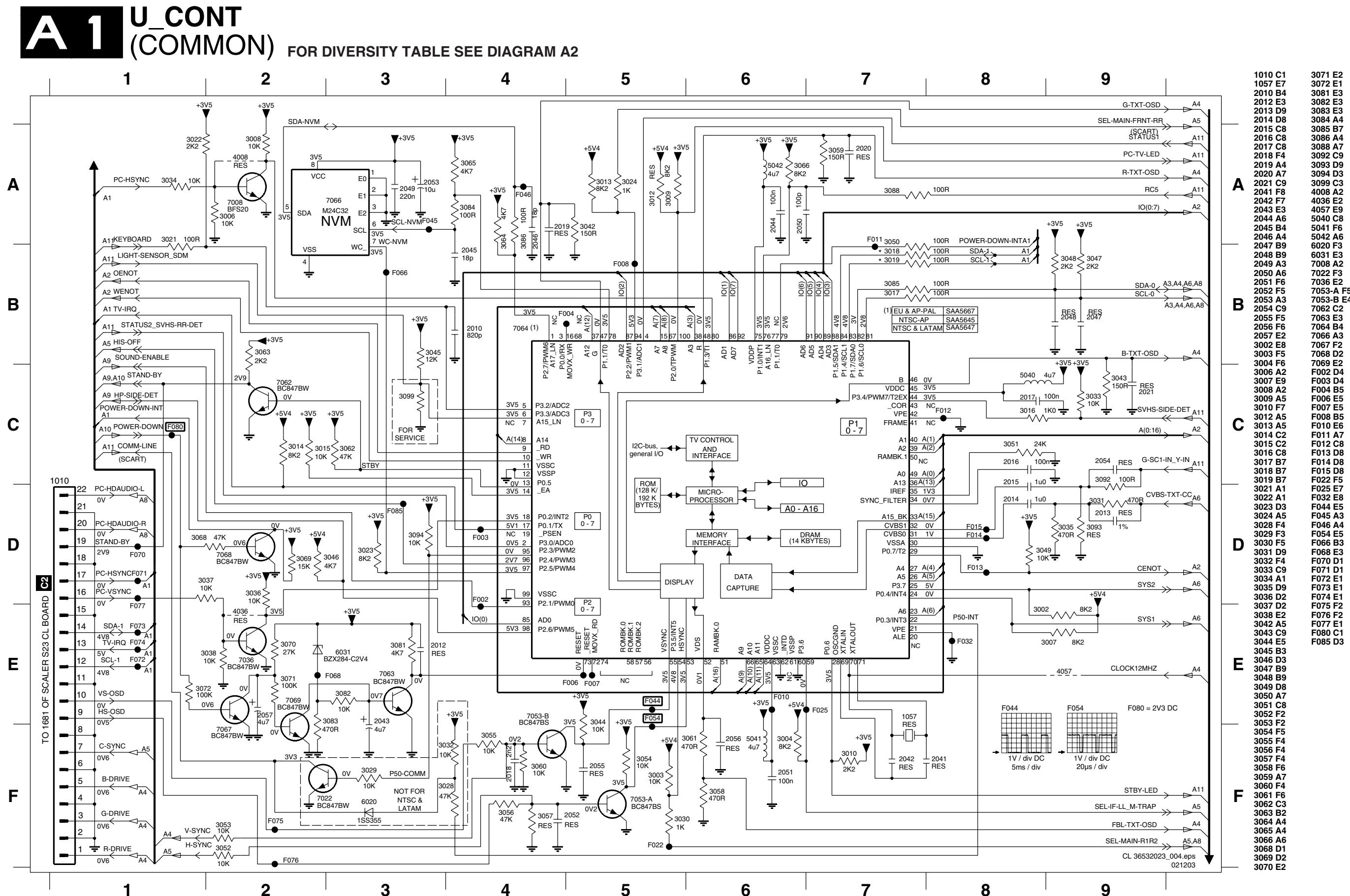
*= Not application

Powerlines Overview

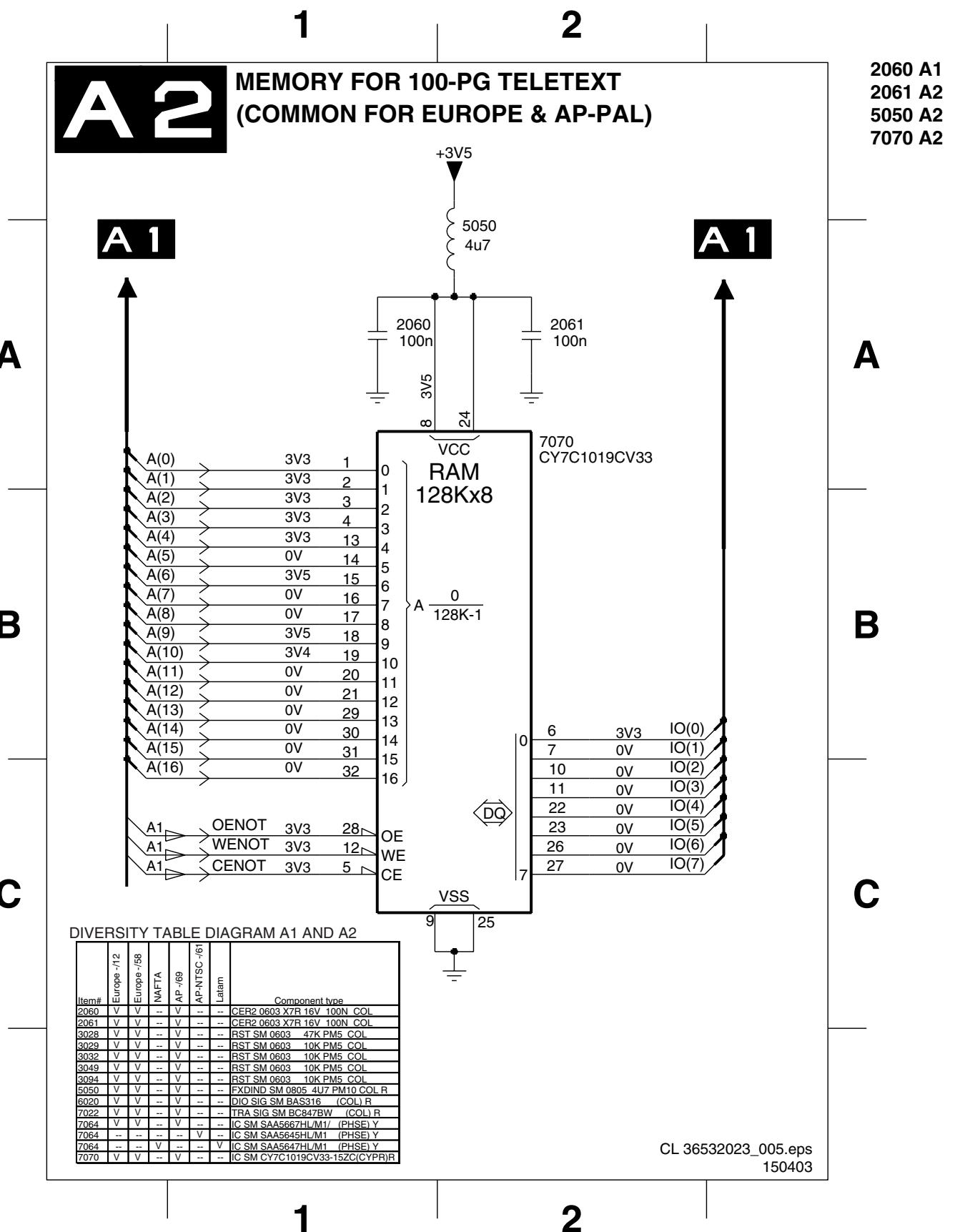


7. Circuit Diagrams and PWB Layouts

TV Board: U Cont



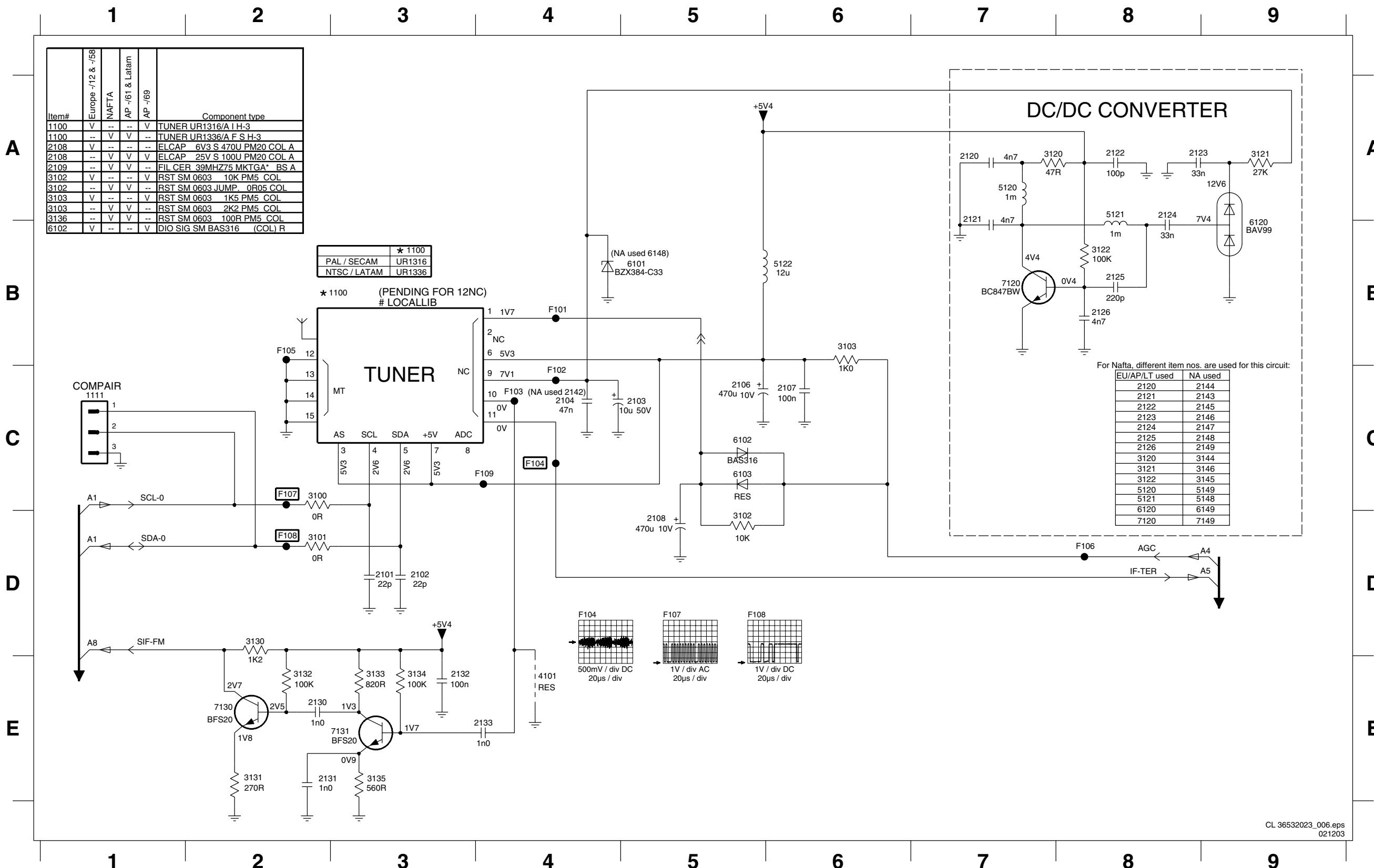
TV Board: Memory for 100-pg Teletext



Personal Notes:

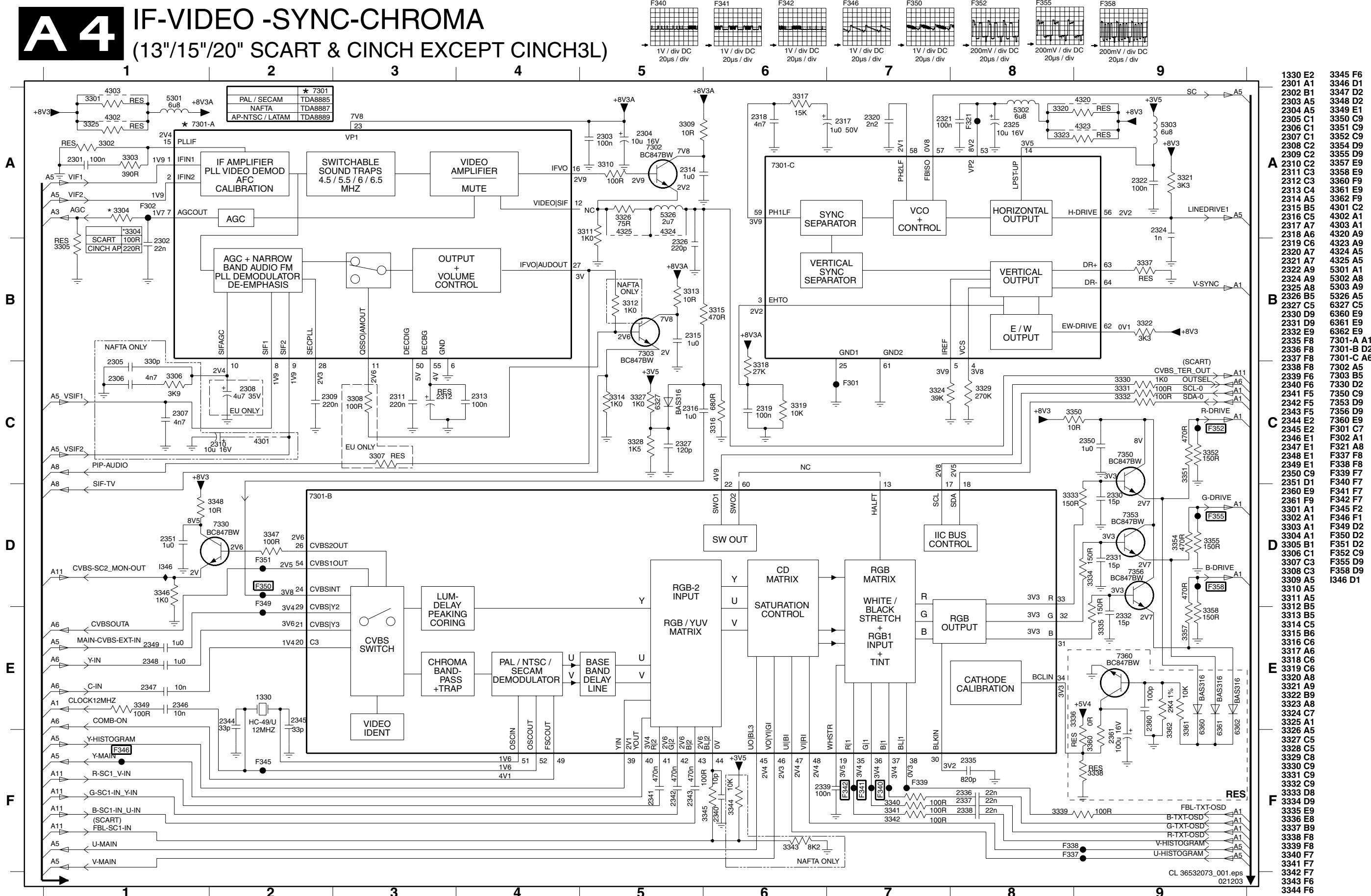
TV Board: Tuner Function

A3 TUNER FUNCTION (13"/15"/20" SCART)

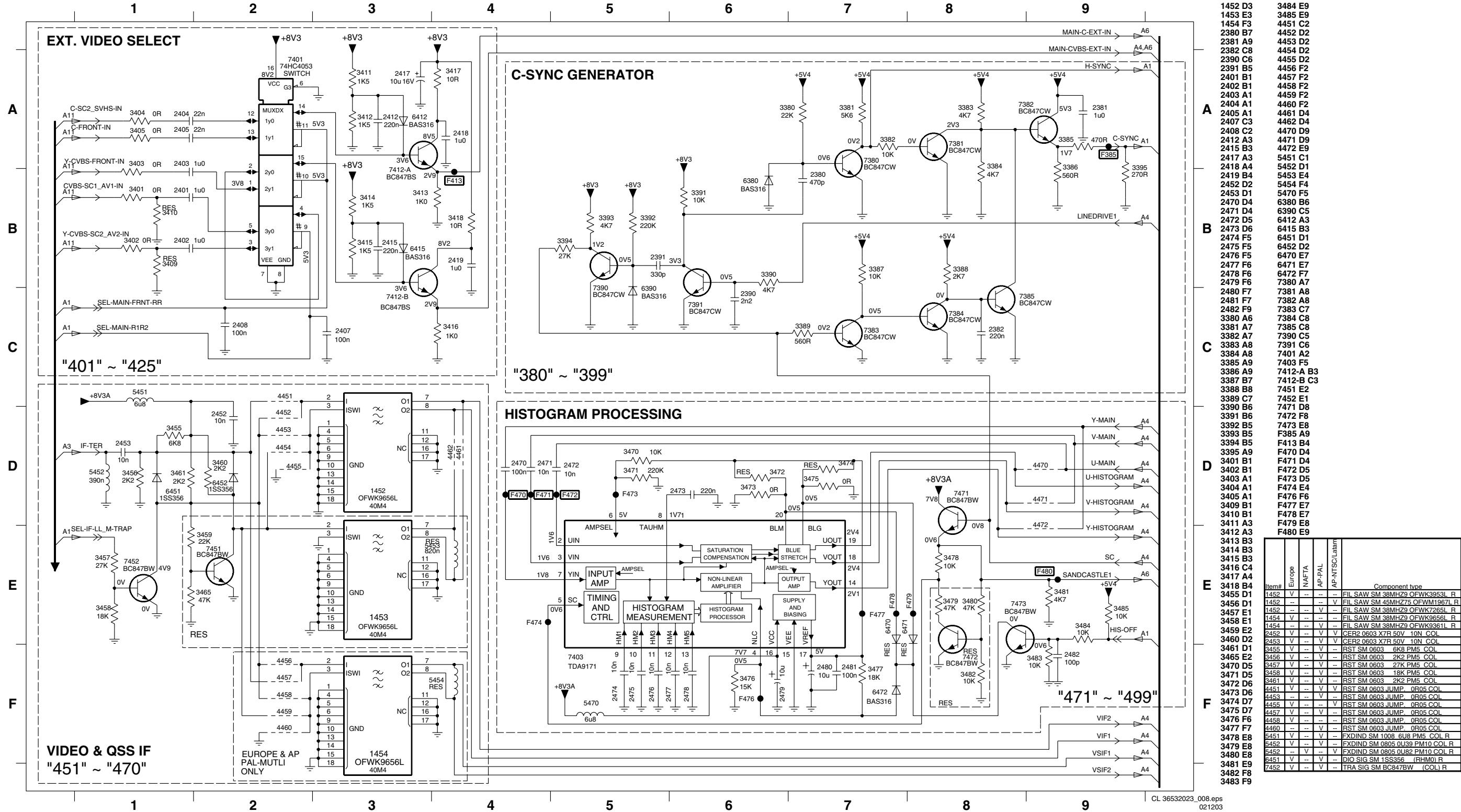
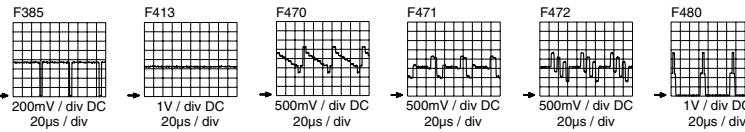


1100 B2
 1111 C1
 2101 D3
 2102 D3
 2103 C5
 2104 C4
 2106 C5
 2107 C6
 2108 D5
 2120 A7
 2121 A7
 2122 A8
 2123 A8
 2124 A8
 2125 B8
 2126 B8
 2130 E2
 2131 E2
 2132 E3
 2133 E4
 3100 C2
 3101 D2
 3102 D5
 3103 B6
 3120 A7
 3121 A9
 3122 B8
 3130 D2
 3131 E2
 3132 E2
 3133 E3
 3134 E3
 3135 E3
 5120 A7
 5121 A8
 5122 B6
 6101 B5
 6102 C5
 6103 C5
 6120 B9
 7120 B7
 7130 E2
 7131 E3
 F101 B4
 F102 C4
 F103 C4
 F104 C4
 F105 B2
 F106 C8
 F107 C2
 F108 D2
 F109 C4

TV Board: IF Video Sync Chroma



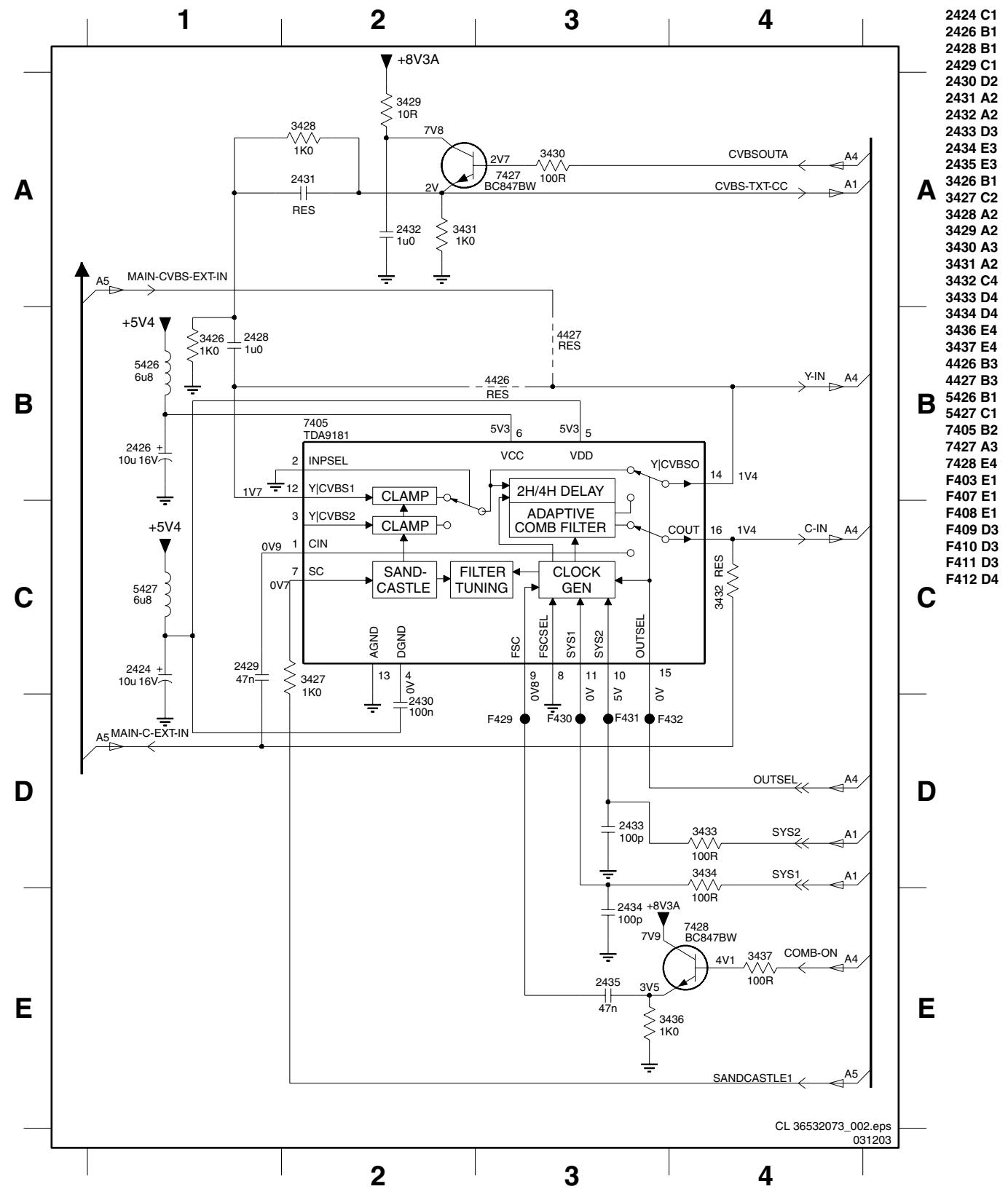
TV Board: SAW Filter, Ext. Video Select, Histogram, & C-Sync Generator

A5 SAW FILTER, EXT. VIDEO SELECT, HISTROGRAM & C-SYNC GEN
(13"/15"/20" EUROPE & AP-PAL)


Item#	Europe	NA/TA	AP-NTSC/Latam	Component type
3484 E9	-	-	-	FIL SAW SM 38MHZ OFWK3953L R
3485 E9	-	-	-	FIL SAW SM 45MHZ OFWN1967L R
4451 F3	-	-	-	FIL SAW SM 38MHZ OFWK7265L R
4452 D2	-	-	-	FIL SAW SM 38MHZ OFWK656L R
2381 A9	-	-	-	FIL SAW SM 38MHZ OFWK3936L R
4453 D2	-	-	-	CER2 0603 X7R 50V 10N COL
2382 C8	-	-	-	RST SM 0603 6K PM5 COL
4454 D2	-	-	-	RST SM 0603 2K PM5 COL
2390 C6	-	-	-	RST SM 0603 27K PM5 COL
4455 D2	-	-	-	RST SM 0603 18K PM5 COL
2391 B5	-	-	-	RST SM 0603 2K PM5 COL
4456 F2	-	-	-	RST SM 0603 JUMP_0R05 COL
2401 B1	-	-	-	RST SM 0603 JUMP_0R05 COL
4457 F2	-	-	-	RST SM 0603 JUMP_0R05 COL
2402 B1	-	-	-	RST SM 0603 JUMP_0R05 COL
4458 F2	-	-	-	RST SM 0603 JUMP_0R05 COL
2403 A1	-	-	-	RST SM 0603 JUMP_0R05 COL
4461 D4	-	-	-	RST SM 0603 JUMP_0R05 COL
2407 C3	-	-	-	RST SM 0603 JUMP_0R05 COL
4462 D4	-	-	-	RST SM 0603 JUMP_0R05 COL
2408 C2	-	-	-	RST SM 0603 JUMP_0R05 COL

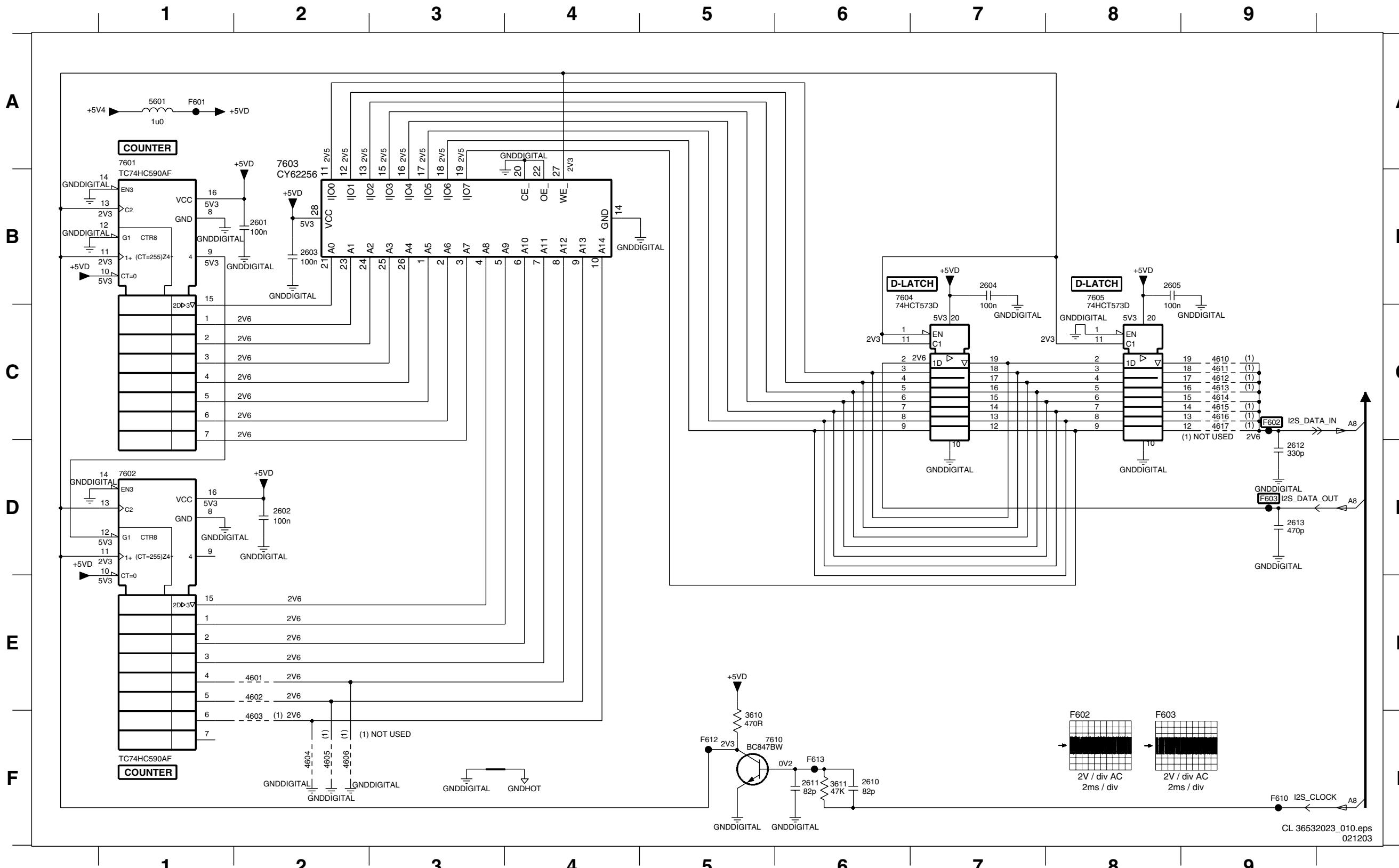
TV Board: Analog Comb Filter

A 6 ANALOG COMB FILTER (13"/15"/20" SCART & CINCH EXCEPT CINCH3L)



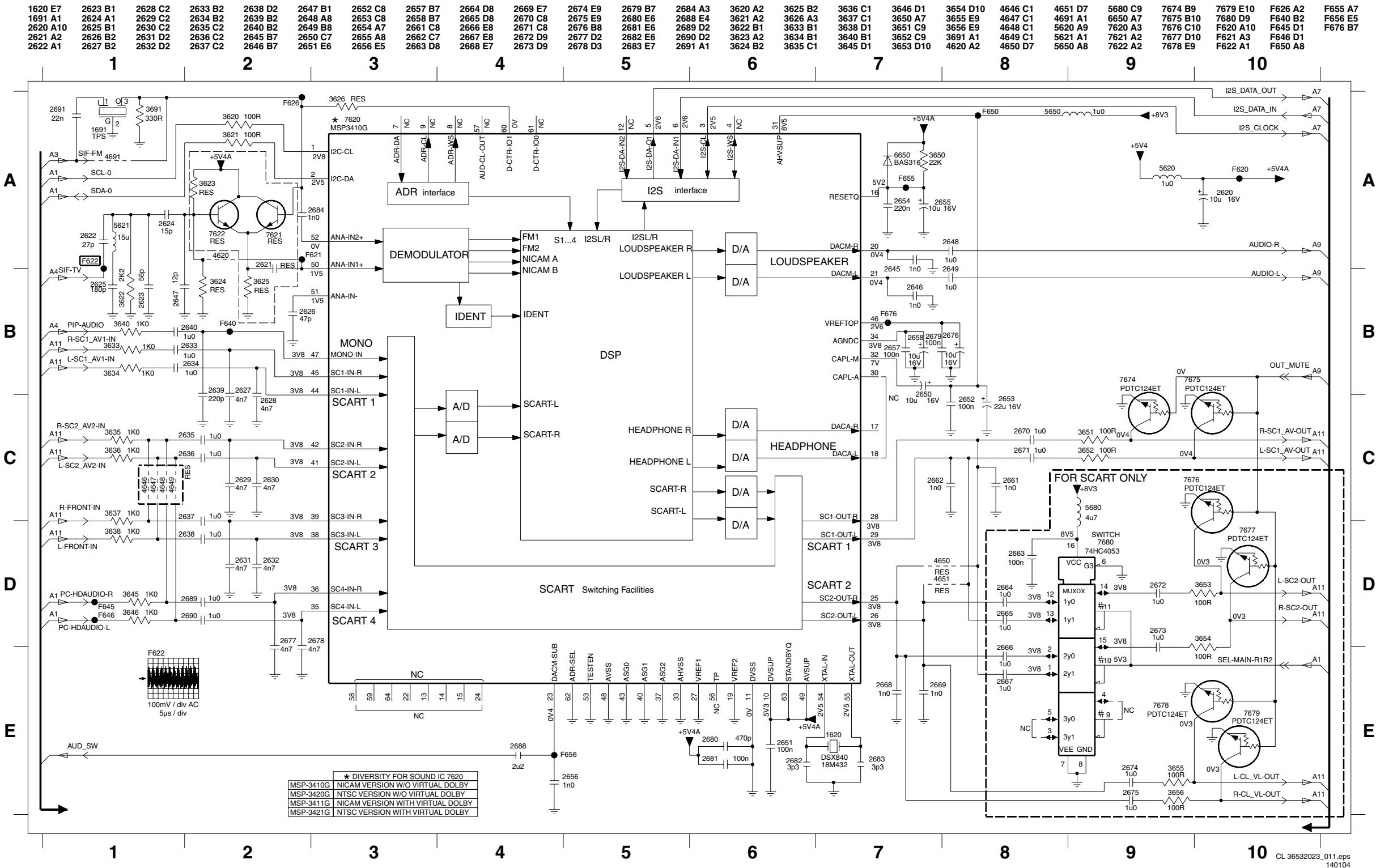
Personal Notes:

TV Board: Audio Delay Line

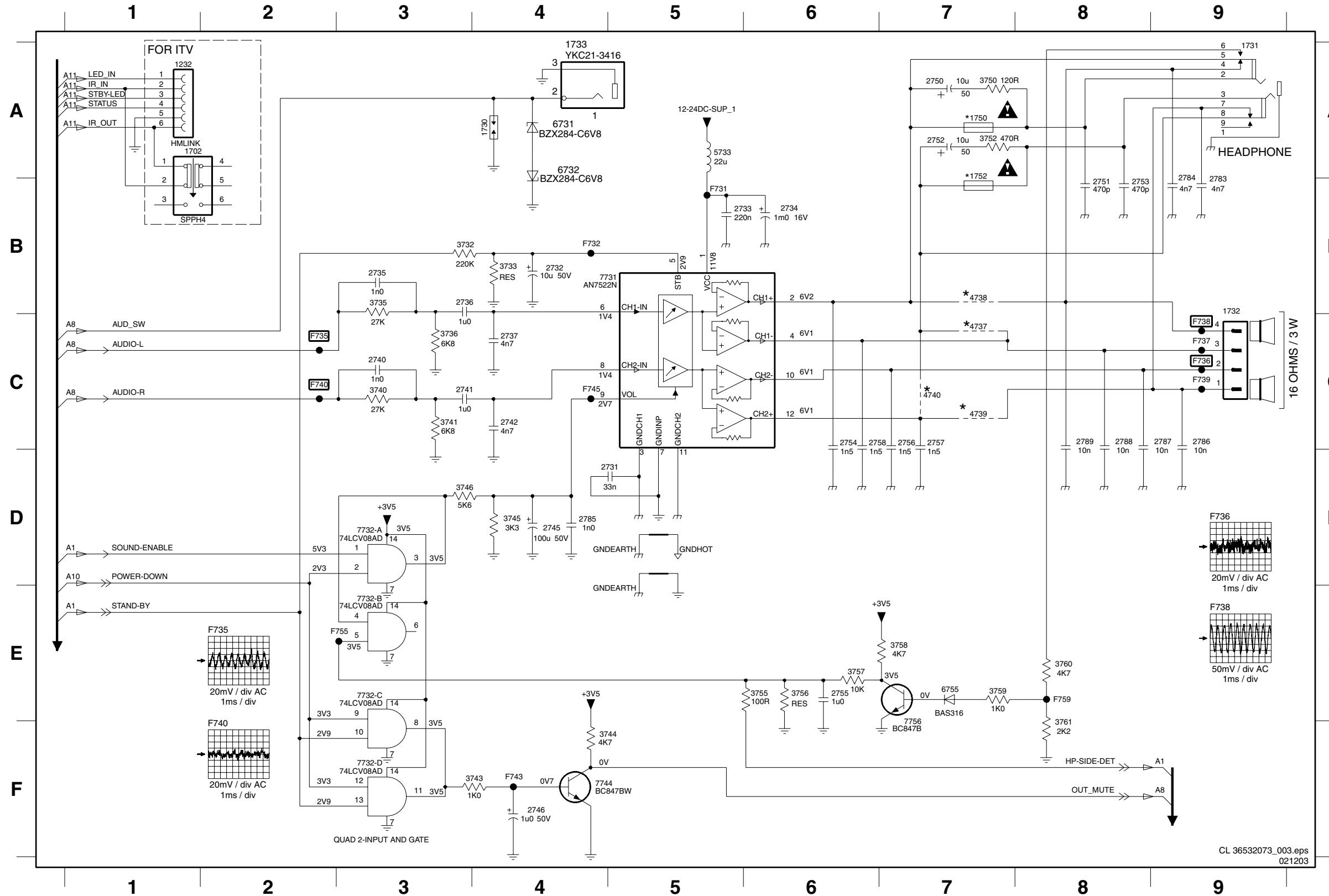
A 7 AUDIO DELAY LINE
(COMMON)


2601 B2
2602 D2
2603 B2
2604 B7
2605 B8
2610 F6
2611 F6
2612 D9
2613 D9
3610 F5
3611 F6
4601 E2
4602 E2
4603 F2
4604 F2
4605 F2
4606 F2
4610 C9
4611 C9
4612 C9
4613 C9
4614 C9
4615 C9
4616 C9
4617 C9
5601 A1
7601 A1
7602 D1
7603 A2
7604 B7
7605 B8
7610 F6
F601 A1
F602 C9
F603 D9
F610 F9
F612 F5
F613 F6

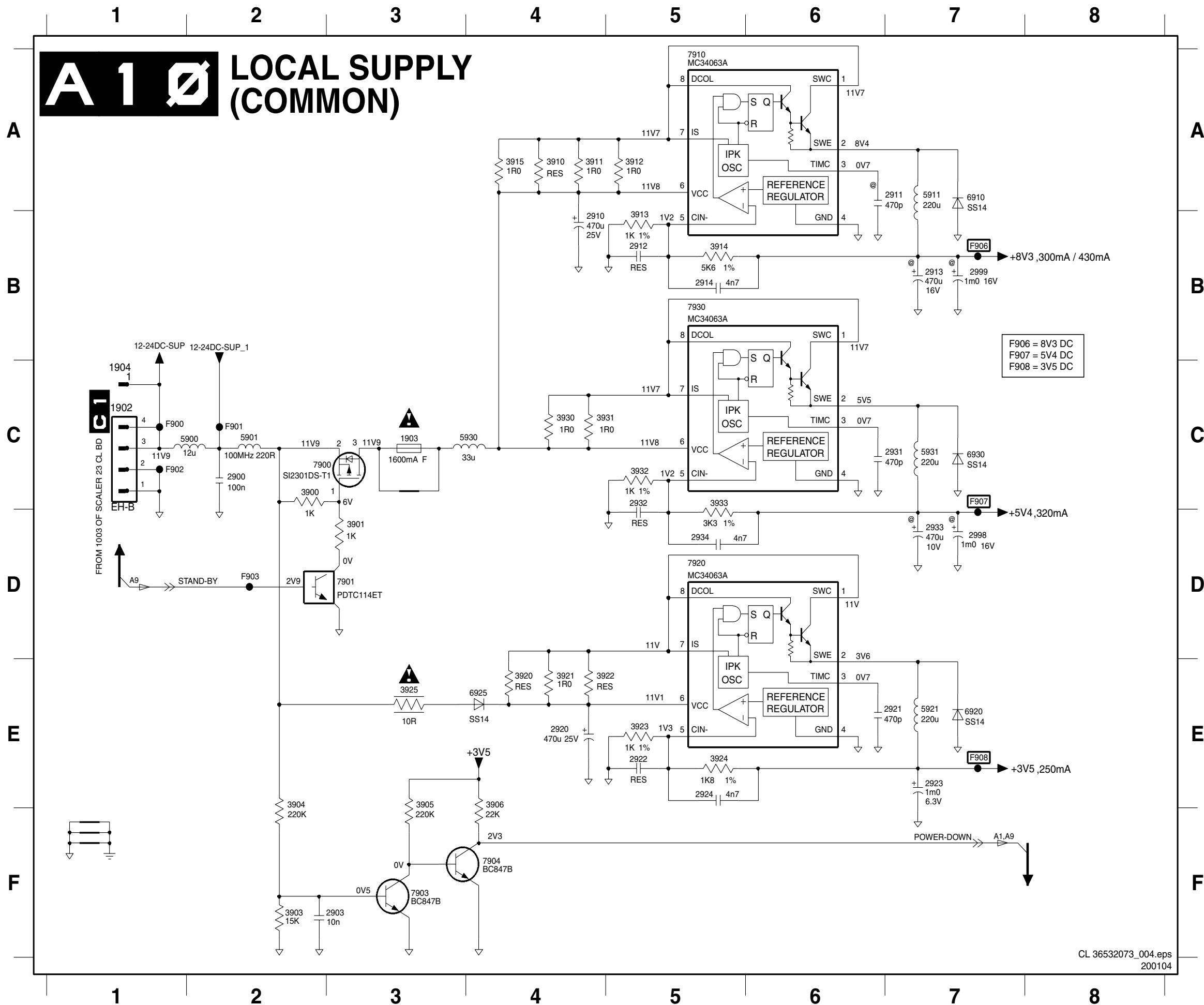
TV Board: Audio Processing

A8 AUDIO PROCESSING
(COMMON)

