LT2008S

SERVICE MANUAL

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1. SAFETY PREAUTIONS

1.1 GENERAL GUIDELINES

1. When servicing, observe the original lead dress. if a short circuit is found, replace all parts which have been overheated or damaged by the short circuit.

2. After servicing, see to it that all the protective devices such as insulation barrier, insulation papers shields are properly installed.

3. After servicing, make the following leakage current checks to prevent the customer from being exposed to shock hazards.

2. PREVENTION OF ELECTRO—STATIC DISCHARGE(ESD)TO ELECTROSTATICALLY SENSITIVE(ES)DEVICES

Some semiconductor(solid state)devices can be damaged easily by static electricity. Such components commonly are called Electrostatically Sensitive(ES)Devices. Examples of typical ES devices are integrated circuits and some field-effect transistors and semiconductor chip components. The following techniques should be used to help reduce the incidence of component damage caused by electro static discharge(ESD).

1. Immediately before handling any semiconductor component or semiconductor-equipped assembly, drain off any ESD on your body by touching a known earth ground. Alternatively, obtain and wear a commercially availabel discharging ESD wrist strap, which should be removed for potential shock reasons prior to applying power to the unit under test.

2. After removing an electrical assembly equipped with ES devices,place the assembly on a conductive surface such as alminum foil, to prevent electrostatic charge buildup or exposure of the assembly.

3. Use only a grounded-tip soldering iron to solder or unsolder ES devices.

4. Use only an anti-static solder removal device. Some solder removal devices not classified as anti-static (ESD protected)can generate electrical charge sufficient to damage ES devices.

5. Do not use freon-propelled chemicals. These can generate electrical charges sufficient to damage ES devices.

6. Do not remove a replacement ES device from its protective package until immediately before you are ready to install it. (Most replacement ES devices are packaged with leads electrically shorted together by conductive foam, alminum foil or comparable conductive material).

7. Immediately before removing the protective material from the leads of a replacement ES device, touch the protective material to the chassis or circuit assembly into which the device will be installed.

Caution

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

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

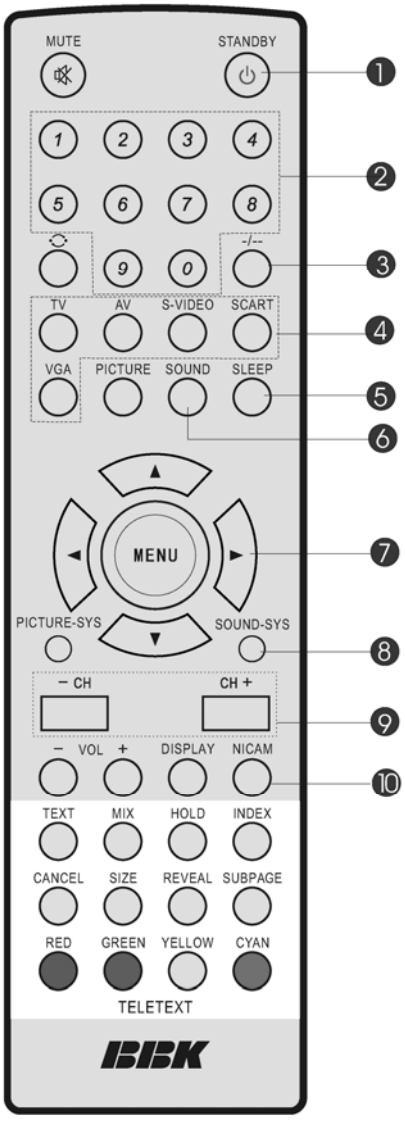
IMPORTANT SAFETY NOTICE

There are special components used in this equipment which are imporant for safety.
These parts are marked by ⚠ in the schematic diagrams, Exploded Views and replacement parts list. It is essential that these critical parts should be replaced with manufacturer's specified parts to prevent shock, fire, or other hazards. Do not modify the original design without permission of manufacturer.

3. Control Button Locations and Explanations

Remote Control Illustration

LOCATION AND FUNCTION OF CONTROLS



All the functions can be controlled with the remote controller. Some functions can also be adjusted with the buttons on the front panel of the set.

Remote Controller

1 STANDBY
To switch the unit on from standby or off to standby.

2 NUMBER BUTTONS
To directly select program number.

3 TWO-DIGIT NUMBER BUTTON
To switch one or two-digit program number.

4 SOURCE
Signal source select rapidly:
AV、S-VIDEO、SCART、TV、VGA

5 SLEEP
Setting sleep timer.

6 SOUND BUTTON
To adjust the sound effect. There are 4 modes for your selection in this function: Music, Film, News and User.

7 ◄/►(MENU LEFT/RIGHT)
To adjust menu settings.

8 SOUND SYSTEM
To select sound system.

9 CHANNEL
To increase or decrease program number.

10 NICAM/A2 BUTTON
To select the sound mode if receive NICAM or A2.

LOCATION AND FUNCTION OF CONTROLS

11 MUTE
To switch on sound or turn off sound .

12 RETURN
To return to previous selected program number.

13 PICTURE
To select picture mode (user/soft/ standard /dynamic)

14 ▲/▼(MENU UP/DOWN)
To select a menu item.

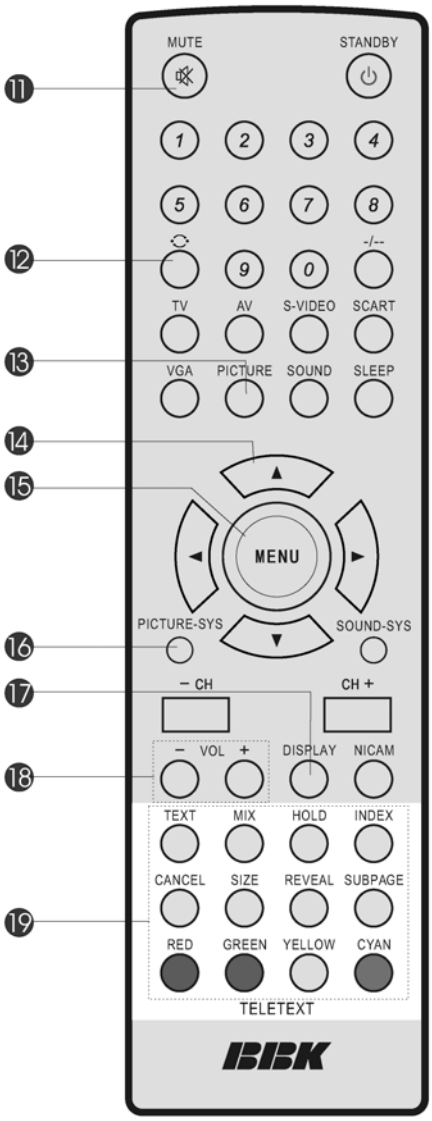
15 MENU
To enter into or exit from the menu.

16 PICTURE SYSTEM
To select video system.

17 DISPLAY
To display setup information of channel or source.

18 VOLUME
To increase or decrease volume.

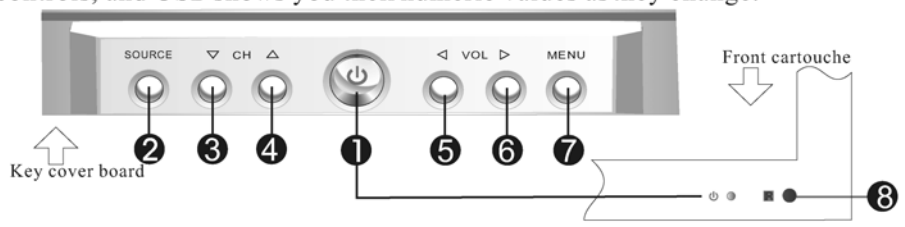
19 TELETEXT BUTTONS (OPTION)
These buttons are used for teletext. For further details, see the TELETEXT FUNCTION section.