TV Board: Audio Amplifier

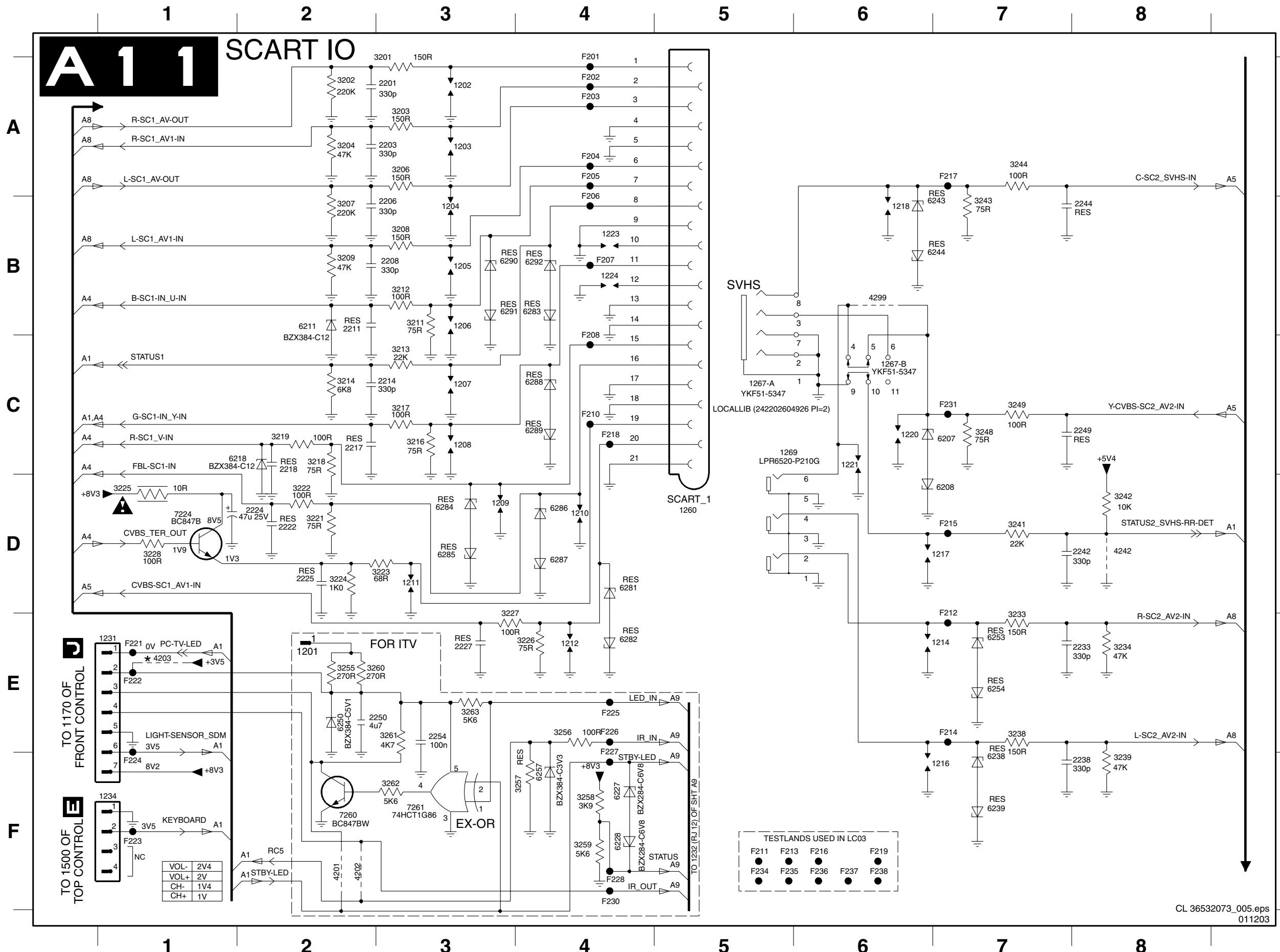
A9 AUDIO AMPLIFIERCL_36532073_003.eps
021203

TV Board: Local Supply



1902 C1
1903 C3
1904 C1
2900 C2
2903 F3
2910 B4
2911 A7
2912 B5
2913 B7
2914 B5
2920 E4
2921 E7
2922 E5
2923 E7
2924 E5
2931 C7
2932 C5
2933 D7
2934 D5
2998 D7
2999 B7
3900 C2
3901 D3
3903 F2
3904 E2
3905 E3
3906 E4
3910 A4
3911 A4
3912 A5
3913 B5
3914 B5
3915 A4
3920 E4
3921 E4
3922 E4
3923 E5
3924 E5
3925 E3
3930 C4
3931 C4
3932 C5
3933 C5
5900 C2
5901 C2
5911 A7
5921 E7
5930 C4
5931 C7
6910 A7
6920 E7
6925 E4
6930 C7
7900 C2
7901 D3
7903 F3
7904 F4
7910 A5
7920 D5
7930 B5
F900 C1
F901 C2
F902 C1
F903 D2
F906 B7
F907 C7
F908 E7

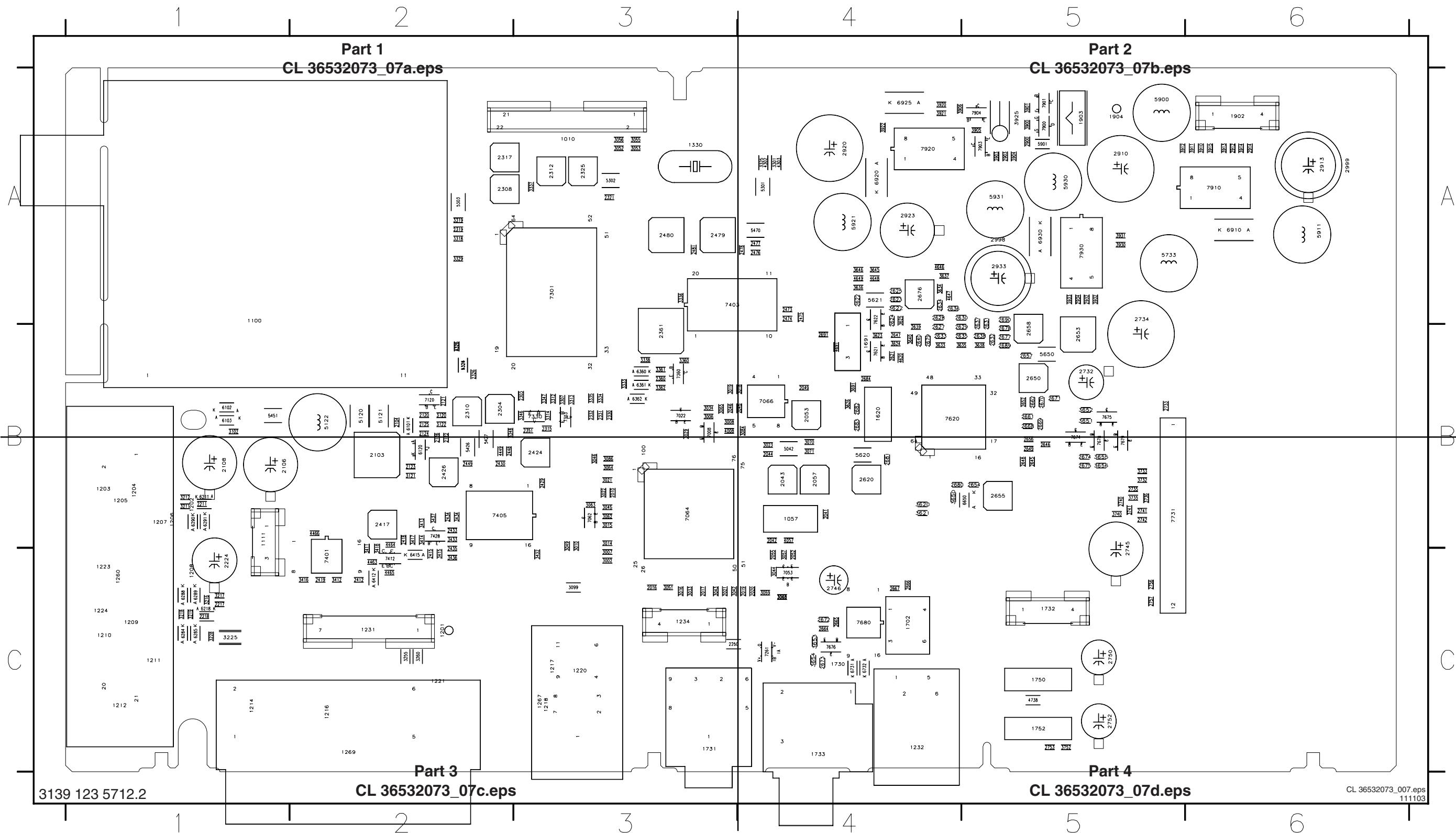
TV Board: SCART I/O



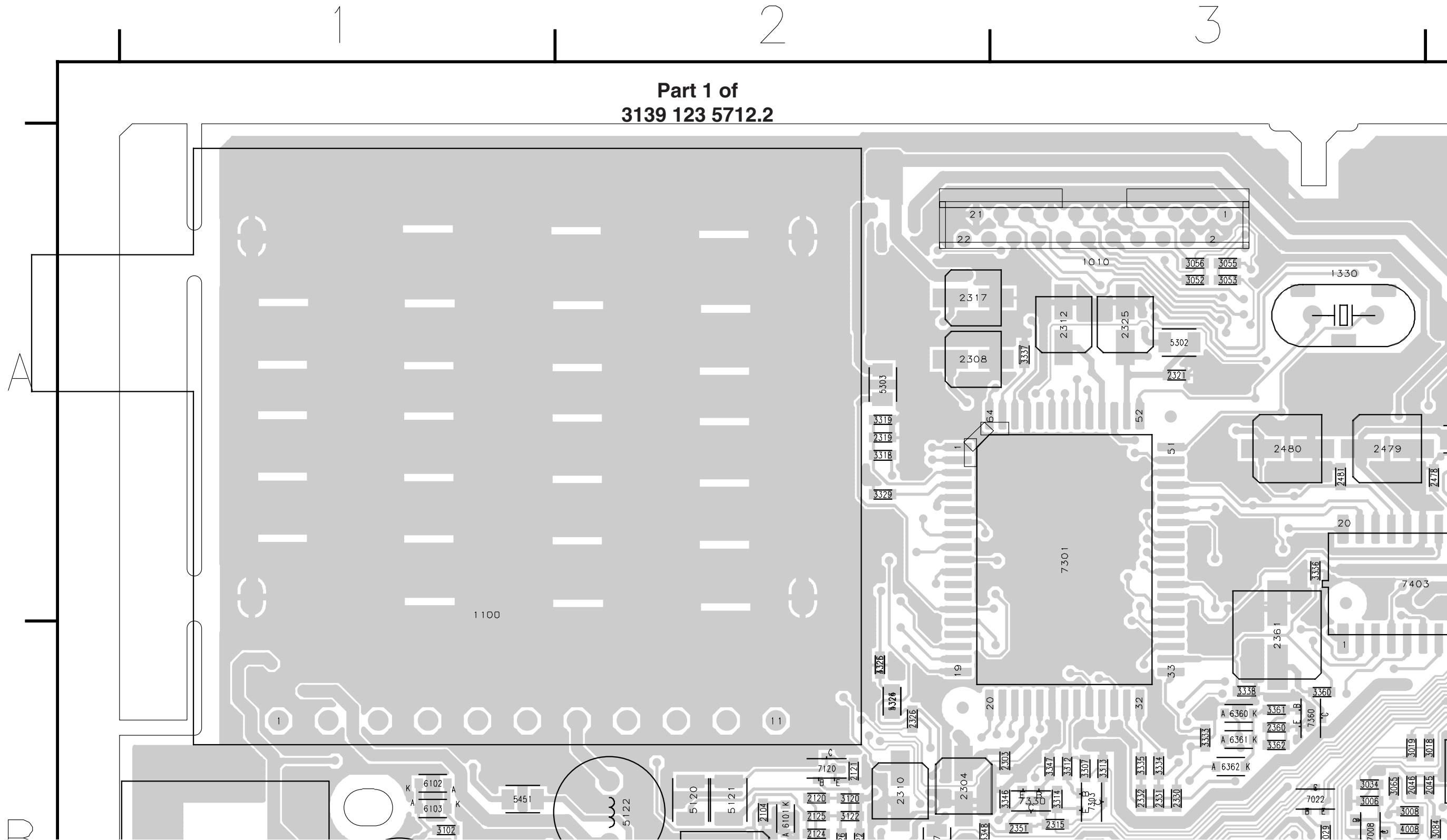
1201 E2	3257 F3
1202 A3	3258 F4
1203 A3	3259 F4
1204 B3	3260 E2
1205 B3	3261 E3
1206 B3	3262 F3
1207 C3	3263 E3
1208 C3	4201 F2
1209 D3	4202 F2
1210 D4	4203 E1
1211 D3	4242 D8
1212 E4	4299 B6
1214 E7	6207 C7
1216 F7	6208 D7
1217 D7	6211 B2
1218 B6	6218 C2
1220 C6	6227 F4
1221 C6	6228 F4
1223 B4	6238 F7
1224 B4	6239 F7
1231 E1	6243 B7
1234 F1	6244 B7
1260 D5	6250 E2
1267-A C5	6253 E7
1267-B C6	6254 E7
1268-1 F5	6257 F4
1268-2 E5	6281 D4
1269 C5	6282 E4
2201 A3	6283 B4
2203 A3	6284 D3
2206 B3	6285 D3
2208 B3	6286 D4
2211 B2	6287 D4
2214 C3	6288 C4
2217 C2	6289 C4
2218 C2	6290 B3
2222 D2	6291 B3
2224 D2	6292 B4
2225 D2	7224 D1
2227 E3	7260 F2
2233 E8	7261 F3
2238 F8	F201 A4
2242 D8	F202 A4
2244 B8	F203 A4
2249 C8	F204 A4
2250 E3	F205 A4
2254 E3	F206 B4
3201 A3	F207 B4
3202 A2	F208 C4
3203 A3	F210 C4
3204 A2	F212 E7
3206 A3	F214 E7
3207 B2	F215 D7
3208 B3	F217 A7
3209 B2	F218 C4
3211 B3	F221 E1
3212 B3	F222 E1
3213 C3	F223 F1
3214 C2	F224 F1
3216 C3	F225 E4
3217 C3	F226 E4
3218 C2	F227 F4
3219 C2	F228 F4
3221 D2	F230 F4
3222 D2	F231 C7
3223 D3	
3224 D2	
3225 D1	
3226 E4	
3227 E3	
3228 D1	
3233 E7	
3234 E8	
3238 E7	
3239 F8	
3241 D7	
3242 D8	
3243 B7	
3244 A7	
3248 C7	
3249 C7	
3255 E2	
3256 E4	

Layout TV Board (13"/15") (Overview Top Side)

1010	A3	1691	B4	2019	C4	2104	B2	2303	B3	2360	B3	2449	B2	2625	A4	2645	B5	2664	C4	2679	B4	2742	B5	2923	A4	3019	B3	3053	A3	3102	B1	3307	B3	3346	B3	3433	B2	3637	A4	3735	B5	3914	A6	4325	B2	5121	B2	5901	A5	6290	B1	7022	B3	7428	B2	7910	A6		
1057	B4	1702	C4	2020	C4	2106	B1	2304	B2	2361	B3	2473	A4	2627	B4	2646	B5	2665	C4	2680	B4	2745	C5	2932	A5	3021	B3	3055	A3	3120	B2	3312	B3	3347	B3	3434	B2	3638	B5	3736	B5	3915	A6	4449	B2	5122	B2	5911	A6	6291	B1	7053	C4	7620	B4	7920	A6	7930	A6
1100	A1	1730	C4	2021	C3	2108	B1	2308	A2	2412	C2	2474	A4	2628	A4	2647	B4	2666	C4	2681	B4	2746	C4	2933	A5	3022	B3	3056	A3	3121	B2	3313	B3	3348	B2	3436	C2	3640	B4	3740	B5	3920	A4	4463	C2	5301	A4	5921	A4	6360	B3	7062	B3	7621	B4	7930	A6		
1111	B1	1731	C3	2041	B4	2120	B2	2310	B2	2415	C2	2475	A4	2629	B5	2648	B5	2667	C4	2682	B4	2750	C5	2934	A5	3023	B4	3057	C4	3122	B2	3314	B3	3360	B3	3437	B2	3645	A4	3741	B5	3921	A4	4464	B2	5302	A3	5930	A5	6361	B3	7064	B3	7622	A4				
1201	C2	1732	C5	2042	B4	2121	B2	2312	A3	2417	B2	2476	A4	2630	A5	2649	B5	2668	B5	2683	B4	2752	C5	2998	A5	3029	B3	3059	C4	3211	B1	3318	A2	3361	B1	3620	B4	3646	A4	3752	C5	3922	A4	4465	C2	5303	A2	5931	A5	6362	B3	7066	B4	7674	B5				
1206	B1	1733	C4	2043	B4	2122	B2	2315	B3	2418	B2	2477	A4	2631	A5	2650	B5	2669	B5	2684	B4	2753	C5	2999	A6	3033	C3	3060	D4	3212	B1	3319	A2	3362	B1	3621	B4	3650	B4	3900	A5	3925	A5	4466	B2	5326	B2	6101	B2	6412	C2	7120	B2	7675	B5				
1208	C1	1750	C5	2044	B4	2123	B2	2317	A2	2419	C2	2478	A4	2632	B5	2652	B5	2670	B5	2689	B5	2756	C5	3002	C3	3034	B3	3062	B3	3216	C1	3325	A4	3411	C2	3622	A4	3651	B5	3901	A5	3930	A5	4620	B4	5426	B2	6102	B1	6415	C2	7261	C4	7676	C4				
1231	C2	1752	C5	2045	B4	2124	B2	2319	A2	2424	B3	2479	A3	2633	B4	2653	B5	2671	B5	2690	A5	2757	C5	3006	B3	3042	C3	3063	B3	3217	C1	3326	B2	3412	C2	3623	B4	3652	B5	3903	A5	3931	A5	4646	A4	5427	B2	6103	B1	6650	B5	7301	A3	7678	B5				
1232	C4	1902	A6	2046	B3	2125	B2	2321	A3	2426	B2	2480	A3	2634	A4	2654	B5	2672	C4	2691	B4	2900	A5	3007	C3	3043	C3	3064	B3	3218	C1	3329	A2	3413	B2	3624	B4	3653	C4	3904	A5	3932	A5	4647	A4	5451	B1	6120	B2	6731	C4	7303	B3	7679	B5				
1234	C3	1903	A5	2049	B4	2126	B2	2325	A3	2429	B3	2481	A3	2635	B5	2655	B5	2673	C4	2732	B5	2903	A5	3008	B3	3044	C4	3065	B3	3219	C1	3333	B3	3414	B2	3625	A4	3654	C4	3905	A5	3948	A4	4570	A4	6211	B1	6732	C4	7330	B3	7680	C4						
1260	C1	1904	A5	2052	C4	2211	B1	2326	B2	2430	B2	2620	B4	2636	A4	2656	B5	2674	B5	2733	B5	2910	A5	3010	B3	3045	B3	3070	B4	3225	C1	3334	B3	3415	C2	3626	B4	3655	B5	3906	A4	4008	B3	4649	A4	5620	B4	6218	C1	6910	A6	7360	B3	7731	B5				
1267	C3	2010	B3	2053	B4	2217	C1	2330	B3	2433	B2	2621	B4	2637	A5	2657	B5	2675	B5	2734	A5	2912	A6	3014	B3	3046	B3	3071	B4	3228	C1	3335	B3	3416	C2	3633	B4	3656	B5	3910	A6	4057	B4	4691	B4	5621	A4	6284	C1	6920	A4	7401	C2	7900	A5				
1269	C2	2016	C3	2055	C4	2218	C1	2331	B3	2434	B2	2622	A4	2638	B5	2658	B5	2676	A4	2735	B5	2913	A6	3015	B3	3049	B3	3084	B4	3255	C2	3336	A3	3417	B2	3634	A4	3691	B4	3911	A6	4302	A4	4738	C5	5650	B5	6285	C1	6925	A4	7403	B3	7901	A5				
1330	A3	2017	C3	2057	B4	2224	C1	2332	B3	2435	C2	2623	A4	2639	B4	2661	B5	2677	B5	2740	B5	2914	A6	3016	C3	3051	C3	3086	B3	3260	C2	3337	A3	3418	C2	3635	B5	3732	B5	3912	A5	4504	B4	5733	A5	6288	C1	6930	A5	7405	B2	7903	A5						
1620	B4	2018	C4	2103	B2	2250	C3	2351	B3	2448	B2	2624	A4	2640	B4	2662	B5	2678	B5	2741	B5	2920	A4	3018	B4	3052	A3	3099	C3	3301	A4	3338	B3	3432	C3	3636	A4	3733	B4	3913	C3	4324	B2	5120	B2	5900	A5	6289	C1	7008	B3	7412	C2	7904	A5				



Layout TV Board (13"/15") (Part 1 Top Side)



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141003

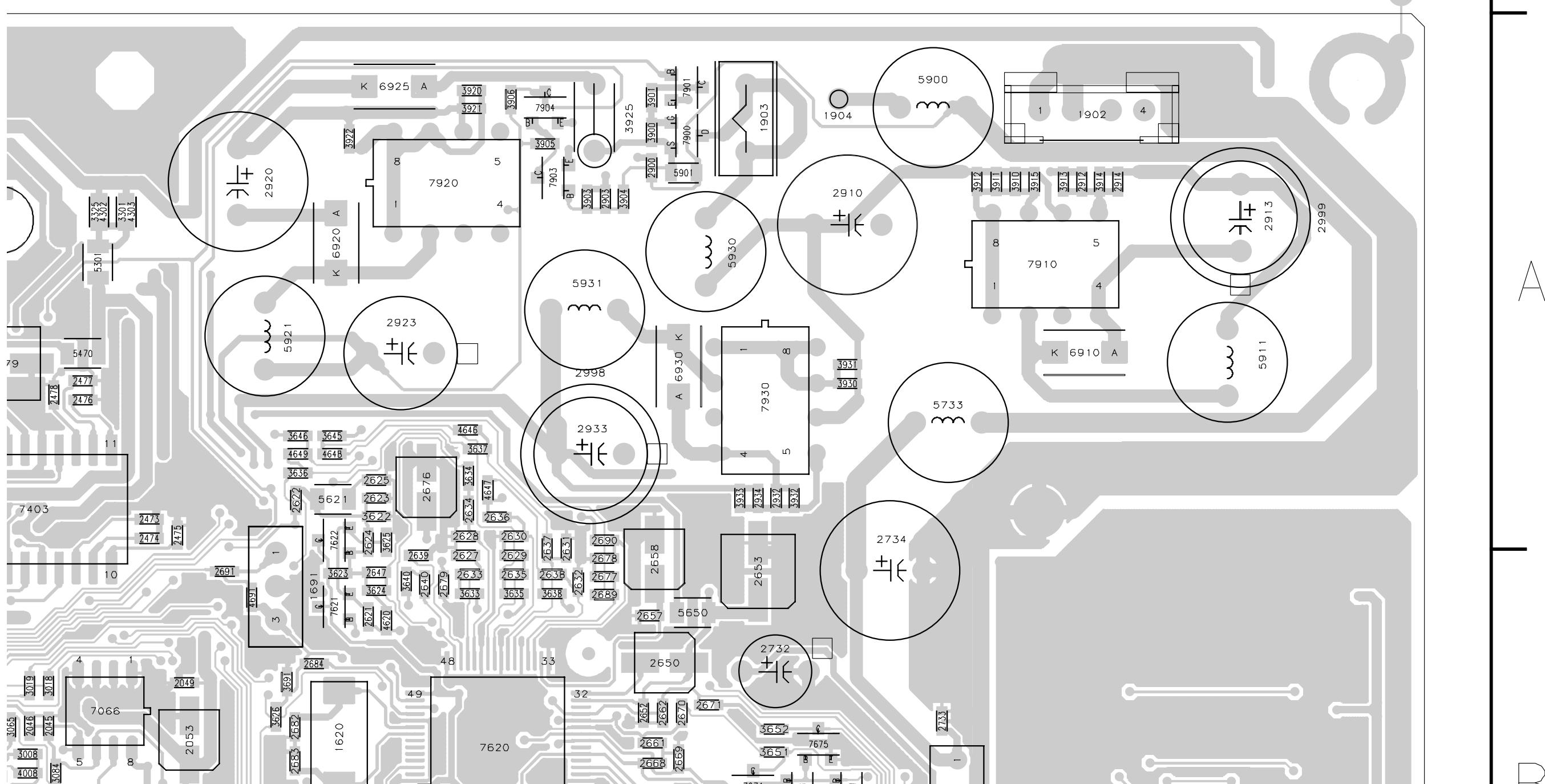
Layout TV Board (13"/15") (Part 2 Top Side)

4

5

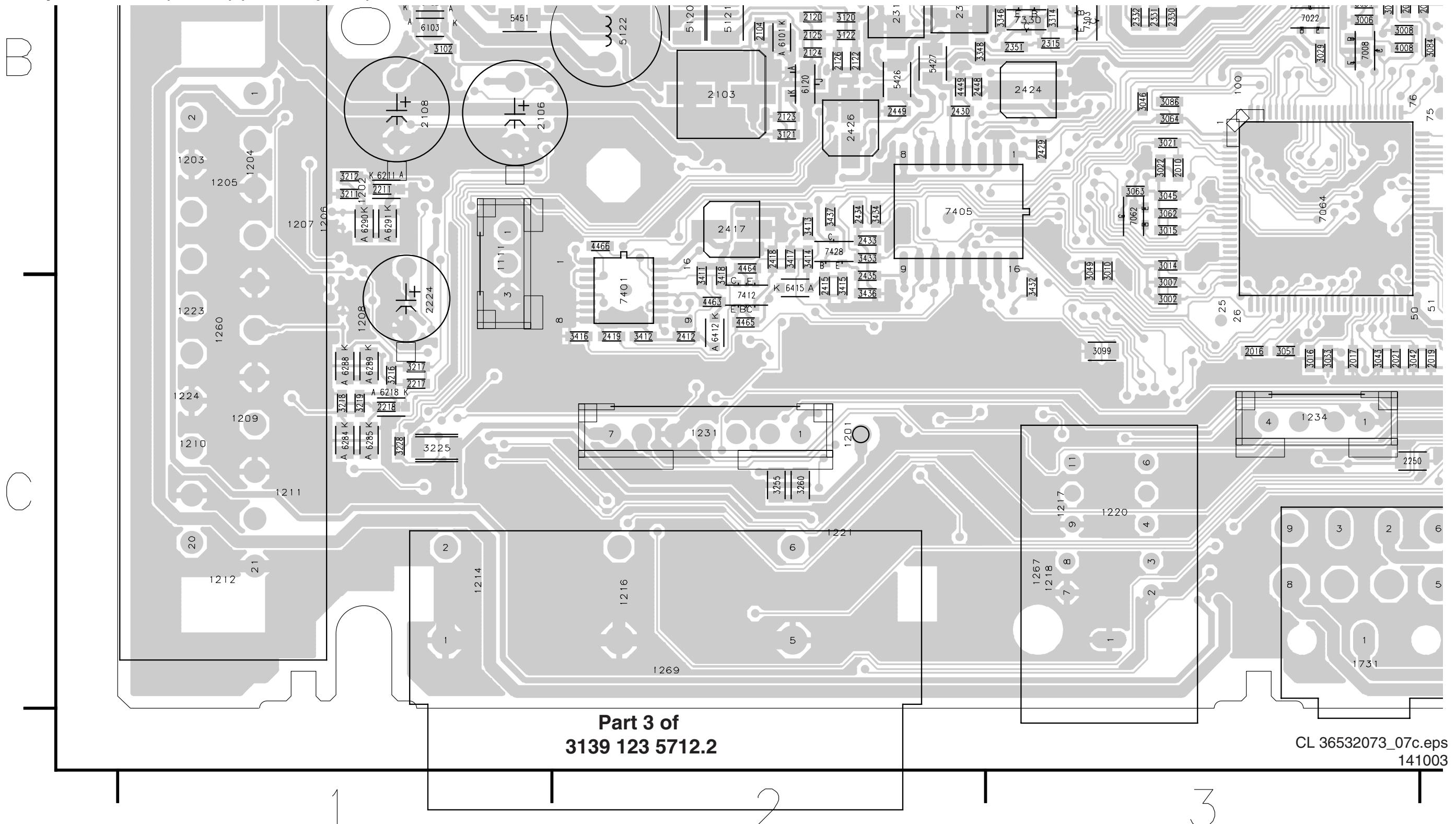
6

Part 2 of
3139 123 5712.2

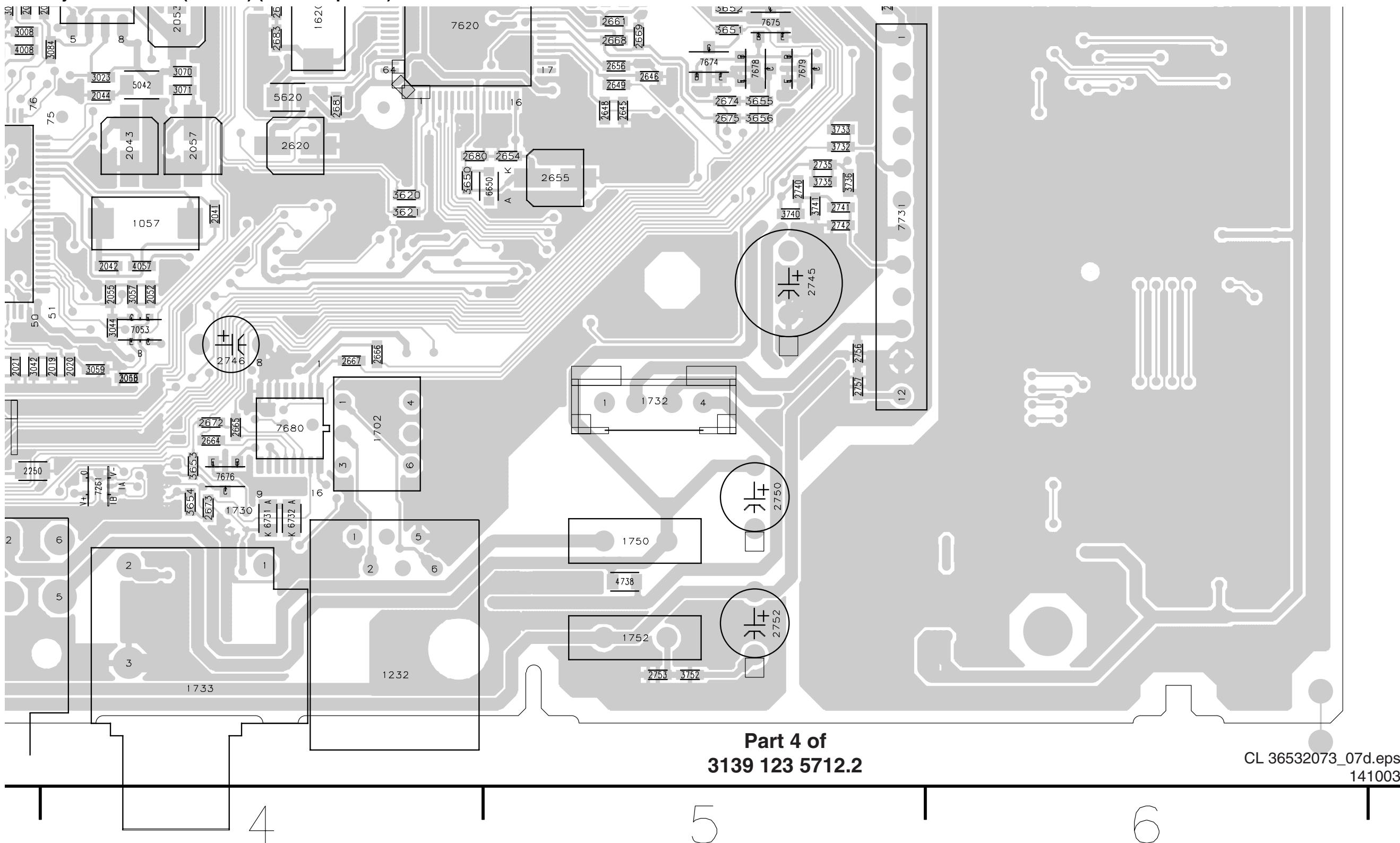


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141003

Layout TV Board (13"/15") (Part 3 Top Side)

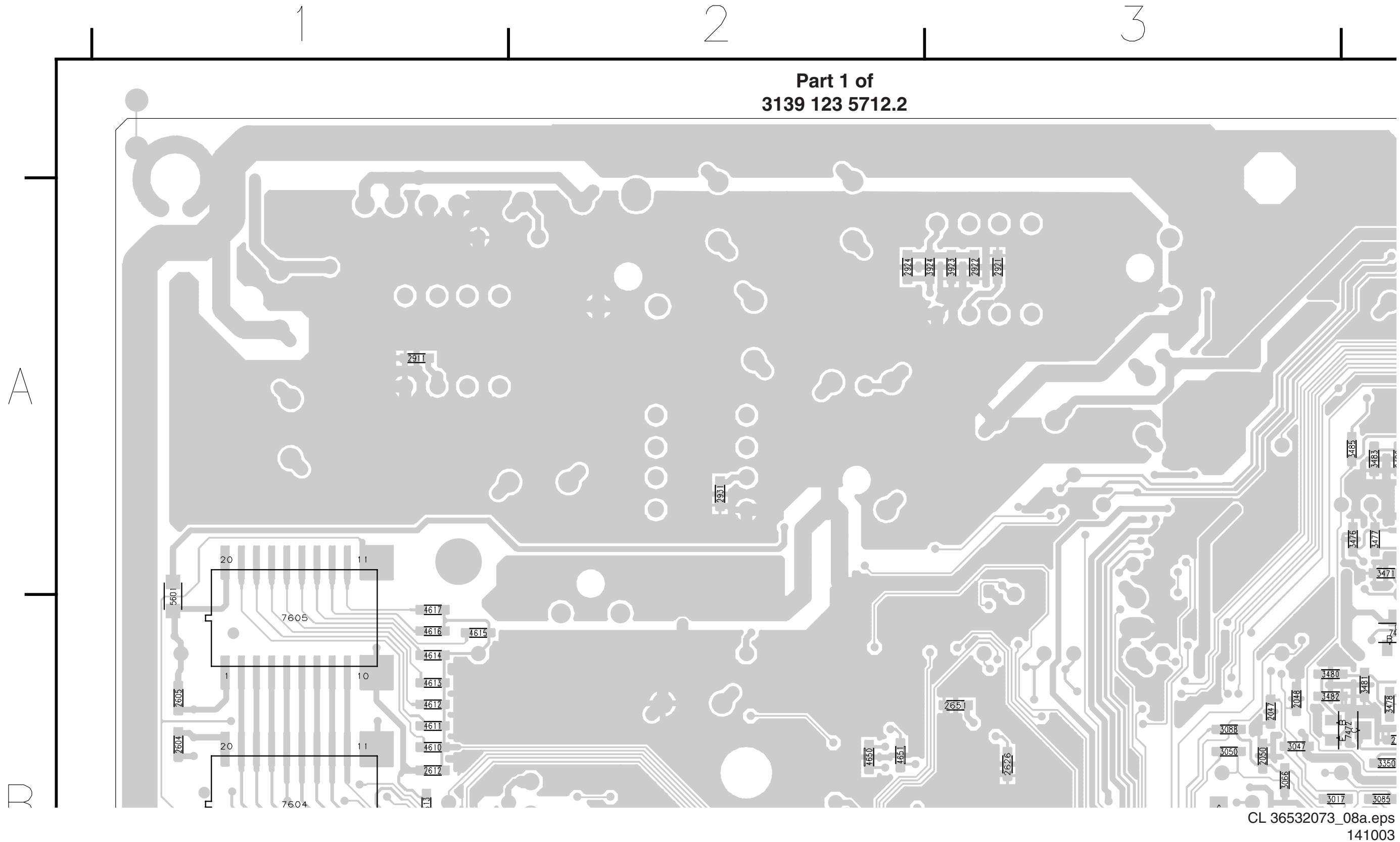


Layout TV Board (13"/15") (Part 4 Top Side)



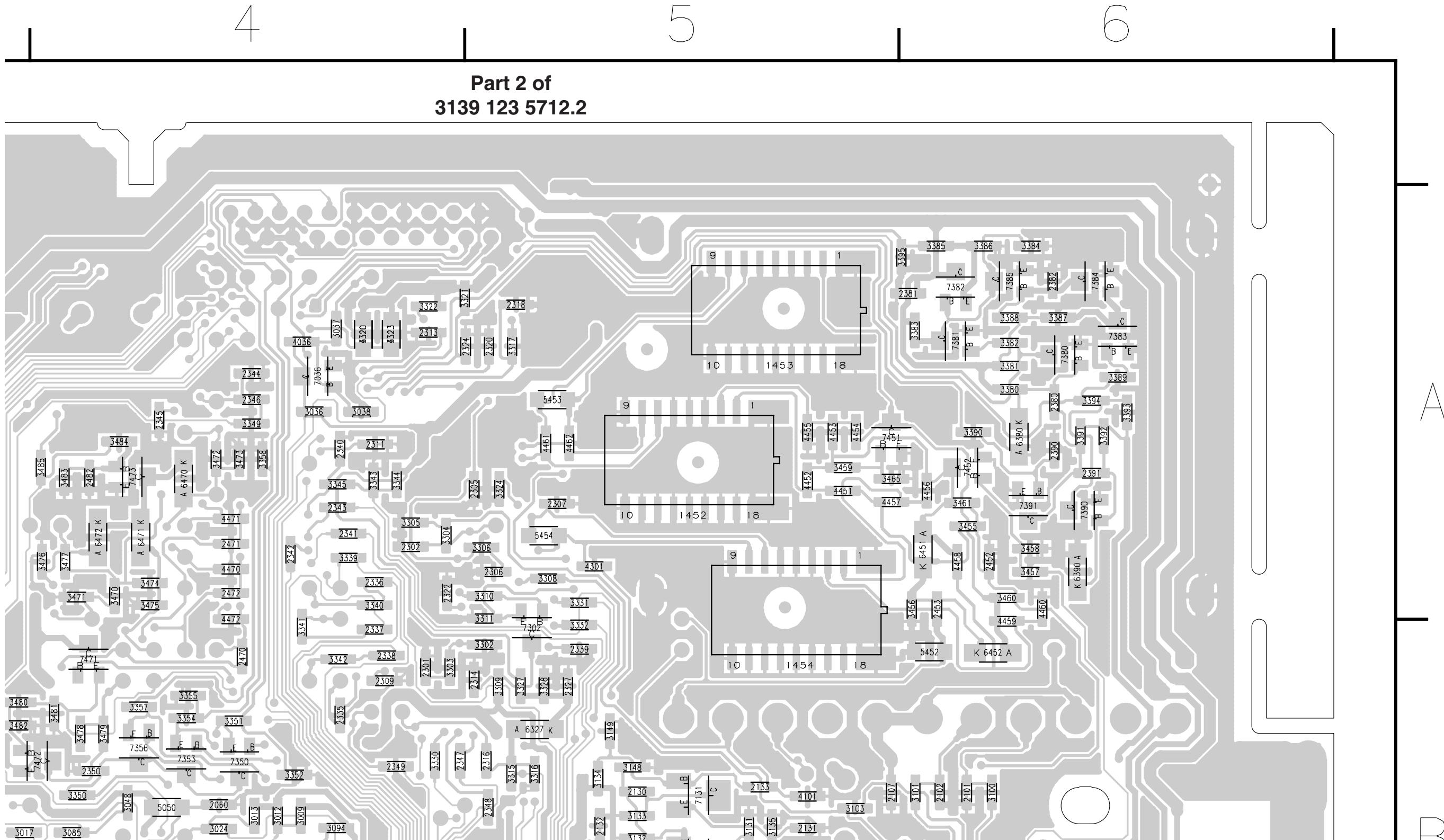
Layout TV Board (13"/15") (Overview Bottom Side)

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Layout TV Board (13"/15") (Part 1 Bottom Side)

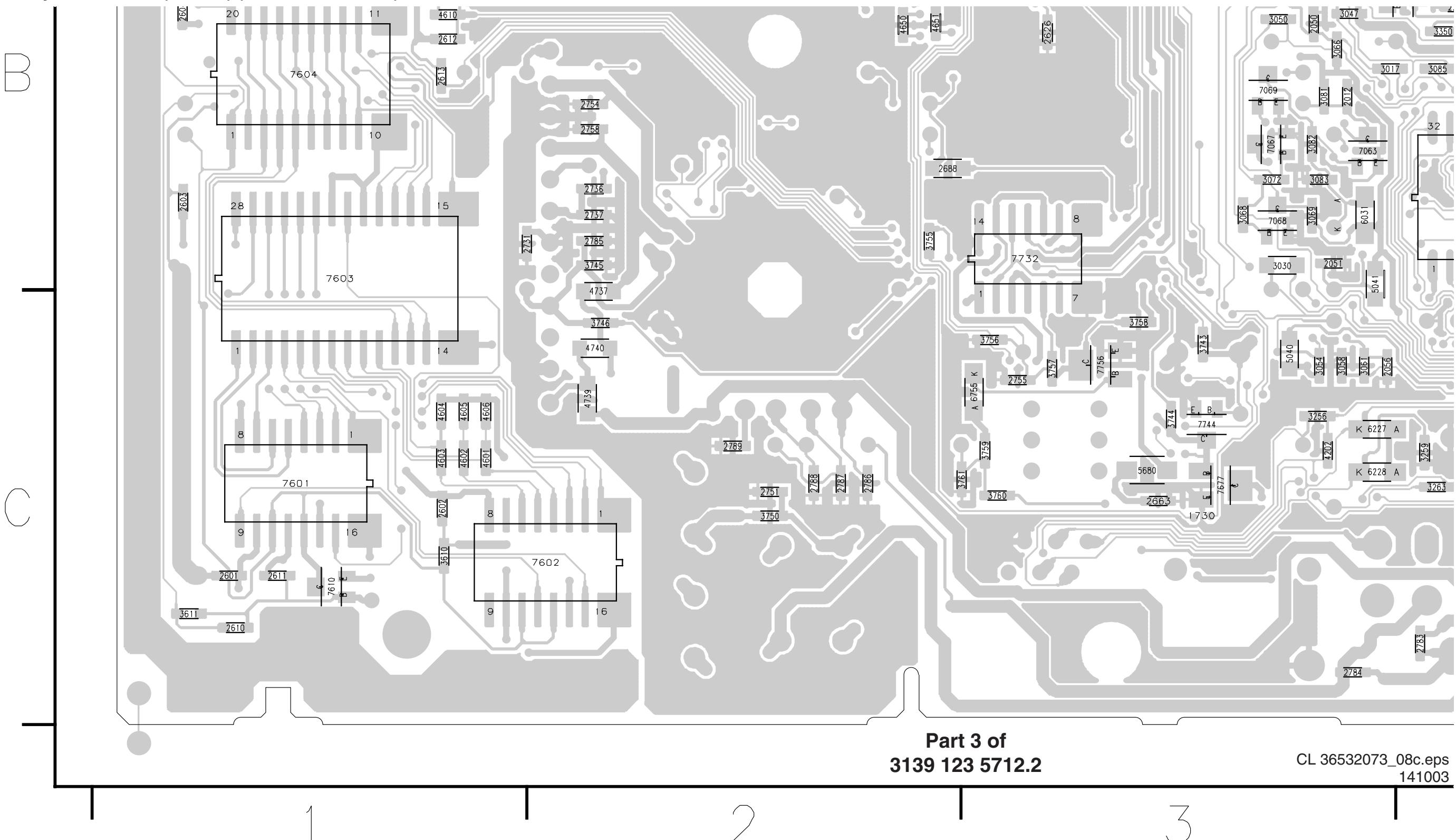
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141003

Layout TV Board (13"/15") (Part 2 Bottom Side)

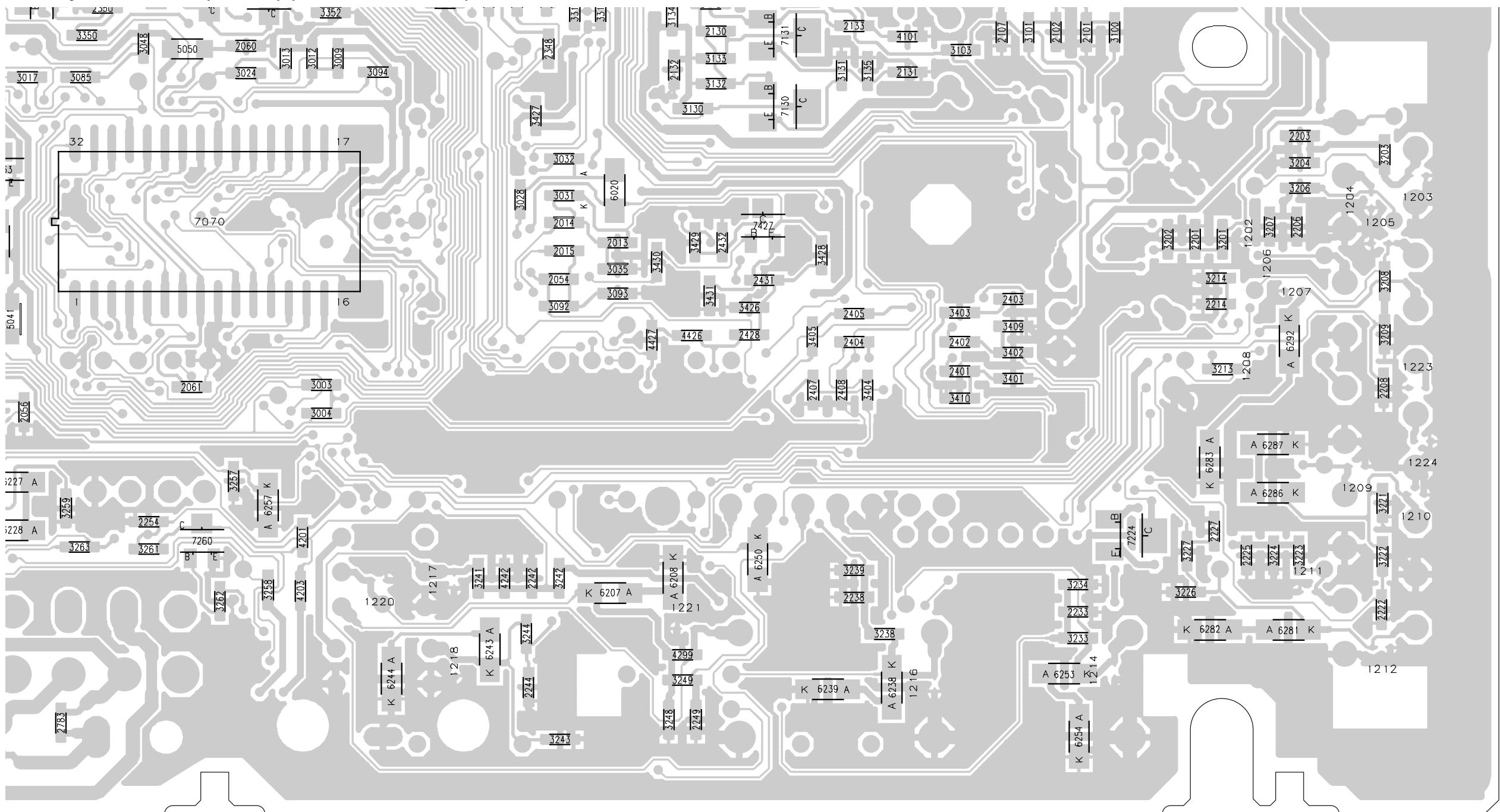


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141003

Layout TV Board (13"/15") (Part 3 Bottom Side)



Layout TV Board (13"/15") (Part 4 Bottom Side)



Part 4 of
3139 123 5712.2

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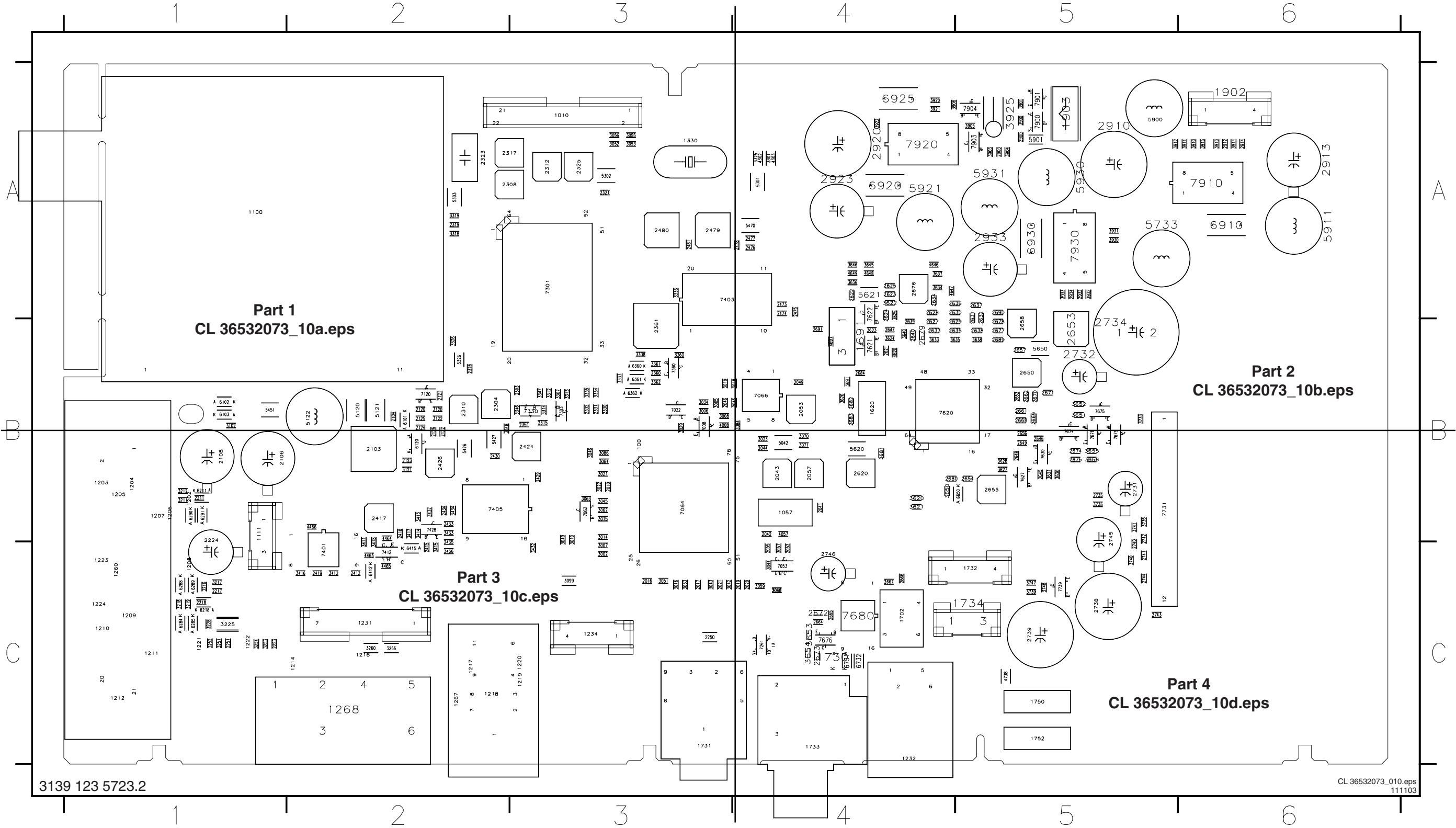
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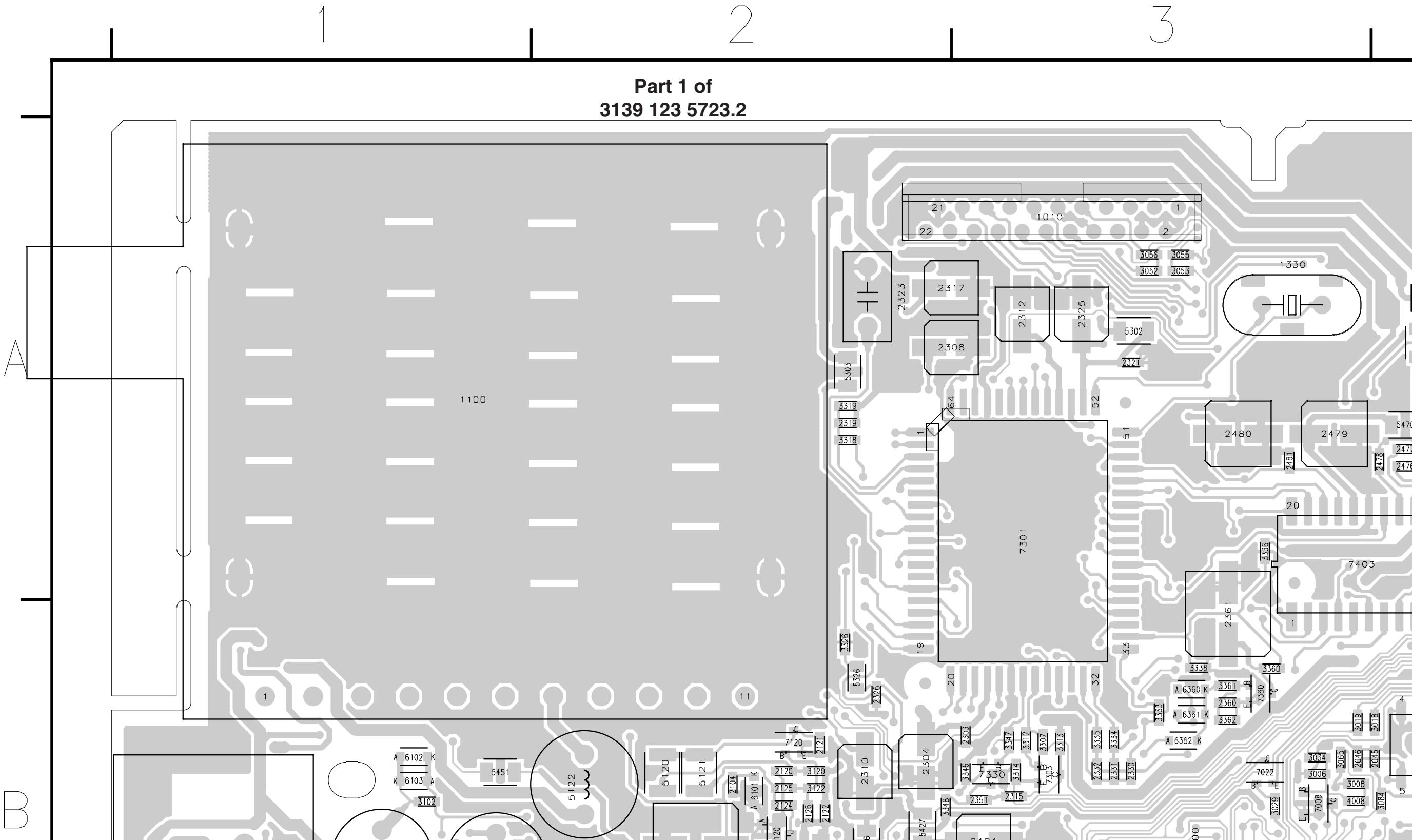
6

Layout TV Board (20") (Overview Top Side)

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1057 B4	1732 C5	2044 B2	2126 B2	2331 B3	2449 B2	2629 B5	2652 C4	2673 C4	2738 C5	2925 A5	3029 B3	3063 B3	3225 C1	3337 A3	3434 B2	3646 A4	3901 A5	3933 A5	4738 C5	5901 A5	6361 B3	7261 C4	7680 C4
1100 A1	1733 C4	2045 B4	2121 B1	2332 B3	2473 A4	2630 A5	2653 B5	2674 B5	2739 C5	2933 A5	3033 C3	3064 B3	3228 C1	3338 B3	3436 C2	3646 B4	3903 A5	4008 B3	5042 B4	5911 A6	6362 B3	7301 A3	7731 B5
1111 B1	1734 C5	2046 B3	2127 C1	2331 B3	2474 A4	2631 A5	2654 B5	2675 B5	2740 C5	2934 A5	3034 B3	3065 B3	3255 C2	3346 B3	3437 B2	3651 B5	3904 A5	4057 B4	5120 B2	5921 A4	6412 C2	7303 B3	7739 C5
1201 C2	1750 C5	2049 B4	2128 B1	2330 B3	2475 A4	2632 B5	2655 B5	2676 A4	2741 C5	2998 A5	3042 C3	3070 B4	3260 C2	3347 B3	3620 B4	3652 B5	3905 A5	4057 B4	5121 B2	5930 A5	6415 C2	7330 B3	7900 A5
1206 B1	1752 C5	2052 C4	2224 C1	2361 B3	2476 A4	2633 B4	2656 B5	2677 B5	2742 B5	2999 A6	3043 C3	3071 B4	3301 A4	3348 B2	3621 B4	3653 C4	3906 A4	4303 A4	5122 B2	5931 A5	6650 B5	7360 B3	7901 A5
1208 C1	1902 A6	2053 B4	2250 C3	2412 C2	2477 A4	2634 A4	2657 B5	2678 B5	2743 C5	3002 C3	3044 C4	3084 B4	3307 B3	3361 B3	3622 A4	3654 C4	3910 A6	4324 B2	5301 A4	6101 B2	6731 C4	7401 C2	7903 A5
1231 C2	1903 A5	2055 C4	2303 B3	2415 C2	2478 A4	2635 B5	2658 B5	2679 B4	2744 C5	3006 B3	3045 B3	3086 B3	3312 B3	3361 B3	3623 B4	3655 B5	3911 A6	4325 B2	5302 A3	6102 B1	6732 C4	7403 A3	7904 A5
1232 C4	1904 A5	2057 B4	2304 B2	2417 B2	2479 A3	2636 A5	2661 B5	2680 B4	2745 B5	3007 C3	3046 B3	3099 C3	3313 B3	3362 B3	3624 B4	3656 B5	3912 A5	4449 B2	5303 A2	6103 B1	6910 A6	7405 B2	7910 A6
1234 C3	2010 B3	2103 B2	2308 A2	2418 B2	2480 A3	2637 A5	2662 B5	2681 B4	2746 C4	3008 B3	3049 B3	3102 B1	3114 B3	3411 C2	3625 A4	3691 B4	3913 A6	4463 C2	5326 B2	6120 B2	6920 A4	7412 C2	7920 A4
1260 C1	2016 C3	2104 B2	2310 B2	2419 C2	2481 A3	2638 B5	2664 C4	2682 B4	2799 B5	3010 B3	3051 C3	3120 B2	3318 A2	3412 C2	3626 B4	3733 B5	3914 A6	4464 B2	5426 B2	6211 B1	6925 A4	7428 B2	7930 A5
1267 C3	2017 C3	2106 B1	2312 A3	2424 B3	2620 B4	2639 B4	2665 C4	2683 B4	2900 A5	3014 B3	3052 A3	3121 B2	3319 A2	3413 B2	3633 B5	3735 B5	3915 A5	4465 C2	5427 B2	6218 C1	6930 A5	7620 B4	
1269 C2	2018 C4	2108 B1	2315 B3	2426 B2	2621 B4	2640 B4	2666 C4	2684 B4	2903 A5	3015 B3	3053 A3	3122 B2	3325 A4	3414 B2	3634 A4	3736 B5	3920 A4	4466 B2	5451 B1	6284 C1	7008 B3	7621 B4	
1330 A3	2019 C4	2120 B2	2317 A2	2429 B3	2622 A4	2645 B5	2667 C4	2689 B5	2910 A5	3016 C3	3055 A3	3211 B1	3326 B2	3415 C2	3635 B5	3739 C5	3921 A5	4620 B4	5470 A4	6285 C1	7022 B3	7622 A4	
1620 B4	2020 C4	2121 B2	2319 A2	2430 B2	2623 A4	2646 B5	2668 B5	2690 A5	2912 A6	3018 B4	3056 A3	3212 B1	3329 A2	3416 C2	3636 B4	3740 C5	3922 A4	4646 A4	5620 B4	6288 C1	7053 C4	7674 B5	
1691 B4	2021 C3	2122 B2	2321 A3	2433 B2	2624 A4	2647 B4	2669 B5	2691 B4	2913 A6	3019 B3	3057 C4	3216 C1	3333 B3	3417 B2	3637 A4	3741 B5	3925 A5	4647 A4	5621 A4	6289 C1	7062 B3	7675 B5	
1702 C4	2041 B4	2123 B2	2325 A3	2434 B2	2625 A4	2648 B5	2670 B5	2732 B5	2914 A6	3021 B3	3059 C4	3217 C1	3334 B3	3418 B2	3638 B5	3747 C5	3930 A5	4648 A4	5650 B5	6290 B1	7064 B3	7676 C4	
1730 C4	2042 B4	2124 B2	2326 B2	2435 C2	2627 B4	2649 B5	2671 B5	2734 B5	2920 A4	3022 B3	3060 C4	3218 C1	3335 B3	3432 C3	3640 B4	3748 C5	3931 A5	4649 A4	5733 A5	6291 B1	7066 B4	7678 B5	

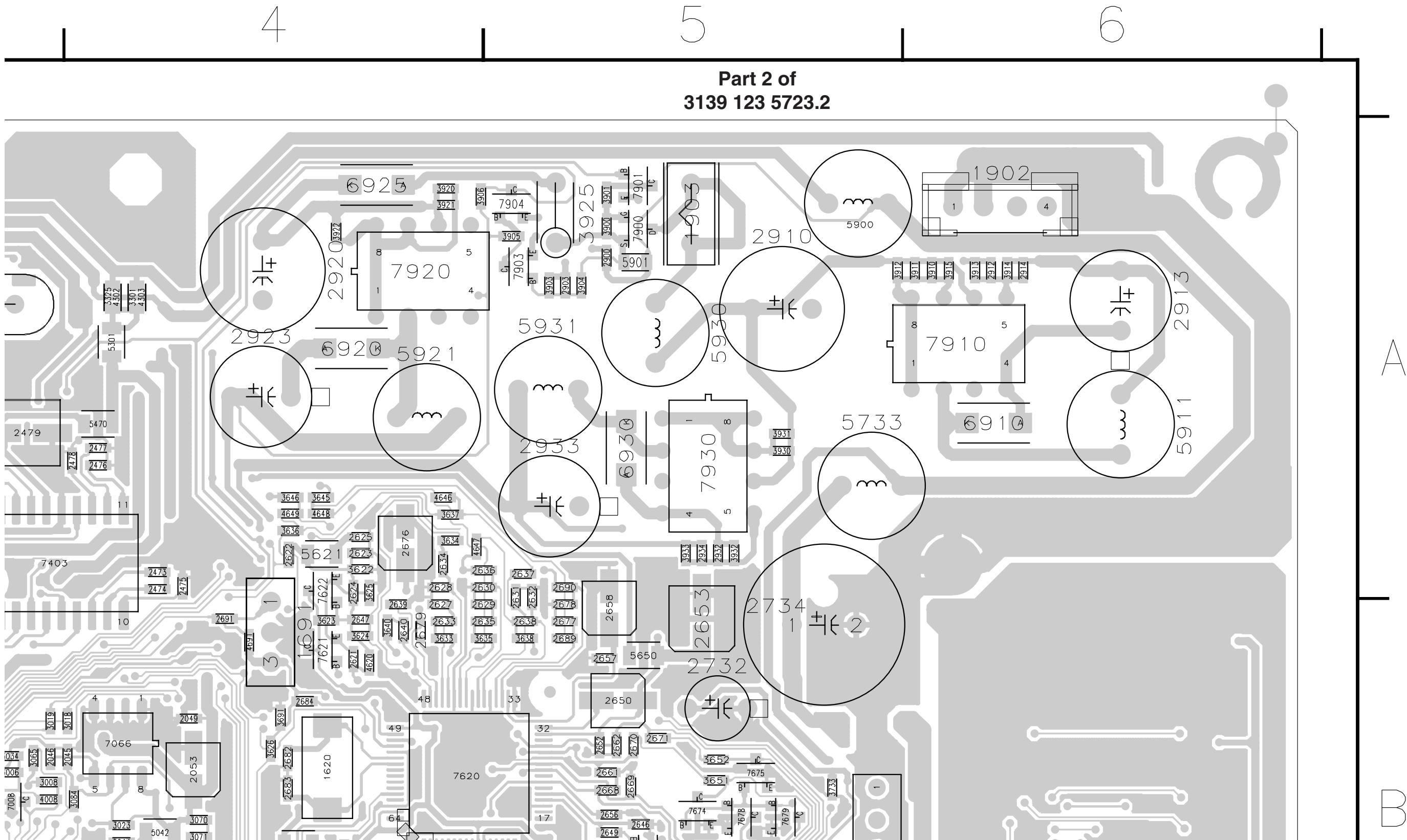


Layout TV Board (20") (Part 1 Top Side)



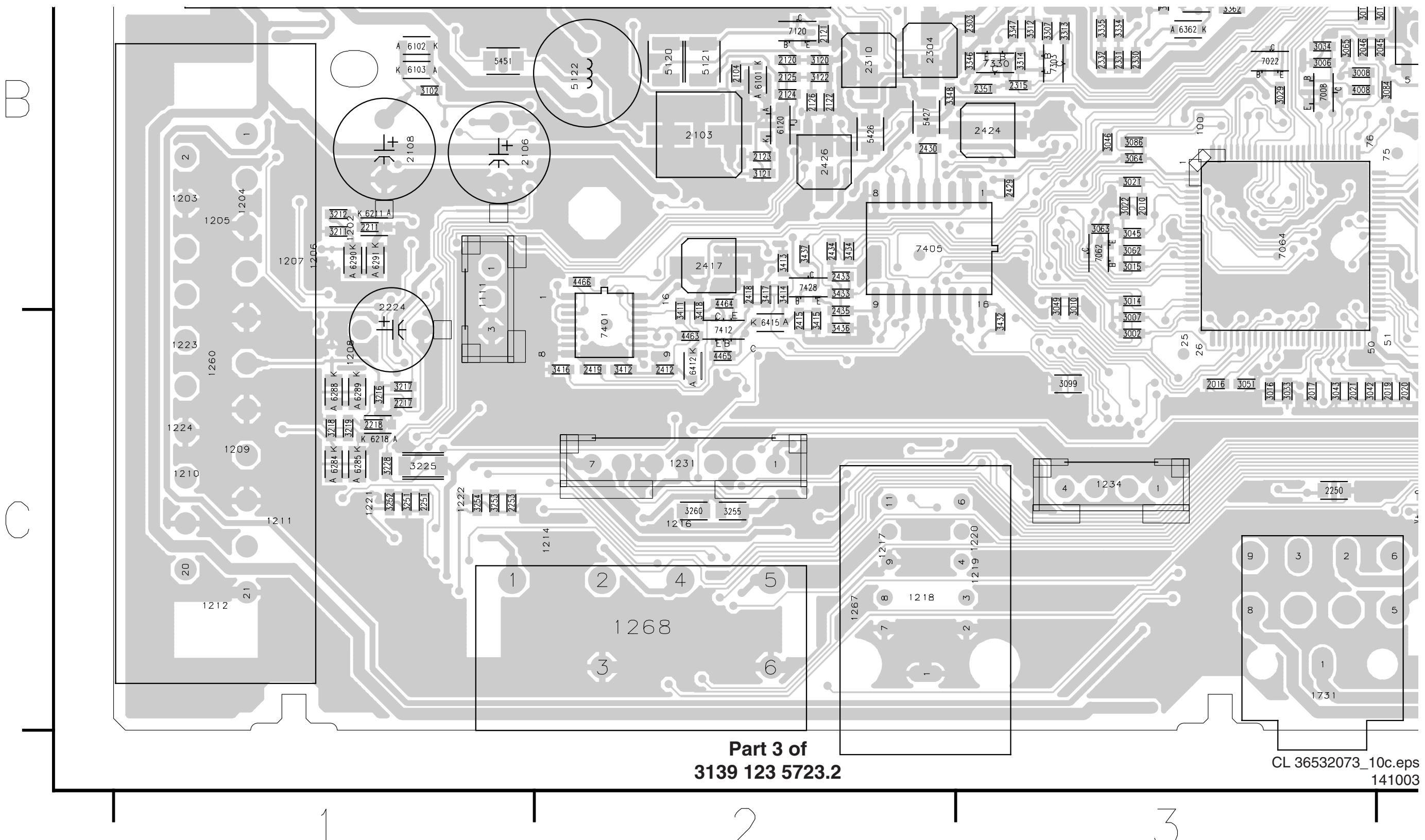
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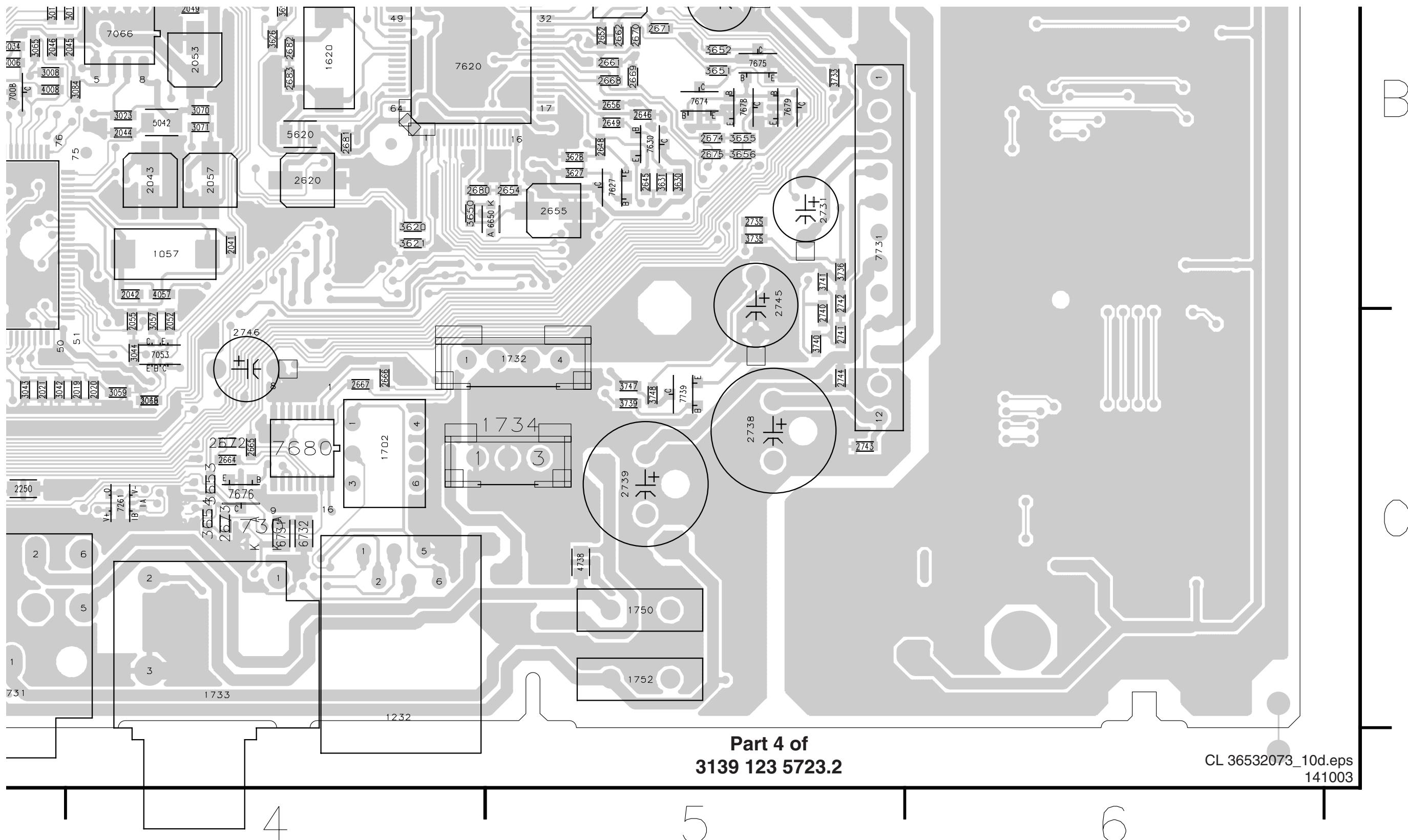
Layout TV Board (20") (Part 2 Top Side)



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141003

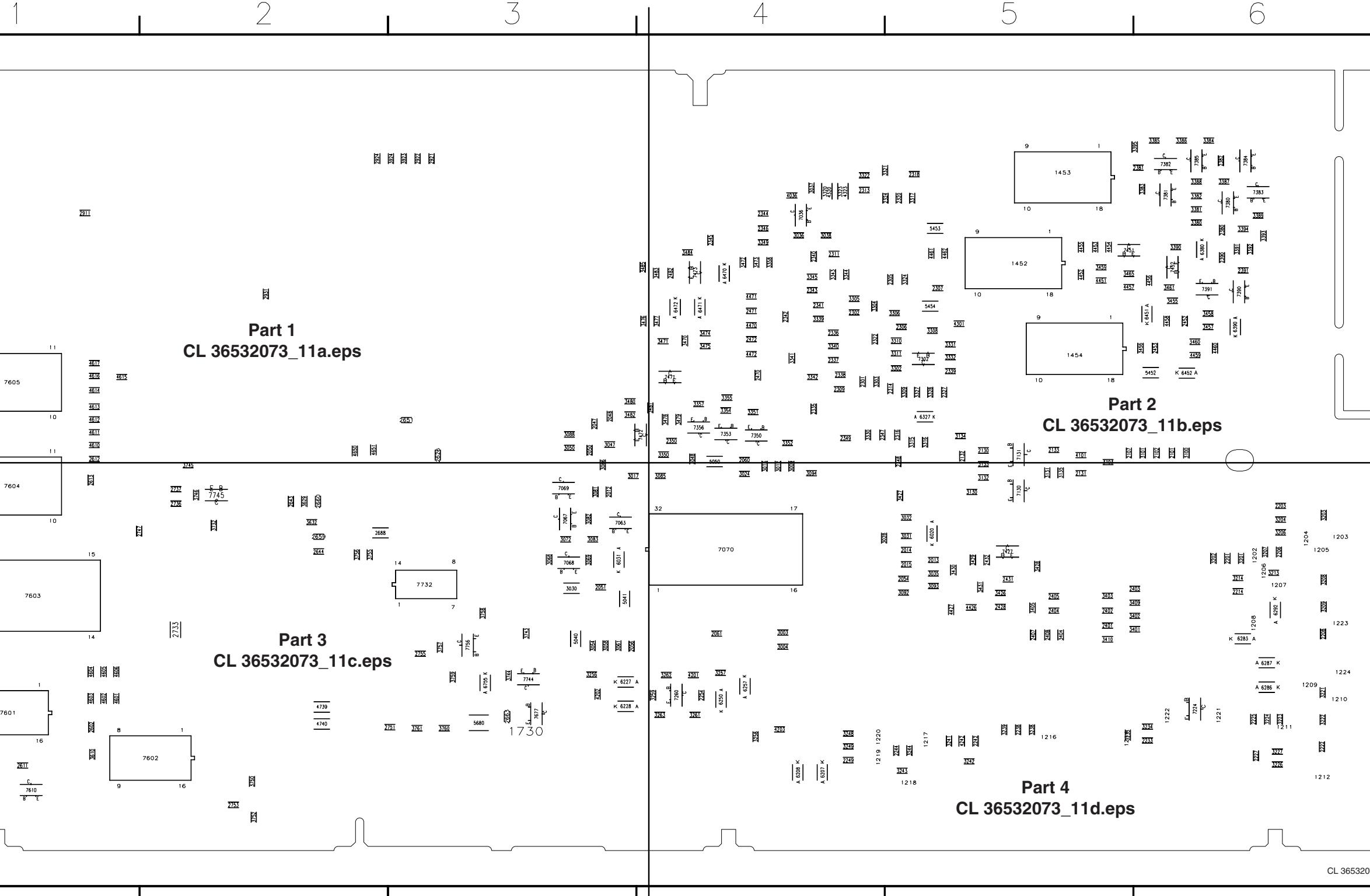
Layout TV Board (20") (Part 3 Top Side)



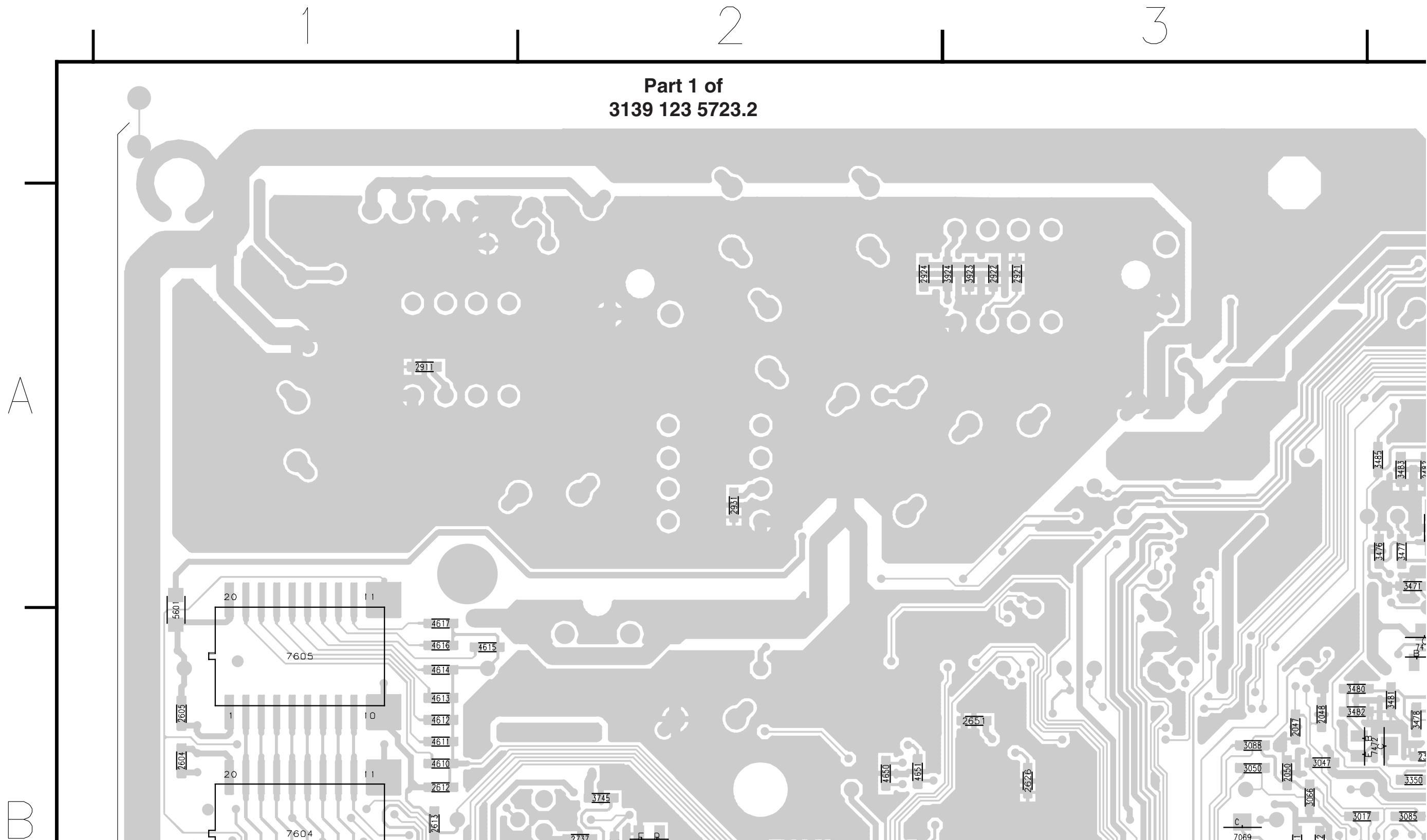
Layout TV Board (20") (Part 4 Top Side)

Layout TV Board (20") (Overview Bottom Side)

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1203	B6	1224	C5	2061	B4	2226	C5	2314	A5	2343	A4	2403	C5	2602	C1	2664	C3	3005	C4	3050	D4	3224	C5	3304	B4	3325	A4	3428	A4	3473	A4	3612	C3	3761	C3	4452	A5	4602	C1	4652	B2	6228	C3	6473	A4	7357	B4	7602	C1
1204	B6	1225	C5	2062	B4	2227	C5	2315	A5	2344	A4	2404	C5	2603	C1	2665	C3	3006	C4	3051	D4	3225	C5	3305	B4	3326	A4	3429	A4	3474	A4	3613	C3	3762	C3	4453	A5	4603	C1	4653	B2	6229	C3	6474	A4	7358	B4	7603	C1
1205	B6	1226	C5	2063	B4	2228	C5	2316	A5	2345	A4	2405	C5	2604	C1	2666	C3	3007	C4	3052	D4	3226	C5	3306	B4	3327	A4	3430	A4	3475	A4	3614	C3	3763	C3	4454	A5	4604	C1	4654	B2	6230	C3	6475	A4	7359	B4	7604	C1
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1208	B6	1229	C5	2066	B4	2231	C5	2319	A5	2348	A4	2408	C5	2607	C1	2669	C3	3010	C4	3055	D4	3229	C5	3309	B4	3330	A4	3433	A4	3478	A4	3617	C3	3766	C3	4457	A5	4607	C1	4657	B2	6233	C3	6478	A4	7362	B4	7607	C1
1209	B6	1230	C5	2067	B4	2232	C5	2320	A5	2349	A4	2409	C5	2608	C1	2670	C3	3011	C4	3056	D4	3230	C5	3310	B4	3331	A4	3434	A4	3479	A4	3618	C3	3767	C3	4458	A5	4608	C1	4658	B2	6234	C3	6479	A4	7363	B4	7608	C1
1210	B6	1231	C5	2068	B4	2233	C5	2321	A5	2350	A4	2410	C5	2609	C1	2671	C3	3012	C4	3057	D4	3231	C5	3311	B4	3332	A4	3435	A4	3480	A4	3619	C3	3768	C3	4459	A5	4609	C1	4659	B2	6235	C3	6480	A4	7364	B4	7609	C1
1211	B6	1232	C5	2069	B4	2234	C5	2322	A5	2351	A4	2411	C5	2610	C1	2672	C3	3013	C4	3058	D4	3232	C5	3312	B4	3333	A4	3436	A4	3481	A4	3620	C3	3769	C3	4460	A5	4610	C1	4660	B2	6236	C3	6481	A4	7365	B4	7610	C1
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1218	B6	1239	C5	2076	B4	2241	C5	2329	A5	2358	A4	2418	C5	2617	C1	2679	C3	3020	C4	3065	D4	3239	C5	3319	B4	3340	A4	3443	A4	3488	A4	3627	C3	3776	C3	4467	A5	4617	C1	4667	B2	6243	C3	6488	A4	7372	B4	7617	C1
1219	B6	1240	C5	2077	B4	2242	C5	2330	A5	2359	A4	2419	C5	2618	C1	2680	C3	3021	C4	3066	D4	3240	C5	3320	B4	3341	A4	3444	A4	3489	A4	3628	C3	3777	C3	4468	A5	4618	C1	4668	B2	6244	C3	6489	A4	7373	B4	7618	C1
1220	B6	1241	C5	2078	B4	2243	C5	2331	A5	2360	A4	2420	C5	2619	C1	2681	C3	3022	C4	3067	D4	3241	C5	3321	B4	3342	A4	3445	A4	3490	A4	3629	C3	3778	C3	4469	A5	4619	C1	4669	B2	6245	C3	6490	A4	7374	B4	7619	C1

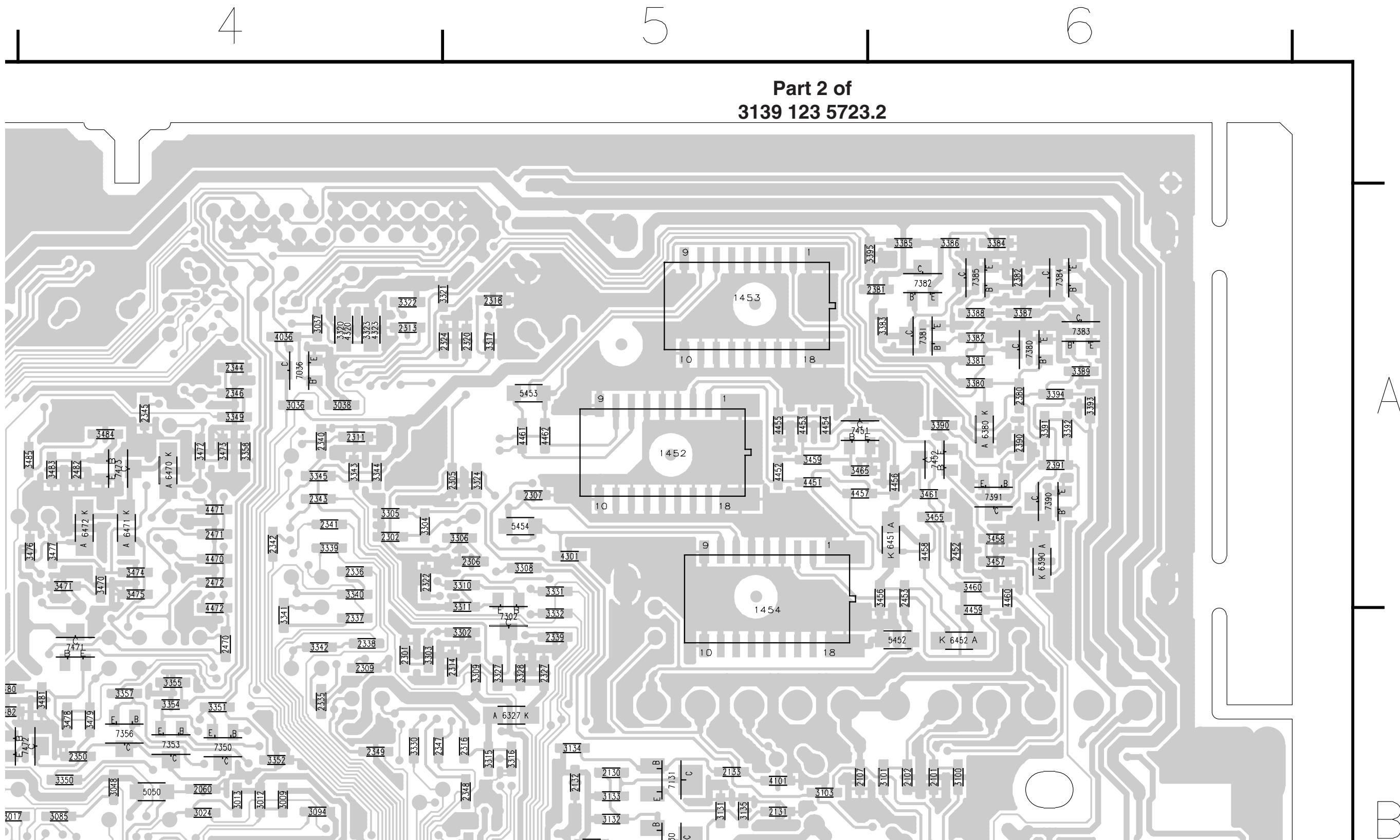


Layout TV Board (20") (Part 1 Bottom Side)