LOCATION AND FUNCTION OF CONTROLS

Front Panel Control

This TFT-LCD TV/monitor allows you to easily adjust the characteristics of the image being displayed. All of these adjustments are made using the control buttons on the front of the monitor. While you use these buttons to adjust the controls, and OSD shows you their numeric values as they change.

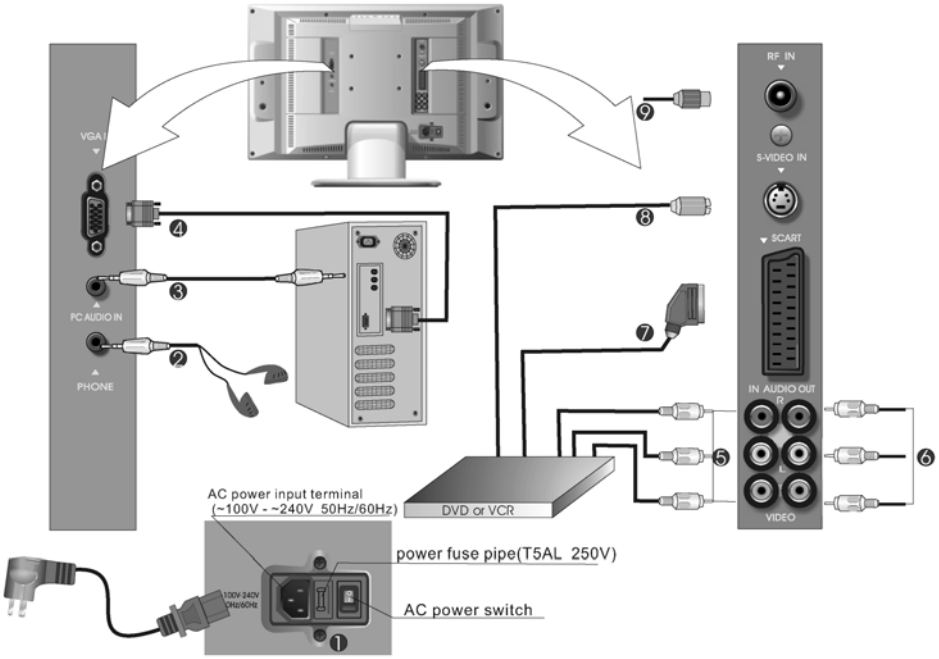


There are 7 keys for user`s control including POWER, SOURCE, MENU , CH-, CH+, VOL- and VOL+. The following descriptions are the introduction of these keys.

Item	Name	Description
1	POWER	Turn ON/OFF the LCD TV/monitor. When there is no signal input from PC port, after 2 minutes, the machine will go to standby mode automatically, on the other hand if the input port is TV/AV, and there is no signal input until 5 minutes, the machine will go to standby mode automatically also , the indicator of the power will turn to red. If you want to power on the machine again, please press power button.
2	SOURCE	Select video sources AV → S-VIDEO → SCART → VGA → TV
3	CH-(▼)	When you watch the TV program, push the button to decrease channel number. In the main-menu, push the button to select the downward menu item.
4	CH+(▲)	When you watch the TV program, push the button to increase channel number. In the main-menu, push the button to select the upward menu item.
5	VOL-(◀)	Decreases the menu adjustment item value and volume.
6	VOL+(▶)	Increase the menu adjustment item value and volume.
7	MENU	Enter or back to menu.
8	Remote signal sensor	

INSTALLATION AND CONNECTION

Connecting Your LCD TV/monitor



1.AC power input terminal(~100V- ~240V 50Hz/60Hz)
2. Connect the headphone cable to **PHONE** port.
3.Connect the **PC** audio source to **PC AUDIO IN** port.
4.Connect the signal cable to the VGA port of your TV/monitor.
5.Connect the RCA cable to your DVD, VCR or camcorder.
6.Connect your external equipment to the RCA out port.
7.Connect the Euro scart connector to the Euro scart socket of your TV/monitor.
8.Connect the s-video cable to your DVD, VCR or camcorder.
9.Connect antenna or CATV cable to **RF** IN port.

NOTE

- After connecting the AC cord and switching on the power, press POWER button and the unit enters working status.
- Do not plug in the power cord until all connections have been completed.
- When connecting a video source via scart connector, please press the SOURCE button on remote controller or front panel to select the SCART mode.

TROUBLESHOOTING

If you have a problem about setting up or using your LCD TV/monitor, you may be able to solve it yourself. Before contacting customer service, try the suggested actions that are appropriate to your problem.

Troubleshooting--Image

Problem	Suggested Actions
Screen is black and power indicator is off	◆ Ensure that the power cord is firmly connected and the LCD TV/monitor is on.
	◆ Ensure that the signal cable is firmly connected to the PC or video sources. ◆ Ensure that the PC or video sources are turned on.
Image is not stable and may appear to vibrate	◆ Check that the display resolution and frequency from your PC or video board is an available mode for your monitor.
	◆ On your computer check: Control Panel, Display, Settings. ◆ If the setting is not correct, change the display settings of your computer.
	◆ Horizontal frequency:30 KHz~48KHz ◆ Vertical frequency:56 Hz ~75 Hz ◆ Maximum timing:20.1″ 800×600@75Hz

Troubleshooting--Audio and TV

Problem	Suggested Actions
The TV/monitor does not turn on	◆ Be sure the power cord is plugged in.
No sound	◆ Ensure that the audio cable is firmly connected to both the audio-in port on your monitor and the audio-out port on your sound card.
	◆ Check the volume level.
Sound level is too low	◆ Check the volume level.
	◆ If the volume is still too low after turning the control to its maximum, check the volume control on the computer sound card or software program.
Snowy picture	◆ The aerial lead-in may be broken or disconnected.
Remote control does not work	◆ The battery in the remote control may be exhausted. ◆ The battery may be improperly installed. ◆ Check that there is no obstruction between the remote control and the remote(infrared) sensor. ◆ Check that a strong light is shining on the remote (infrared) sensor.

SPECIFICATION

❖ Panel	Size Display Size Type Pixel pitch Viewing Angle	20.1" Diagonal 408(H)×306(V)mm TFT color 0.51(H)×0.51(V)mm 80/80/80/80(Depending on the panel manufacturer, the viewing angle manufacturer, the viewing angle may be different from this spec.)
❖ Frequency	Horizontal Vertical Display color	30~48KHz 56~75Hz 16.7M colors
❖ Display Mode	Optimum Mode Maximum Mode	800×600@75Hz 800×600@75Hz
Input Signal	Sync. Video signal	H/V Separate, TTL,P.or N. H/V Composite, TTL,P.or N. Sync-on-green 0.3 Vp_p,N. 0.7 Vp_p @ 75 ohm
TV, Video	Color system Sound system Video format	PAL/NTSC/SECAM DK/ I/ BG/L CVBS/ S-VHS/RGB
Power Supply	Input	~ 100-240V (50Hz/ 60Hz)
Power consumption	Maximum Power Saving	60W ＜3W
Dimensions/ Weight (W×H×D)		620×451×201mm/10Kg
Environmental Considerations	Operating Temperature Operating Humidity Storage Temperature Storage Humidity	5℃ to 35℃ 10% to 80% -20℃ to 45℃ 5% to 95%
Audio Characteristics	Audio in Input L Audio in Input R Audio out Input L Audio out Input R Frequency Response	RCA Jack White (L), 0.5±0.3Vrms RCA Jack RED(R), 0.5 ±0.3Vrms RCA Jack White (L) , 0.5 ±0.3Vrms RCA Jack RED(R), 0.5 ±0.3Vrms RF:100Hz~12KHz (at -3dB) AV: 100Hz~15KHz (at -3dB)

❖ These items are depended on the TFT panel,Design and specification are subject to change without notice.