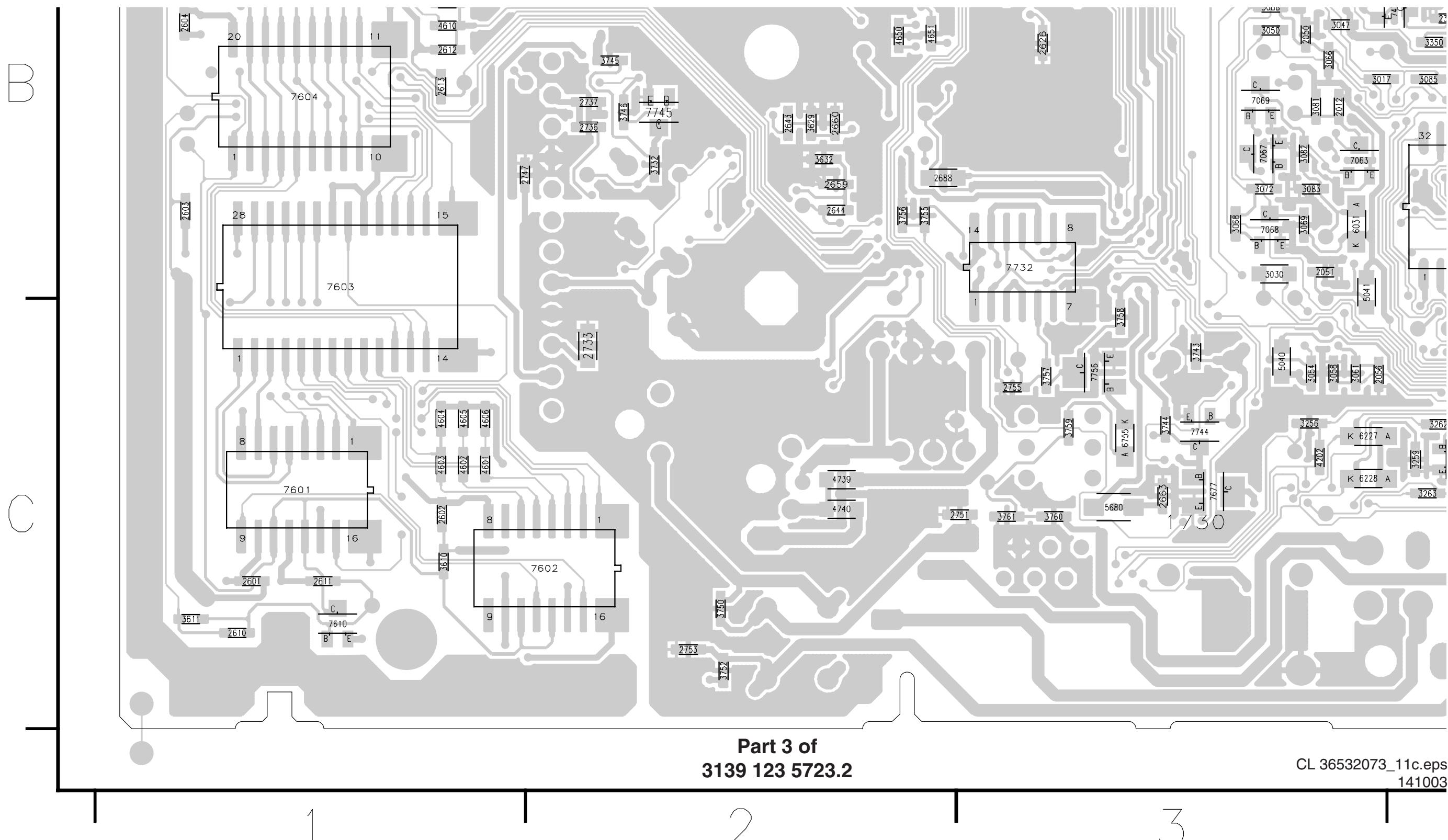
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141003

Layout TV Board (20") (Part 2 Bottom Side)

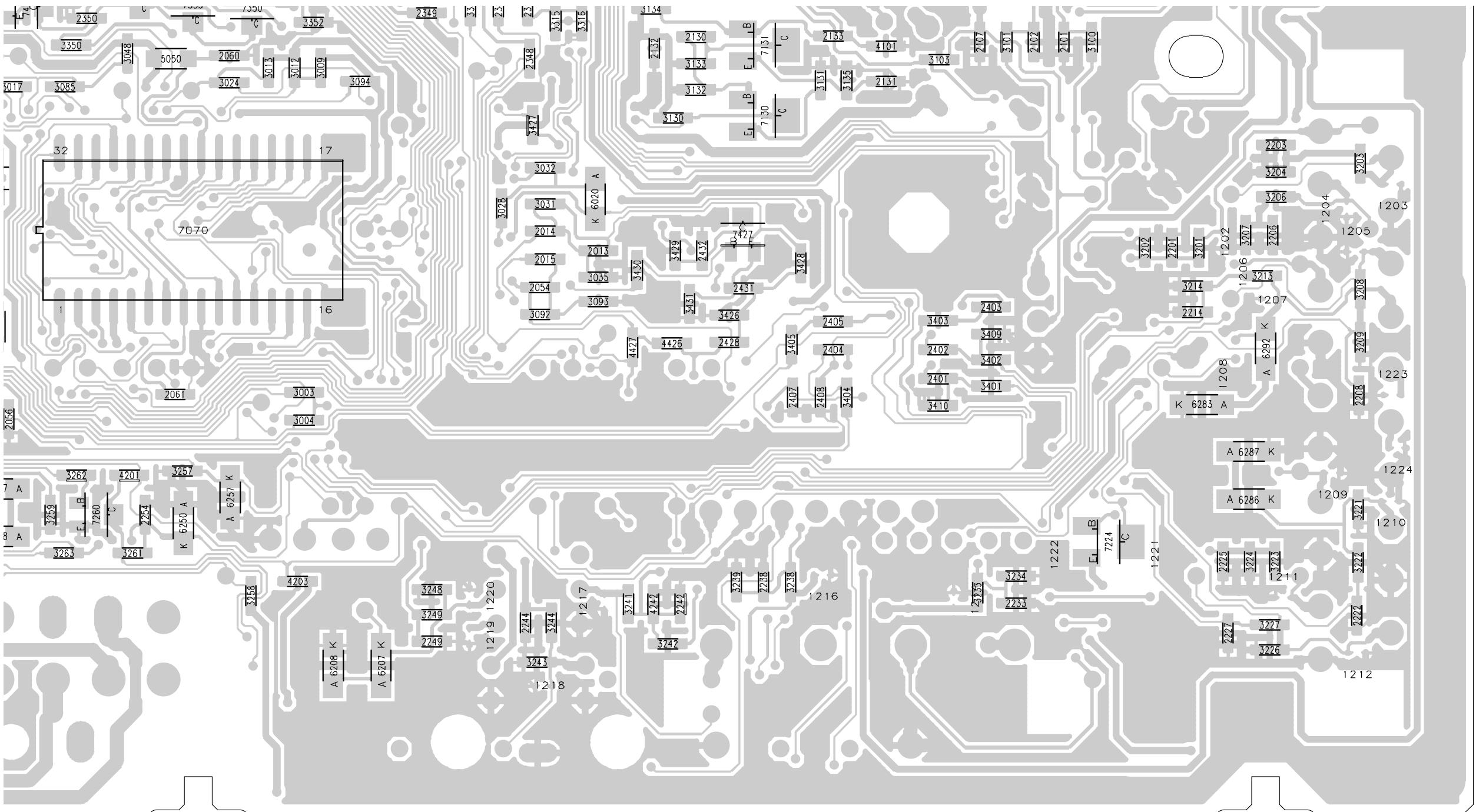


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Layout TV Board (20") (Part 3 Bottom Side)



Layout TV Board (20") (Part 4 Bottom Side)

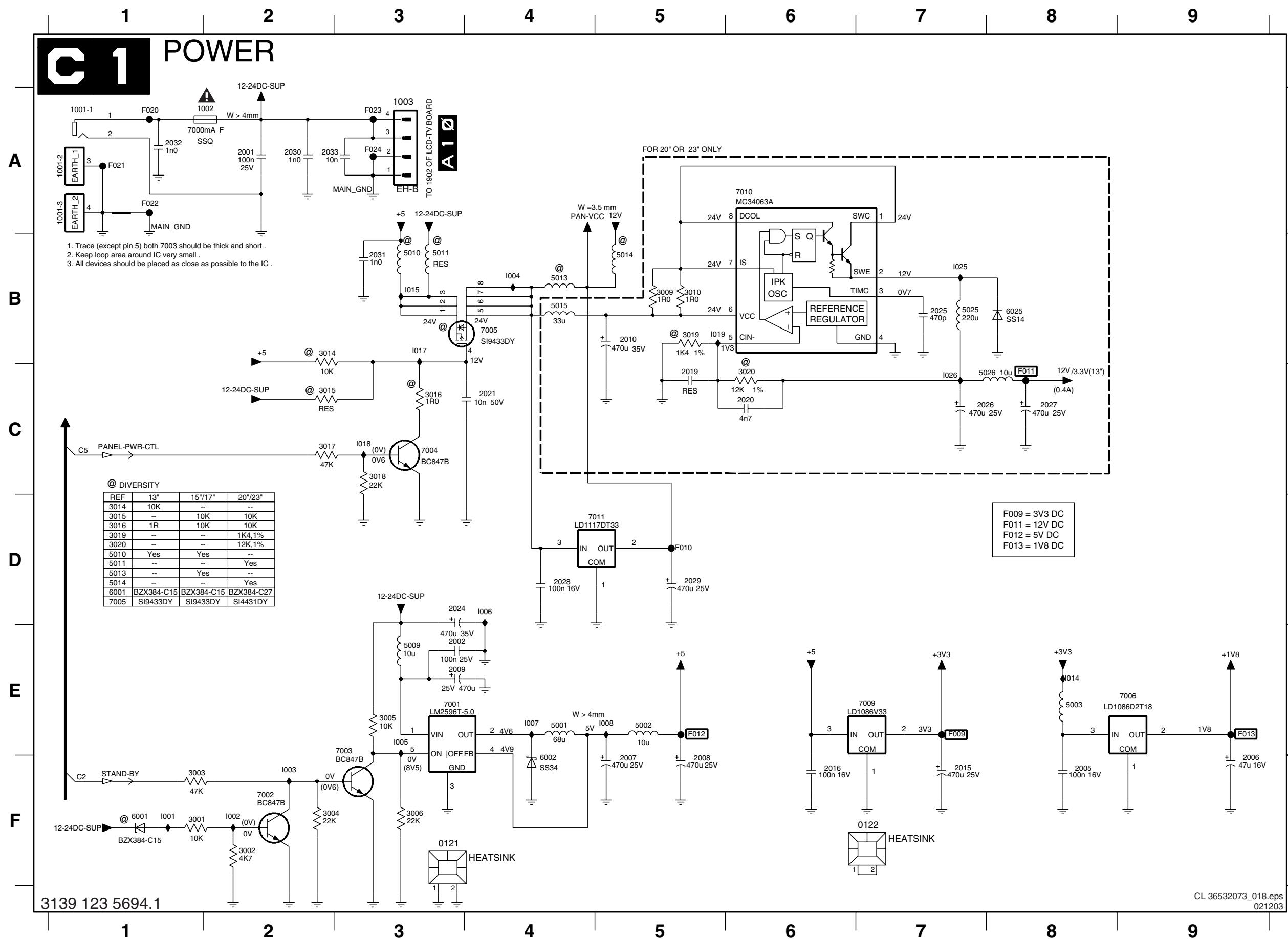


**Part 4 of
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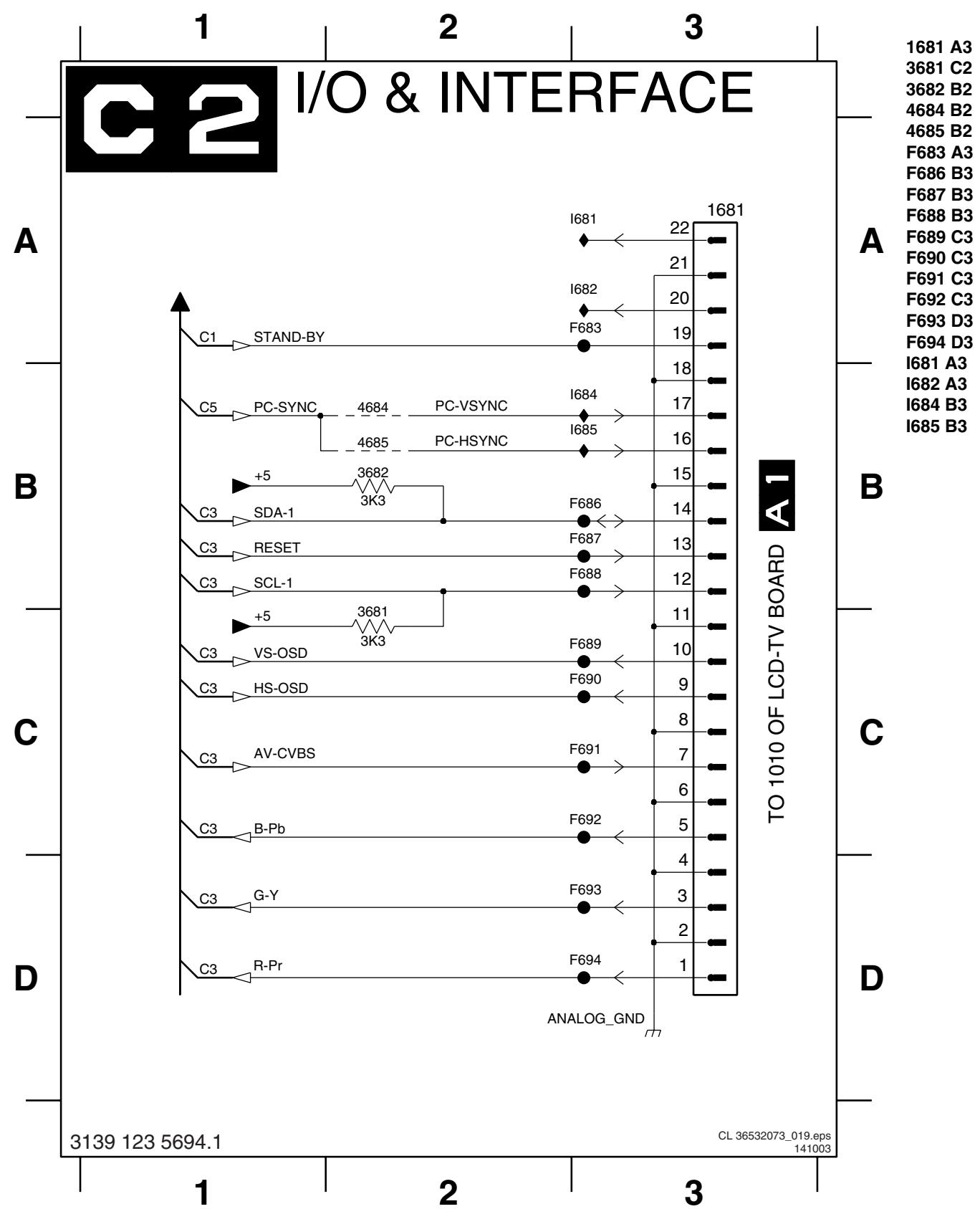
4

Scaler Board: Power



0121 F3	F024 A3
0122 F7	I001 F1
1001-1 A1	I002 F2
1001-2 A1	I003 F2
1001-3 A1	I004 B4
1002 A2	I005 E3
1003 A3	I006 D4
2001 A2	I007 E4
2002 E3	I008 E5
2004 D5	I014 E8
2005 F8	I015 B3
2006 E9	I017 B3
2007 E5	I018 C3
2008 E5	I019 B5
2009 E3	I025 B7
2010 B5	I026 C7
2015 F7	
2016 F6	
2019 C5	
2020 C6	
2021 C4	
2024 D3	
2025 B7	
2026 C7	
2027 C8	
2028 D4	
2030 A2	
2031 B3	
2032 A1	
2033 A2	
3001 F1	
3002 F2	
3003 F1	
3004 F2	
3005 E3	
3006 F3	
3009 B5	
3010 B5	
3014 B2	
3015 C2	
3016 C3	
3017 C2	
3018 C3	
3019 B5	
3020 C6	
5001 E4	
5002 E5	
5003 E8	
5009 E3	
5010 B3	
5011 B3	
5013 B4	
5014 B5	
5015 B4	
5025 B7	
5026 C8	
6001 F1	
6002 E4	
6025 B8	
7001 E3	
7002 F2	
7003 E3	
7004 C3	
7005 B4	
7006 E9	
7009 E7	
7010 A6	
7011 D5	
F009 E7	
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F011 C8	
F012 E5	
F013 E9	
F020 A1	
F021 A1	
F022 A1	
F023 A3	

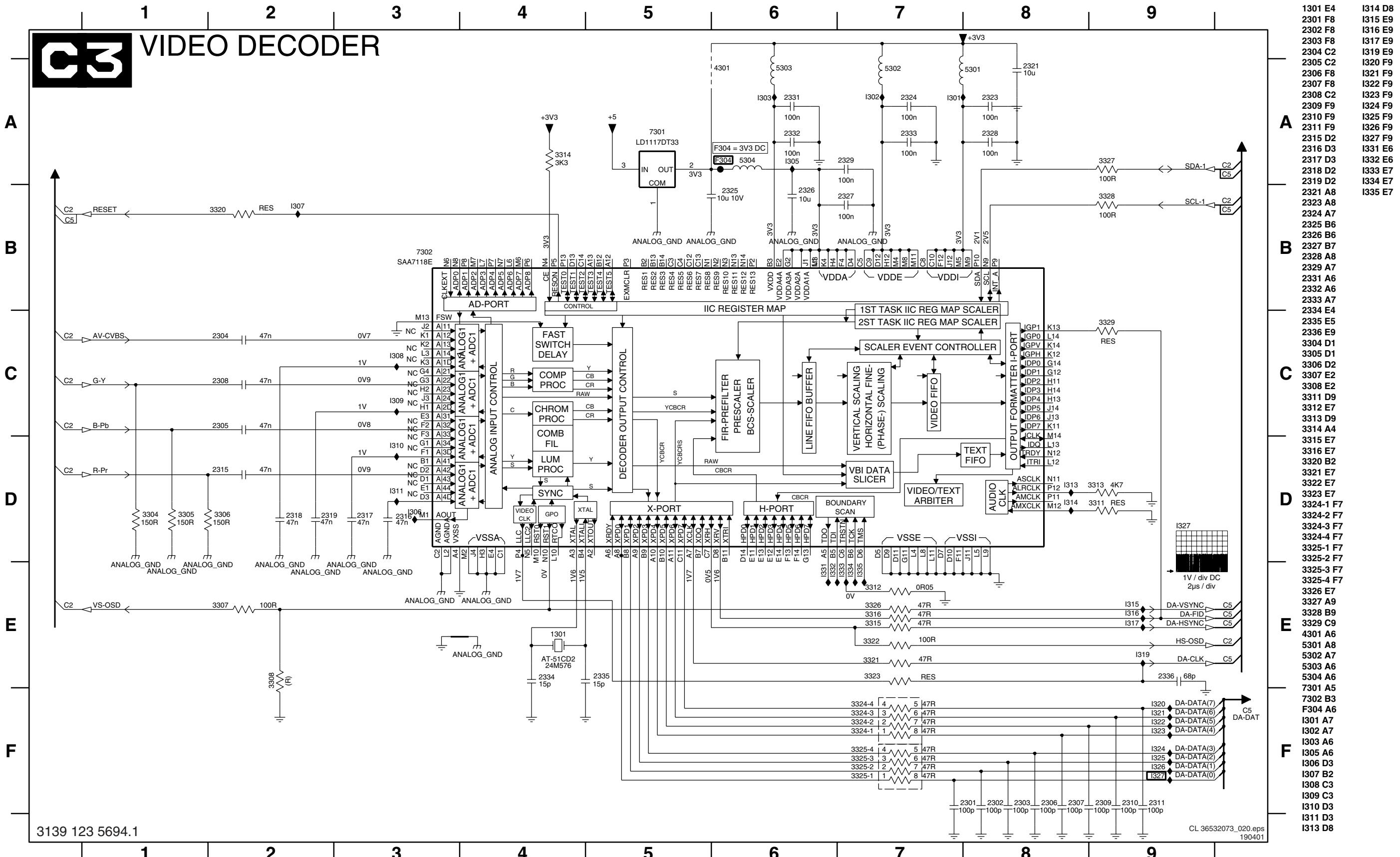
Scaler Board: I/O & Interface



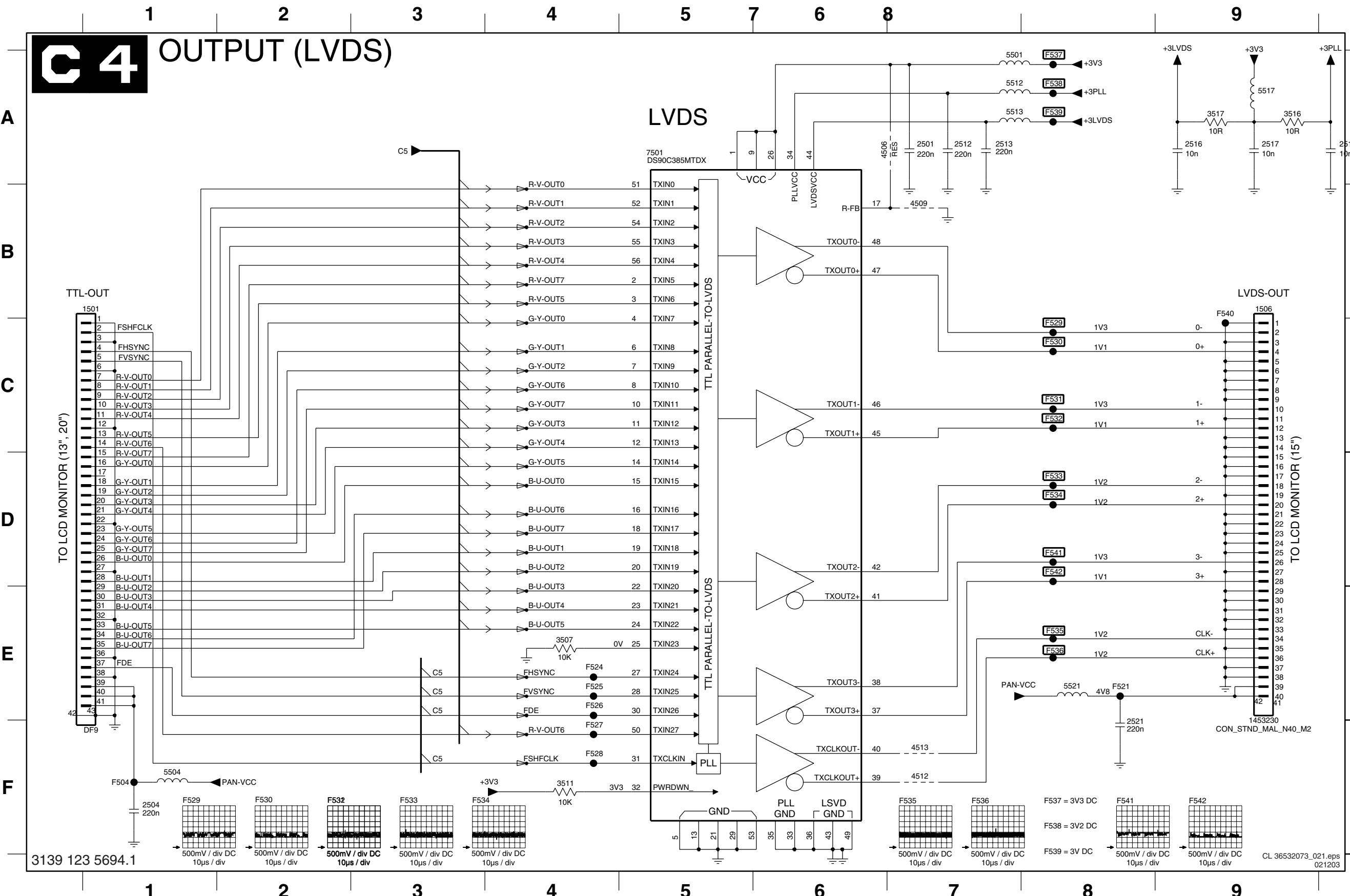
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- 1681 A3
3681 C2
3682 B2
4684 B2
4685 B2
F683 A3
F686 B3
F687 B3
F688 B3
F689 C3
F690 C3
F691 C3
F692 C3
F693 D3
F694 D3
I681 A3
I682 A3
I684 B3
I685 B3**

Scaler Board: Video Decoder



Scaler Board: Output (LVDS)

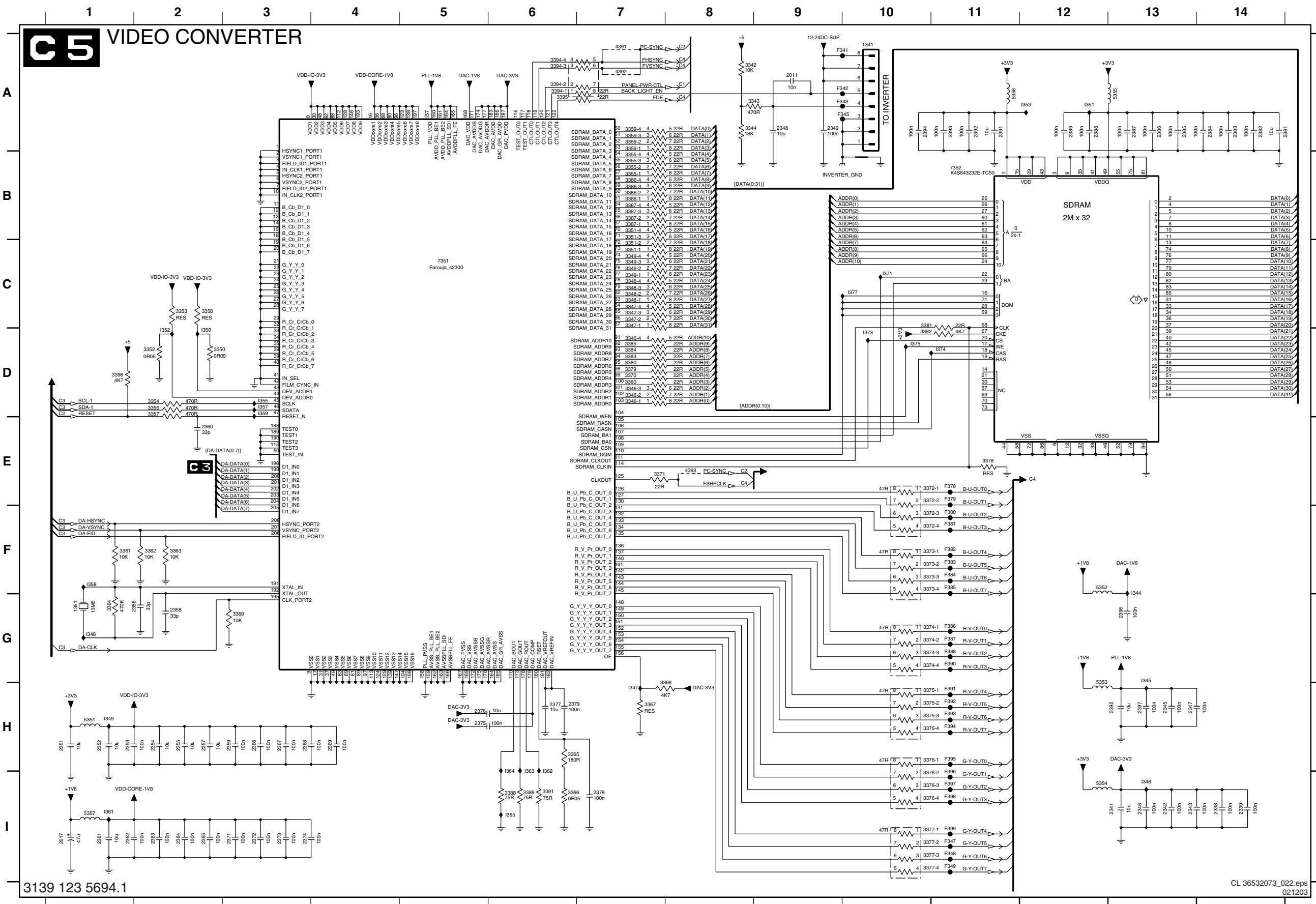


1501 B1
1506 B9
2501 A7
2504 F1
2512 A7
2513 A7
2516 A9
2517 A9
2521 E8
3507 E4
3511 F4
3516 A9
3517 A9
4506 A6
4509 B7
4512 F7
4513 F7
5501 A7
5504 F1
5512 A7
5513 A7
5517 A9
5521 E8
7501 A5
F504 F1
F521 E8
F524 E4
F525 E4
F527 F4
F528 F4
F529 C8
F530 C8
F531 C8
F532 C8
F533 D8
F534 D8
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F536 E8
F537 A8
F538 A8
F539 A8
F540 B9
F541 D8
F542 D8

E
F

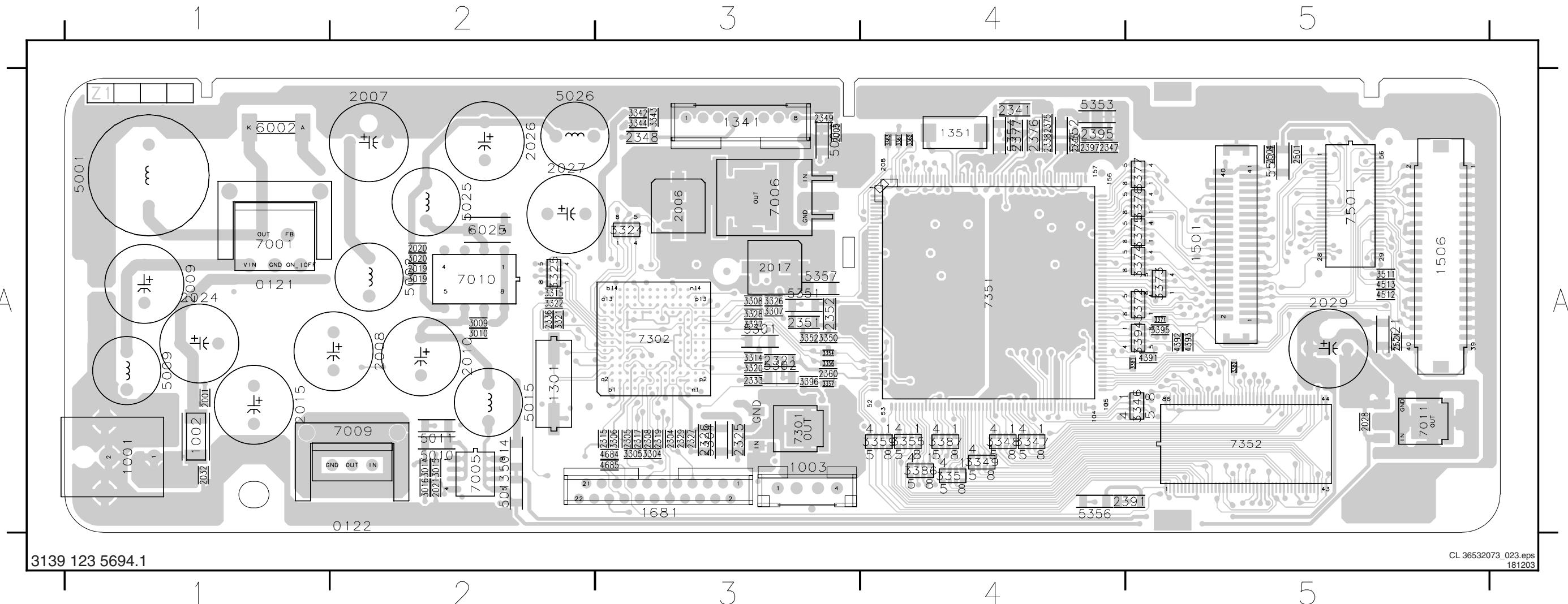
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021203

Scaler Board: Video Converter



Layout Scaler Board (Top Side)

0121 A1	1351 A4	2007 A2	2020 A2	2032 A1	2321 A3	2338 A4	2352 A3	2397 A4	3015 A2	3307 A3	3324 A3	3344 A3	3352 A3	3362 A4	3376 A5	3395 A5	4513 A5	5010 A2	5301 A3	5356 A4	7005 A2	7351 A4
0122 A2	1501 A5	2008 A2	2021 A2	2304 A3	2325 A3	2341 A4	2360 A3	2501 A5	3016 A2	3308 A3	3325 A3	3346 A3	3354 A3	3363 A4	3377 A5	3396 A3	4684 A3	5011 A2	5302 A3	5357 A3	7006 A3	7352 A5
1001 A1	1506 A5	2009 A1	2024 A1	2305 A3	2326 A3	2345 A3	2375 A4	2504 A5	3019 A2	3314 A3	3326 A3	3347 A4	3355 A4	3371 A5	3381 A5	3511 A5	4685 A3	5013 A2	5304 A3	5504 A5	7009 A2	7501 A5
1002 A1	1681 A3	2010 A2	2026 A2	2308 A3	2327 A3	2347 A4	2376 A4	2521 A5	3020 A2	3315 A2	3327 A3	3348 A4	3356 A3	3372 A5	3382 A5	4391 A5	5001 A1	5014 A2	5351 A3	5521 A5	7010 A2	
1003 A3	2001 A1	2015 A1	2027 A2	2315 A3	2329 A3	2348 A3	2377 A4	3009 A2	3304 A3	3320 A3	3328 A3	3349 A4	3357 A3	3373 A5	3386 A4	4392 A5	5002 A2	5015 A2	5352 A4	6002 A1	7011 A5	
1301 A2	2005 A3	2017 A3	2028 A5	2317 A3	2333 A3	2349 A3	2391 A5	3010 A2	3305 A3	3321 A2	3342 A3	3350 A3	3359 A4	3374 A5	3387 A4	4393 A5	5003 A3	5025 A2	5353 A4	6025 A2	7301 A3	
1341 A3	2006 A3	2019 A2	2029 A5	2319 A3	2336 A2	2351 A3	2395 A4	3014 A2	3306 A3	3322 A2	3343 A3	3351 A4	3361 A4	3375 A5	3394 A5	4512 A5	5009 A1	5026 A2	5354 A4	7001 A1	7302 A3	



Layout Scaler Board (Bottom Side)

2002	A5	2302	A4	2318	A3	2339	A2	2357	A2	2366	A2	2378	A2	2387	A1	2513	A1	3005	A5	3323	A3	3367	A2	3384	A2	3681	A3	5512	A1
2011	A3	2303	A4	2323	A3	2342	A2	2359	A2	2367	A2	2379	A2	2388	A1	2516	A1	3006	A5	3329	A3	3368	A2	3385	A2	3682	A3	5513	A1
2016	A4	2306	A4	2324	A3	2343	A2	2359	A2	2368	A2	2381	A1	2389	A1	2517	A1	3017	A4	3353	A2	3369	A2	3388	A2	4301	A3	5517	A1
2025	A4	2307	A3	2328	A3	2353	A2	2362	A2	2371	A2	2383	A1	2393	A1	2501	A5	3311	A3	3358	A2	3370	A2	3389	A2	4506	A1	6001	A5
2030	A3	2309	A3	2331	A4	2354	A2	2365	A2	2372	A2	2384	A1	2394	A1	2502	A5	3312	A4	3364	A2	3378	A2	3391	A2	4509	A1	7002	A5
2031	A4	2310	A3	2332	A4	2355	A2	2364	A2	2373	A2	2385	A1	2396	A2	2503	A5	3313	A3	3365	A2	3379	A2	3397	A1	5303	A4	7003	A5
2033	A3	2311	A3	2334	A4	2356	A2	2365	A2	2374	A2	2386	A1	2512	A1	3004	A5	3316	A3	3383	A2	3380	A2	3517	A1	5355	A1	7004	A4
2301	A4	2316	A3	2335	A4	2356	A2	2365	A2	2374	A2	2386	A1	2512	A1	3004	A5	3316	A3	3383	A2	3380	A2	3517	A1	5501	A1	7004	A4

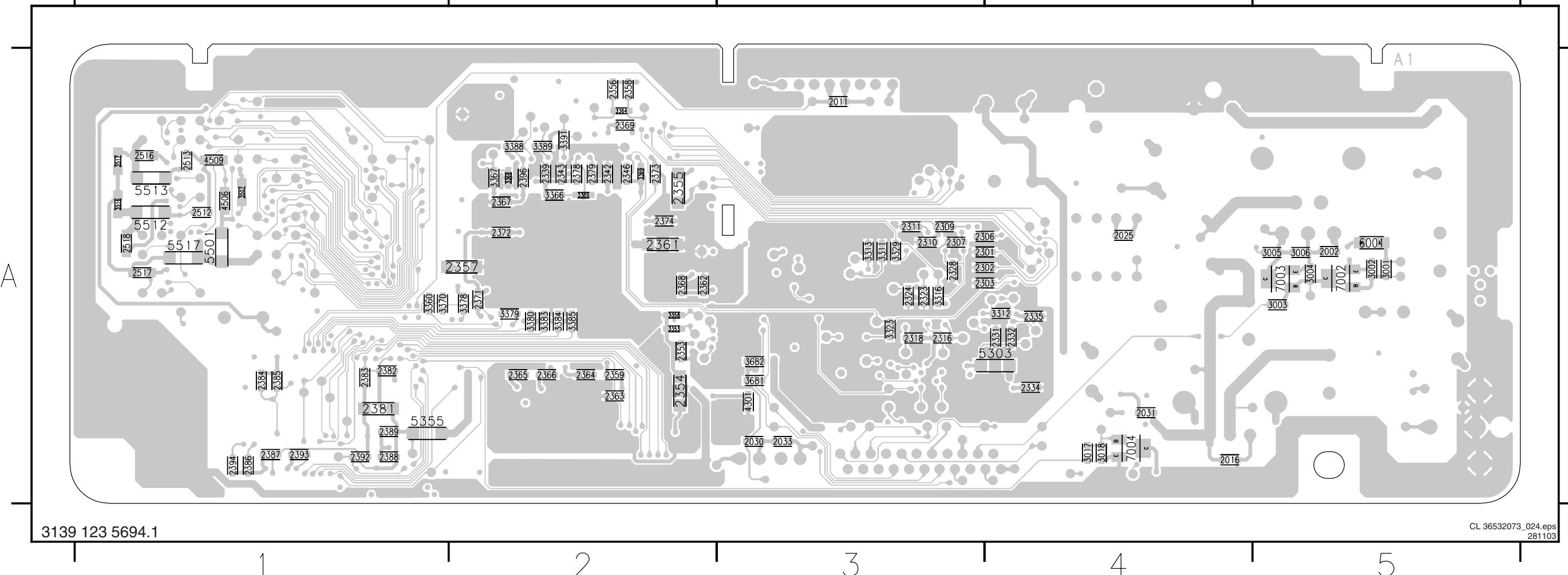
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2

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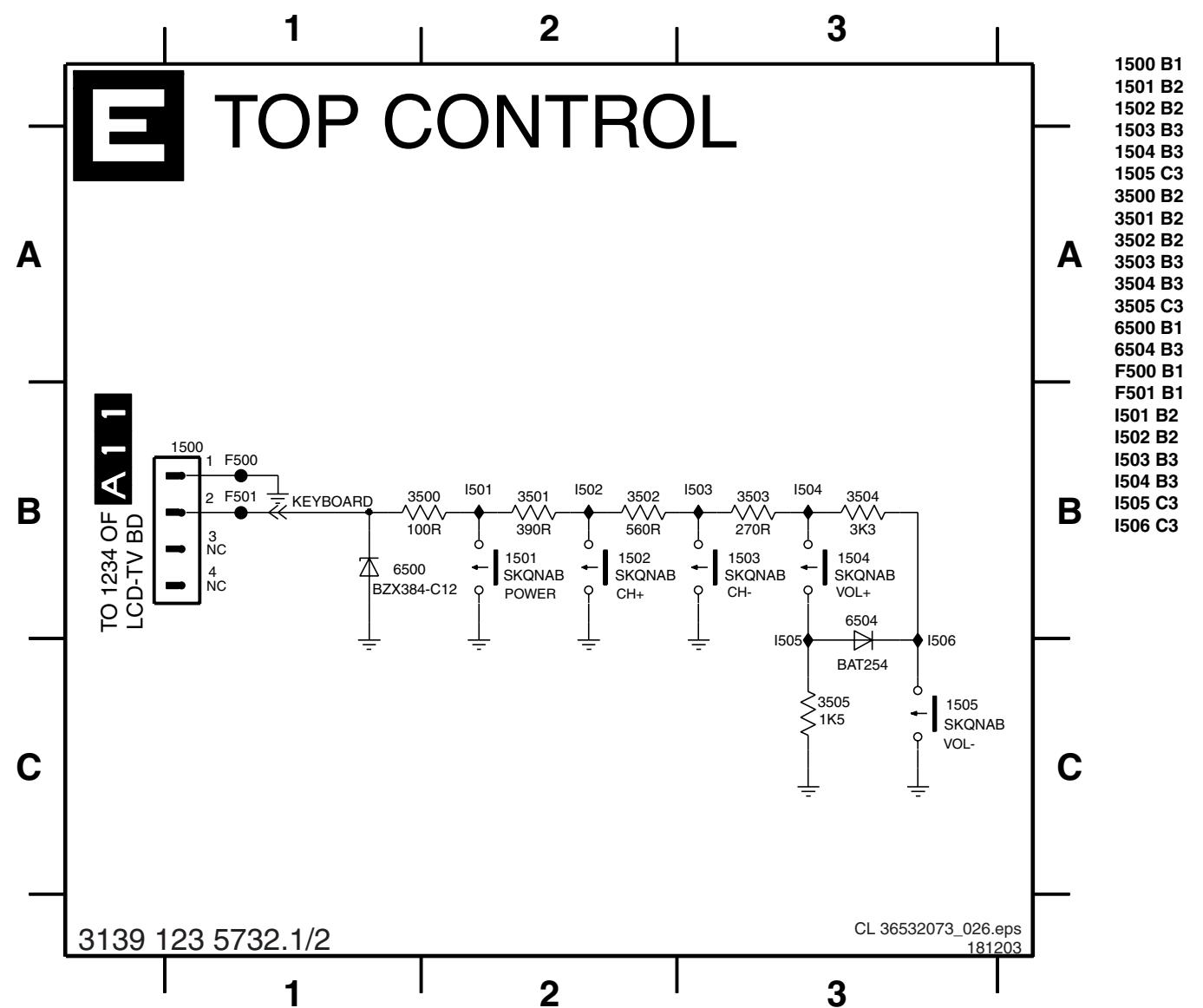
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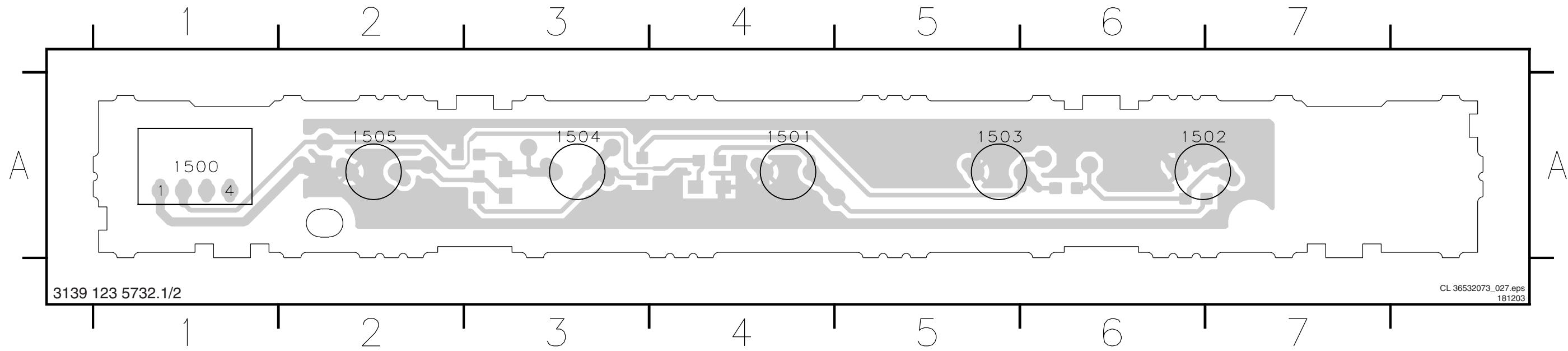
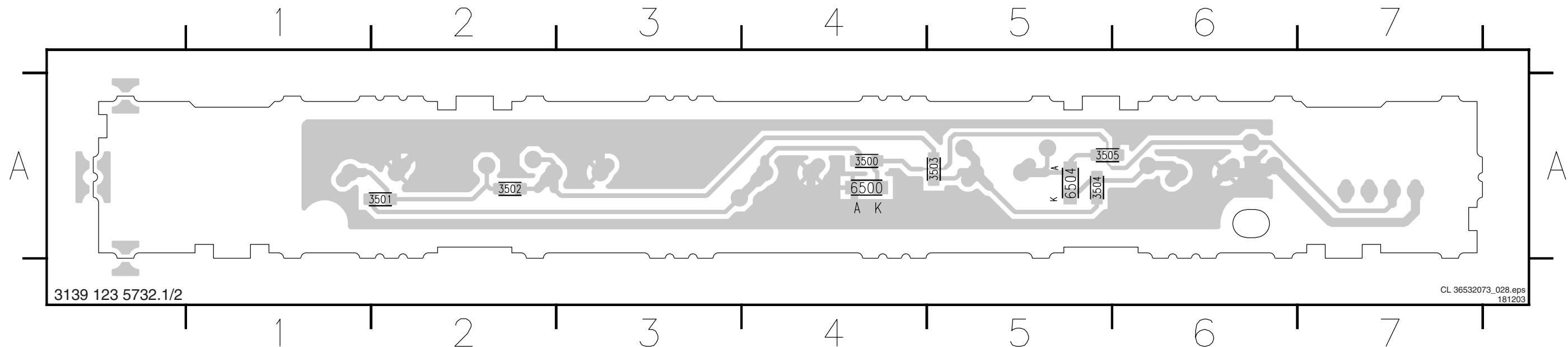
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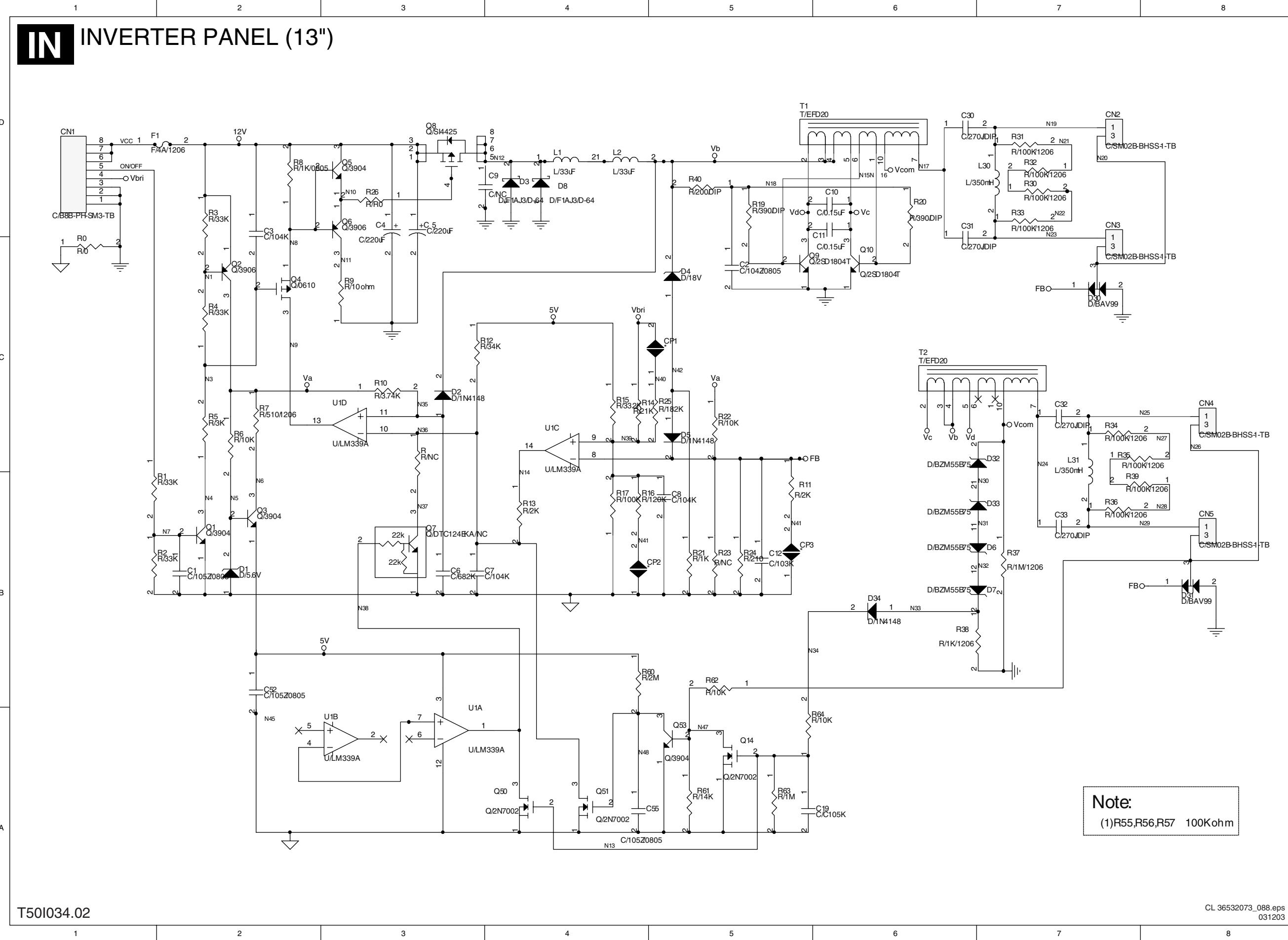
Top Control