DISPLAY MODES

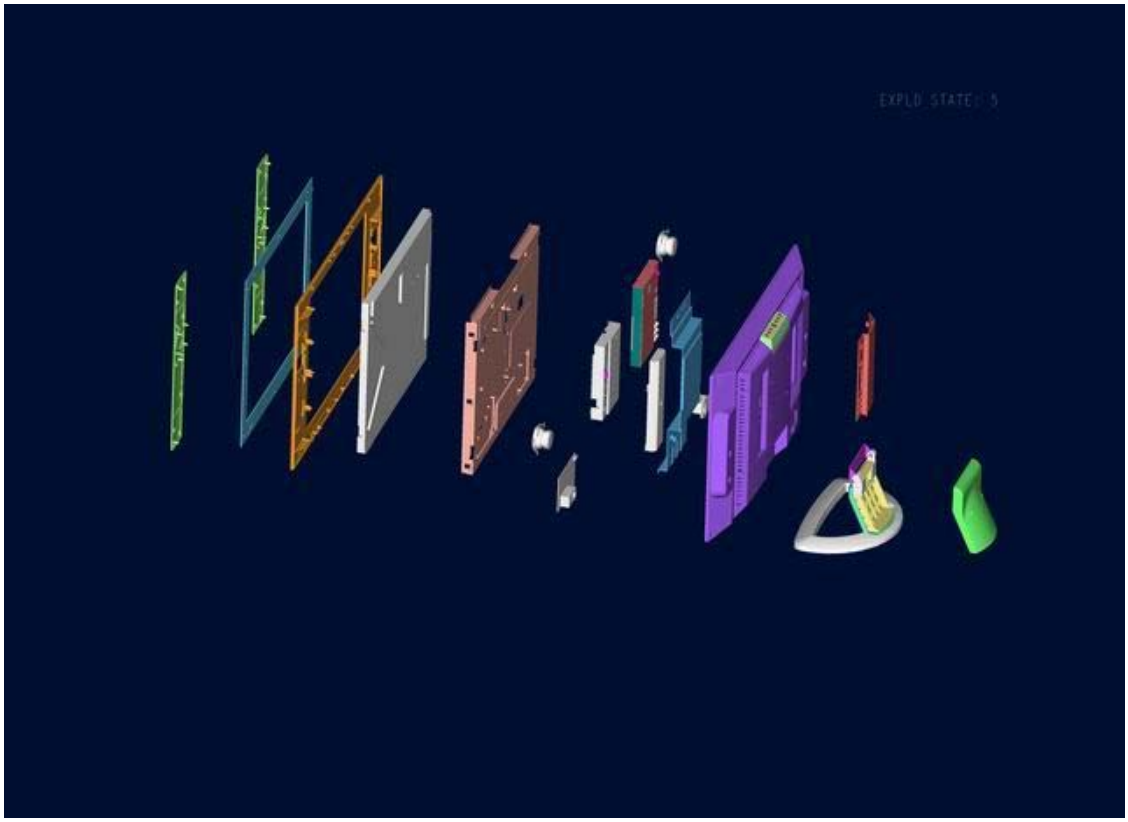
Incoming display mode (input)				
Resolution	Horizontal Frequency (KHz)	Vertical Frequency (Hz)	Pixel Frequency (MHz)	Comment
640×350	31.5	70.0	25.17	DOS
720×400	31.5	70.0	28.32	DOS
640×480	31.5	60.0	25.18	DOS
640×480	37.9	72.0	31.50	VESA
640×480	37.5	75.0	31.50	VESA
800×600	35.1	56.2	36.00	VESA
800×600	37.9	60.0	40.00	VESA
800×600	48.1	72.0	50.00	VESA
800×600	46.9	75.0	49.50	VESA

- Modes, which are not listed in the above table, may not be supported. For an optimal picture it is recommended to choose a mode listed in the table.
- You have 9 available modes compatible with Windows.
- It can happen that the image is disrupted. This can occur as result of a signal frequency from the VGA card, which does not correspond with the usual standard. This is not, however, an error. You can improve this situation by altering an automatic setting or by manually changing the phase setting and the pixel frequency menu.
- If you switch off the TV/monitor, interference lines can occur on your screen. But do not concern about this, as it is normal.
- To extend the service life of the product, we recommend that you use your computer`s power management function.

NOTE

- Design and Specifications are subject to change without notice.
- Weight and Dimensions shown are approximate.

4. Assembling and disassembling the mechanism unit



5. Test Scheme for LT2008S

Description of purpose of the test scheme:

The electric functional part of LT2008 LCD color TV set is composed of driving board, audio and video board, control key board and backlight power supply board. The backlight power supply is a bought module and the supplier and IQC of our company will check its function and consistency together; the other functional boards are designed and manufactured by us. This test scheme will make a guiding criterion of test method for these modules machined and manufactured by us.

After testing of all the functional modules, the assembled machine will be tested completely so as to confirm the indexes of all performance to be qualified or not.

This test scheme is only a guiding document which can not replace the operating manual book for the production. The test scope of the operating manual book shall be adjusted according to the real practice. However, the key technique index must reach the requirement prescribed by this test scheme.

2. The test scheme for driving board and control key board

1) Testing equipments

A. FLUKE45 multimeter one set
B. Special test host computer one set
C. DVD player with SCART terminal one set
D. Audio-board in perfect condition one set
E. Testing frock one piece
F. Remote controller one piece

2) Testing flow

A. Tested driving board into clamp and connect the control key board, then fulfill and affirm the related testing set-ups.

B. Switch on power, check the power supply voltage of +5、+3.3V、+2.5V boards by multimeter so as to affirm they are in normal status or not, then press key “POWER” on the control key board to start the machine.

C. Link the VGA signal outputted from computer to the tested driving board (or linked by the thimble of clamp), then switch to “VGA” state by remote controller or “SOURCE” key on the control key board.

D. Check the display quality of all display modes under VGA mode, the character shall be clear and without distinct jamming.

E. Activate the special “DisplayMate for Windows” test software and select the “Set up Display”, the exact requirements as follow① There isn’t distinct jamming. on the tested pictures; ② All colors are in normal status; ③ The brightness and definition of pane picture of horizontal lines should be consistent with that of vertical lines; ④ The color of color stripe is correct and transition edge is clear; ⑤ The tested picture of DisplayMate Utilities is clear and arranged properly, focalized normally without distinct jamming.

F. Switch signal source to “AV” mode, start DVD Player and play the Panasonic demonstration disc so as to check the picture display quality under AV state, it is required that picture is stable, clear without distinct transverse and netted striation jamming.