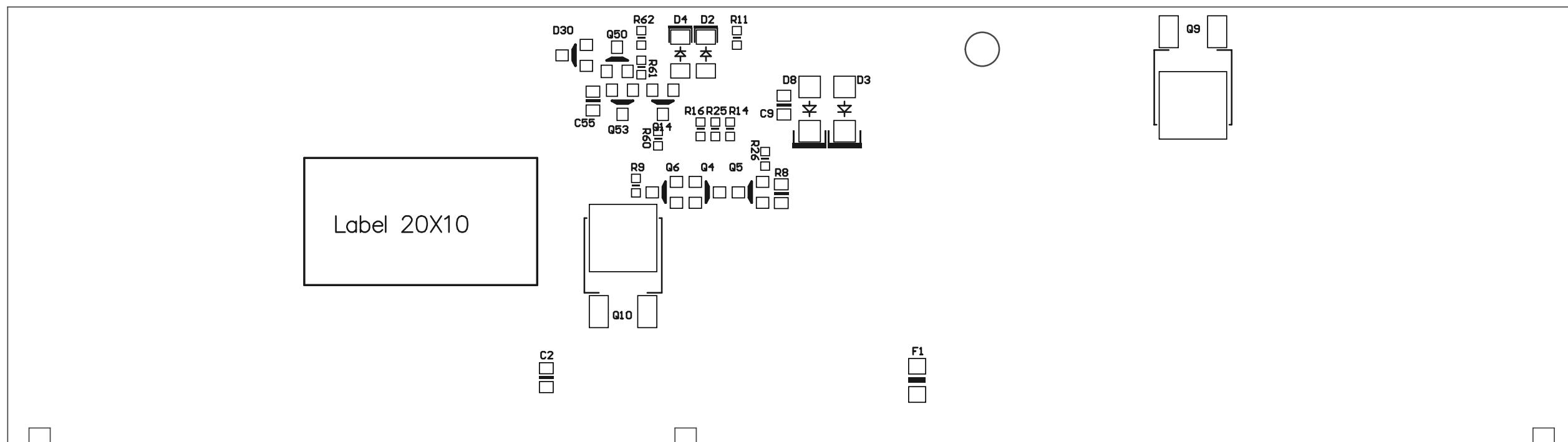
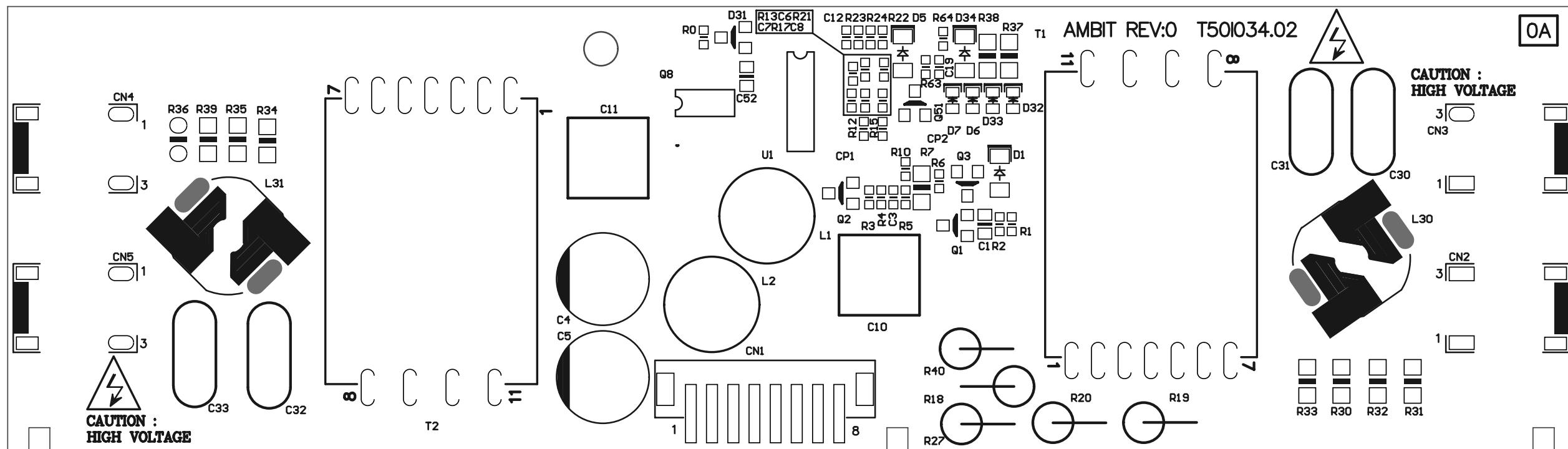
Personal Notes:

**1500 B1
1501 B2
1502 B2
1503 B3
1504 B3
1505 C3
3500 B2
3501 B2
3502 B2
3503 B3
3504 B3
3505 C3
6500 B1
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I502 B2
I503 B3
I504 B3
I505 C3
I506 C3**

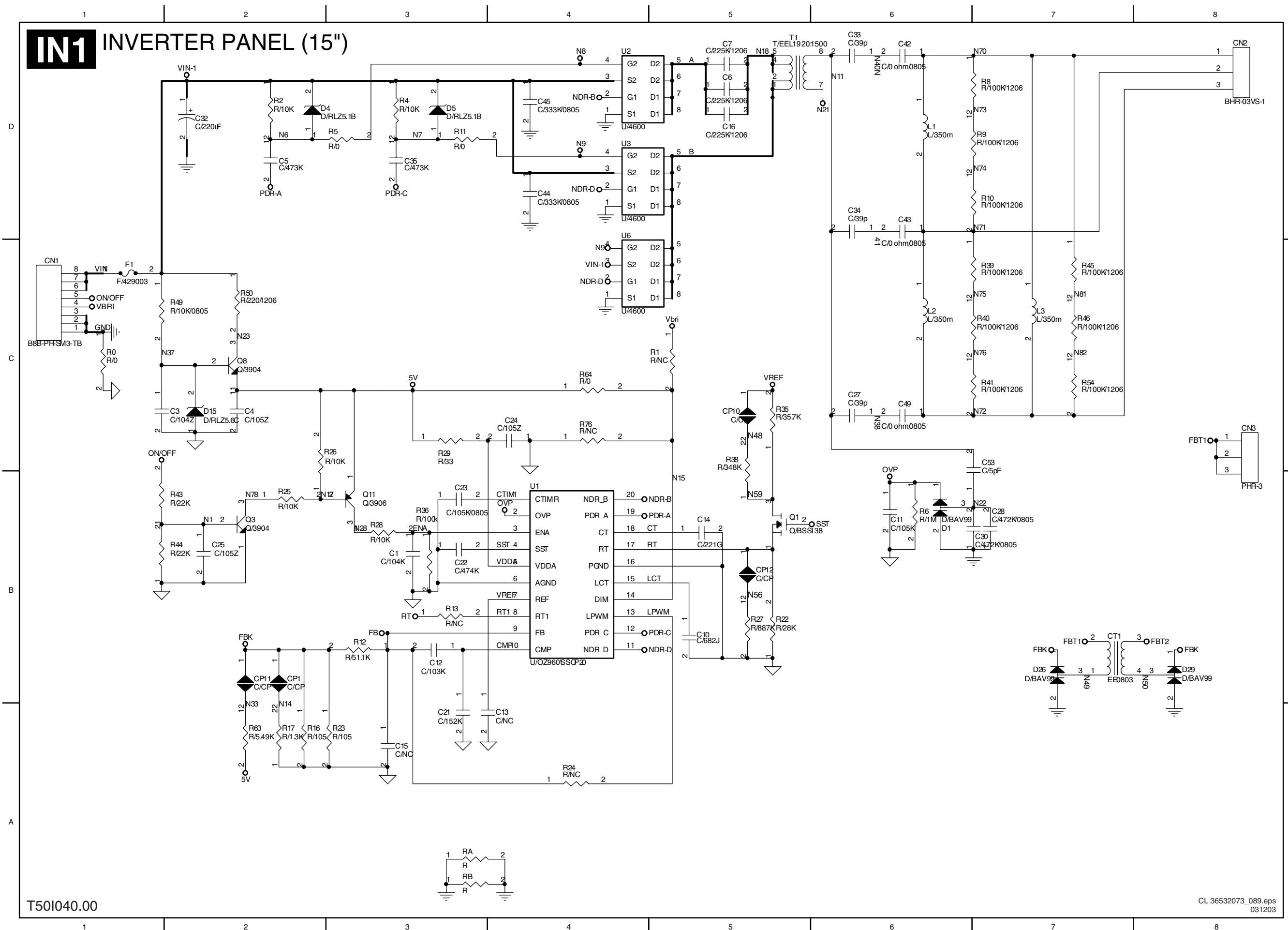
Layout Top Control (Top Side)**Layout Top Control (Bottom Side)**

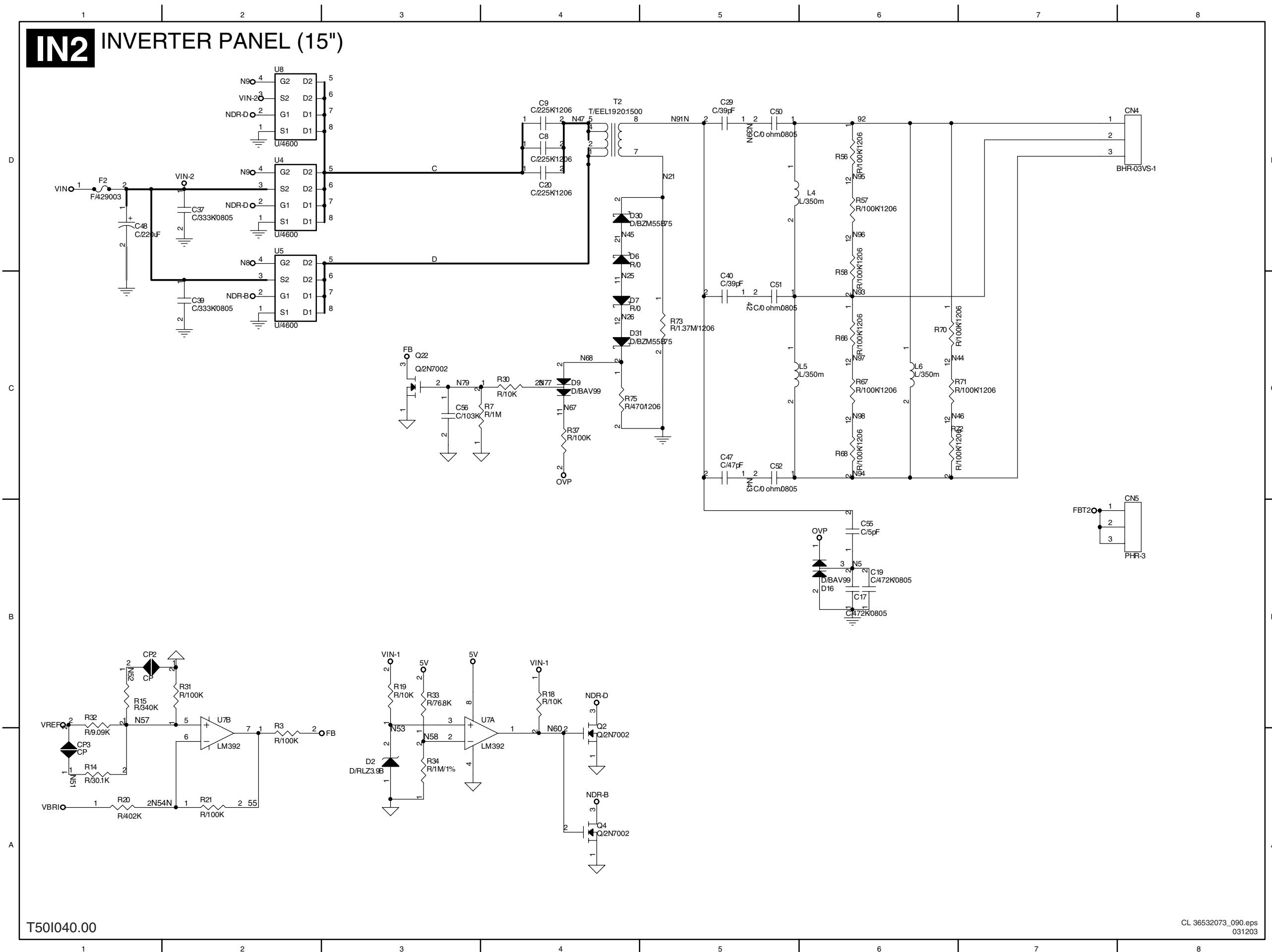
Inverter Panel (13")

Layout Inverter Panel (13")
INVERTER PANEL (13")



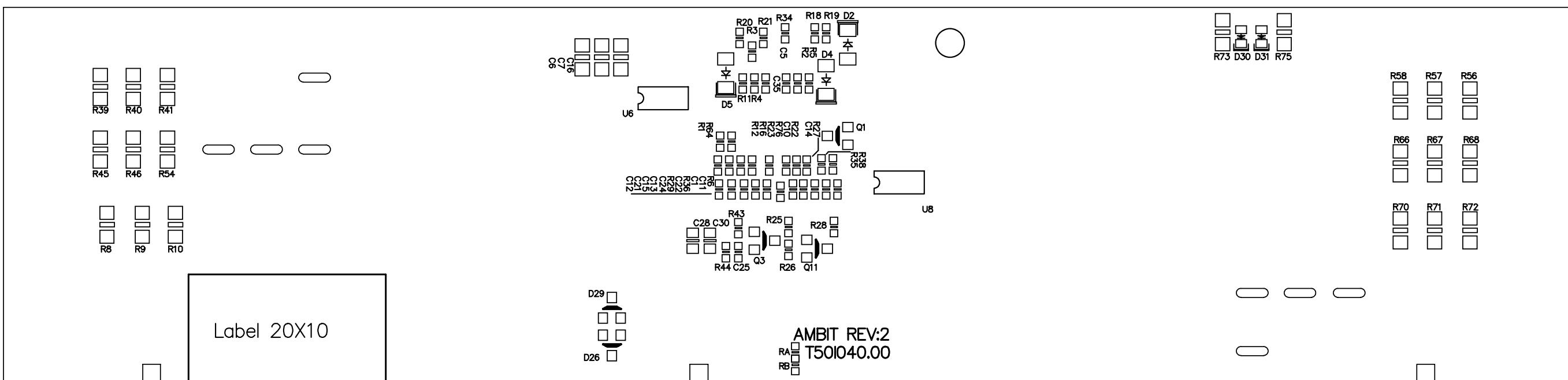
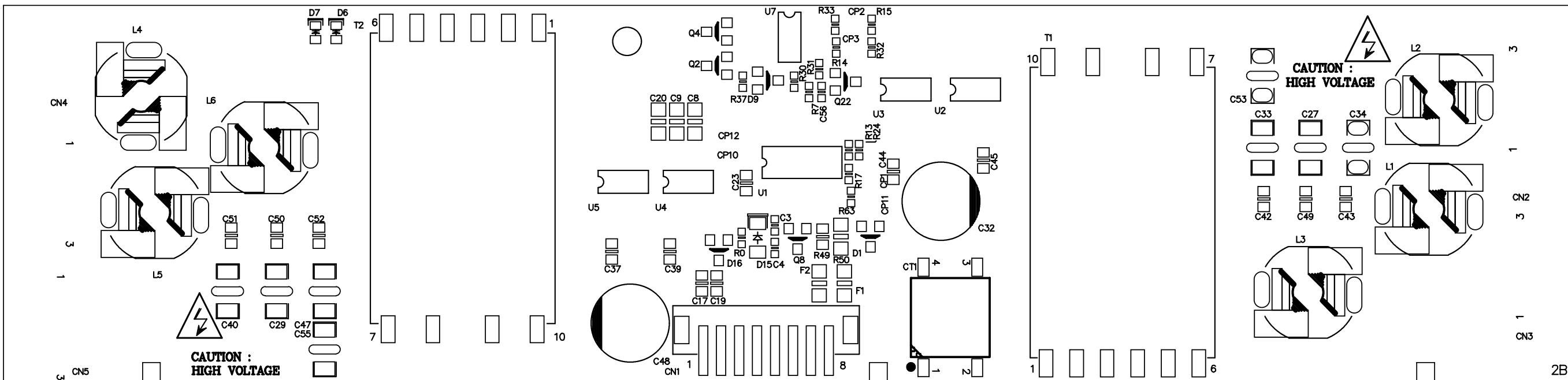
Inverter Panel (15")



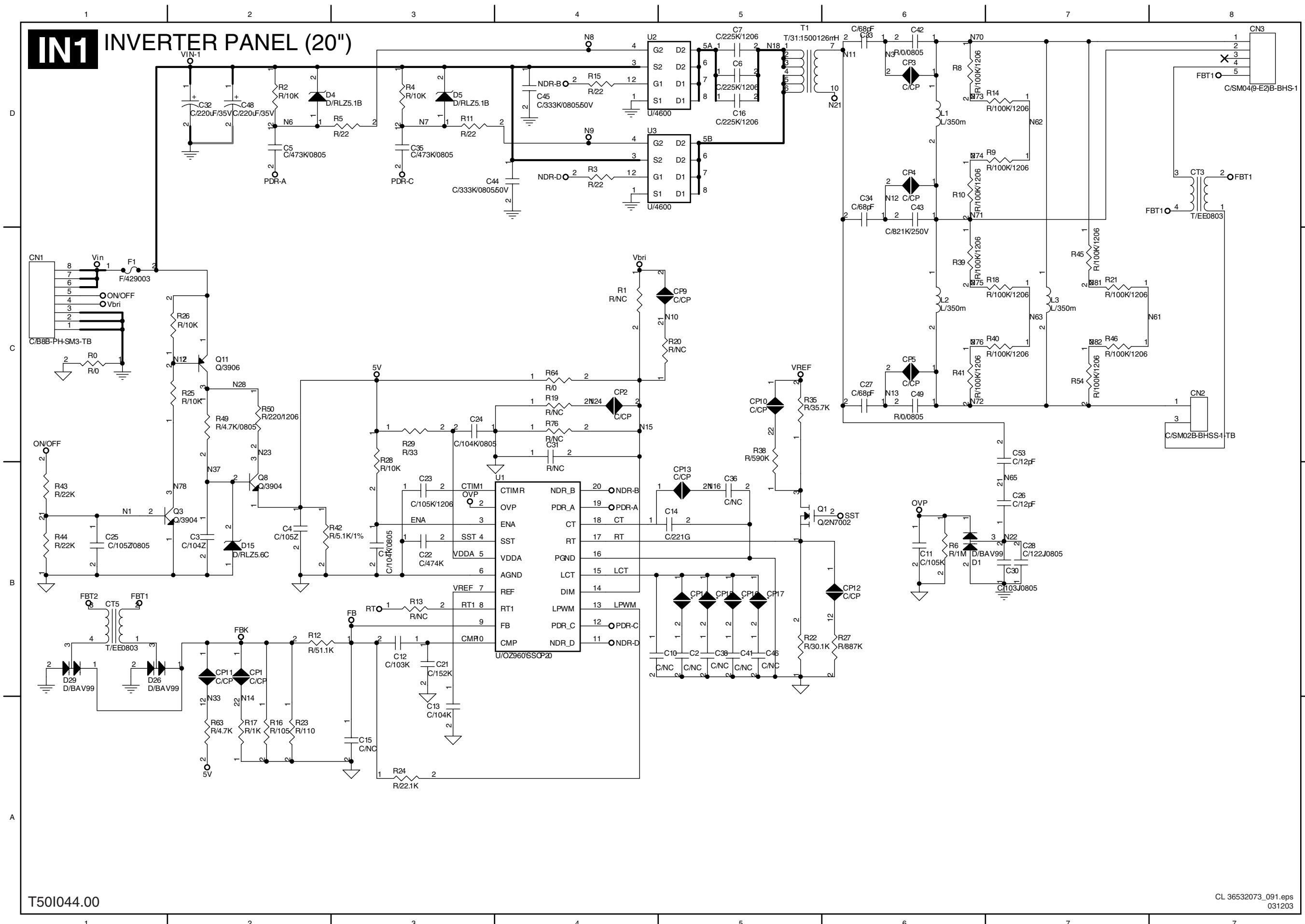
Inverter Panel (15")

Layout Inverter Panel (15")

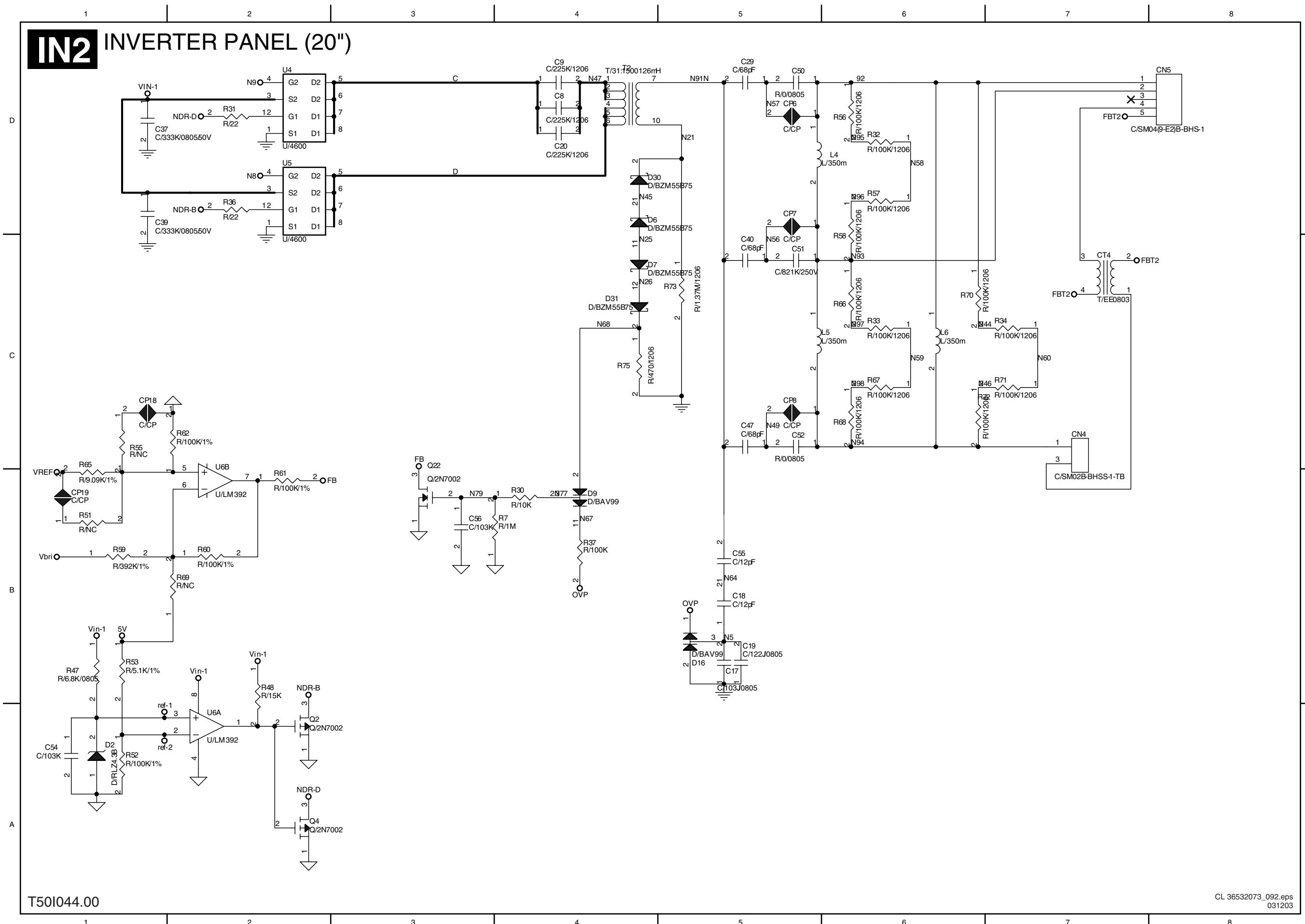
INVERTER PANEL (15")



Inverter Panel (20")

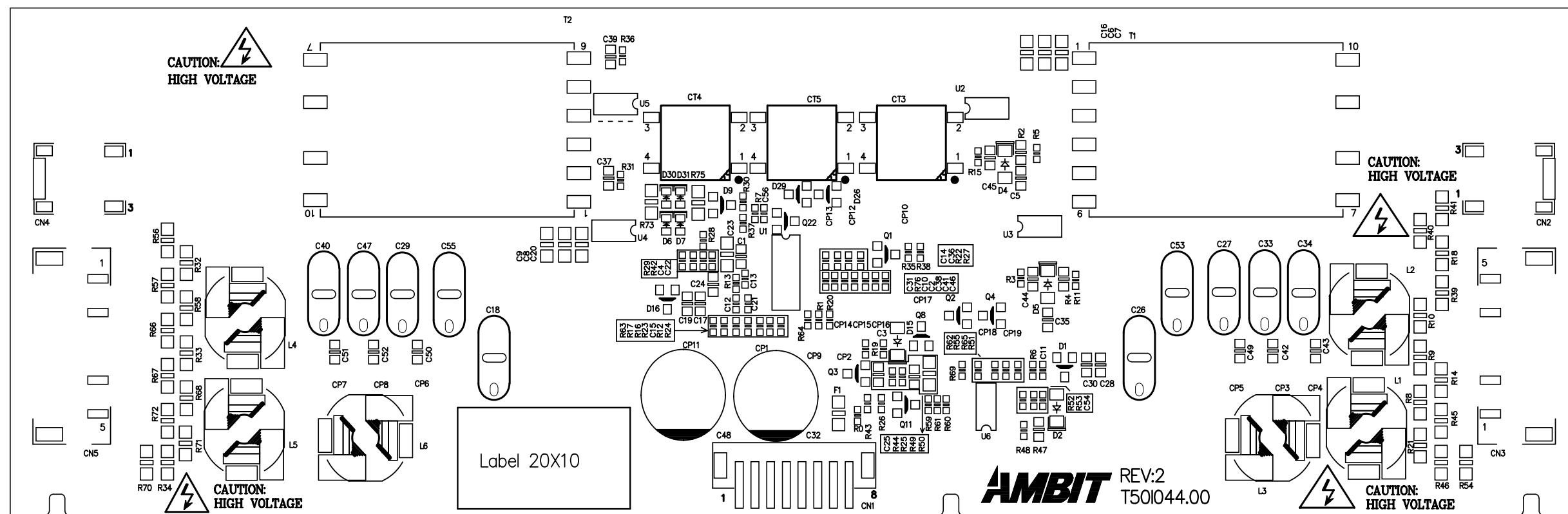


Inverter Panel (20")

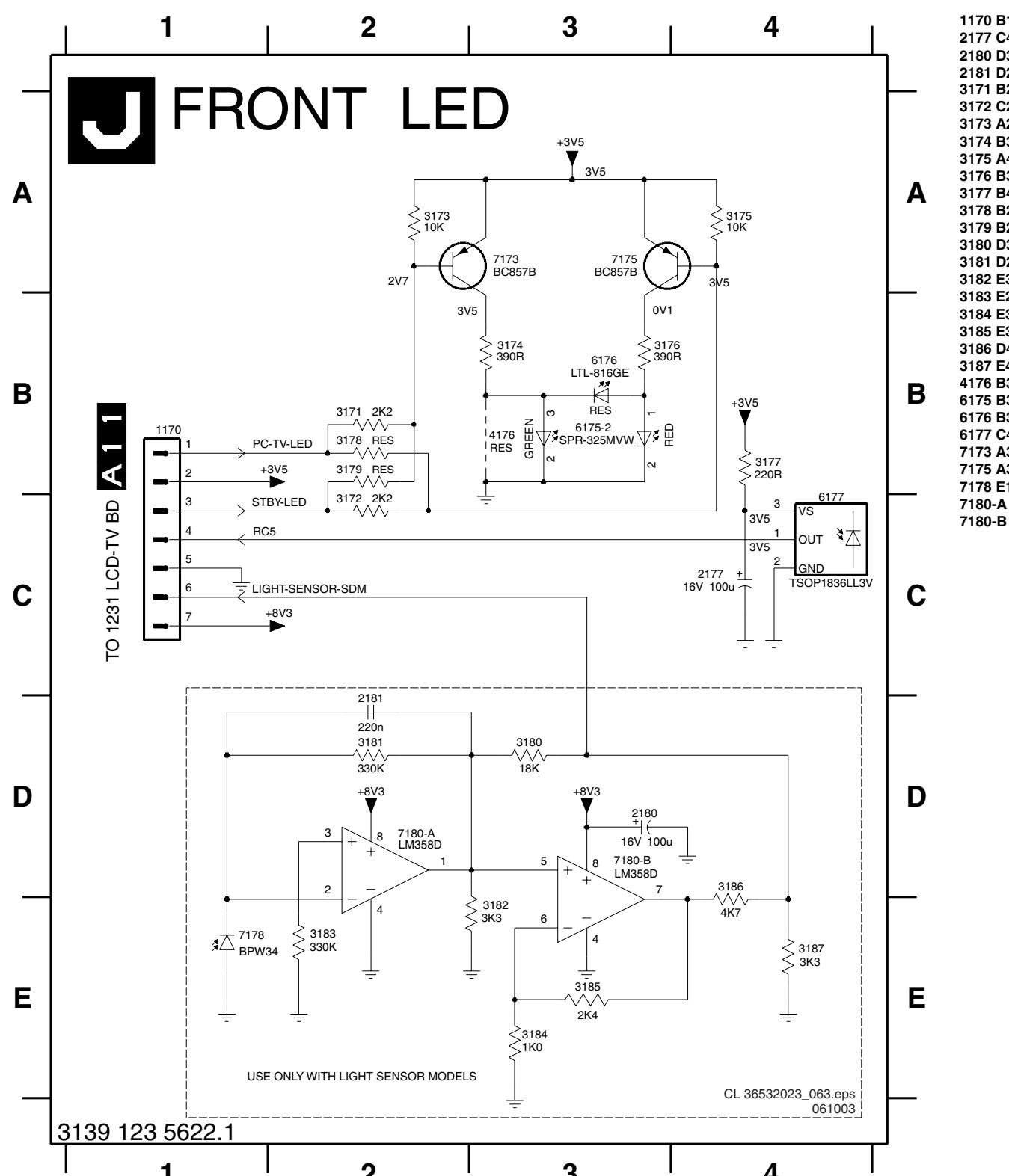


Layout Inverter Panel (20")

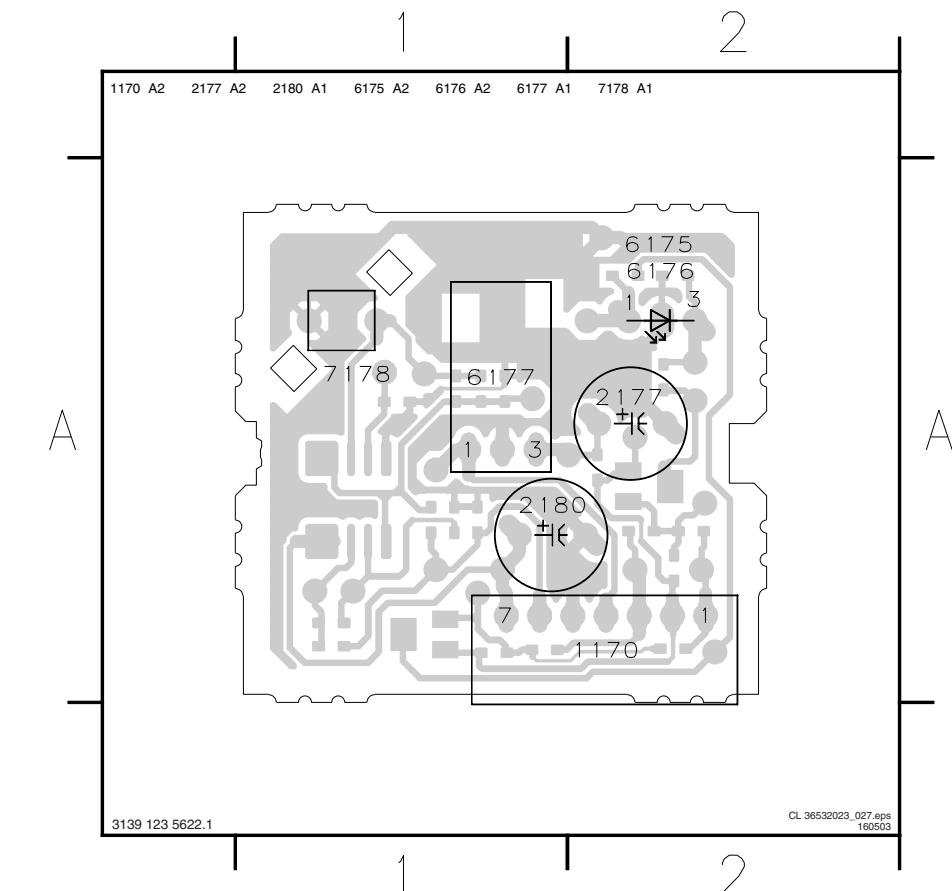
INVERTER PANEL (20")



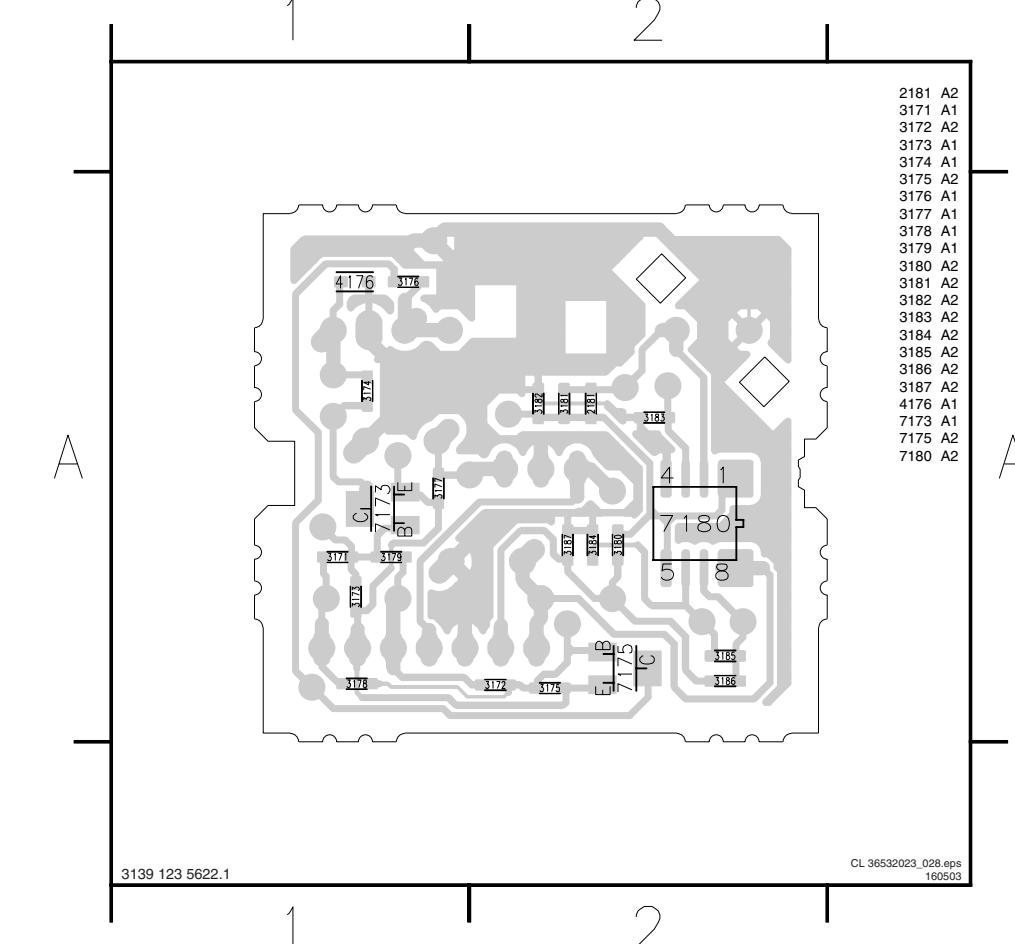
Front LED Panel



Layout Front LED Panel (Top Side)



Layout Front LED Panel (Bottom Side)



8. Alignments

The Service Default Mode (SDM) and Service Alignment Mode (SAM) are described in chapter 5. Menu navigation is done with the CURSOR UP, DOWN, LEFT or RIGHT keys of the remote control transmitter.

8.1 General Alignment Conditions

Perform all electrical adjustments under the following conditions:
 Mains voltage and frequency: 100-240 V / 50/60 Hz.
 Allow the set to warm up for approximately 10 minutes.
 Test probe: $R_i > 10 \text{ M ohm}$; $C_i < 2.5 \text{ pF}$.

8.3.1 SAM Menu

SAM Menu

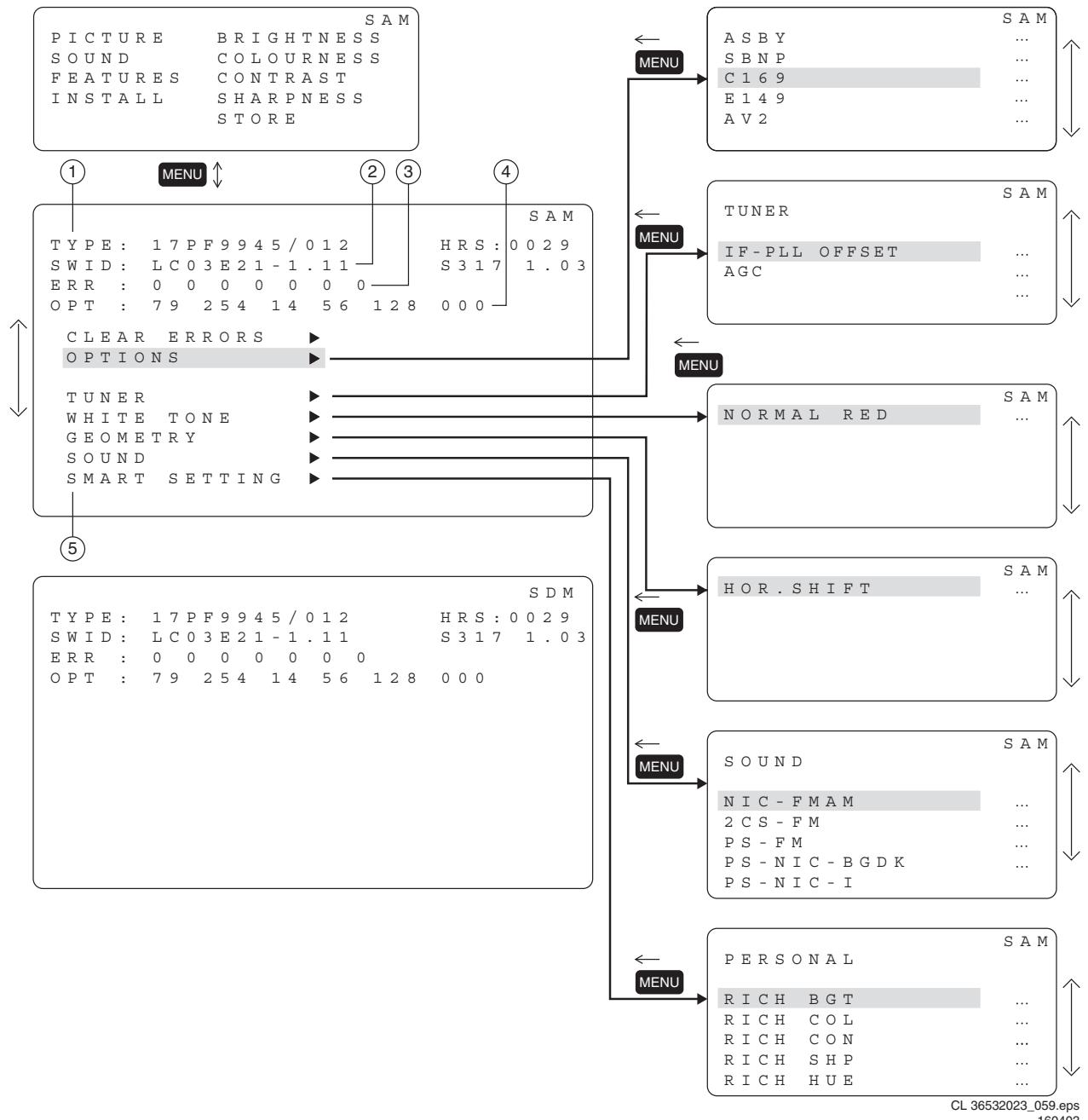


Figure 8-1 SAM menu

8.3.2 Tuner Adjustment

AGC (RF AGC Take Over Point)

Set pattern generator (e.g. PM5418) with colour bar pattern and connect to aerial input with RF signal amplitude - 10 mV and set frequency for PAL/SECAM to 475.25 MHz. For France select the L'-signal.