G. Switch signal source to “S-Video” state, the items to be checked and requirements are as same as that of “AV” state.

H. Switch signal source to “SCART” mode, test the Video mode outputted by “SCART” under “CVBS” mode and “RGB” mode respectively. It is required that the picture is stable and clear without any jamming. At the same time, test the picture under RGB mode and it shall have advantage over that of CVBS mode. The identification of RGB of the machine is in normal state.

3) The qualified criterion and others

Only if the functions of all tested signal source channels have reached their related standards, the tested board shall be affirmed to be qualified, as to the board not qualified will be maintained and retested.

3. Testing of audio & video board

1) Testing equipments

A. FLUKE 54200 television signal generator one set
B. HITACHI VC-6545 oscillograph one set
C. Testing frock one piece
D. Driving board in perfect condition one piece
E. CATV antenna one piece
F. TV set with AV input port one set
G. 5MHz Twin channel audio oscillograph one set
H. Remote controller one piece

2) Testing flow

A. Put the tested audio & video board into clamp and link well signal connections of AV In/Out、S- Video 、TV、SCART (or linked by thimble of clamp). Install the related instruments and equipments and mark the often used fixed devices with symbol strip codes.

B. Switch LCD TV to TV receiving mode, set Pattern as “MULTI BURST”+“GREY SCALE”+“COLOR BAR”, test respectively the watching situation on the three frequency points of 48.25、168.25、471.25MHz. It is required that under any Pattern mode, it can reach to the following statuses that the layer of Pattern is distinct, each grayscale is clear; the color of color strip is real and transition edge is clear; the brightness of each section of 0.5MHZ/1.0/2.0/4.0MHz of the multi-wave are consistent with each other, they are so clearly that the vertical lines inside pane can be identified, and so do 4.8MHZ (this section shall be a little darker under that of TV mode).

C. Set the sound mode as BG under TV mode, activate NICAM option as well, then adjust RF level to 45dB, test respectively the sound quality of FM MONO/DUAL/STEREO on 48.25、168.25、471.25MHZ, it is required that sound is clear without distinct noise，for example crack.

D. Set Pattern as “MULTI BURST”, select one channel and input modes of AV、S-VIDEO、SCART, measure the wave profile between R908 and 7^{th} -contact by oscillograph, as indicated in the attached chart hereafter, it is required that the synchronizing header pulse wave profile of CVBS signal is square wave and its range of amplitude is $0.3+0.05/-0.1V_{pmp.}$ The range of amplitude of whole video frequency signal is $1.0\pm0.2V_{P\text{-}P;\ the}$ range of amplitude of multi-wave at 4.0MHZ is as same as that of 1.0MHZ, the difference shall be ≤2dB(calculated according to $20\lg V_{4.0}/V_{1.0}$), the value of amplitude at 4.0MHz shall be prescribed by the project office.

E. Under TV mode, set RF level as 50dBμV and receive anyone of the above mentioned three frequencies. Awaiting until the normalization of pattern, then press “TEXT” key on remote controller, the related information of picture will appear; again press “INDEX” key to let picture return to the menu page; press

“CHANNEL+”key to select picture’s 101 pages, it will be refreshed page by page. Please observe the character or graphics of each refreshed page so as to confirm any imperfect character or image, it is required that less two pictures with imperfect character or image in each 10 pictures; please test respectively the functions of keys including “MIX”、“HOLD”、“CANCEL”、“SIZE”、“REVEAL” and “RED”、“GREEN”、“YELLOW”、“CYAN” and confirm them normal or not.

F. Under SCART mode, use 54200 “Video” edit key to enter edit menu of Video, select CVBS and RGB from “SCAROUT” column in order to observe the image quality of picture, the transition edge of RGB’s COLOR BAR shall be clear and frequency spectrum of multi-wave are clear and bright under the two modes of CVBS and RGB., the image quality in CABS mode is consistent with that of AV state, in the same time, please note that there is any sound outputted and the receiving status of TEXT in CABS mode.

G. Link 5MHz audio oscillograph to the output ports of loudspeaker, adjust RF signal with 1KHz audio frequency, tune up volume and let audio outputting wave profile be distorted just, then measure the peak value of wave profile, it is required that the value is not less than 10Vp-p.

H. Turn on /off the machine with “POWER” key on remote controller or control key board and confirm there is any “POP” noise while turning on/off it, there isn’t any abnormal color block, flashing and astigmatism on picture as well.

4. The test scheme for machine

1) Testing equipment

A. FLUKE	54200	one set
B. FLUKE	5418	one set
C. Special test host computer		one set
D. DVD Player		one set
E. TV set with AV input port		one set
F. CATV antenna		4 pieces
G. Remote controller		several pieces

2) Testing requirement

The testing requirement for the related functions of PC and audio & video are consistent with that of above mentioned boards; the switch testing shall be done between all modes under PC mode (the display mode of 640×480、800×600、1024×768(LT1703)、1280×1024(LT1703)), and there will be no any abnormal grating during the switching. The project office may arrange reasonably the testing stations according to exact status and change of capacity of the production line.

In addition, the color sensitivity and FM sound sensitivity also shall be tested while testing the receiving station of RF signal. The color sensitivity is ≤37db and FM sound sensitivity is≤30db.

As to the qualified finished products, the related indexes of at least two machines adopted in accordance with the sample standard shall be tested. The testing form, please refer to the attached page.

As to those products largely for exportation, it is suggested herein that a related placement test EMC should be done.

6. IC BLOCK DIAGRAM & DESCRIPTION

6.1 RTD2020

6.1.1 FEATURES

General

- Integrated Spread-Spectrum DCLK PLL
- Integrated 8-bit triple-channel 140MHz ADC/PLL
- Integrated programmable timing controller
- Integrated microcontroller compatible with the standard 8032
- 24 General-purpose input/outputs (GPIOs)
- Embedded fully functional multi-language OSD support
- Embedded DDC supports DDC1, DDC2B, and DDC/CI
- Supports ISP functionality on DDC channel
- 3 Embedded programmable PWM
- Zoom scaling up and down
- Embedded Pattern Generator
- No external memory required
- Requires only one crystal to generate all timing

Analog RGB Input Interface

- Supports up to 140MHz (SXGA @ 75Hz)
- Supports Sync On Green (SOG) and de-composite sync modes
- On-chip high-performance PLLs

Digital Input Interface

- Supports 24-bit pixel digital input up to 160MHz
- Supports 12-bit DVO input
- Supports 16/24-bit YUV422/444 video format input
- Supports 8-bit video format input
- Built-in YUV to RGB color space converter & de-interlace
- Capture window auto position & auto phase tracking capability

Auto Detection /Auto Calibration

- Input format detection
- Compatibility with standard VESA mode and support for user-defined mode
- Smart engine for Phase and Image position calibration

Scaling

- Fully programmable zoom ratios
- Independent horizontal/vertical scaling
- Advanced zoom algorithm provides high image quality
- Sharpness/Smooth filter enhancement

Color Processor

- Digital brightness and contrast adjustments
- Gamma correction
- Dithering logic for 18-bit panel color depth enhancement

Output Interface

- Fully programmable, built-in display timing generator
- 1 and 2-pixel/clock panel support, up to 140MHz
- Pin swap, odd/even swap and red/blue group swap
- Programmable TCON function support
- Reduced EMI and Power saving features

Host Interface

- Supports 3/4 pins MCU serial bus interface
- Support parallel bus interface while using internal MCU