- Activate the SAM-menu. Go to the sub-menu TUNER, select the sub-menu option AFC WINDOW and adjust the value to 100kHz.
- Select the AGC sub-menu.
- Connect a DC multi-meter to pin 1 of the tuner (item 1100).
- Adjust the AGC until the voltage at pin 1 of the tuner is 1.0V +/- 0.1V.
- The value can be incremented or decremented by pressing the right/left MENU-button on the RC.
- Switch the set to main menu and select the STORE item, by pressing the right/left button on the RC to store the data.

IF PLL OFFSET

No adjustments needed for these alignments.

The default values for these options are:

- IF PLL OFFSET: 31 (default).
- AGC WINDOW: 24 (default).

8.3.3 White Tone

In the WHITE TONE sub menu the color values for the colour value for RED can be changed.

In this way the colour temperature mode (NORMAL) is adjusted. Range: 0-63, 33 represent the middle of the value (no offset difference).

Note: the alignment values are non-linear. The range is: -50 to +50, 0 represents the middle value, (no offset difference).

- Input signal strength: >=10 mV rms (80 dBuV) terminal voltage.
- Input injection point: Aerial input.

Align Method

Initial Set-up

- 12 minutes soaking time before carrying out Colour Temp alignment.
- Incredible Picture/Contrast+ and Active Control (Blue stretch off) must be switched OFF for proper tracking.
- The alignment is done for NORMAL only.

Method of alignments

1. Place the colour sensor of the meter at the centre of the screen.
2. Set the meter in (T, delta UV, Y) mode.
3. Set brightness and colour to nominal (factory mode).
4. Set contrast to make the light output Y on the meter 250 nit +/-10%.
5. Adjust GREEN to bring delta UV to the value as in the table.

Expected Results

Measured parameters: Refer to table.

Specifications: Refer to table.

Units of measurement: Kelvin.

Table 8-1 Colour Temperatures

Colour temperature	13" VGA (NORMAL)		15" XGA (NORMAL)		20" VGA (NORMAL)	
	T (K)	Δ UV	T (K)	Δ UV	T (K)	Δ UV
EUROPE	8,500	-0.003	9,500	-0.003	9,000	-0.003
AP	8,500	-0.003	9,500	-0.003	9,000	-0.003
USA	8,500	-0.003	9,500	-0.003	9,000	-0.003
LATAM	8,500	-0.003	9,500	-0.003	9,000	-0.003
Tolerance	+/-10%	+/-0.003	+/-10%	+/-0.003	+/-10%	+/-0.003

8.3.4 Geometry

The geometry alignments menu contains 1 item to align correct picture geometry. The geometry alignments is :

- HOR SHIFT; align the horizontal center of the picture to the horizontal center of the display.

8.3.5 Sound

No adjustments needed for sound.

The default values for the audio alignments are:

- NIC-FMAM: 250 (NICAM error rate threshold, the higher the more tolerance).
- 2CS-FM: 40.
- PS-FM: 38 (Pre-scale for FM).
- PS-NIC BG/DK: 82 (Pre-scale for NICAM in BG/DK system).
- PS-NIC I: 127 (Pre-scale for NICAM in I system).
- PS-NIC L: 82 (Pre-scale for NICAM in L system).
- DEVIATION: on/off.

8.4 Options

8.4.1 Options

Options are used to control the presence / absence of certain features and hardware. There are two ways to change the option settings, see figure 1: "Service Alignments Mode screens and structure".

Changing a single option

An option can be selected with the MENU UP/DOWN keys and its setting can be changed with the MENU LEFT/RIGHT keys.

Changing multiple options by changing option byte values

Option bytes make it possible to set very fast all options. An option byte represents a number of different options. All options of the chassis are controlled via 8 option bytes. Select the option byte (OB1, OB2, OB3, OB4, OB5, OB6, OB7, OB8) and key in the new value.

8.4.2 List of options

Unless otherwise stated:

- Y(es) means present (or ON),
- N(o) means not present (or OFF).

Table 8-2 List of options

Features	Abbreviations LC13	Description
Auto Standby (after 2 hours)	ASBY	OFF=Disabled auto standby. ON=Enabled auto standby after 2 hours.
Auto Standby No Picture	SBNP	OFF=Disabled, no automatic switch to standby. ON=Enabled, switches to standby after 10 minutes when no ident.
Picture setting for Compress 16:9	C169	OFF=Disabled, 16:9 COMPRESS setting is not available in FORMAT menu. ON=Enabled 16:9 COMPRESS setting is available in FORMAT menu item.
Picture setting for Expand 14:9	E149	OFF=Disabled, 14:9 EXPAND setting is not available in FORMAT menu. ON=Enabled 14:9 EXPAND setting is available in FORMAT menu item.
SCART2 AV Source	AV2	OFF=Disabled, AV2 not available. ON=Enabled, AV2 available.
Auto Standby with timer	AUSB	OFF=Disabled. ON=Enabled.
Wide Screen	WSCR	OFF=Disabled, wide screen is displayed by FORMAT. ON=Enabled, FORMAT is replaced by WIDESCREEN.
Comb Filter	CBFL	OFF=Disabled, no comb filter on the SSB. ON=Enabled, comb filter on the SSB.
Incredible Picture	IPIX	OFF=Disabled, INCR, PICT is replaced by CONTRAST+ ON=Enabled, CONTRAST+ is replaced by INCR, PICT.
Incredible Picture via Menu	IPMU	OFF=Disabled, menu item INCR, PICT not available. ON=Enabled, menu item INCR, PICT available.
Virtual Dolby	VDBY	OFF=Disabled, menu item DOLBY VIRTUAL not available. ON=Enabled, menu item DOLBY VIRTUAL available.
Philips Tuner	PITN	OFF=Disabled, ALPS compatible tuner is used. ON=Enabled, Philips compatible tuner is used.
Automatic Channel Installation	ACI	OFF=Disabled, Automatic Channel Installation. ON=Enabled Automatic Channel Installation.
Automatic Tuning System	ATS	OFF=Disabled, automatic tuning system is ignored. ON=Enabled Automatic tuning system, sort the program in an ascending order starting from Program 1.
Program List	PLST	OFF=Disabled, the access to program List Command is ignored. ON=Enabled the access to program List Command is processed.
Virgin Mode	VMOD	OFF= Virgin mode disabled. ON= Virgin mode enabled.
Smart OSD (Picture and sound)	SOSD	OFF=Disabled, full display of OSD not available. ON=Enabled, full display of OSD available.
Favorite Page	FAPG	OFF=Disabled favorite page in Teletext mode. ON=Enabled favorite page in Teletext mode.
UK Plug and Play	UKPNP	OFF=Disabled, cannot access 'Plug and Play'. ON=Enabled, can access 'Plug and Play'.
Dynamic noise reduction	DNRM	OFF= Dynamic noise reduction ON= Dynamic noise reduction
Video Mute	VMUT	OFF=Disabled, no video blanking during channel/source change. ON=Enabled, video blanking during channel/source change.
Automatic Volume Leveller	AAVL	OFF=Disable, menu item AVL not available. ON=to enable, menu item AVL available.
Sound Board MSP3451	SNIC	OFF=Disabled, Sound IC MSP3451 is not present. ON=Enabled, Sound IC MSP3451 is present.
Time Window	TMWIN	OFF=Disabled, Time Window is set to 2 secs. ON=Enabled, Time Window is set to 5 secs.
Max No. of Programs	NPRG	OFF=Disabled, maximum no. of program 100. ON=Enabled maximum no. of program 80.
Wide Screen Signal Bit	WSSB	OFF=disable the detection of off-air transmission wide screen signal bit. ON=to enable the detection.
Internal Comb Filter	INCF	OFF=disable the BOCMA internal comb filter (for demo purpose). ON=to enable.
NVM data protection	NVM	OFF=Disabled. ON=Enabled.
HML	HML	OFF ON
FM radio ON	FMON	OFF=Disable FM radio. ON=Enable FM radio.
Lip synchronisation	LSYN	OFF= Lip synchronisation ON= Lip synchronisation
Panel size	PASI	OFF for 20" ON for 13"
System	SYSTEM	EW - Select West. Europe's colour and sound system. EE - Select East. Europe's colour and sound system. EM - Select Central Europe's colour and sound system.
Option Byte 1	OB1	8 bits, 7-1 (used)
Option Byte 2	OB2	8 bits, 7-1 (used)
Option Byte 3	OB3	8 bits, 7-1 (used)
Option Byte 4	OB4	8 bits, 7-1 (used)
Option Byte 5	OB5	8 bits, 7-1 (not used)
Option Byte 6	OB6	8 bits, 7-1 (not used)
Option Byte 7	OB7	8 bits, 7-1 (not used)
Option Byte 8	OB8	8 bits, 7-1 (used)

8.4.3 Option bits/bytes (Default values)

Table 8-3 Option bytes default values

	13PF7835/58	15PF7835/58	20PF7835/58	13PF7835/12	15PF7835/12	20PF7835/12
OB1	124	124	125	124	124	125
OB2	223	223	223	222	222	222
OB3	95	95	95	94	94	94
OB4	52	52	52	52	52	52
OB5	0	0	0	0	0	0
OB6	0	0	0	0	0	0
OB7	0	0	0	0	0	0
OB8	1	1	1	0	0	0

Note: Set all "Not used" Option bytes to 0

9. Circuit Descriptions, Abbreviation List, and IC Data Sheets

Index of this chapter

1. Introduction
 2. Block Diagram
 3. Power Supply
 4. Input/Output
 5. Tuner and IF
 6. Video: TV board
 7. Video: Scaler Board
 8. Audio Processing
 9. Control
 10. Inverter
 11. LCD Display
 12. Abbreviation List
 13. IC Data Sheets

9.1 Introduction

The LC13 LCD TV is based on the A10 Small Signal Board, with additional I/O's, Tuner, Scaler Board, and Audio Amplifier. The Scaler board is added, for scaling all input signals to the preferred LCD resolution.

9.2 Block Diagram

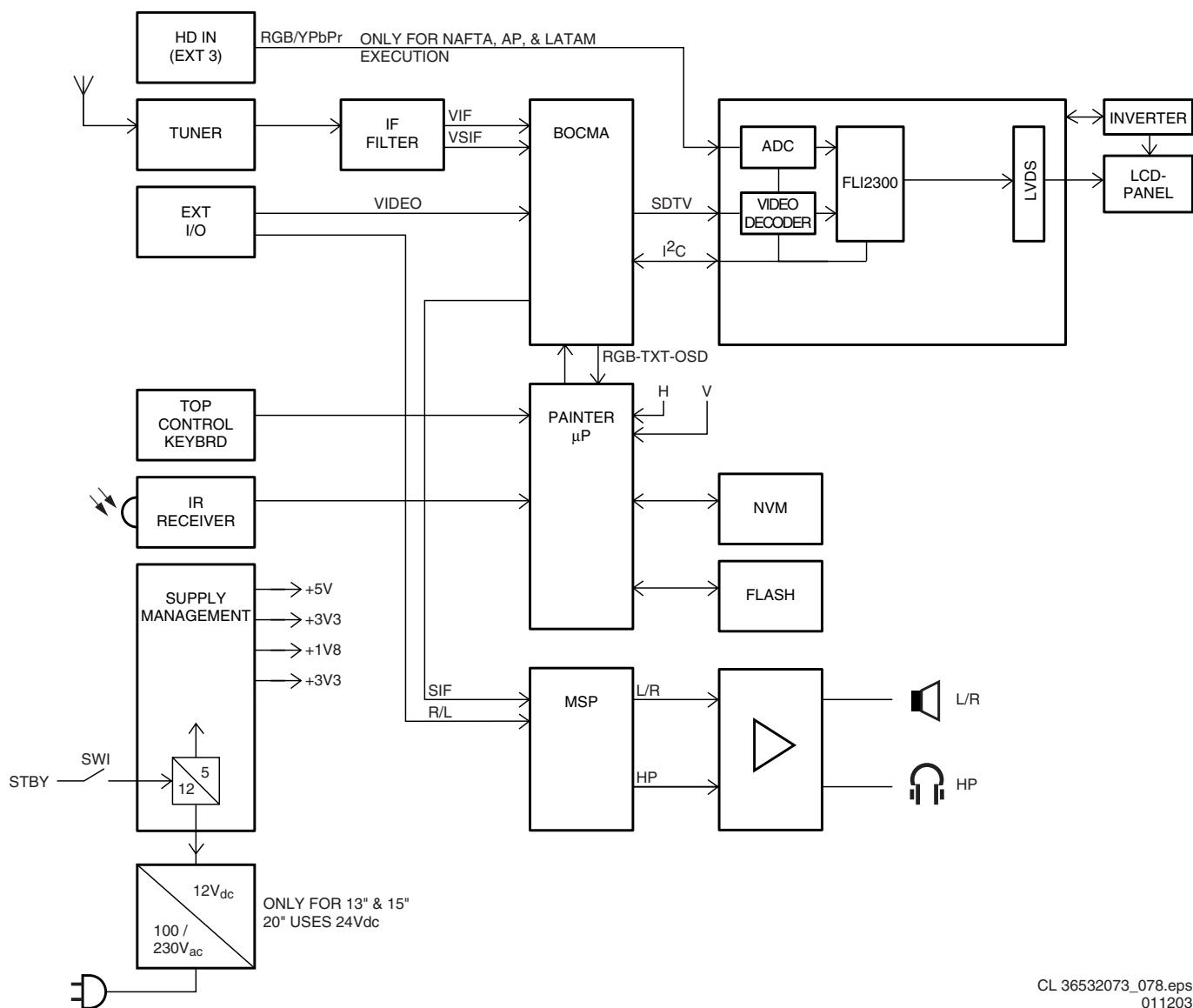


Figure 9-1 Block diagram LCD TV

The PLL tuner UR1316 (with FM radio) delivers the IF-signal, via audio & video SAW-filters, to the multi-system TV processor TDA888x (item 7301, also called BOCMA). This IC has the following functions:

- Multi-system decoder.
- Video source- and record select.
- Colour decoder.
- RGB output.
- Sound demodulator.
- Geometry control.
- Picture improvement.
- Synchronisation.

The BOCMA has one input for the internal CVBS signal and two inputs for external CVBS or Y signals. It has only one chroma input so that it is not possible to apply two separate Y/C inputs. The selection is made via the I₂C-bus.

It has two independently switchable CVBS outputs for e.g. TXT, Comb-filter, CVBS-monitor, or PIP (optional).

Two SCART-connectors are used: SCART1 is fully equipped and SCART2 is meant for VCR. Pin 10 of SCART2 is used for Easylink (P50) and there is a possibility for Y/C in. The CVBS-out on pin 19 can be used for WYSIWYR (What You See Is What You Record).

Internal video processing is done with YUV-signals. It also handles the video control, geometry part, and the insertion of the TXT/OSD RGB-signals. The video part delivers the RGB signals to the Scaler panel.

The Scaler board can receive two video input signals: SDTV (from BOCMA) or HD (from external HD source like DVD).

The SDTV and HD signals are first digitalised, after which they enter the Fli2300. This component does de-interlacing, scaling, and video processing.

After the video processing, the digital data is sent via a Low Voltage Differential Signalling bus to the LCD panel. LVDS is used to improve data speed and to reduce EMI significantly.

The microprocessor, called Painter (SAA55XX, IC7064), takes care of the set control, error generation and analogue TXT/OSD input- and output processing.

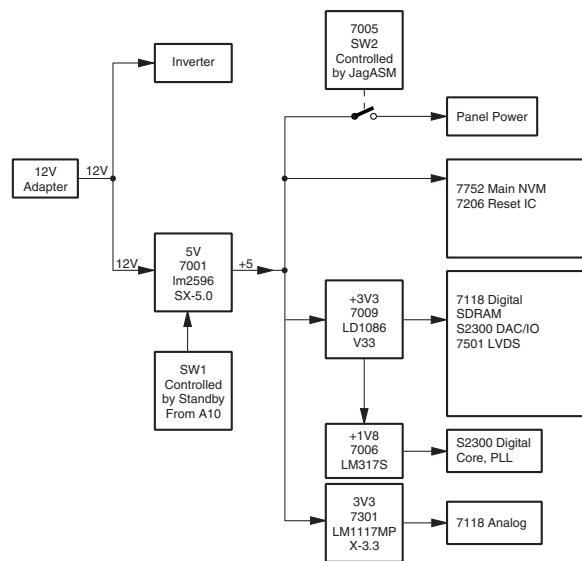
The Painter, ROM, and RAM are supplied with 3.3 V, which is also present during STANDBY.

The NVM (Non Volatile Memory) is used to store the settings, the flash-RAM contains the set software and the DRAM (located inside the microprocessor) is capable for storing 10 Teletext pages.

The sound part is built up around the MSP34xx (Multi-channel Sound Processor) for IF sound detection, sound control and source selection. Dolby decoding is also done by the MSP. Amplification is done via an integrated power amplifier IC (AN7522 for 13" and 15" models, AN5277 for 20" models).

Power supply input is a DC voltage coming from an external power adapter.

9.3 Power Supply



CL 36532073_079.eps
281105

Figure 9-2 Block diagram power distribution.

9.3.1 External Power Adapter

The power source for the LC13 is an **external** AC/DC adapter (not repairable). The type and power of this adapter depends on the screen size of the LCD panel and the rated audio output power. For the 13" and 15" versions, the same 12 V_{dc} adapter is used. However, the 20" model uses an adapter with 24 V_{dc} output.

Specifications for 13" and 15" models:

Power	: 12 V / 5 A
Type number	: SA165A-1250V-3
Supplier	: Sino American
Ordering code	: 3139 128 76811

Specifications for 20" models:

Power	: 24 V / 5 A
Type number	: AD3591
Supplier	: PI Electronic
Ordering code	: 3139 128 76771

9.3.2 Internal Power Distribution

For the internal power distribution, the following regulators are used:

- Low power supply regulator LM2596T-5: working frequency 150 kHz, switch current 3 A, max. input voltage 40 V, max. output voltage 5 V.
- Low power supply regulator MC34063A: working frequency 24 - 42 kHz, switch current 1.5 A, max. input voltage 40 V.

The supply voltages for the TV board are derived via three MC34063A voltage regulators.

Standby: The STANDBY line (active "low") comes from the microprocessor and pulls the gate of FET 7900 to ground when activated. This will block the FET. Directly after this FET, a fuse (1903) is located.

Power down: When the DC voltage from the external adapter drops below a certain value, the POWER_DOWN line will inform this to the microprocessor (active "low").

9.4 Input/Output

The I/O is divided over two parts: Rear I/O and Side I/O. The rear has two SCART inputs, and a HD (YPbPr) input. The side has a CVBS and Y/C (SVHS) input.

EXT1: The input of SCART1 is CVBS + RGB + L/R and the output is the video (+ sound) signal from the tuner (CVBS_TER_OUT).

EXT2: The input of SCART2 is Y/C + CVBS + L/R. The output signal is CVBS_SC2_MON_OUT (+ sound).

SCART2 is meant for VCR and has therefore some additional signals in relation to EXT1 but no RGB: it has the possibility for Y/C_in and Easylink-Plus (P50): Y_in on pin 20 and Chroma_in on pin 15.

Easylink is handled via pin 10 of the SCART2 (this is a bi-directional communication with the microprocessor) and supports the next features:

- Signal quality and aspect ratio matching
- One touch play & text
- PIP
- Pre-set download
- WYSIWYR
- Automatic Standby
- Country and language installation
- System Standby
- Intelligent set top box features
- NexTView download
- Timer record control
- VCR control feature

The selection of the external I/O's is controlled by the Painter microprocessor (pins 16 & 55) and handled via IC7401:

- SEL-MAIN-R1R2 is the selection between SCART1 (R1) and SCART2 (R2).
- SEL-FRNT-RR selection is made between Side and Rear I/O.

The status signals (on SCART pin 8) and Front detection are fed to the Painter (pins 2, 4 and 6).

HD (YPbPr) in: This input is directly going to the Scaler board. See paragraph "Video: Scaler Board".

9.5 Tuner and IF

9.5.1 Tuner (diagram A3, A4, and A5)

A Philips UR13xx Tuner with second input (for FM Radio) is used in the TV board. The SIF FM signal is decoded by the Micronas IC.

The tuner is I2C controlled, and is capable of receiving off-air, S- (cable) and Hyperband channels.

Tuning is done via I2C. The reference voltage on pin 9 is 7.1 V. This voltage is derived from the +5 V via a DC/DC converter.

Video IF amplifier

The IF-filter is integrated in a SAW (Surface Acoustic Wave) filter. One for filtering IF-video (1452, or 1453 in case of system L/L') and one for IF-audio (1454). The type of these filters is depending of the standard(s) that has to be received.

The output of the tuner is controlled via an IF-amplifier with AGC-control. This is a voltage feedback from pin 7 of the BOCMA to pin 1 of the tuner. The AGC-detector operates on top sync and top white level. AGC take-over point is adjusted via the service alignment mode 'Tuner' - 'AGC'. If there is too much noise in the picture, then it could be that the AGC setting is wrong. The AGC-setting could also be mis-aligned if the picture deforms with perfect signal; the IF-amplifier amplifies too much.

An (alignment free) PLL carrier regenerator with an internal VCO demodulates the video signal. This VCO is calibrated by means of a digital control circuit, which uses the clock frequency of the microprocessor as a reference. The frequency setting for the various standards is realised via the I2C-bus. The AFC output is generated by the digital control circuit of the IF-PLL demodulator and can be read via the I2C-bus.

The video identification circuit is used to identify the selected CBVS or Y/C signal. The IC contains a "group delay correction" circuit, which can be switched between the BG and a flat group delay response characteristic. This has the advantage that in multi-standard receivers no compromise has to be made for the choice of the SAW filter. Also, the sound trap is integrated. The centre frequency of the trap can be switched via the I2C-bus. The signal is available on pin 27.

QSS sound circuit

The single reference QSS mixer is realised by a multiplier. In this multiplier, the SIF signal is converted to the intercarrier frequency by mixing it with the regenerated picture carrier from the VCO. The mixer output signal is supplied to the output via a high-pass filter for attenuation of the residual video signals. With this system, a high performance hi-fi stereo sound processing can be achieved.

The AM sound demodulator is realised by a multiplier. The modulated sound IF signal is multiplied in phase with the limited SIF signal. The demodulator output signal is supplied to the output via a low-pass filter for attenuation of the carrier harmonics. The AM signal is supplied to the output (pin 27) via the volume control.

9.6 Video: TV-board (diagrams A4 and A5)

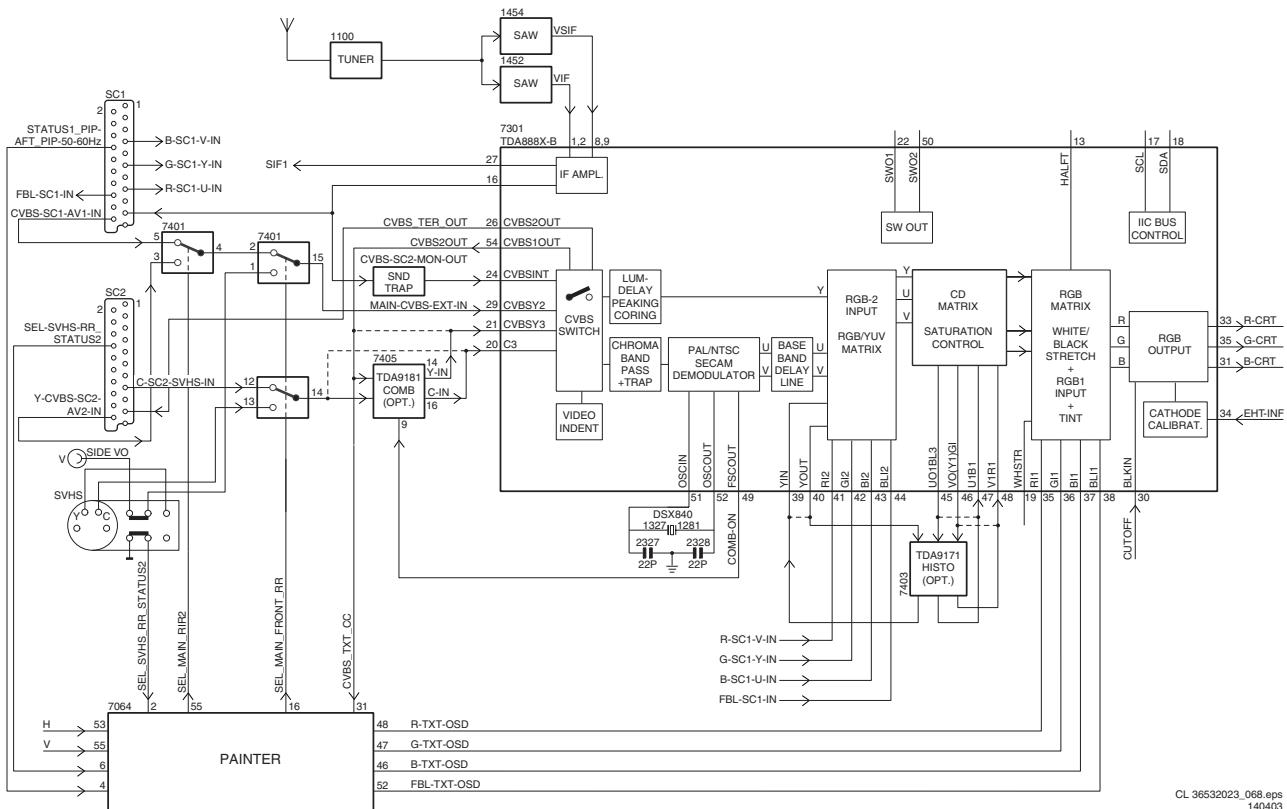


Figure 9-3 Block diagram video processing

The video processing is completely handled by a one-chip video processor: the TDA888x. This IC is called BOCMA (Bimos One Chip Mid-end Architecture) and contains:

- IF demodulator.
- Chrominance decoder
- Sync separator.
- Horizontal & vertical drive.
- RGB processing.
- CVBS and SVHS source select.

It has also build in features like:

- CTI.
- Black stretch.
- Blue stretch.
- White stretch.
- Slow start up.
- Dynamic skin tone correction etc.

Further, it also incorporates sound IF traps and filters, and requires only one crystal for all systems.

9.6.1 Source selection

The BOCMA has an input for the internal CVBS signal and two inputs for external CVBS or Y signals. The circuit has only one chroma input so that it is not possible to apply two separate Y/C inputs.

The selection of the various sources is made via the I2C-bus. The used IC version has two independently switchable outputs:

- The CVBS1 output (pin 54) is identical to the selected signal that is supplied to the internal video processing circuit and is used as source signal for the teletext decoder (Painter). Both CVBS outputs have an amplitude of 2.0 V_{pp}.
- The CVBS2 output (pin 26) is fed to pin 19 of SCART2 for WYSIWYR (What You See Is What You Record).

If the Y3/C3 signal is selected for one of the outputs, the luminance and chrominance signals are added so that a CVBS signal is obtained again.

9.6.2 Analogue Comb filter

After the selection of the external signals (EXT1, EXT2 or Side I/O) is made, the Y/CVBS signal is fed to the TDA888x (pin 29) along with the Front-end signal (pin 24). The selection between the two is made in the BOCMA and the output (pin 26) is fed to the (optional) 2-line comb filter (to separate the luminance from the chroma). The comb filter output is again fed to the BOCMA (pin 21) for further processing.

The external colour signals are also fed to the comb filter. In SVHS mode the comb filter is bypassed and the external signals are directly fed to the BOCMA.

Switching the comb filter is done via pin 49 of IC7301. The "video standard" selection is done via the SYS1 and SYS2 signals from the microprocessor. If the comb filter is not used, jumpers are present and the external Y/C signals are directly fed to the pins 20, 21 of IC7301.

After this stage, the external RGB signals (from SCART) are added to pins 40 - 44.

9.6.3 Histogram (YUV picture improvement) IC

The demodulated video-signal can be checked on pins 40, 45, and 46 of IC7301 and is fed to pins 39, 47, and 48. In this path, the Histogram IC TDA9171 can be inserted. Without this IC, jumpers are used.

The TDA9171 can control picture improvements like: histogram processing and blue stretch.

9.6.4 Chroma and Luminance processing

The BOCMA (IC7301-B) contains a chroma band pass and trap circuit (including a luminance delay line and the delay for

the peaking circuit). The centre frequency of the chroma band pass filter is switchable via the I₂C-bus so that the performance can be optimised for 'front-end' signals and external CVBS signals.

9.6.5 Colour decoder

The colour decoder (demodulator) can decode PAL, NTSC, and SECAM signals. The internal clock signals for the various colour standards are generated by means of an internal VCO, which uses the 12 MHz crystal (item 1330) frequency as a reference.

Under bad-signal conditions (e.g. VCR-playback), it may occur that the colour killer is activated although the colour PLL is still in lock. When this killing action is not wanted it is possible to overrule it.

The IC contains an Automatic Colour Limiting (ACL) circuit, which is switchable via the I₂C-bus, and which prevents that over saturation occurs when signals with a high chroma-to-burst ratio are received.

The reference frequency of the colour decoder is fed to the FSC output (pin 49) and can be used to control an external comb filter (only for 20 inch models).

The base-band delay line is integrated. The demodulated colour difference signals are internally supplied to the delay line. The colour difference matrix switches automatically between PAL/SECAM and NTSC.

9.6.6 Picture improvement features

In the BOCMA, various picture improvement features have been integrated. These features are:

- Video dependent coring in the peaking circuit. The coring can be activated only in the low-light parts of the screen. This effectively reduces noise while having maximum peaking in the bright parts of the picture.
- Colour Transient Improvement (CTI). This circuit improves the rise and fall times of the colour difference signals.
- Black-stretch. This circuit corrects the black level for incoming video signals, which have a deviation between the black level and the blanking, level (back porch).
- Blue-stretch. This circuit is intended to shift colour near 'white' with sufficient contrast values towards more blue to obtain a brighter impression of the picture
- White-stretch. This function adapts the transfer characteristic of the luminance amplifier in a non-linear way dependent on the picture content. The system operates such that maximum stretching is obtained when signals with a low video level are received. For bright pictures, the stretching is not active.
- Dynamic skin tone (flesh) control. This function is realised in the YUV domain by detecting the colours near to the skin tone. The correction angle can be controlled via the I₂C-bus.

9.6.7 RGB output

The ICs have a flexible control circuit for RGB and YUV input signals which has the following features:

- Input, which can be used for YUV or RGB, input signals and as YUV interface. The selection of the various modes can be realised via the I₂C-bus. For the YUV input 2 different input signal conditions can be chosen. It is also possible to connect the synchronisation circuit to the incoming Y input signal. This input signal can be controlled on saturation, contrast, and brightness.
- The RGB-1 input which is intended for OSD/text signals and which can be controlled on contrast and brightness. By means of software, the insertion blanking can be switched "on" or "off". It is also possible to convert the incoming RGB-1 signal to a YUV signal. The resulting signal is supplied to the YUV outputs.
- The TDA888x versions have an additional YUV or RGB input which can be controlled on contrast, saturation, and

brightness. This signal is supplied to the control circuit via the YUV interface so that an external picture improvement IC will also have effect on this signal.

9.6.8 Synchronisation (diagrams A4 and A5)

Horizontal Sync (H Sync)

Before the video processor IC7301 can generate horizontal drive pulses (LINEDRIVE, pin 56), the supply voltages on both pins 23 and 53 must be present. After the start-up command of the Painter (via the I₂C), the BOCMA starts giving horizontal pulses.

Vertical Sync (V Sync)

The vertical saw tooth generator drives the vertical output drive circuit. On pins 63 and 64 are two differential voltages DR+ and DR-. For this chassis, only DR- is used. This line is called V-SYNC, and goes to the Painter microprocessor.

Composite Sync (C Sync)

On pin 57 of IC7301 the sandcastle pulse (SC) is available. This is a 2-state pulse that is used for synchronisation of the (optional) histogram IC (item 7403).

Together with the LINEDRIVE pulse, this signal is also used to create the C-SYNC signal, which is used to synchronise the Scaler board.

9.7 Video: Scaler Board

The Scaler Board controls the display processing in an LCD TV, e.g. like the deflection circuit in a CRT-based TV. It controls all the view modes (e.g. like "zooming" and "shifting"). Features like HD inputs, are also handled by this board.

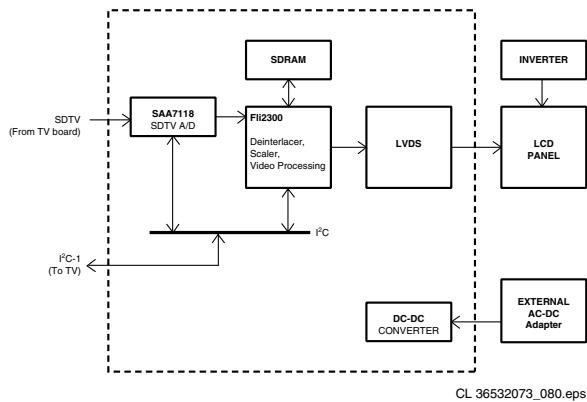


Figure 9-4 Block diagram Scaler board

9.7.1 Inputs

HD (YPbPr) input specifications

Input via Scaler Board. Supports:

- 576p, 720p and 1080i for PAL
- 480p, 720p, and 1080i for NTSC.
- Sync Detection: SOG/SOY and YUV/RGB supported.

9.7.2 Video Converter: FII2300

This 208-pins BGA-IC creates a picture signal with double the scan lines of a conventional interlaced picture, to create a noticeably sharper and smoother image. It offers higher picture resolution and eliminates virtually all motion artefacts. Even on large screens, the progressive scan lines are barely noticeable and it reduces picture flickering significantly.

Below listed processing is done in the FII2300:

- HD/SDTV brightness, saturation, hue, and sharpness control.
- Noise reduction and de-interlacing (only for SDTV).
- Scaling
- DAC RGB output for fault finding (on connector 1352)

9.8 Audio Processing

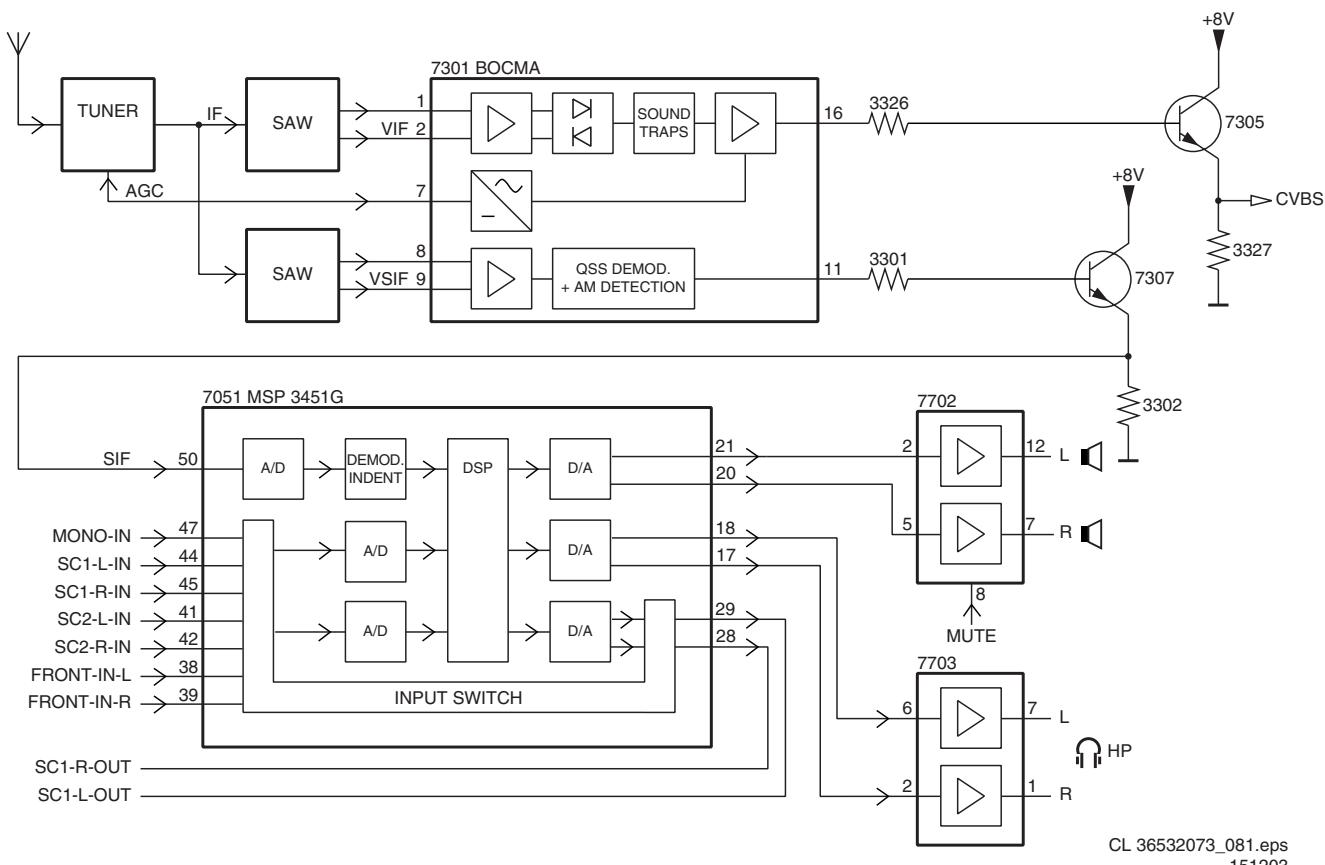


Figure 9-5 Block diagram audio processing

9.8.1 Introduction

All sets contain one of ITT's Multistandard Sound Processing ICs for sound decoding:

- MSP3410 (or 3411): Multi System (incl. NICAM) decoding for Europe and AP (Virtual Dolby).
- MSP3421 (or 3421): BTSC decoding for NAFTA and LATAM (Virtual Dolby).

This IC takes care of the main FM, AM and NICAM sound decoding.

The analogue input and output sections of MSP offer wide range of switching facilities such that it is possible to distribute all possible source signals (internal and external) to the desired output channels (main, headphone or SCART outputs).

All MSP versions contain digital audio processing, used for the basic left/right stereo sound, such as bass, treble, balance, incredible sound and spatial and source selection (SIF-signal, EXT1 or EXT2).

In addition to that, the MSP34x1 versions are also able to perform Virtual Dolby, a Dolby approved sound mode for surround sound reproduction with left/right speakers only.

9.8.2 Source selection

Table 9-1 MSP Overview

Micronas IC	System	Virtual Dolby	Region
MSP3410G	Multi-system	No	Europe/AP
MSP3411G	Multi-system	Yes	Europe/AP
MSP3420G	BTSC	No	Nafta/Latam
MSP3421G	BTSC	Yes	Nafta/Latam

The above-mentioned Micronas ICs are all having four pairs (L/R) of SCART audio inputs. The fourth input pair (AV4) is used as audio-in (input cinches located at the Scaler board) for PC and HD modes.

To get a constant level output if the Tuner is selected, the SCART1 output (Tuner at any time) has to be fed back to the input selector and selected as input for the MSP (SCART1 input).

9.8.3 Audio decoding

At the input, a choice can be made between two IF-signals; SIF and SIFM.

The selected signal is fed to the AGC. After this, an ADC converts the IF-signal to digital.

This digital signal can be processed by two demodulation channels. The first one is able to handle FM and NICAM signals. The second one can handle FM and AM signals.

Each channel contains a mixer to shift the incoming signal in the frequency domain. This shift is determined by the value of a DCO (Digital Controlled Oscillator).

After the down-mix, the signal is fed, via a filter, to a discriminator. From here the AM, FM or NICAM demodulation can be performed.

Both channels contain an 'automatic carrier mute' function, which automatically mutes the output of the analogue section when no carrier is detected.

After demodulation, the FM-signals are subjected to a de-emphasis operation. After that, the matrix of the stereo system is applied.

9.8.4 Audio processing

The sound processing is completely done by the MSP34xx:

- **Volume control** is done by the user via the SOUND menu.
- **Tone control** in 'Stereo' sets is done via the BASS/TREBLE control.
- **Headphone control** in 'Stereo'-sets is done via the loudspeaker output of the MSP, no sound control possible. In 'Virtual Dolby'-sets, the MSP has a separate Headphone output so separate sound control is possible.
- **Mute control** can be done in different ways:
 - System muting. System muting is implemented for "special events" such as channel/source change event, loss of identification signal, on/off of set, during search and auto store/program, sound mode change. This muting is transparent to the user. Audio output should be muted before the above "special events" occurred, to prevent problems such as audible plop. Muting is done via the SOUND-ENABLE line (active "low") connected to the amplifier-IC and coming from the Painter.
 - Headphone status mute. A headphone status is available to detect the presence of the headphone and mute the main speakers if the headphone is detected. The microprocessor will read the HP-SIDE-DETECT status.
 - User muting. This is a mute option available to the user. The user select the MUTE option on the remote control to switched off/on the sound output to the main loudspeaker and the subwoofer.

Automatic Volume Levelling (AVL)

One of the features of the MSP-family is AVL. If used, it limits the big volume differences in the broadcast between e.g. news transmissions and commercials or within a movie.

To be able to get a Dolby approval (for the Virtual Dolby sets), the AVL feature must be switchable. Therefore, the AVL feature is customer switchable via the menu.

9.8.5 Audio amplification (diagram A9)

Some specifications:

- 13" and 15" models: 2 x 3 W with power amplifier AN7522N.
- 20" models: 2 x 5 W with power amplifier AN5277N.
- All models are equipped with a subwoofer output.

The audio output stage is built around IC7731, which is a balanced amplifier, and is located on the TV board. It uses a monolithic integrated power amplifier IC, the AN5277. The gain of the amplifier is constant. This means that volume control has

to be done via the MSP. The supply voltage (12 or 24 V depending on the screen size) is filtered by L5733.