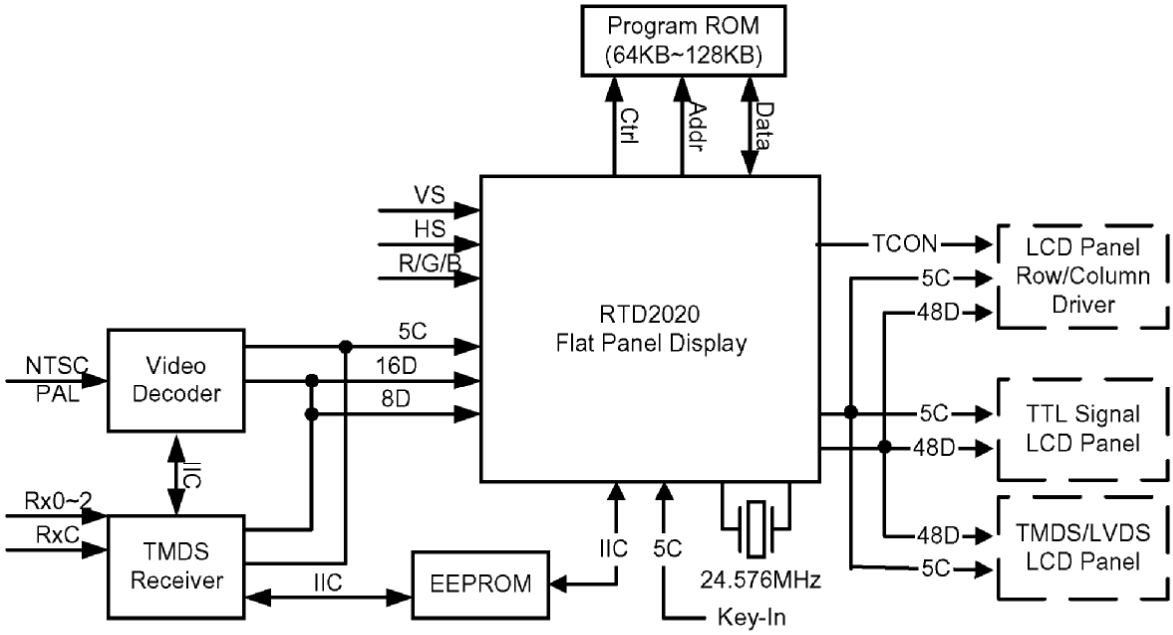
Embedded OSD

- 12*18 dot font per character
- Embedded 256 characters and symbols including 16 multi-color symbols
- User font RAM, which allows programming of 128 special symbols
- 7 background colors and 8 character colors
- Programmable width and height control
- 4 background windows
- Selectable shadow color for windows and characters
- Intensity, blinking effects
- Fade-in/out effect
- Frame shadowing and independent row shadowing
- Frame bordering and independent row bordering
- 4 channel 8-bits PWM output, and selectable PWM clock frequency
- Row-to-Row spacing to maintain constant display height
- Window alpha-blending effect