The AN5277 (for 20 inch models) delivers an output of 2 x 10 W_RMS to two full range speakers. A subwoofer is not implemented.

Headphone Amplifier

The headphone outputs are from the same audio power amplifier. The headphone jack will disconnect the audio output to the speakers when a headphone plug is inserted. Hence, the speakers are muted if a headphone is connected.

Resistors (items 3750 and 3752) limit the audio output to the HP against short circuits.

9.8.6 Audio: Lip Sync

A "lip sync" circuit with an 80 ms audio delay is added, in order to synchronise with video delay due to the complexity of the display processing. See table:

Table 9-2 Lip sync overview

Input	Speaker out(delay)	Monitor out(delay)	SCART1 out(delay)	SCART2 out(delay)
AV1	AV1 (80 ms)	AV1 (80 ms)	RF (none)	AV1 (80 ms)
AV2	AV2 (80 ms)	AV2 (80 ms)	RF (none)	RF (none)
AV3	AV3 (80 ms)	AV3 (80 ms)	RF (none)	AV3 (80 ms)
AV4	AV4 (80 ms)	AV4 (80 ms)	RF (none)	AV4 (80 ms)
RF	RF (80 ms)	RF (80 ms)	RF (80 ms)	RF (80 ms)

Note: SCART out not valid for NAFTA/Latam versions.

The video delay is significant, due to memory based processing. For instance, the "frame rate conversion" cause a delay of two frames, while the LCD panel response also cause a delay.

The circuit is a (16 bit) FIFO based digital delay. The memory size required for a 80 ms delay (with a data clock of 1.024 MHz) can be calculated with: Memory size = delay time * f_clk. This gives: 80 ms * 1.024 MHz = 81920 bits.

To calculate the memory size for a 16 bits mode I2S digital audio stream we must use the following data:

- f_s = 32 kHz, 16 bits, stereo
- Data clock = 32 kHz * 16 * 2 = 1.024 MHz
- Memory size for 1 ms delay = 1 ms * 1.024 MHz = 1024 bits = 1 kbit

So, the delay time of 80 ms can be built with five steps of 16 ms, which is close to the frame rate. Therefore, a 128 kbit SRAM (16 x 8) is chosen.

9.9 Control

9.9.1 Painter

The microprocessor (SAA55xx, IC7064 called Painter) provides:

- Control functions for the TV-set.
- On Screen Display (OSD).
- Teletext functions.
- P50 (Easylink) communication.
- I/O-ports for I2C, RC5, LED, and service modes.
- Error code generation.

Ten pages TXT-data can be stored internally. For 100 pages, an external memory is used (IC7070).

The Non Volatile Memory IC7066 is a 4 kB version M24C32W6.

All ICs in this part are supplied with 3V5 that is also present during Standby. This voltage is supplied via voltage regulator IC7920.

For stable OSD and TXT, the display is synchronised to the TV signal processing device by way of horizontal and vertical sync signals provided by external circuits (H-SYNC and V-SYNC). From these signals, all display timings are derived. The OSD/TXT RGB-outputs (46/47/48) and fast blanking (52) are fed to the BOCMA (pins 35 - 38).

9.9.2 I2C-busses

In this chassis, two I2C-busses used:

- Hardware I2C-bus, used for all IC communication.
- Separate short bus for the Non Volatile Memory (NVM), to avoid data corruption.

9.9.3 NVM

The Non Volatile Memory IC7066 contains all set related data that must be kept permanently, such as:

- Software identification.
- Operational hours.
- Error-codes.
- Option codes.
- All factory alignments.
- Last Status items for the customer + a complete factory recall.

9.9.4 Light control

A pair of light sensors, at the Front Control panel, is used to monitor the external ambient light condition and adjust the brightness, contrast, and any relevant video parameters of the display.

9.10 Inverter

1. Introduction
2. Control
3. Buck Converter
4. Royer Circuit
5. HV Circuit
6. Balance Circuit
7. Feedback Circuit
8. Protection Circuit

9.10.1 Introduction

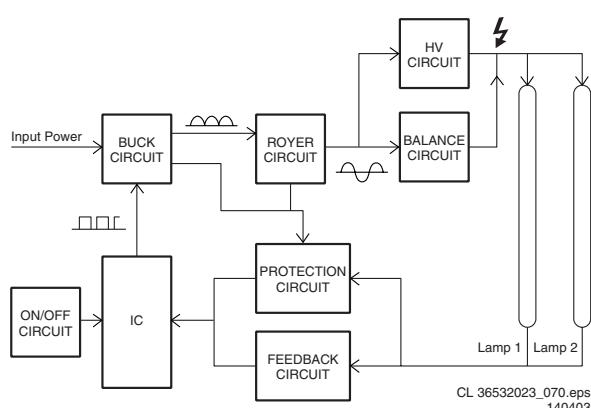


Figure 9-6 Block diagram Inverter Circuit

This is a separate panel (separate from LCD) for the 13" and 15" models, but is built-in in the 20" LCD panel.

This circuit is a basic DC/AC inverter for driving Cold Cathode Fluorescent Lamps (CCFL) who are located behind the LCD panel.

9.10.2 Control

The "On/Off circuit" delivers an input signal to turn the AC output voltage "on" or "off":

- ON ≥ 2.5 V
- OFF ≤ 2.0 V

This signal switches transistor Q4 "on/off", resulting in "start/stop" of the buck converter.

9.10.3 Buck Converter

This circuit uses the Power MOSFET (item Q8) to control the input power for the Royer circuit. It is based on the "Buck Converter" principle. The transistor switch (Q8) is the heart of the buck converter, and it controls the power supplied to the load. It is controlled via a PWM controller (U1, LM339). The LM339 controls the lamp current and brightness. Its functions include burst mode control, PWM control, and "soft start".

Note: this circuit needs a minimum load, in order to work properly.

9.10.4 Royer Circuit

This is a standard Royer structure. It transfers the DC input signal into an AC output signal.

It is a self-resonant oscillator, where one transistor conducts current while the opposite one does not, and vice versa. The transformer core saturates in each half cycle, causing each transistor to switch "on" or "off".

The energy required to operate the transistors as switches, is supplied by the feedback windings of the transformer to the bases of the transistors.

The resistors R19 and R20 supply the base current for Q5 and Q6. Capacitor C10/C11 and transformer T1 define the oscillation frequency (working frequency). For the 13" model, the working frequency lies around 45 kHz, for the 15" model, this is about 47 kHz.

Example: If the primary voltage is 15 V_rms, and the transformer turn ratio is 100, the secondary voltage is about $15 \times 100 = 1500$ V_rms.

9.10.5 HV Circuit

The High Voltage (HV) circuit supplies the power to drive the lamps. The output voltage () is:

- 13" model: 540 V (with load), 1430 V (without load).
- 15" model: 645 V (with load), 1430 V (without load).

Note: Ensure that the backlight connectors are fully inserted, in order to prevent high voltage arcing.

9.10.6 Balance Circuit

The Balance circuit uses an LCR resonant mode, to control the output current. It delivers the same output current, even if the load is different.

9.10.7 Feedback Circuit

The sense voltage of the feedback circuit is set at half the 5 V supply voltage via R15 and R17 (at pin 9 of the comparator). The control IC compares this voltage with the output current, and regulates the PWM drive signal.

9.10.8 Protection Circuit

The protection circuit senses the output for current and for abnormal signal behaviour, in order to protect the inverter:

- Output current: It monitors the lamp current. If this current is correct, the inverter will operate continuous. If the current is incorrect, the inverter will be shut down. This means for instance that if one lamp is not working, the inverter will go into protection.
- **Note:** Be sure that the lamp connectors are connected properly.
- Abnormal signals: It monitors the signals from the PWM and Royer stage. If anything is wrong, the protection circuit will shutdown the inverter.

9.11 LCD Display

9.11.1 Specifications

Panel model	: LC130V01 (13") : LC150X01 (15") : LC201V02 (20")
Resolution (HxV)	: 640x480 pixels (13") : 1280x768 pixels (15") : 640x480 pixels (20")
Luminance	: 450 nit (13") : 450 nit (15") : 450 nit (20")
Contrast ratio	: 400 (13") : 400 (15") : 350 (20")
Supplier	: LG.Philips LCD

9.11.2 LCD Failure Modes

Figures below can be used to evaluate problems with the LCD display.

Defect Part	Failure Mode	Description	Phenomenon	Root Cause / Responsibility	
TCP	V B/D	Block defect (Entire TCP defect)		Block defect : TCP crack or chip broken Dim or L/D : TCP dent(External stress) : TCP lead crack : Conductive particle inside ACF bonding area : Conductive particle induced from outside of LCD or due to improper condition : Mis-align between TCP & panel : Panel defect : TCP malfunction	- Can find damaged mark - Can find damaged mark - Can find damaged mark
	V Dim	Dim line		(A) Chip broken (B) TCP crack (C) TCP dent (D) Conductive particle inside ACF bonding area (E) Mis-align btwn TCP & panel	- Easy to find out responsibility with ingredient analysis for conductive particle
	V L/D	Vertical line defect (Always bright or dark)			
	H B/D	Block type defect (Entire TCP defect)			
	H Dim	Dim line			
	H L/D	Vertical line defect (Always bright or dark)			

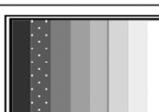
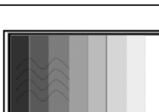
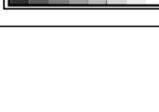
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Figure 9-7 LCD failure modes (1)

Defect Part	Failure Mode	Description	Phenomenon	Root Cause / Responsibility
Panel or Polarizer	Dot Defect	Panel has bright or dark dot. Sometimes adjacent 2 dot		Malfunction of TFT inside panel. - Follow IIS(Incoming Inspection Standard)
	Polarizer Bubble	Polarizer has bubbles		Bubble between upper glass and polarizer. - Follow IIS(Incoming Inspection Standard)
	Polarizer Scratch	Polarizer has scratch		Hard or sharp tool made this defect. - Follow IIS(Incoming Inspection Standard)
	F/M inside Polarizer	Foreign material inside polarizer. It shows linear or dot shape.		Foreign material inside polarizer. - Follow IIS(Incoming Inspection Standard)
	Yellowish /Purplish	Some area is different on white screen		1. Panel gap between upper and down layer glass is not uniform 2. Liquid crystal deteriorated 3. Limit sample
	Mura/ Mottling	Small area/ spot of un-uniformity /		1. Panel gap between upper and down layer glass is not uniform 2. Limit sample

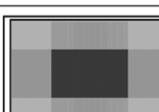
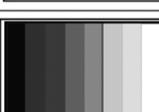
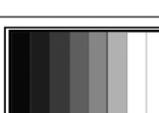
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Figure 9-8 LCD failure modes (2)

Defect Part	Failure Mode	Description	Phenomenon	Root Cause / Responsibility
Panel or Polarizer	New Ring	Ringed brightness uneven		Cell gap is not uniformity
	Chromaticity shift	Color coordinates is deviation		Transmittivity of panel declined (cell gap declined)
Circuit	Noise on grayscale	Noise on grayscale bar		Frame convertor IC(GMZ1) abnormal output(monitor system problem)
	Picture waving	Foreign material inside polarizer. It shows linear or dot shape.		Drive IC output is not stable (interference)
	Abnormal Display	Any kind of abnormal display except vertical or horizontal block defect.		1. Malfunction of any chipsets inside LCM - Customer responsibility 2. mechanical or electrical stress from customer system after analysis. - customer responsibility 3. Cold/short soldering of any components - Supplier responsibility 4. Poor connection between LCD and customer system. - Customer responsibility
	Flashing	Bright and dark display by turns.		

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Figure 9-9 LCD failure modes (3)

Defect Part	Failure Mode	Description	Phenomenon	Root Cause / Responsibility
Circuit	White Screen	LCD displays only white screen when B/L is normal condition. It corresponds to normally white mode.		1. LCD Fuse would be open because of surge current need to check compatibility 2. LCM cable no connecting (normal white)
	Black Screen	LCD displays only black screen when B/L is normal condition. It corresponds to normally black mode.		1. LCD Fuse would be open because of surge current need to check compatibility 2. LCM cable no connecting (normal Black, IPS)
	Flicker	LCD flickers at special pattern.		1. Vcom voltage in LCD is not balanced well - supplier responsibility but it can re-adjustable.
	Crosstalk	Brightness is different due to crosstalk at the pattern for crosstalk check.		1. An un-desired, parasite capacitance inside LCD panel can make vertical or horizontal crosstalk. All LCDs have weak crosstalk inevitably. But most of weak crosstalks are difficult to distinguish, especially with naked eye. 2. Follow IIS spec.
	Abnormal Color	LCD operate normally except different color.		1. Malfunction of any chipsets inside LCM-- Supplier responsibility 2. Mechanical or electrical stress from customer system after analysis-- Customer responsibility 3. Cold/short soldering of any components-- supplier responsibility 4. Poor connection between LCD and customer system -- customer responsibility
	Saturation	Higher grayscale bars is mixed (on 32 grayscale pattern)		1. Drive IC DC level is not correct 2. Monitor system improper adjustment on sub_contrast/sub_bright

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Figure 9-10 LCD failure modes (4)

Defect Part	Failure Mode	Description	Phenomenon	Root Cause / Responsibility
Mechanical or B/L	Mechanical Noise	Mechanical noise heard when twisted.		Mechanical interference in back light unit. - Needs limit sample
	Ripple	Concentric circle formed		Mechanical interference between panel and any mechanical structure including back light unit, customer's connector or front bezel effects cell gap of the LCD. As a result, Concentric circle observed. - Mechanical Interference : need to co-work
	B/L off	B/L is not working without any damaged in appearance		1. Cold soldering between wire and lamp electrode supplier responsibility 2. Lamp broken -- Customer responsibility
	B/L dark	B/L is darker than normality		1. Cold soldering between wire and lamp electrode. 2. Intermittent short between wire and lamp housing. Supplier responsibility
	B/L wire damaged	B/L wire damaged		Mis handling or any interference with customer system - Customer responsibility
	B/L wire open	No B/L		Mis handling or any interference with customer system - Customer responsibility
	B/L shutdown	B/L shutdown after a period of time		Intermittent short between wire and lamp housing happened because the power consumption is over than capacity of B/L inverter. - LG.PHILIPS LCD responsibility
	F/M	B/L has foreign material. Black or white color, linear or circular type		Foreign material inside B/L unit - Depend on IIS(Incoming Inspection Standard)

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Figure 9-11 LCD failure modes (5)

Defect Part	Failure Mode	Description	Phenomenon	Root Cause / Responsibility
Mechanical or B/L	Light leakage	Bottom part(B/L) of LCM is brighter than normal		Light from the B/L lamp directly shown through the irregular gap of B/L unit. - need to discuss or Needs limit sample
	Uniformity	B/L un-uniformity		Light is scattered by wrinkled sheet inside B/L unit. depend on product specification or Needs limit sample
	Mount hole	No mount hole or mount damaged		• No mount hole -- Supplier responsibility • Mount damaged -- Customer responsibility
	Low brightness	Brightness out of spec		Backlight declined due to diffuser isn't normal
	Panel crack	Panel glass is broken		1. Improper handle the panel 2. Poor packing on panel
Etc.	Label	No label or incorrect label or barcode can't read	 15198P2801834	Poor workmanship Supplier responsibility
	Can not screw	Impossible to screw		No spiral in nut or smaller diameter -- Supplier responsibility
	Etc.	Others		Any other defect that hard to classify into any defect item from above, should be classified into etc with detail description.

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Figure 9-12 LCD failure modes (6)

9.12 Abbreviation list

0/6/12	SCART switch control signal on A/V board. 0 = loop through (AUX to TV), 6 = play 16:9 format, 12 = play 4:3 format		FLASH	FLASH memory
1080i	1080 visible lines, interlaced		FM	Field Memory / Frequency Modulation
1080p	1080 visible lines, progressive scan		FMR	FM Radio
2CS	2 Carrier Stereo		FRC	Frame Rate Converter
480i	480 visible lines, interlaced		FRONT-C	Front input chrominance (SVHS)
480p	480 visible lines, progressive scan		FRONT-DETECT	Front input detection
ACI	Automatic Channel Installation: algorithm that installs TV channels directly from a cable network by means of a predefined TXT page		FRONT-Y_CVBS	Front input luminance or CVBS (SVHS)
ADC	Analogue to Digital Converter		G-SC1-IN	Green SCART1 in
AFC	Automatic Frequency Control: control signal used to tune to the correct frequency		G-SC2-IN	Green SCART2 in
AGC	Automatic Gain Control: algorithm that controls the video input of the feature box		G-TXT	Green teletext
AM	Amplitude Modulation		H	H_sync to the module
AP	Asia Pacific		HA	Horizontal Acquisition: horizontal sync pulse coming out of the BOCMA
AR	Aspect Ratio: 4 by 3 or 16 by 9		HD	High Definition
Artistic	See Painter 2.5: main processor		HP	HeadPhone
ASD	Automatic Standard Detection		I	Monochrome TV system. Sound carrier distance is 6.0 MHz
AV	Audio Video		I2C	Integrated IC bus
B-SC1-IN	Blue SCART1 in		I2S	Integrated IC Sound bus
B-SC2-IN	Blue SCART2 in		IC	Integrated Circuit
B-TXT	Blue teletext		IF	Intermediate Frequency
B/G	Monochrome TV system. Sound carrier distance is 5.5 MHz		Interlaced	Scan mode where two fields are used to form one frame. Each field contains half the number of the total amount of lines. The fields are written in "pairs", causing line flicker.
BOCMA	Bimos one Chip Mid-end Architecture: video and chroma decoder		IR	Infra Red
C-FRONT	Chrominance front input		IRQ	Interrupt ReQuest
CBA	Circuit Board Assembly (or PWB)		Last Status	The settings last chosen by the customer and read and stored in RAM or in the NVM. They are called at start-up of the set to configure it according the customers wishes
CL	Constant Level: audio output to connect with an external amplifier		LATAM	LATin AMerica
CLUT	Colour Look Up Table		LC03	Philips chassis name for LCD TV 2003 project
ComPair	Computer aided rePair		LCD	Liquid Crystal Display
CSM	Customer Service Mode		LED	Light Emitting Diode
CVBS	Composite Video Blanking and Synchronisation		LINE-DRIVE	Line drive signal
CVBS-EXT	CVBS signal from external source (VCR, VCD, etc.)		L/L'	Monochrome TV system. Sound carrier distance is 6.5 MHz. L' is Band I, L is all bands except for Band I
CVBS-INT	CVBS signal from Tuner		LS	LoudSpeaker
CVBS-MON	CVBS monitor signal		LVDS	Low Voltage Differential Signalling, data transmission system for high speed and low EMI communication.
CVBS-TER-OUT	CVBS terrestrial out		M/N	Monochrome TV system. Sound carrier distance is 4.5 MHz
DAC	Digital to Analogue Converter		MOSFET	Metal Oxide Semiconductor Field Effect Transistor
DBE	Dynamic Bass Enhancement: extra low frequency amplification		MPEG	Motion Pictures Experts Group
DFU	Directions For Use: owner's manual		MSP	Multi-standard Sound Processor: ITT sound decoder
DNR	Dynamic Noise Reduction		MUTE	MUTE Line
DRAM	Dynamic RAM		NC	Not Connected
DSP	Digital Signal Processing		NICAM	Near Instantaneous Compounded Audio Multiplexing. This is a digital sound system, used mainly in Europe.
DST	Dealer Service Tool: special (European) remote control designed for service technicians		NTSC	National Television Standard Committee. Colour system used mainly in North America and Japan. Colour carrier NTSC M/N = 3.579545 MHz, NTSC 4.43 = 4.433619 MHz (this is a VCR norm, it is not transmitted off-air)
DTS	Digital Theatre Sound		NVM	Non Volatile Memory: IC containing TV related data (for example, options)
DVD	Digital Video Disc		O/C	Open Circuit
EEPROM	Electrically Erasable and Programmable Read Only Memory		ON/OFF LED	On/Off control signal for the LED
EPG	Electronic Program Guide: system used by broadcasters to transmit TV guide information (= NexTView)		OSD	On Screen Display
EU	EUrope		P50	Project 50 communication: protocol between TV and peripherals
EXT	EXternal (source), entering the set by SCART or by cinches (jacks)		PAL	Phase Alternating Line. Colour system used mainly in Western Europe
FBL	Fast Blanking: DC signal accompanying RGB signals			
FBL-SC1-IN	Fast blanking signal for SCART1 in			
FBL-SC2-IN	Fast blanking signal for SCART2 in			
FBL-TXT	Fast Blanking Teletext			

	(colour carrier = 4.433619 MHz) and South America (colour carrier PAL M = 3.575612 MHz and PAL N = 3.582056 MHz)	VGA	Video Graphics Array
PC	Personal Computer	WD	Watch Dog
PCB	Printed Circuit Board (or PWB)	WYSIWYR	What You See Is What You Record: record selection that follows main picture and sound
PIG	Picture In Graphic	XTAL	Quartz crystal
PIP	Picture In Picture	YPbPr	Component video (Y= Luminance, Pb/ Pr= Colour difference signals)
PLL	Phase Locked Loop. Used, for example, in FST tuning systems. The customer can directly provide the desired frequency	Y/C	Luminance (Y) and Chrominance (C) signal
Progressive Scan	Scan mode where all scan lines are displayed in one frame at the same time, creating a double vertical resolution.	Y-OUT	Luminance-signal
PWB	Printed Wiring Board (or PCB)	YUV	Component video
RAM	Random Access Memory		
RC	Remote Control transmitter		
RC5	Remote Control system 5, the signal from the remote control receiver		
RGB	Red, Green, and Blue. The primary colour signals for TV. By mixing levels of R, G, and B, all colours (Y/C) are reproduced.		
RGBHV	Red, Green, Blue, Horizontal sync, and Vertical sync		
ROM	Read Only Memory		
SAM	Service Alignment Mode		
SIF	Sound Intermediate Frequency		
SC	SandCastle: two-level pulse derived from sync signals		
SC1-OUT	SCART output of the MSP audio IC		
SC2-B-IN	SCART2 Blue in		
SC2-C-IN	SCART2 chrominance in		
SC2-OUT	SCART output of the MSP audio IC		
S/C	Short Circuit		
SCART	Syndicat des Constructeurs d'Appareils Radiorecepteurs et Televisieurs		
SCL	CLock Signal on I2C bus		
SD	Standard Definition		
SDA	DAta Signal on I2C bus		
SDRAM	Synchronous DRAM		
SECAM	SEquence Couleur Avec Memoire. Colour system used mainly in France and Eastern Europe. Colour carriers = 4.406250 MHz and 4.250000 MHz		
SIF	Sound Intermediate Frequency		
SMPS	Switch Mode Power Supply		
SND	SouND		
SNDL-SC1-IN	Sound left SCART1 in		
SNDL-SC1-OUT	Sound left SCART1 out		
SNDL-SC2-IN	Sound left SCART2 in		
SNDL-SC2-OUT	Sound left SCART2 out		
SNDR-SC1-IN	Sound right SCART1 in		
SNDR-SC1-OUT	Sound right SCART1 out		
SNDR-SC2-IN	Sound right SCART2 out		
SNDR-SC2-OUT	Sound right SCART2 out		
SNDS-VL-OUT	Surround sound left variable level out		
SNDS-VR-OUT	Surround sound right variable level out		
SOPS	Self Oscillating Power Supply		
S/PDIF	Sony Philips Digital InterFace		
SRAM	Static RAM		
STBY	STandBY		
SVHS	Super Video Home System		
SW	SubWoofe / SoftWare		
THD	Total Harmonic Distortion		
TXT	TeleteXT		
uP	Microprocessor		
VA	Vertical Acquisition		
UVSH	UHF/VHF/S-Chanel Hyperband		
VL	Variable Level out: processed audio output toward external amplifier		
VCR	Video Cassette Recorder		

9.13 IC Data Sheets

This section shows the internal block diagrams and pin layouts of ICs that are drawn as "black boxes" in the electrical diagrams (with the exception of "memory" and "logic" ICs).

9.13.1 Diagram C9, Type Fli2300 (IC7351)

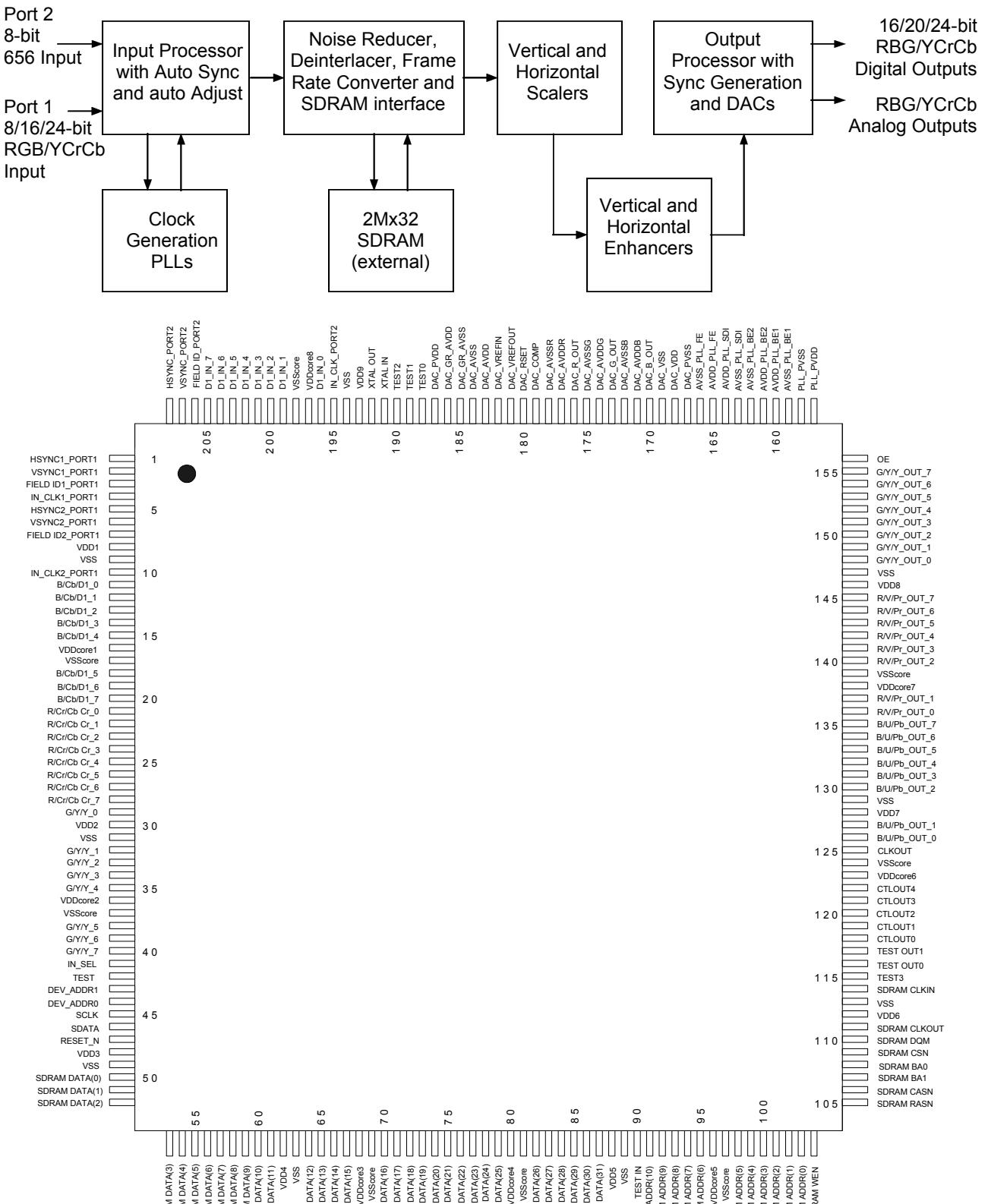


Figure 9-13 Internal Block Diagram and Pin Configuration

10. Spare Parts List

TV Board [A]

Various

1010	4822 265 11154	Connector 22p	2324	3198 016 31020	1nF 10% 25V 0603	2655	4822 124 23002	10μF 20% 16V
1111	4822 267 10735	Connector 3p m	2325	4822 124 23002	10μF 20% 16V	2656	3198 016 31020	1nF 10% 25V 0603
1231	2422 025 11244	Connector 7p m	2326	4822 126 14508	180pF 5% 50V	2657	2238 586 59812	100nF 20-80% 50V 0603
1234	4822 267 10565	Connector 4p	2327	5322 122 33861	120pF 10% 50V	2658	4822 124 23002	10μF 20% 16V
1260	2422 025 16725	Connector SCART f m Bk	2330	4822 122 33752	15pF 5% 50V	2661	3198 016 31020	1nF 10% 25V 0603
1267	2422 026 04926	Socket SVHS 4p f	2331	4822 122 33752	15pF 5% 50V	2662	3198 016 31020	1nF 10% 25V 0603
1269	2422 026 05499	Socket CINCH 3p f	2332	4822 122 33752	15pF 5% 50V	2668	3198 016 31020	1nF 10% 25V 0603
	RdWhYe		2333	3198 016 38210	22nF 10% 25V 0603	2669	3198 016 31020	1nF 10% 25V 0603
1330	4822 242 10685	Xtal 12MHz	2334	2238 916 15641	22nF 10% 25V 0603	2670	3198 017 41050	1μF 10V 0603
1452	2422 549 44372	SAW 38.9MHz K3953L	2335	3198 016 38210	22nF 10% 25V 0603	2671	3198 017 41050	1μF 10V 0603
1454	2422 549 44369	SAW 38.9MHz K9656L	2336	2238 916 15641	22nF 10% 25V 0603	2674	3198 017 41050	1μF 10V 0603
1620	2422 543 01059	Xtal 18.432MHz	2337	2238 916 15641	22nF 10% 25V 0603	2675	3198 017 41050	1μF 10V 0603
1731	2422 026 05449	Connector phono 1p f	2338	2238 916 15641	22nF 10% 25V 0603	2676	4822 124 23002	10μF 20% 16V
1732	4822 267 10565	Connector 4p	2339	2238 586 59812	100nF 20-80% 50V 0603	2677	4822 126 13193	4.7nF 10% 63V
1734	2422 025 16382	Connector 3p m	2340	4822 122 33741	10pF 10% 50V	2678	4822 126 13193	4.7nF 10% 63V
1902	4822 267 10565	Connector 4p	2341	3198 017 44740	470nF 10V 0603	2679	2238 586 59812	100nF 20-80% 50V 0603
8010	3139 131 03011	Cable 22p 80mm	2342	3198 017 44740	470nF 10V 0603	2680	4822 126 13881	470pF 5% 50V
8902	3139 131 03081	Cable 4p 140mm	2343	3198 017 44740	470nF 10V 0603	2681	2238 586 59812	100nF 20-80% 50V 0603
			2344	2222 867 15339	33pF 5% 50V 0603	2682	3198 016 33380	3.3pF 50V 0603
			2345	2222 867 15339	33pF 5% 50V 0603	2683	3198 016 33380	3.3pF 50V 0603
			2346	5322 126 11583	10nF 10% 50V 0603	2684	3198 016 31020	1nF 10% 25V 0603
			2347	5322 126 11583	10nF 10% 50V 0603	2685	3198 017 41050	1μF 10V 0603
			2348	3198 017 41050	1μF 10V 0603	2686	4822 126 14491	2.2μF -20-80% 10V 0805
			2349	3198 017 41050	1μF 10V 0603	2687	3198 017 41050	1μF 10V 0603
			2350	3198 017 41050	1μF 10V 0603	2688	3198 017 41050	1μF 10V 0603
			2351	3198 017 41050	1μF 10V 0603	2689	3198 017 41050	1μF 10V 0603
			2361	4822 124 80151	47μF 20% 16V	2731	4822 126 14549	33nF 16V 0603
			2380	4822 126 13881	470pF 5% 50V	2732	4822 124 40248	10μF 20% 63V
			2381	3198 017 41050	1μF 10V 0603	2733	4822 126 13879	220nF 20% 16V
			2382	4822 126 13879	220nF 20% 16V	2734	4822 124 12056	1000μF 20% 35V
			2390	2238 916 15641	22nF 10% 25V 0603	2734	4822 124 81144	1000μF 16V
			2391	4822 126 14241	330pF 50V 0603	2735	3198 016 31020	1nF 10% 25V 0603
			2401	3198 017 41050	1μF 10V 0603	2736	3198 017 41050	1μF 10V 0603
			2402	3198 017 41050	1μF 10V 0603	2737	4822 126 13193	4.7nF 10% 63V
			2404	2238 916 15641	22nF 10% 25V 0603	2737	5322 126 11579	3.3nF 10% 63V
			2407	2238 586 59812	100nF 20-80% 50V 0603	2738	2020 012 93762	330μF 20% 50V
			2408	2238 586 59812	100nF 20-80% 50V 0603	2739	2020 012 93762	330μF 20% 50V
			2412	4822 126 13879	220nF 20% 16V	2740	3198 016 31020	1nF 10% 25V 0603
			2415	4822 126 13879	220nF 20% 16V	2741	3198 017 41050	1μF 10V 0603
			2417	4822 124 23002	10μF 20% 16V	2742	4822 126 13193	4.7nF 10% 63V
			2418	3198 017 41050	1μF 10V 0603	2742	5322 126 11579	3.3nF 10% 63V
			2419	3198 017 41050	1μF 10V 0603	2745	4822 124 40207	100μF 20% 25V
			2424	4822 124 23002	10μF 20% 16V	2746	4822 124 21913	1μF 20% 63V
			2426	4822 124 23002	10μF 20% 16V	2750	4822 124 40248	10μF 20% 63V
			2428	3198 017 41050	1μF 10V 0603	2751	4822 126 13881	470pF 5% 50V
			2429	3198 017 34730	47nF 16V 0603	2752	4822 124 40248	10μF 20% 63V
			2432	3198 017 41050	1μF 10V 0603	2753	4822 126 13881	470pF 5% 50V
			2433	2020 552 94427	100pF 5% 50V 0603	2799	4822 124 40255	100μF 20% 63V
			2434	2020 552 94427	100pF 5% 50V 0603	2900	2238 586 59812	100nF 20-80% 50V 0603
			2435	3198 017 34730	47nF 16V 0603	2903	5322 126 11583	10nF 10% 50V 0603
			2448	2238 586 59812	100nF 20-80% 50V 0603	2910	4822 123 14026	470μF 20% 35V
			2452	5322 126 11583	10nF 10% 50V 0603	2910	4822 124 11767	470μF 20% 25V
			2453	5322 126 11583	10nF 10% 50V 0603	2911	4822 126 13881	470pF 5% 50V
			2601	2238 586 59812	100nF 20-80% 50V 0603	2911	4822 126 14506	270pF 5% 50V 0603
			2602	2238 586 59812	100nF 20-80% 50V 0603	2913	4822 124 80791	470μF 20% 16V
			2603	2238 586 59812	100nF 20-80% 50V 0603	2914	4822 126 13193	4.7nF 10% 63V
			2604	2238 586 59812	100nF 20-80% 50V 0603	2920	4822 123 14026	470μF 20% 35V
			2605	2238 586 59812	100nF 20-80% 50V 0603	2920	4822 124 11767	470μF 20% 25V
			2610	4822 126 14226	82pF 5% 50V 0603	2921	4822 126 13881	470pF 5% 50V
			2611	4822 126 14226	82pF 5% 50V 0603	2923	4822 124 40184	1000μF 20% 10V
			2612	4822 126 14241	330pF 50V 0603	2924	4822 126 13193	4.7nF 10% 63V
			2613	4822 126 13881	470pF 5% 50V	2931	4822 126 13881	470pF 5% 50V
			2620	4822 124 23002	10μF 20% 16V	2933	4822 124 80195	470μF 20% 10V
			2622	4822 126 11669	27pF 5% 50V 0603	2934	4822 126 13193	4.7nF 10% 63V
			2623	4822 126 14225	56pF 5% 50V 0603	2998	4822 124 81144	1000μF 16V
			2624	4822 122 33752	15pF 5% 50V	2999	4822 124 81144	1000μF 16V
			2625	4822 126 14508	180pF 5% 50V			
			2626	4822 126 11785	47pF 5% 50V 0603			
			2627	4822 126 13193	4.7nF 10% 63V			
			2628	4822 126 13193	4.7nF 10% 63V			
			2629	4822 126 13193	4.7nF 10% 63V			
			2630	4822 126 13193	4.7nF 10% 63V			
			2631	4822 126 13193	4.7nF 10% 63V			
			2632	4822 126 13193	4.7nF 10% 63V			
			2633	3198 017 41050	1μF 10V 0603			
			2634	3198 017 41050	1μF 10V 0603			
			2635	3198 017 41050	1μF 10V 0603			
			2636	3198 017 41050	1μF 10V 0603			
			2637	3198 017 41050	1μF 10V 0603			
			2638	3198 017 41050	1μF 10V 0603			
			2639	4822 126 13883	220pF 5% 50V			
			2640	3198 017 41050	1μF 10V 0603			
			2645	3198 016 31020	1nF 10% 25V 0603			
			2646	3198 016 31020	1nF 10% 25V 0603			
			2647	4822 126 11663	12pF 5% 50V 0603			
			2648	3198 017 41050	1μF 10V 0603			
			2649	3198 017 41050	1μF 10V 0603			
			2650	4822 124 23002	10μF 20% 16V			
			2651	2238 586 59812	100nF 20-80% 50V 0603			
			2652	2238 586 59812	100nF 20-80% 50V 0603			
			2653	5322 124 41945	22μF 20% 35V			
			2654	4822 126 13879	220nF 20% 16V			
			2655	4822 124 23002	10μF 20% 16V			
			2656	3198 016 31020	1nF 10% 25V 0603			
			2657	2238 586 59812	100nF 20-80% 50V 0603			
			2658	4822 124 23002	10μF 20% 16V			
			2661	3198 016 31020	1nF 10% 25V 0603			
			2662	3198 016 31020	1nF 10% 25V 0603			
			2668	3198 016 31020	1nF 10% 25V 0603			
			2669	3198 016 31020	1nF 10% 25V 0603			
			2670	3198 017 41050	1μF 10V 0603			
			2671	3198 017 41050	1μF 10V 0603			
			2674	3198 017 41050	1μF 10V 0603			
			2675	3198 017 41				