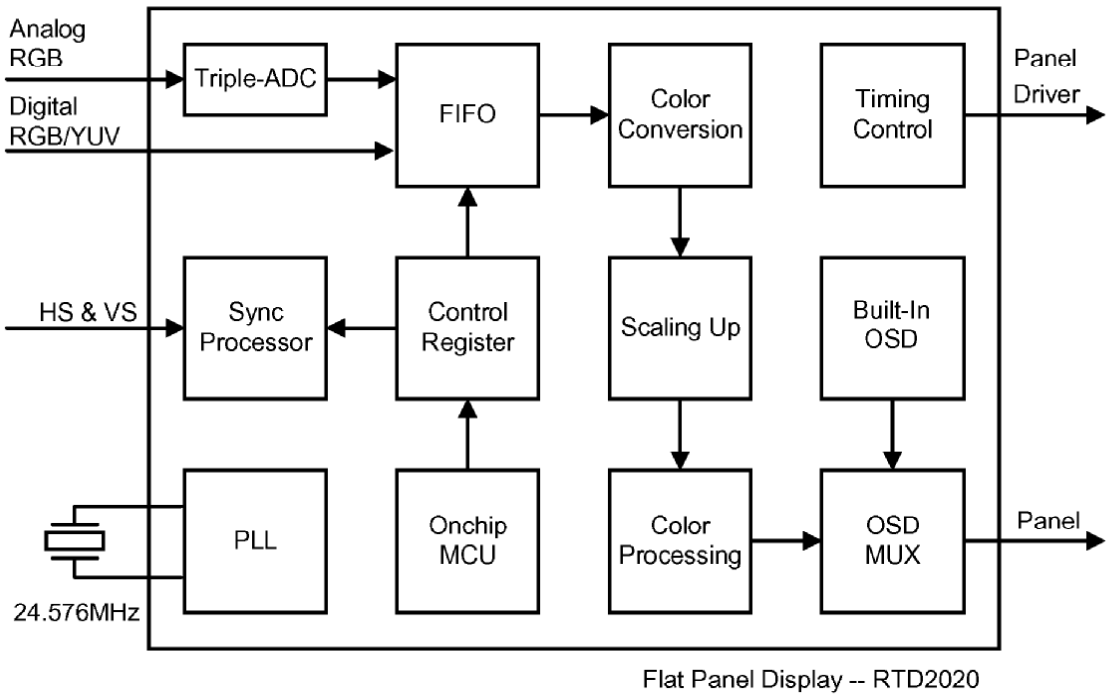
Power & Technology

- 2.5V/3.3V power supply
- 0.25μm CMOS process; 208-pin PQFP package

7.1.2 BLOCK DIAGRAM

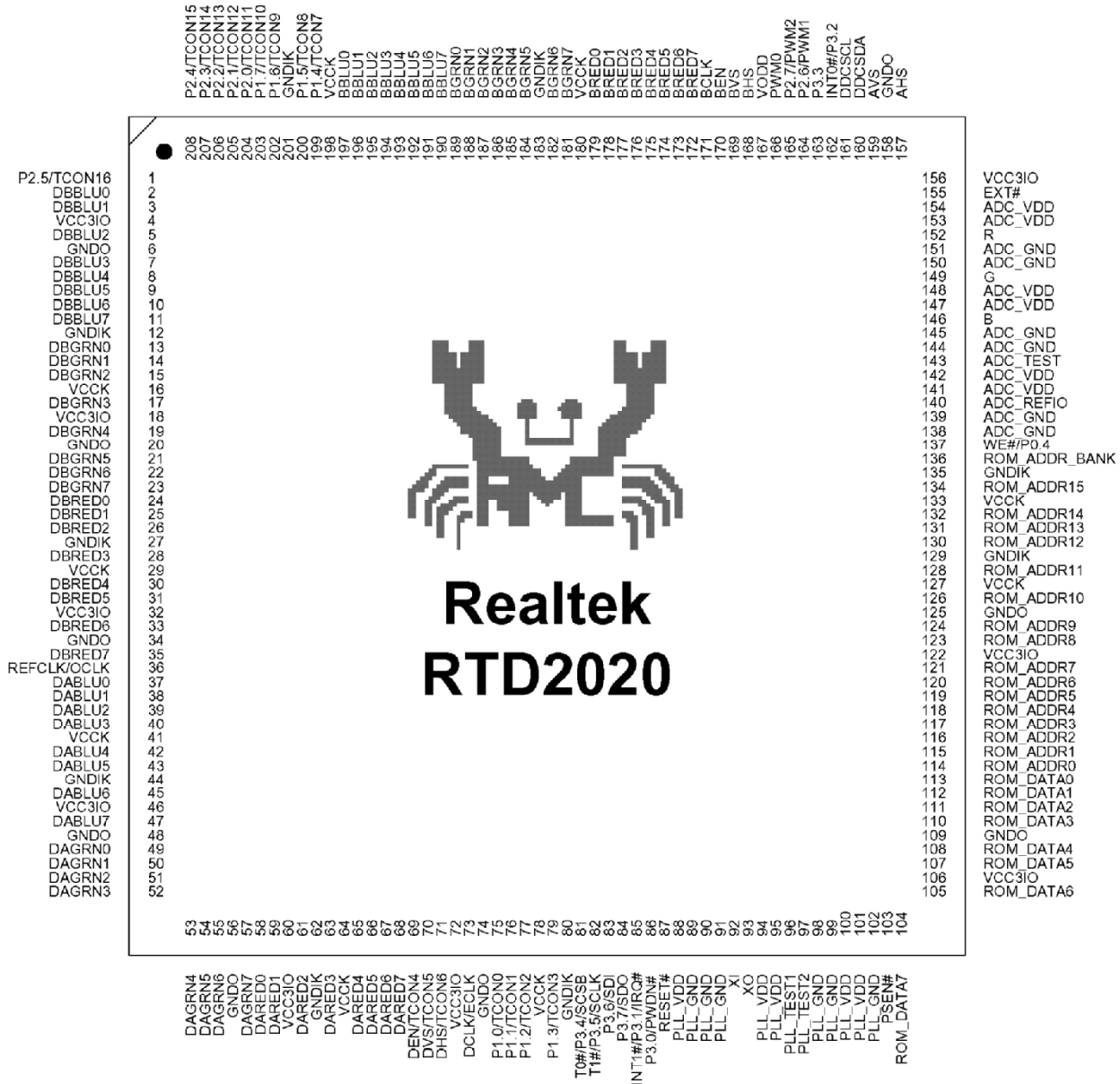


Application System Block Diagram



Chip Functional Block Diagram

7.1.3 PIN ASSIGNMENTSCONTENTS



RTD2020 Pin-Out Diagram

7.1.4 PIN DESCRIPTIONS

In order to reduce pin count, and therefore size and cost, some pins have multiple functions. In those cases, the functions are separated with a "/" symbol. Refer to the Pin Assignment diagram for a graphical representation.

A = Analog P = Power
I = Input G = Ground
O = Output

ADC

Name	Type	Pin No	Description
ADC_REFIO	AI	140	**ADC Reference Pad**
ADC_TEST	AIO	143	**ADC Test Pin / SOG**
B	AI	146	**Analog Input from BLUE Channel**
G	AI	149	**Analog Input from GREEN Channel**
R	AI	152	**Analog Input from RED Channel**
ADC_VDD	AP	141,142 147,148 153,154	**ADC Analog Power**
ADC_GND	AG	138,139 144,145 150,151	**ADC Analog Ground**
			Total: 17 Pins

PLL

Name	Type	Pin No	Description
XI	AI	92	**Reference Clock Input**
XO	AO	93	**Reference Clock Output**
PLL_TEST1	AIO	96	**Test Pin 1**
PLL_TEST2	AIO	97	**Test Pin 2**
PLL_VDD	AP	88,94 95,100 101	**PLL Analog Power**
PLL_GND	AG	89,90 91,98 99,102	**PLL Analog Ground**
			Total: 15 Pins

Control Interface

Name	Type	Pin No	Description
(EXT# =0): SCSB (EXT# =1): GPIO_P3.4	I I/O	81	**Serial Control I/F Chip Select** **GPIO_P3.4 / T0#**
(EXT# =0): SCLK (EXT# =1): GPIO_P3.5	I I/O	82	**Serial Control I/F Clock** **GPIO_P3.5 / T1#**
(EXT# =0): SDI (EXT# =1): GPIO_P3.6	I I/O	83	**Serial Control I/F Data in** **GPIO_P3.6**
(EXT# =0): SDO (EXT# =1): GPIO_P3.7	O I/O	84	**Serial Control I/F Data out** **GPIO_P3.7**
(EXT# =0): IRQ# (EXT# =1): GPIO_P3.1	O I/O	85	**Controller's IRQ# Output;** **GPIO_P3.1 / INT#1**
(EXT# =0): PWDN# (EXT# =1): GPIO_P3.0	I I/O	86	**PowerDown# for Controller** **GPIO_P3.0**
RESET#	I	87	**(EXT#=0): RESET# for Controller;** **(EXT#=1): RESET# for MCU**
			Total: 7 Pins

Digital Input

Name	Type	Pin No	Description
AHS	I	158	**VGA-port Horizontal Sync**
AVS	I	160	**VGA-port Vertical Sync**
VODD	I	167	**Video ODD Signal**
BHS	I	168	**VGB-port Horizontal Sync**
BVS	I	169	**VGB-port Vertical Sync**
BENA	I	170	**VGB-port Input Data Enable**
BCLK	I	171	**VGB-port Input Clock**
BRED/YIN [7:0] / DVODATA [11:4] / VIDEO8	I	172,173 174,175 176,177 178,179	**VGB-port Input Data (Red/Y)**
BGRN [7:0] / DVODATA [3:0]	I	181,182 184,185 186,187 188,189	**VGB-port Input Data (Green)**
BBLU/UVIN [7:0]	I	190,191 192,193 194,195 196,197	**VGB-port Input Data (Blue/UV)**
			Total: 31 Pins

Display Port

Name	Type	Pin No	Description
DCLK	O	73	**Display clock; / TCON_ECLK**
DHS	O	71	**Display Horizontal Sync; / TCON_6**
DVS	O	70	**Display Vertical Sync; / TCON_5**
DEN	O	69	**Display Data Enable; / TCON_4**
DARED [7:0]	O	68, 67, 66 65, 63, 61 59, 58	**Display A-port RED Data**
DAGRN [7:0]	O	57, 55, 54 53, 52, 51 50, 49	**Display A-port GREEN Data**
DABLU [7:0]	O	47, 45, 43 42, 40, 39 38, 37	**Display A-port BLUE Data**
DBRED [7:0]	O	35, 33, 31 30, 28, 26 25, 24	**Display B-port RED Data**
DBGRN [7:0]	O	23, 22, 21 19, 17, 15 14, 13	**Display B-port GREEN Data**
DBBLU [7:0]	O	11, 10, 9, 8 7, 5, 3, 2	**Display B-port BLUE Data**
			Total: 52 Pins

Miscellaneous Interface

Name	Type	Pin No	Description
REFCLK	IO	36	**In/out Test Pin for DCLK; / TCON_OCLK**
PWM_0	O	166	**PWM_0 Output**
			Total: 2 Pins

DDC Channel

Name	Type	Pin No	Description
DDCSDA	I O	156	**DDC Serial Control I/F Data Input** **DDC Serial Control I/F Data Output**
DDCSCL	I	161	**DDC Serial Control I/F Clock**
			Total: 2 Pins

Power & Ground

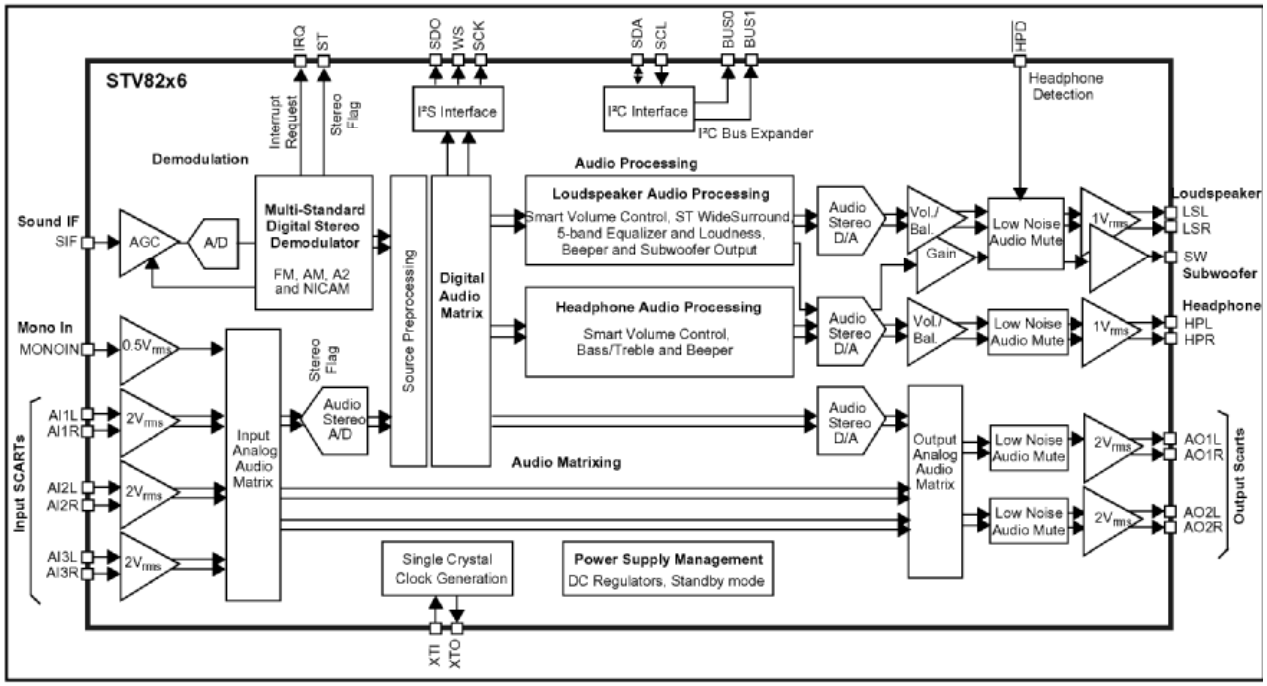
Name	Type	Pin No	Description
3.3V Power	P	4, 18 32, 46 60, 72 106,122 157	**VCC3IO: 9**
3.3V Ground	G	6, 20 34, 48 56, 74 109,125 159	**GNDO: 9**
2.5V Power	P	16, 29 41, 64 78,127 133,180 198	**VCCK: 9**
2.5V Ground	G	12, 27 44, 62 80,129 135,183 201	**GNDIK: 9**
			Total: 36 Pins

MCU Interface

Name	I/O	Pin No	Description
PSEN#	O	103	**Program Load Enable**
ROM_DATA [7:0]	IO	104,105,107 108,110,111 112,113	**ROM Data Input**
ROM_ADDR [15:9]	O I	134,132,131 130,128,126 124	**ROM Address Output** **DDC_CA latch**
ROM_ADDR [8:0]	O	123,121,120 119,118,117 116,115,114	**ROM Address Output**
ROM_ADDR_BANK	O	136	**XDATA/PROG# Bank Select**
GPIO_P0.4	I/O	137	**GPIO_P0.4 / WR#**
EXT#	I	155	**External MCU, Internal MCU Disable**
GPIO_P1.0	I/O	75	**GPIO_P1.0 / TCON_0**
GPIO_P1.1	I/O	76	**GPIO_P1.1 / TCON_1**
GPIO_P1.2	I/O	77	**GPIO_P1.3 / TCON_2**
GPIO_P1.3	I/O	79	**GPIO_P1.3 / TCON_3**
GPIO_P1.4	I/O	199	**GPIO_P1.4 / TCON_7**
GPIO_P1.5	I/O	200	**GPIO_P1.5 / TCON_8**
GPIO_P1.6	I/O	202	**GPIO_P1.6 / TCON_9**
GPIO_P1.7	I/O	203	**GPIO_P1.7 / TCON_10**
GPIO_P2.0	I/O	204	**GPIO_P2.0 / TCON_11**
GPIO_P2.1	I/O	205	**GPIO_P2.1 / TCON_12**
GPIO_P2.2	I/O	206	**GPIO_P2.2 / TCON_13**
GPIO_P2.3	I/O	207	**GPIO_P2.3 / TCON_14**
GPIO_P2.4	I/O	208	**GPIO_P2.4 / TCON_15**
GPIO_P2.5	I/O	1	**GPIO_P2.5 / TCON_16**
GPIO_P2.6	I/O	164	**GPIO_P2.6 / PWM1**
GPIO_P2.7	I/O	165	**GPIO_P2.7 / PWM2**
(EXT# =0): PWDN# (EXT# =1): GPIO_P3.0	I I/O	Share	**PowerDown# for Controller** **GPIO_P3.0**
(EXT# =0): IRQ# (EXT# =1): GPIO_P3.1	O I/O	Share	**Controller's IRQ# output;** **GPIO_P3.1 / INT1#**
GPIO_P3.2	I/O	162	**GPIO_P3.2 / INT0#**
GPIO_P3.3	I/O	163	**GPIO_P3.3**
(EXT# =0): SCSB (EXT# =1): GPIO_P3.4	I I/O	Share	**Serial control I/F chip select** **GPIO_P3.4 / T0#**
(EXT# =0): SCLK (EXT# =1): GPIO_P3.5	I I/O	Share	**Serial control I/F clock** **GPIO_P3.5 / T1#**
(EXT# =0): SDI (EXT# =1): GPIO_P3.6	I I/O	Share	**Serial control I/F data in** **GPIO_P3.6**
(EXT# =0): SDO (EXT# =1): GPIO_P3.7	O I/O	Share	**Serial control I/F data out** **GPIO_P3.7**
			Total: 46 pins (6 share)

7.2 STV82x6

Multistandard TV Audio Processor
and Digital Sound Demodulator



This device incorporates the SRS (Sound Retrieval System) under licence from SRS Labs, Inc.

Key Features

- NICAM, AM, FM Mono and FM 2 Carrier Stereo Demodulators for all sound carriers between 4.5 and 7 MHz
- Mono input provided for optimum AM Demodulation performances
- Demodulation controlled by Automatic Standard Recognition System
- Sound IF AGC with wide range
- Overmodulation and Carrier Offset recovery
- Smart Volume Control
- 5-band Equalizer & Bass/Treble Control
- Automatic Loudness Control
- Loudspeaker and Headphone outputs with Volume/Balance Controls and Beeper
- Subwoofer output with Volume Control and Programmable Bandwidth
- Spatial Sound Effects (ST WideSurround and Pseudo-Stereo)
- SRS® 3D Surround
- 3-to-2 Analog Stereo Audio I/Os (SCART compatible) with Audio Matrix
- Low-noise Audio Mutes and Switches
- I²S Output to interface with Dolby® Pro Logic® Decoder
- I²C Bus-controlled
- Single and standard 27 MHz Crystal Oscillator
- Power supplies: 3.3 V Digital, 5 V or 8 V Analog
- Embedded 3.3 V Regulators
- Packages: SDIP56 or TQFP80