3023	4822 117 12902	8.2kΩ 1% 0.063W 0603	3253	4822 117 12891	220kΩ 1% 0.063W 0603	3620	4822 051 30101	100Ω 5% 0.062W
3023	5322 117 13056	8.2kΩ 1% 0.063W 0603	3254	4822 051 30151	150Ω 5% 0.062W	3621	4822 051 30101	100Ω 5% 0.062W
3024	4822 051 30102	1kΩ 5% 0.062W	3303	4822 051 30391	390Ω 5% 0.062W	3622	4822 051 30222	2.2kΩ 5% 0.062W
3030	4822 051 30102	1kΩ 5% 0.062W	3304	4822 051 30101	100Ω 5% 0.062W	3633	4822 051 30102	1kΩ 5% 0.062W
3031	4822 051 30471	470Ω 5% 0.062W	3307	4822 051 30101	100Ω 5% 0.062W	3634	4822 051 30102	1kΩ 5% 0.062W
3033	4822 051 30103	10kΩ 5% 0.062W	3308	4822 051 30101	100Ω 5% 0.062W	3635	4822 051 30102	1kΩ 5% 0.062W
3034	4822 051 30101	100Ω 5% 0.062W	3309	4822 051 30109	10Ω 5% 0.062W	3636	4822 051 30102	1kΩ 5% 0.062W
3035	4822 051 30471	470Ω 5% 0.062W	3310	4822 051 30101	100Ω 5% 0.062W	3637	4822 051 30102	1kΩ 5% 0.062W
3037	4822 051 30101	100Ω 5% 0.062W	3311	4822 051 30102	1kΩ 5% 0.062W	3638	4822 051 30102	1kΩ 5% 0.062W
3042	4822 051 30151	150Ω 5% 0.062W	3313	4822 051 30109	10Ω 5% 0.062W	3640	4822 051 30102	1kΩ 5% 0.062W
3043	4822 051 30151	150Ω 5% 0.062W	3314	4822 051 30102	1kΩ 5% 0.062W	3645	4822 051 30102	1kΩ 5% 0.062W
3044	4822 051 30103	10kΩ 5% 0.062W	3315	4822 051 30471	470Ω 5% 0.062W	3646	4822 051 30102	1kΩ 5% 0.062W
3045	4822 051 30123	12kΩ 5% 0.062W	3316	4822 051 30471	470Ω 5% 0.062W	3650	4822 051 30223	22kΩ 5% 0.062W
3046	4822 051 30472	4.7kΩ 5% 0.062W	3316	4822 051 30681	680Ω 5% 0.062W	3651	4822 051 30101	100Ω 5% 0.062W
3047	4822 051 30222	2.2kΩ 5% 0.062W	3317	4822 051 30153	15kΩ 5% 0.062W	3652	4822 051 30101	100Ω 5% 0.062W
3048	4822 051 30222	2.2kΩ 5% 0.062W	3318	4822 051 30273	27kΩ 5% 0.062W	3655	4822 051 30101	100Ω 5% 0.062W
3050	4822 051 30101	100Ω 5% 0.062W	3319	4822 051 30103	10kΩ 5% 0.062W	3656	4822 051 30101	100Ω 5% 0.062W
3051	4822 117 13525	24kΩ 1% 0.62W 0603	3321	4822 051 30332	3.3kΩ 5% 0.062W	3732	4822 117 12891	220kΩ 1% 0.063W 0603
3053	4822 051 30222	2.2kΩ 5% 0.062W	3322	4822 051 30332	3.3kΩ 5% 0.062W	3735	4822 051 30183	18kΩ 5% 0.062W
3054	4822 051 30103	10kΩ 5% 0.062W	3324	4822 051 30393	39kΩ 5% 0.062W	3735	4822 051 30273	27kΩ 5% 0.062W
3056	4822 117 12925	47kΩ 1% 0.063W 0603	3326	4822 051 30479	47Ω 5% 0.062W	3736	4822 051 30392	3.9kΩ 5% 0.063W 0603
3058	4822 051 30471	470Ω 5% 0.062W	3327	4822 051 30102	1kΩ 5% 0.062W	3736	4822 051 30682	6.8kΩ 5% 0.062W
3059	4822 051 30151	150Ω 5% 0.062W	3328	4822 051 30152	1.5kΩ 5% 0.062W	3739	4822 051 30102	1kΩ 5% 0.062W
3060	4822 051 30222	2.2kΩ 5% 0.062W	3329	4822 117 12889	270kΩ 1% 0.063W 0603	3740	4822 051 30183	18kΩ 5% 0.062W
3061	4822 051 30471	470Ω 5% 0.062W	3330	4822 051 30102	1kΩ 5% 0.062W	3740	4822 051 30273	27kΩ 5% 0.062W
3062	4822 117 12925	47kΩ 1% 0.063W 0603	3331	4822 051 30101	100Ω 5% 0.062W	3741	4822 051 30392	3.9kΩ 5% 0.063W 0603
3063	4822 051 30222	2.2kΩ 5% 0.062W	3332	4822 051 30101	100Ω 5% 0.062W	3741	4822 051 30682	6.8kΩ 5% 0.062W
3064	4822 051 30472	4.7kΩ 5% 0.062W	3333	4822 051 30151	150Ω 5% 0.062W	3743	4822 051 30102	1kΩ 5% 0.062W
3065	4822 051 30472	4.7kΩ 5% 0.062W	3334	4822 051 30151	150Ω 5% 0.062W	3744	4822 051 30472	4.7kΩ 5% 0.062W
3066	4822 117 12902	8.2kΩ 1% 0.063W 0603	3335	4822 051 30151	150Ω 5% 0.062W	3745	4822 051 30332	3.3kΩ 5% 0.062W
3066	5322 117 13056	8.2kΩ 1% 0.063W 0603	3339	4822 051 30101	100Ω 5% 0.062W	3745	4822 051 30472	4.7kΩ 5% 0.062W
3068	4822 117 12925	47kΩ 1% 0.063W 0603	3340	4822 051 30101	100Ω 5% 0.062W	3746	4822 051 30102	1kΩ 5% 0.062W
3069	4822 051 30153	15kΩ 5% 0.062W	3341	4822 051 30101	100Ω 5% 0.062W	3746	4822 051 30562	5.6kΩ 5% 0.063W 0603
3070	4822 051 30273	27kΩ 5% 0.062W	3342	4822 051 30101	100Ω 5% 0.062W	3747	4822 051 30472	4.7kΩ 5% 0.062W
3071	4822 117 13632	100kΩ 1% 0.62W 0603	3345	4822 051 30101	100Ω 5% 0.062W	3748	5322 117 13056	8.2kΩ 1% 0.063W 0603
3072	4822 117 13632	100kΩ 1% 0.62W 0603	3346	4822 051 30102	1kΩ 5% 0.062W	3750	4822 051 30471	470Ω 5% 0.062W
3081	4822 051 30472	4.7kΩ 5% 0.062W	3347	4822 051 30102	1kΩ 5% 0.062W	3752	4822 051 30471	470Ω 5% 0.062W
3082	4822 051 30103	10kΩ 5% 0.062W	3348	4822 051 30109	10Ω 5% 0.062W	3799	4822 117 12891	220kΩ 1% 0.063W 0603
3083	4822 051 30471	470Ω 5% 0.062W	3349	4822 051 30101	100Ω 5% 0.062W	3900	4822 051 30102	1kΩ 5% 0.062W
3084	4822 051 30101	100Ω 5% 0.062W	3350	4822 051 30109	10Ω 5% 0.062W	3901	4822 051 30102	1kΩ 5% 0.062W
3085	4822 051 30101	100Ω 5% 0.062W	3351	4822 051 30271	270Ω 5% 0.062W	3903	4822 051 30153	15kΩ 5% 0.062W
3086	4822 051 30101	100Ω 5% 0.062W	3352	4822 051 30151	150Ω 5% 0.062W	3904	4822 117 12891	220kΩ 1% 0.063W 0603
3088	4822 051 30101	100Ω 5% 0.062W	3353	4822 051 30103	10kΩ 5% 0.062W	3905	4822 117 12891	220kΩ 1% 0.063W 0603
3092	4822 051 30101	100Ω 5% 0.062W	3354	4822 051 30271	270Ω 5% 0.062W	3906	4822 051 30223	22kΩ 5% 0.062W
3100	4822 051 30008	Jumper 0603	3355	4822 051 30151	150Ω 5% 0.062W	3911	4822 117 12917	1Ω 5% 0.062W 0603
3101	4822 051 30008	Jumper 0603	3357	4822 051 30271	270Ω 5% 0.062W	3912	4822 117 12917	1Ω 5% 0.062W 0603
3102	4822 051 30103	10kΩ 5% 0.062W	3358	4822 051 30151	150Ω 5% 0.062W	3913	2322 704 61002	1kΩ 1% 0603
3103	4822 051 30152	1.5kΩ 5% 0.062W	3360	4822 051 30008	Jumper 0603	3913	5322 117 13018	1kΩ 1% 0.063W 0603
3120	4822 051 30479	47Ω 5% 0.062W	3380	4822 051 30223	22kΩ 5% 0.062W	3914	5322 117 13031	5.6kΩ 1% 0603
3121	4822 051 30273	27kΩ 5% 0.062W	3381	4822 051 30562	5.6kΩ 5% 0.063W 0603	3915	4822 117 12917	1Ω 5% 0.062W 0603
3122	4822 051 30333	33kΩ 5% 0.062W	3382	4822 051 30103	10kΩ 5% 0.062W	3921	4822 117 12917	1Ω 5% 0.062W 0603
3122	4822 117 13632	100kΩ 1% 0.62W 0603	3383	4822 051 30472	4.7kΩ 5% 0.062W	3923	2322 704 61002	1kΩ 1% 0603
3130	4822 117 11817	1.2kΩ 1% 0.062W	3384	4822 051 30472	4.7kΩ 5% 0.062W	3923	5322 117 13018	1kΩ 1% 0.063W 0603
3131	4822 051 30271	270Ω 5% 0.062W	3385	4822 051 30471	470Ω 5% 0.062W	3924	5322 117 13046	1.8kΩ 1% 0.063W 0603
3132	4822 117 13632	100kΩ 1% 0.62W 0603	3386	4822 051 30561	560Ω 5% 0.062W	3925	4822 052 11109	10Ω 5% 0.5W
3133	4822 117 12968	820Ω 5% 0.62W	3387	4822 051 30103	10kΩ 5% 0.062W	3930	4822 117 12917	1Ω 5% 0.062W 0603
3134	4822 117 13632	100kΩ 1% 0.62W 0603	3388	4822 051 30272	2.7kΩ 5% 0.062W	3930	4822 117 13613	2.2Ω 5% 0.603
3135	4822 051 30561	560Ω 5% 0.62W	3389	4822 051 30183	18kΩ 5% 0.062W	3931	4822 117 12917	1Ω 5% 0.062W 0603
3201	4822 051 30151	150Ω 5% 0.062W	3390	4822 051 30472	4.7kΩ 5% 0.062W	3932	2322 704 61002	1kΩ 1% 0603
3202	4822 117 12891	220kΩ 1% 0.063W 0603	3391	4822 051 30103	10kΩ 5% 0.062W	3932	5322 117 13018	1kΩ 1% 0.063W 0603
3203	4822 051 30151	150Ω 5% 0.062W	3392	4822 051 30154	150kΩ 5% 0.062W	3933	5322 117 13048	3.3kΩ 1% 0.063W 0603
3204	4822 117 12925	47kΩ 1% 0.063W 0603	3393	4822 051 30472	4.7kΩ 5% 0.062W	4xxx	4822 051 30008	Jumper 0603
3206	4822 051 30151	150Ω 5% 0.062W	3394	4822 051 30273	27kΩ 5% 0.062W	4xxx	4822 051 20008	Jumper 0805
3207	4822 117 12891	220kΩ 1% 0.063W 0603	3395	4822 051 30271	270Ω 5% 0.062W			
3208	4822 051 30151	150Ω 5% 0.062W	3401	4822 051 30101	100Ω 5% 0.062W			
3209	4822 117 12925	47kΩ 1% 0.063W 0603	3402	4822 051 30101	100Ω 5% 0.062W			
3211	4822 051 30759	75Ω 5% 0.062W	3404	4822 051 30101	100Ω 5% 0.062W			
3212	4822 051 30101	100Ω 5% 0.062W	3411	4822 051 30152	1.5kΩ 5% 0.062W	5040	4822 157 10977	4.7μH 10%
3213	4822 051 30223	22kΩ 5% 0.062W	3412	4822 051 30152	1.5kΩ 5% 0.062W	5041	4822 157 10977	4.7μH 10%
3214	4822 051 30682	6.8kΩ 5% 0.062W	3413	4822 051 30102	1kΩ 5% 0.062W	5042	3198 018 64780	4.7μH 5%
3216	4822 051 30759	75Ω 5% 0.062W	3414	4822 051 30152	1.5kΩ 5% 0.062W	5120	2422 535 94713	1000μF 10%
3217	4822 051 30101	100Ω 5% 0.062W	3415	4822 051 30152	1.5kΩ 5% 0.062W	5121	2422 535 94713	1000μF 10%
3218	4822 051 30759	75Ω 5% 0.062W	3416	4822 051 30102	1kΩ 5% 0.062W	5122	2422 536 00059	12μH 10%
3219	4822 051 30101	100Ω 5% 0.062W	3417	4822 051 30109	10Ω 5% 0.062W	5123	4822 157 1334	0.68μH

→	6031	9340 548 42115	PDZ2.4B	7739	5322 130 60159	BC846B	2351	2020 552 96507	10µF 10V	
	6101	9340 548 71115	PDZ33B	7744	3198 010 42310	BC847BW	2352	2020 552 96507	10µF 10V	
	6102	4822 130 11397	BAS316	7745	3198 010 42310	BC847BW	2353	2238 586 59812	100nF 20-80% 50V 0603	
	6120	5322 130 34337	BAV99	7900	9322 157 51685	S112301DS	2354	2020 552 96507	10µF 10V	
	6207	4822 130 10852	BZX284-C6V8	7901	4822 130 11155	PDT114ET	2355	2020 552 96507	10µF 10V	
	6208	4822 130 10852	BZX284-C6V8	7903	5322 130 60159	BC846B	2356	2222 867 15339	33pF 5% 50V 0603	
	6211	9340 548 61115	PDZ12B	7904	5322 130 60159	BC846B	2357	2020 552 96507	10µF 10V	
	6218	9340 548 61115	PDZ12B	7910	4822 209 60059	MC34063AP1	2358	2222 867 15339	33pF 5% 50V 0603	
	6238	9340 548 61115	PDZ12B	7920	4822 209 60059	MC34063AP1	2359	2238 586 59812	100nF 20-80% 50V 0603	
	6239	9340 548 61115	PDZ12B	7930	4822 209 60059	MC34063AP1	2361	2020 552 96507	10µF 10V	
	6243	9340 548 61115	PDZ12B				2362	2238 586 59812	100nF 20-80% 50V 0603	
	6244	9340 548 61115	PDZ12B				2363	2238 586 59812	100nF 20-80% 50V 0603	
	6253	9340 548 61115	PDZ12B				2364	2238 586 59812	100nF 20-80% 50V 0603	
	6254	9340 548 61115	PDZ12B				2365	2238 586 59812	100nF 20-80% 50V 0603	
	6281	9340 548 61115	PDZ12B				2366	2238 586 59812	100nF 20-80% 50V 0603	
	6282	9340 548 61115	PDZ12B				2367	2238 586 59812	100nF 20-80% 50V 0603	
	6283	9340 548 61115	PDZ12B				2368	2238 586 59812	100nF 20-80% 50V 0603	
	6284	9340 548 61115	PDZ12B	1001	8238 277 11021	Socket power 1p f	2369	2238 586 59812	100nF 20-80% 50V 0603	
	6285	9340 548 61115	PDZ12B	1002	8238 277 10841	Fuse 7A 125V	2371	2238 586 59812	100nF 20-80% 50V 0603	
	6286	9340 548 61115	PDZ12B	1003	4822 267 10565	Connector 4p	2372	2238 586 59812	100nF 20-80% 50V 0603	
	6287	9340 548 61115	PDZ12B	1301	2422 543 01255	Xtal 24.576MHz 30pF	2373	2238 586 59812	100nF 20-80% 50V 0603	
	6288	9340 548 61115	PDZ12B	1341	4822 265 11352	Connector 8p	2374	2238 586 59812	100nF 20-80% 50V 0603	
	6289	9340 548 61115	PDZ12B	1351	2422 543 01246	Xtal 13.5MHz 12pF DSX840	2375	2238 586 59812	100nF 20-80% 50V 0603	
	6290	9340 548 61115	PDZ12B	1501	2422 025 18059	Connector 4p m	2376	2020 552 96507	10µF 10V	
	6291	9340 548 61115	PDZ12B	1506	2422 025 18024	Connector 40p m	2377	2020 552 96507	10µF 10V	
	6292	9340 548 61115	PDZ12B	1681	4822 265 11154	Connector 22p	2378	2238 586 59812	100nF 20-80% 50V 0603	
	6327	4822 130 11397	BAS316	8341	3139 110 27991	Cable 8p 80mm	2379	2020 552 96507	10µF 10V	
	6380	4822 130 11397	BAS316	8341	3139 110 28001	Cable 8p 100mm	2380	2238 586 59812	100nF 20-80% 50V 0603	
→	6390	4822 130 11397	BAS316				2381	2238 586 59812	100nF 20-80% 50V 0603	
	6412	4822 130 11397	BAS316				2382	2238 586 59812	100nF 20-80% 50V 0603	
	6415	4822 130 11397	BAS316				2383	2238 586 59812	100nF 20-80% 50V 0603	
	6451	4822 130 11525	1SS356				2384	2238 586 59812	100nF 20-80% 50V 0603	
	6650	4822 130 11397	BAS316	2001	2238 586 59812	100nF 20-80% 50V 0603	2385	2238 586 59812	100nF 20-80% 50V 0603	
	6731	9340 548 61115	PDZ12B	2002	2238 586 59812	100nF 20-80% 50V 0603	2386	2238 586 59812	100nF 20-80% 50V 0603	
	6732	9340 548 61115	PDZ12B	2005	2238 586 59812	100nF 20-80% 50V 0603	2387	2238 586 59812	100nF 20-80% 50V 0603	
	6910	9322 128 70685	SMSS14	2006	4822 124 80151	47µF 20% 16V	2388	2238 586 59812	100nF 20-80% 50V 0603	
	6920	9322 128 70685	SMSS14	2007	4822 124 11767	470µF 20% 25V	2389	2238 586 59812	100nF 20-80% 50V 0603	
	6925	9322 128 70685	SMSS14	2008	4822 124 11767	470µF 20% 25V	2390	2238 586 59812	100nF 20-80% 50V 0603	
	6930	9322 128 70685	SMSS14	2009	4822 123 14026	470µF 20% 35V	2391	2020 552 96507	10µF 10V	
	7066	9322 156 81668	M24C32-WMN6TNKSA	2010	4822 123 14026	470µF 20% 35V	2392	2238 586 59812	100nF 20-80% 50V 0603	
	7067	3198 010 42310	BC847BW	2015	4822 124 11767	470µF 20% 25V	2393	2238 586 59812	100nF 20-80% 50V 0603	
	7068	3198 010 42310	BC847BW	2020	4822 126 13193	4.7nF 10% 63V	2394	2238 586 59812	100nF 20-80% 50V 0603	
	7069	3198 010 42310	BC847BW	2021	5322 126 11583	10nF 10% 50V 0603	2395	2020 552 96507	10µF 10V	
	7120	3198 010 42310	BC847BW	2024	4822 123 14026	470µF 20% 35V	2396	2238 586 59812	100nF 20-80% 50V 0603	
	7130	5322 130 42718	BFS20	2025	4822 126 13881	470pF 5% 50V	2397	2238 586 59812	100nF 20-80% 50V 0603	
	7131	5322 130 42718	BFS20	2026	4822 124 11767	470µF 20% 25V	2398	2238 586 59812	100nF 20-80% 50V 0603	
	7224	5322 130 60159	BC846B	2027	4822 124 11767	470µF 20% 25V	2399	2238 586 59812	100nF 20-80% 50V 0603	
	7301	9352 626 19557	TDA8885	2028	2238 586 59812	100nF 20-80% 50V 0603	2400	4822 126 13879	220nF 20% 16V	
	7302	3198 010 42310	BC847BW	2029	4822 124 11767	470µF 20% 25V	2401	4822 126 13879	220nF 20% 16V	
	7303	3198 010 42310	BC847BW	2030	4822 122 33753	150pF 5% 50V	2402	4822 126 13879	220nF 20% 16V	
	7330	3198 010 42310	BC847BW	2031	4822 122 33753	150pF 5% 50V	2403	5322 126 11583	10nF 10% 50V 0603	
	7350	3198 010 42310	BC847BW	2032	4822 122 33753	150pF 5% 50V	2404	5322 126 11583	10nF 10% 50V 0603	
	7353	3198 010 42310	BC847BW	2033	4822 122 33753	150pF 5% 50V	2405	5322 126 11583	10nF 10% 50V 0603	
	7356	3198 010 42310	BC847BW	2034	4822 122 33753	150pF 5% 50V	2406	5322 126 11583	10nF 10% 50V 0603	
	7380	3198 010 42310	BC847BW	2035	4822 122 33753	150pF 5% 50V	2407	4822 126 13879	220nF 20% 16V	
	7381	3198 010 42310	BC847BW	2036	4822 122 33753	150pF 5% 50V	2408	4822 126 13879	220nF 20% 16V	
	7382	3198 010 42310	BC847BW	2037	4822 122 33753	150pF 5% 50V	2409	4822 126 13879	220nF 20% 16V	
	7383	3198 010 42310	BC847BW	2038	4822 122 33753	150pF 5% 50V	2410	4822 126 13879	220nF 20% 16V	
	7384	3198 010 42310	BC847BW	2039	2020 552 96507	10µF 10V	2411	4822 126 13879	220nF 20% 16V	
	7385	3198 010 42310	BC847BW	2040	2238 586 59812	100nF 20-80% 50V 0603	2412	4822 126 13879	220nF 20% 16V	
	7390	3198 010 42310	BC847BW	2041	2020 552 96507	10µF 10V	2413	3304	4822 051 30151	150Ω 5% 0.062W
	7391	3198 010 42310	BC847BW	2042	2238 586 59812	100nF 20-80% 50V 0603	2414	3305	4822 051 30151	150Ω 5% 0.062W
	7401	9351 869 40118	74HC4053PW	2043	2238 586 59812	100nF 20-80% 50V 0603	2415	4822 051 30151	150Ω 5% 0.062W	
	7405	9352 630 99118	TDA9181T	2044	2238 586 59812	100nF 20-80% 50V 0603	2416	4822 051 30151	150Ω 5% 0.062W	
	7412	9340 425 20115	BC847BS	2045	2238 586 59812	100nF 20-80% 50V 0603	2417	4822 051 30151	150Ω 5% 0.062W	
	7427	3198 010 42310	BC847BW	2046	2238 586 59812	100nF 20-80% 50V 0603	2418	4822 051 30151	150Ω 5% 0.062W	
	7428	3198 010 42310	BC847BW	2047	2238 586 59812	100nF 20-80% 50V 0603	2419	4822 051 30151	150Ω 5% 0.062W	
	7452	3198 010 42310	BC847BW	2048	2238 586 59812	100nF 20-80% 50V 0603	2420	4822 051 30151	150Ω 5% 0.062W	
	7471	3198 010 42310	BC847BW	2049	4822 122 33752	15pF 5% 50V	2421	4822 051 30151	150Ω 5% 0.062W	
	7601	9322 167 76668	TC74HC590AF	2050	4822 122 33752	15pF 5% 50V	2422	4822 051 30151	150Ω 5% 0.062W	
	7602	9322 167 76668	TC74HC590AF	2051	4822 126 14221	68pF 5% NP0 50V 0603	2423	4822 051 30151	150Ω 5% 0.062W	
	7603	4822 209 91023	UM62256EM-70LL	2052	2238 586 59812	100nF 20-80% 50V 0603	2424	4822 051 30151	150Ω 5% 0.062W	
	7604	5322 209 31276	SN74HCT573DW	2053	2238 586 59812	100nF 20-80% 50V 0603	2425	4822 051 30151	150Ω 5% 0.062W	
	7605	5322 209 31276	SN74HCT573DW	2054	2020 552 96507	10µF 10V	2426	4822 051 30151	150Ω 5% 0.062W	
	7610	3198 010 42310	BC847BW	2055	2238 586 59812	100nF 20-80% 50V 0603	2427	4822 051 30151	150Ω 5% 0.062W	
	7620	9322 195 11671	MSP3410G-QI-C12	2056	2238 586 59812	100nF 20-80% 50V 0603	2428	4822 051 30151	150Ω 5% 0.062W	
	7674	4822 130 63732	MMUN2212	2057	4822 124 80151	47µF 20% 16V	2429	4822 051 30479	47Ω 5% 0.062W	
	7675	4822 130 63732	MMUN2212	2058	2238 586 59812	100nF 20-80% 50V 0603	2430	4822 051 30479	47Ω 5% 0.062W	
	7678									

3352	4822 117 12917	1Ω 5% 0.062W 0603
3354	4822 051 30471	470Ω 5% 0.062W
3355	2350 035 10229	4 x 22Ω 5%
3356	4822 051 30471	470Ω 5% 0.062W
3357	4822 051 30471	470Ω 5% 0.062W
3359	2350 035 10229	4 x 22Ω 5%
3360	4822 117 12139	22Ω 5% 0.062W
3361	4822 051 30103	10kΩ 5% 0.062W
3362	4822 051 30103	10kΩ 5% 0.062W
3363	4822 051 30103	10kΩ 5% 0.062W
3364	4822 051 30474	470kΩ 5% 0.062W
3365	4822 051 30181	180Ω 5% 0.062W
3366	4822 117 12917	1Ω 5% 0.062W 0603
3368	4822 051 30472	4.7kΩ 5% 0.062W
3369	4822 051 30103	10kΩ 5% 0.062W
3370	4822 117 12139	22Ω 5% 0.062W
3371	4822 117 12139	22Ω 5% 0.062W
3372	2350 035 10229	4 x 22Ω 5%
3372	4822 117 13573	4 x 47Ω 5%
3373	2350 035 10229	4 x 22Ω 5%
3373	4822 117 13573	4 x 47Ω 5%
3374	2350 035 10229	4 x 22Ω 5%
3374	4822 117 13573	4 x 47Ω 5%
3375	2350 035 10229	4 x 22Ω 5%
3375	4822 117 13573	4 x 47Ω 5%
3376	2350 035 10229	4 x 22Ω 5%
3376	4822 117 13573	4 x 47Ω 5%
3377	2350 035 10229	4 x 22Ω 5%
3377	4822 117 13573	4 x 47Ω 5%
3379	4822 117 12139	22Ω 5% 0.062W
3380	4822 117 12139	22Ω 5% 0.062W
3381	4822 117 12139	22Ω 5% 0.062W
3382	4822 051 30472	4.7kΩ 5% 0.062W
3383	4822 117 12139	22Ω 5% 0.062W
3384	4822 117 12139	22Ω 5% 0.062W
3385	4822 117 12139	22Ω 5% 0.062W
3386	2350 035 10229	4 x 22Ω 5%
3387	2350 035 10229	4 x 22Ω 5%
3388	4822 051 30759	75Ω 5% 0.062W
3389	4822 051 30759	75Ω 5% 0.062W
3391	4822 051 30759	75Ω 5% 0.062W
3394	2350 035 10229	4 x 22Ω 5%
3395	4822 117 12139	22Ω 5% 0.062W
3396	4822 051 30472	4.7kΩ 5% 0.062W
3507	4822 051 30103	10kΩ 5% 0.062W
3511	4822 051 30103	10kΩ 5% 0.062W
3516	4822 051 30109	10Ω 5% 0.062W
3517	4822 051 30109	10Ω 5% 0.062W
3681	4822 051 30472	4.7kΩ 5% 0.062W
3682	4822 051 30472	4.7kΩ 5% 0.062W
4xxx	4822 051 30008	Jumper 0603
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5001	2422 536 00504	68µH 10%
5002	2422 535 94639	10µH 20%
5003	2422 549 45333	Bead 120Ω at 100MHz
5009	2422 535 94639	10µH 20%
5010	2422 549 45333	Bead 120Ω at 100MHz
5011	2422 549 45333	Bead 120Ω at 100MHz
5013	2422 549 45333	Bead 120Ω at 100MHz
5014	2422 549 45333	Bead 120Ω at 100MHz
5015	4822 157 11869	33µH 10%
5025	2422 535 94648	220µH 10%
5026	2422 535 94639	10µH 20%
5301	2422 549 45333	Bead 120Ω at 100MHz
5302	2422 549 45333	Bead 120Ω at 100MHz
5303	2422 549 45333	Bead 120Ω at 100MHz
5304	2422 549 45333	Bead 120Ω at 100MHz
5351	2422 549 45333	Bead 120Ω at 100MHz
5352	2422 549 45333	Bead 120Ω at 100MHz
5353	2422 549 45333	Bead 120Ω at 100MHz
5354	2422 549 45333	Bead 120Ω at 100MHz
5355	2422 549 45333	Bead 120Ω at 100MHz
5356	2422 549 45333	Bead 120Ω at 100MHz
5357	2422 549 45333	Bead 120Ω at 100MHz
5501	2422 549 45333	Bead 120Ω at 100MHz
5504	2422 549 45333	Bead 120Ω at 100MHz
5512	2422 549 45333	Bead 120Ω at 100MHz
5513	2422 549 45333	Bead 120Ω at 100MHz
5517	2422 549 45333	Bead 120Ω at 100MHz
5521	2422 549 45333	Bead 120Ω at 100MHz
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→		
6001	4822 130 11522	UDZ15B
6001	9340 548 69115	PDZ27B
6002	9322 082 82668	SS34
6025	9322 128 70685	SMSS14
—		
QE		
7001	9322 142 69667	LM2596T-5.0
7002	5322 130 60159	BC846B
7003	5322 130 60159	BC846B
7004	5322 130 60159	BC846B
7005	9322 115 29668	SI9433DY
7005	9965 000 13595	SI4431DY (SO8)
7006	9322 189 19668	LD1086D2T18
7009	9322 152 53687	LD1086V33
7010	4822 209 60059	MC34063AP1
7011	4822 209 17398	LD1117DT33
7301	4822 209 17398	LD1117DT33
7302	9352 673 95518	SAA7118E/V1
7351	9322 190 49671	FLI2300-AB
7352	9322 190 51671	MT48LC2M32B2TG-5
7501	9322 171 82668	SN75LVDS83DGGR
C09	9965 000 21131	22,5nF 25V 1206
C0T	9965 000 21132	GJ-EE0803-002
C10	9965 000 17802	0.15µF
C10	9965 000 21133	68.2pF 50V 0603
C11	9965 000 17802	0.15µF
C11	9965 000 21134	10.5nF
C12	5322 126 11583	10nF 10% 50V 0603
C12	9965 000 05464	10.3nF 50V 0603
C12	9965 000 21138	10,3nF 50V 0603
C14	9965 000 21139	221G 50V 0603
C16	9965 000 21131	22,5nF 25V 1206
C17	5322 122 33063	2,2PF 5%NP0 0805
C17	9965 000 21140	47.2nF 50V 0805
C18	2020 558 90659	12pF 5% 3kV
C19	5322 122 31866	6.8nF 10% 63V
C19	9965 000 05465	1µF 10V 0603
C19	9965 000 21140	47.2nF 50V 0805
C20	9965 000 21131	22,5nF 25V 1206
C21	4822 126 14247	1.5nF 50V 0603
C21	9965 000 21141	15.2nF 50V 0603
C22	9965 000 14747	47.4nF 10V 0603
C22	9965 000 23096	220nF 10V 0603
C23	2020 552 96671	1µF 10% 25V 1206
C23	9965 000 21142	10.5nF 10V 0805
C24	4822 126 14585	100nF 10% 50V
C24	9965 000 05465	1µF 10V 0603
C25	9965 000 05465	1µF 10V 0603
C25	9965 000 18606	1µF 16V
C26	2020 558 90659	12pF 5% 3kV
C27	9965 000 21143	39pF 3kV 1808
C27	9965 000 23097	47pF
C28	5322 122 31866	6.8nF 10% 63V
C28	9965 000 21140	47.2nF 50V 0805
C29	9965 000 21143	39pF 3kV 1808
C29	9965 000 23097	47pF
C30	5322 122 33063	2,2PF 5%NP0 50V
C30	9965 000 21140	47.2nF 50V 0805
C30	9965 000 23126	10nF
C31	9965 000 23126	10nF
C32	9965 000 14741	220µF 25V
C32	9965 000 23098	220µF
C32	9965 000 23126	10nF
C33	9965 000 21143	39pF 3kV 1808
C33	9965 000 23097	47pF
C33	9965 000 23126	10nF
C34	9965 000 21143	39pF 3kV 1808
C34	9965 000 23097	47pF
C35	4822 126 13751	47nF 10% 63V
C35	9965 000 21130	47.3nF 25V 0603
C37	4822 126 12105	33nF 5% 50V
C37	9965 000 14745	33.3nF 50V 0805
C39	4822 126 12105	33nF 5% 50V
C39	9965 000 14745	33.3nF 50V 0805
C40	9965 000 21143	39pF 3kV 1808
C40	9965 000 23097	47pF
C42	4822 051 20008	Jumper 0805
C43	4822 051 20008	Jumper 0805
C43	9965 000 23099	220pF
C44	4822 126 12105	33nF 5% 50V
C44	9965 000 14745	33.3nF 50V 0805
C45	4822 126 12105	33nF 5% 50V
C45	9965 000 14745	33.3nF 50V 0805
C45	9965 000 23098	220pF
C47	9965 000 21143	39pF 3kV 1808
C47	9965 000 23097	47pF
C48	9965 000 14741	220µF 25V
C48	9965 000 23098	220µF
C49	4822 051 20008	Jumper 0805
C50	4822 051 20008	Jumper 0805
C51	4822 051 20008	Jumper 0805
C51	9965 000 23099	220pF
C52	4822 051 20008	Jumper 0805
C52	9965 000 17804	1µF 50V 0805
C53	2020 558 90659	12pF 5% 3kV
C53	9965 000 21144	5pF 3kV 1808
C54	5322 126 11583	10nF 10% 50V 0603
C55	2020 558 90659	12pF 5% 3kV
C55	9965 000 17804	1µF 50V 0805
C55	9965 000 21144	5pF 3kV 1808
C56	5322 126 11583	10nF 10% 50V 0603
C56	9965 000 21138	10,3nF 50V 0603
CT5	9965 000 23101	GJ-EE0803-002
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→		
C04	4822 126 14585	100nF 10% 50V
C01	9965 000 17804	1µF 50V 0805
C01	9965 000 21129	10.4nF 16V 0603
C02	4822 126 14118	100nF 20-80% 50V 0805
C03	9965 000 05466	10.4nF 16V 0603
C03	9965 000 05476	100nF 25V 0603
C03	9965 000 23095	100nF 25V 0603
C04	2222 586 18812	100nF 10% 50V 0603
C04	9965 000 05465	1µF 10V 0603
C05	4822 126 13751	220µF 25V
C05	9965 000 14741	220µF 25V
C05	9965 000 21130	47.3nF 25V 0603
C06	9965 000 17805	68.2nF 50V 0603
C06	9965 000 21131	22.5nF 25V 1206
C07	9965 000 05466	10.4nF 16V 0603
C07	9965 000 21131	22.5nF 25V 1206
C08	9965 000 05466	10.4nF 16V 0603
C08	9965 000 21131	22.5nF 25V 1206
R00	4822 051 20008	Jumper 0805
R00	4822 051 30008	Jumper 0603
R01	4822 051 30333	33kΩ 5% 0.062W
R02	4822 051 30103	10kΩ 5% 0.062W
R02	4822 051 30333	33kΩ 5% 0.062W
R02	9965 000 05488	10kΩ 5% 0.0603
R03	4822 051 30333	33kΩ 5% 0.062W
R03	9965 000 21146	100kΩ 5% 0.0603
R03	9965 000 23109	22.5nF 5% 0.0603

R04	4822 051 30103	10kΩ 5% 0.062W	R41	4822 051 10104	100kΩ 2% 0.25W	D05	9965 000 23103	RLZ5.1B/TE-11
R04	4822 051 30333	33kΩ 5% 0.062W	R41	9965 000 21147	100kΩ 5% 1206	D06	9965 000 14749	BZM55B75-TR
R04	9965 000 05488	10kΩ 5% 0603	R42	9965 000 23116	5.1Ω 1% 0603	D06	9965 000 23104	BZM55B75-TR
R05	2322 704 63002	3kΩ 1% 0603	R43	4822 051 30223	22kΩ 5% 0.062W	D07	9965 000 14749	BZM55B75-TR
R05	4822 051 30008	Jumper 0603	R43	9965 000 21159	22kΩ 5% 0603	D07	9965 000 23104	BZM55B75-TR
R05	9965 000 23109	22Ω 5% 0603	R44	4822 051 30223	22kΩ 5% 0.062W	D08	9965 000 17809	SR24 SMA
R06	4822 051 30105	1MΩ 5% 0.062W	R44	9965 000 21159	100kΩ 5% 0603	D09	5322 130 34337	BAV99
R06	4822 117 12706	10kΩ 1% 0.063W 0603	R45	4822 051 10104	100kΩ 2% 0.25W	D15	9965 000 12954	RLZ5.6B
R07	4822 051 10511	510Ω 2% 0.25W	R45	9965 000 21147	100kΩ 5% 1206	D15	9965 000 23105	RLZ5.6C/TE-11
R07	4822 051 30105	1MΩ 5% 0.062W	R46	4822 051 10104	100kΩ 2% 0.25W	D16	5322 130 34337	BAV99
R08	4822 051 10104	100kΩ 2% 0.25W	R46	9965 000 21147	100kΩ 5% 1206	D26	5322 130 34337	BAV99
R08	9965 000 17817	1Ω 1% 0805	R47	9965 000 17507	6.8kΩ 5% 0.1W	D29	5322 130 34337	BAV99
R08	9965 000 22147	100kΩ 5% 1206	R48	4822 051 30153	15kΩ 5% 0.062W	D30	5322 130 34337	BAV99
R09	4822 051 10104	100kΩ 2% 0.25W	R49	4822 051 20472	4.7kΩ 5% 0.1W	D30	9965 000 14749	BZM55B75-TR
R09	4822 051 30109	10Ω 5% 0.062W	R49	9965 000 21160	10kΩ 1% 0805	D30	9965 000 23104	BZM55B75-TR
R09	9965 000 21147	100kΩ 5% 1206	R50	4822 051 10221	22Ω 2% 0.25W	D31	5322 130 34337	BAV99
R10	4822 051 10104	100kΩ 2% 0.25W	R50	9965 000 21161	220Ω 5% 1206	D31	9965 000 14749	BZM55B75-TR
R10	9965 000 17821	3.74kΩ 1% 0603	R51	9965 000 23117	53.6kΩ 1% 0603	D31	9965 000 23104	BZM55B75-TR
R10	9965 000 22147	100kΩ 5% 1206	R52	5322 117 13019	100kΩ 1% 0.063W 0603	D32	9965 000 14749	BZM55B75-TR
R11	2322 704 62002	2kΩ 1% 0603	R53	9965 000 23116	5.1Ω 1% 0603	D33	9965 000 14749	BZM55B75-TR
R11	4822 051 30008	Jumper 0603	R54	4822 051 10104	100kΩ 2% 0.25W	D34	5322 130 83609	LS4148/GS08
R11	9965 000 23109	22Ω 5% 0603	R54	9965 000 21147	100kΩ 5% 1206			
R12	9965 000 17823	34kΩ 1% 0603	R55	9965 000 23118	340kΩ 1% 0603			
R12	9965 000 22148	51.1kΩ 1% 0603	R56	4822 051 10104	100kΩ 2% 0.25W			
R13	2322 704 62002	2kΩ 1% 0603	R56	9965 000 21147	100kΩ 5% 1206			
R14	4822 051 10104	100kΩ 2% 0.25W	R57	4822 051 10104	100kΩ 2% 0.25W	Q01	9965 000 08855	MMBT3904LT1
R14	9965 000 23127	21Ω 1% 0603	R57	9965 000 21147	100kΩ 5% 1206	Q01	9965 000 12956	BSS138 (SOT23)
R15	9965 000 17822	33.2kΩ 1% 0603	R58	4822 051 10104	100kΩ 2% 0.25W	Q01	9965 000 17814	2N7002E
R15	9965 000 223109	22Ω 5% 0603	R58	9965 000 21147	100kΩ 5% 1206	Q02	4822 130 11057	2N7002
R16	5322 117 13017	100Ω 1% 0.063W 0603	R59	9965 000 23119	422kΩ 1% 0603	Q02	9965 000 12392	MMBT3906LT1
R16	9965 000 21149	105Ω 0603 1%	R60	5322 117 13019	100kΩ 1% 0.063W 0603	Q02	9965 000 17814	2N7002E
R16	9965 000 23128	120kΩ 5% 0603	R60	9965 000 17820	2MΩ 5% 0603	Q03	9965 000 08855	MMBT3904LT1
R17	4822 051 30102	1kΩ 5% 0.062W	R61	5322 117 13019	100kΩ 1% 0.063W 0603	Q03	9965 000 23108	PMBS3904 SOT23
R17	5322 117 13019	100kΩ 1% 0.063W 0603	R61	9965 000 05482	14kΩ 1% 0603	Q04	4822 130 11057	2N7002
R17	9965 000 21150	1kΩ 0603 5%	R62	4822 117 12706	10kΩ 1% 0.063W 0603	Q04	9965 000 17810	NDS0610
R18	4822 051 10104	100kΩ 2% 0.25W	R62	5322 117 13019	100kΩ 1% 0.063W 0603	Q04	9965 000 17814	2N7002E
R18	9965 000 05488	10kΩ 5% 0603	R63	4822 051 30105	1MΩ 5% 0.062W	Q05	9965 000 08855	MMBT3904LT1
R19	9965 000 05488	10kΩ 5% 0603	R63	9965 000 21162	4.7kΩ 5% 0603	Q06	9965 000 12392	MMBT3906LT1
R19	9965 000 20794	390Ω 5% 0.5W	R63	9965 000 23120	5.49kΩ 1% 0603	Q08	9965 000 08855	MMBT3904LT1
R20	9965 000 20794	390Ω 5% 0.5W	R64	4822 051 20008	Jumper 0805	Q08	9965 000 17815	S14425DY
R20	9965 000 221151	392kΩ 1% 0603	R64	4822 051 30008	Jumper 0603	Q08	9965 000 23108	PMBS3904 SOT23
R21	4822 051 10104	100kΩ 2% 0.25W	R64	4822 117 12706	10kΩ 1% 0.063W 0603	Q09	9965 000 12326	2SD1804T-TL
R21	5322 117 13018	1kΩ 1% 0.063W 0603	R65	9965 000 21155	9.09Ω 1% 0603	Q10	9965 000 12326	2SD1804T-TL
R21	9965 000 22146	100kΩ 5% 0603	R66	4822 051 10104	100kΩ 2% 0.25W	Q11	9339 728 80215	PMBS3906 SOT23
R22	4822 117 12706	10kΩ 1% 0.063W 0603	R66	9965 000 21147	100kΩ 5% 1206	Q11	9965 000 12392	MMBT3906LT1
R22	9965 000 221152	28kΩ 1% 0603	R67	4822 051 10104	100kΩ 2% 0.25W	Q14	4822 130 11057	2N7002
R22	9965 000 23110	30.1kΩ 1% 0603	R67	9965 000 21147	100kΩ 5% 1206	Q22	4822 130 11057	2N7002
R23	5322 117 13017	100Ω 1% 0.063W 0603	R68	4822 051 10104	100kΩ 2% 0.25W	Q22	9965 000 17814	2N7002E
R23	9965 000 221149	105Ω 0603 1%	R68	9965 000 21147	100kΩ 5% 1206	Q50	4822 130 11057	2N7002
R24	9965 000 231111	22.1Ω 1% 0603	R70	4822 051 10104	100kΩ 2% 0.25W	Q51	4822 130 11057	2N7002
R24	9965 000 23129	210Ω 1% 0603	R70	9965 000 21147	100kΩ 5% 1206	Q53	9965 000 08855	MMBT3904LT1
R25	4822 051 30103	10kΩ 5% 0.062W	R71	4822 051 10104	100kΩ 2% 0.25W	U01	9965 000 12327	LM339AM
R25	9965 000 05488	10kΩ 5% 0603	R71	9965 000 21147	100kΩ 5% 1206	U01	9965 000 12960	IOZ960DS
R25	9965 000 20795	182kΩ 1% 0603	R72	4822 051 10104	100kΩ 2% 0.25W	U01	9965 000 23121	OZ960DS
R26	4822 051 30008	Jumper 0603	R72	9965 000 21147	100kΩ 5% 1206	U02	9965 000 21165	AO4600 (SO8)
R26	4822 051 30103	10kΩ 5% 0.062W	R73	9965 000 21163	1.37MΩ 1% 1206	U03	9965 000 21165	AO4600 (SO8)
R26	9965 000 05488	10kΩ 5% 0603	R75	4822 117 11645	470Ω 1% 0.125W	U04	9965 000 21165	AO4600 (SO8)
R27	9965 000 221153	590kΩ 1% 0603	R75	9965 000 21164	470Ω 5% 1206	U05	9965 000 21165	AO4600 (SO8)
R27	9965 000 231112	887kΩ 1% 0603				U06	9965 000 21166	LM392M (SO8)
R28	4822 051 30103	10kΩ 5% 0.062W				U07	9965 000 21166	LM392M (SO8)
R28	9965 000 05488	10kΩ 5% 0603						
R29	4822 051 30339	33Ω 5% 0.062W	L01	9965 000 06270	RLZ5.1B			
R29	9965 000 21154	33Ω 5% 0603	L01	9965 000 20791	33μH			
R30	4822 051 30103	10kΩ 5% 0.062W	L01	9965 000 23107	350mH			
R30	9965 000 05488	10kΩ 5% 0603	L02	9965 000 06270	RLZ5.1B			
R30	9965 000 221147	100kΩ 5% 1206	L02	9965 000 20791	33μH			
R31	9965 000 221146	100kΩ 5% 0603	L02	9965 000 23107	350mH			
R31	9965 000 21147	100kΩ 5% 1206	L03	9965 000 06270	RLZ5.1B			
R31	9965 000 23109	22Ω 5% 0603	L03	9965 000 23107	350mH			
R32	4822 051 10104	100kΩ 2% 0.25W	L04	9965 000 06270	RLZ5.1B			
R32	9965 000 221147	100kΩ 5% 1206	L04	9965 000 23107	350mH			
R32	9965 000 21155	9.09Ω 1% 0603	L05	9965 000 06270	RLZ5.1B			
R33	4822 051 10104	100kΩ 2% 0.25W	L05	9965 000 23107	350mH			
R33	9965 000 221147	100kΩ 5% 0603	L06	9965 000 06270	RLZ5.1B			
R33	9965 000 221156	76.8kΩ 1% 0603	L06	9965 000 23107	350mH			
R34	4822 051 10104	100kΩ 2% 0.25W	L30	9965 000 12391	SPC-1005P-354-SMD			
R34	9965 000 221147	100kΩ 5% 1206	L31	9965 000 12391	SPC-1005P-354-SMD			
R34	9965 000 221157	1MΩ 1% 0603	T01	9965 000 17824	Transf. DC-AC inverter			
R35	9965 000 221147	100kΩ 5% 1206	T02	9965 000 17824	Transf. DC-AC inverter			
R35	9965 000 221158	35.7kΩ 1% 0603						
R36	9965 000 221146	100kΩ 5% 0603						
R36	9965 000 221147	100kΩ 5% 1206						
R36	9965 000 23109	22Ω 5% 0603	D01	5322 130 34337	BAV99			
R37	4822 051 10104	100kΩ 2% 0.25W	D01	9965 000 12954	RLZ5.6B			
R37	4822 051 10105	1MΩ 5% 0.25W	D02	5322 130 83609	LS4148/GS08			
R37	9965 000 221146	100kΩ 5% 0603	D02	9965 000 21145	RLZ3.9B			
R38	9965 000 05483	1K 5% 1206	D02	9965 000 23102	RLZ5.1B/TE-11			
R38	9965 000 05484	348kΩ 1% 0603	D02	9965 000 17809	SR24 SMA			
R38	9965 000 221153	590kΩ 1% 0603	D03	9965 000 06270	RLZ5.1B			
R39	4822 051 10104	100kΩ 2% 0.25W	D04	9965 000 06270	RLZ18B/TE-11			
R39	9965 000 221147	100kΩ 5% 1206	D04	9965 000 17808	RLZ18B/TE-11			
R40	4822 051 10104	100kΩ 2%						

11. Revision List

Manual xxxx xxx xxxx.0

- First release.

Manual xxxx xxx xxxx.1

- Chapter 3: DFU was wrong and is changed to the correct version.
- Chapter 5: ComPair instruction added.
- Chapter 7: Small corrections in diagrams, like diversity table and mapping.
- Chapter 10: Parts list updated.
- Chapter 11: This chapter added.
- Other chapters: small updates and corrections