Table 1: STV82x6 Version List

Feature	STV8206	STV8216	STV8226	STV8236
AM-FM Mono	X	X	X	X
Zweiton	X	X	X	X
NICAM		X		X
ST WideSurround	X	X	X	X
SRS® 3D Surround			X	X

I/O Pin Description

Legend / Abbreviations for Table 2:

Type:

- AP = Analog Power Supply
- DP = Digital Power Supply
- I = Input
- O = Output
- OD = Open Drain
- B = Bidirectional
- A = Analog

Table 2: Pin Description

SDIP 56	TQFP 80	Name	Type	Function
1	73	SIF	A	Sound IF Input
2	74	VTOP	A	ADC V_{TOP} Decoupling Pin
3	75	VREFIF	A	AGC Voltage Reference Decoupling Pin
4	76	VDDIF	AP	3.3 V Power Supply for IF AGC & ADC
5	77	GNDIF	AP	0 V Power Supply for IF AGC & ADC
6	78	MONOIN	A	Mono Input
	79/80	N/C		Not Used
7	1	AO1L	A	Left SCART1 Audio Output
8	2	AO1R	A	Right SCART1 Audio Output
-	3/4/5/6	N/C		Not used
9	7	VDDC	AP	3.3 V Power Supply for Audio DAC/ADC
10	8	GNDC	AP	0 V Power Supply for DAC/ADC
11	9	AI1L	A	Left SCART1 Audio Input
12	10	AI1R	A	Right SCART1 Audio Input
13	11	VMC1	A	Switched V_{REF} Decoupling Pin for Audio Converters (VMCP)
14	13	VMC2	A	V_{REF} Decoupling Pin for Audio Converters (VMC)
15	14	AI2L	A	Left SCART2 Audio Input
16	15	AI2R	A	Right SCART2 Audio Input
17	16	VDDA	AP	3.3 V Power Supply for Audio Buffers, Matrix & Bias
18	17	GNDAH	AP	0 V Power Supply for Audio Buffers & SCART
19	18	AO2L	A	Left SCART2 Audio Output
20	19	AO2R	A	Right SCART2 Audio Output
21	20	VDDH	AP	8 V / 5 V Power Supply for SCART & Audio Buffers
-	21	N/C		Not Used
22	22	VREFA	A	Voltage Reference for Audio Buffers
23	23	AI3L	A	Left SCART3 Audio Input
24	24	AI3R	A	Right SCART3 Audio Input
-	25	N/C		Not Used
25	26	BGAP	A	Bandgap Voltage Source Decoupling
-	27	N/C		Not Used

Table 2: Pin Description (Continued)

SDIP 56	TQFP 80	Name	Type	Function
26	28	LSL	A	Left Loudspeaker Output
27	29	LSR	A	Right Loudspeaker Output
28	30	SW	A	Subwoofer Output
29	31	HPL	A	Left Headphone Output
30	32	HPR	A	Right Headphone Output
31	33	GNDSA	AP	Substrate Analog/Digital Shield
-	34	N/C		Not Used
32	35	$\overline{\text{HPD}}$	B	Headphone Detection Input (Active Low)
33	36	ADR	I	Hardware I²C Chip Address Control
-	37/38	N/C		Not Used
34	39	SCL	OD	I²C Serial Clock
35	40	SDA	OD	I²C Serial Data
-	41	N/C		Not Used
36	42	REG	A	5 V Power Regulator Control
37	43	$\overline{\text{RESET}}$	I	Hardware Reset (Active Low)
38	44	SYSCK	B	System Clock Output
39	45	MCK	B	I²S Master Clock Output
40	46	VDD1	DP	3.3V Power Supply for Digital Core & IO Cells
41	47	GND1	DP	0V Power Supply for Digital Core & IO Cells
-	48	N/C		Not Used
42	49	GNDSP	AP	Substrate Analog/Digital Shield for Clock-PLL
	50/51	N/C		Not Used
43	52	XTI	I	Crystal Oscillator Input
44	53	XTO	O	Crystal Oscillator Output
45	54	VDDP	AP	3.3 V Power Supply for Analog PLL Clock
46	55	GNDP	AP	0 V Power Supply for Analog PLL Clock
47	56	GND2	DP	0 V Power Supply for Digital Core, DSPs & IO Cells
48	57	VDD2	DP	3.3 V Power Supply for Digital Core, DSPs & IO Cells
49	58	CKTST	I	Must be Connected to 0 V
-	59/60	N/C		Not Used
50	61	SDO	B	I²S Bus Data Output
51	62	ST/SDI	B	Stereo Detection Output / I²S Bus Data Input
52	63	WS	B	I²S Bus Word Select Output
53	64	SCK	B	I²S Bus Clock Output
54	65	BUS1	B	I²C Bus Expander Output 1
-	66/67	N/C		Not Used
55	68	BUS0	B	I²C Bus Expander Output 2
56	69	IRQ	B	I²C Status Read Request
-	70	N/C		Not Used
-	71	N/C		Not Used
-	72	N/C		Not Used

1. Introduction

1.1 Features

- Single chip Teletext system with Integrated digital data slicer.
- Ten pages of on-chip display RAM.
- Multi-alphabet solution : Latin, Cyrillic, Arabic and Greek.
- Minimum software requirement.
- Automatic Full Level One Features (FLOF) & Table Of Pages (TOP) decoding.
- Flicker-free packet 26 processing on chip.
- Program delivery control (PDC).
- Menu page capability.
- Instantaneous page memory clear.
- Two Digital PLLs to manage the composite synchronization signal.
- Backward Software Compatible with other ET Teletext solutions.
- Direct access to subtitles.
- VPS data decoding.
- WSS data capture and store.

1.2 Description

The ET-TVT0310A device is a ten page intelligent single-chip Teletext decoder for use with 625 line TV transmissions having Teletext in the Vertical Blanking Interval (VBI). The device integrates an on-chip digital data slicer and a decoder to provide a flexible Teletext solution incorporating internal software to implement FLOF and TOP Teletext decoding automatically. Additionally, the ET-TVT0310A supports decoding of Video Programming System (VPS) signals, and Wide Screen Signaling (WSS) data capture and storage.

The ET-TVT0310A is part of the ET Teletext family of devices. This chip supports all the languages of the ET family of devices comprising the Latin, Cyrillic, Arabic and Greek alphabets. A full list of languages supported is shown on Page 16.

On-chip processing of packet 26 characters (flicker free) is automatically implemented as required. All Teletext including packet 26 is processed in 'real time' without the need for any additional memory. This allows the decoder to store up to ten pages of Teletext irrespective of the language selected and the mode of operation. The decoder is controlled by an on-chip 11.5 MIPs micro-coded processor which manages all the Teletext processing requirements, including ghost row processing and TOP table processing. The output of the device is RGB and blanking signals.

Device management is by simple high level commands for most features. The commands are described in the Software Application Guide and allow the TV micro-controller to communicate with ET-TVT0310A through an I2C interface. These commands have been designed to give a backward software compatibility between the single chip ET-TVT0310A and two chip solutions (e.g. ET206 + ET417).

In addition to the FLOF and TOP modes, the ET-TVT0310A decoder has a default Normal mode for any TV channel that is not transmitting FLOF or TOP. The decoder is ideally suited to VCR applications as it is able to receive and decode PDC information from packets 26 and 8/30 and store this information inside the decoder. In this mode of operation, memory can also be assigned for menu pages (pages downloaded from main microprocessor).

2. Internal block diagram of the ET-TVT0310A device

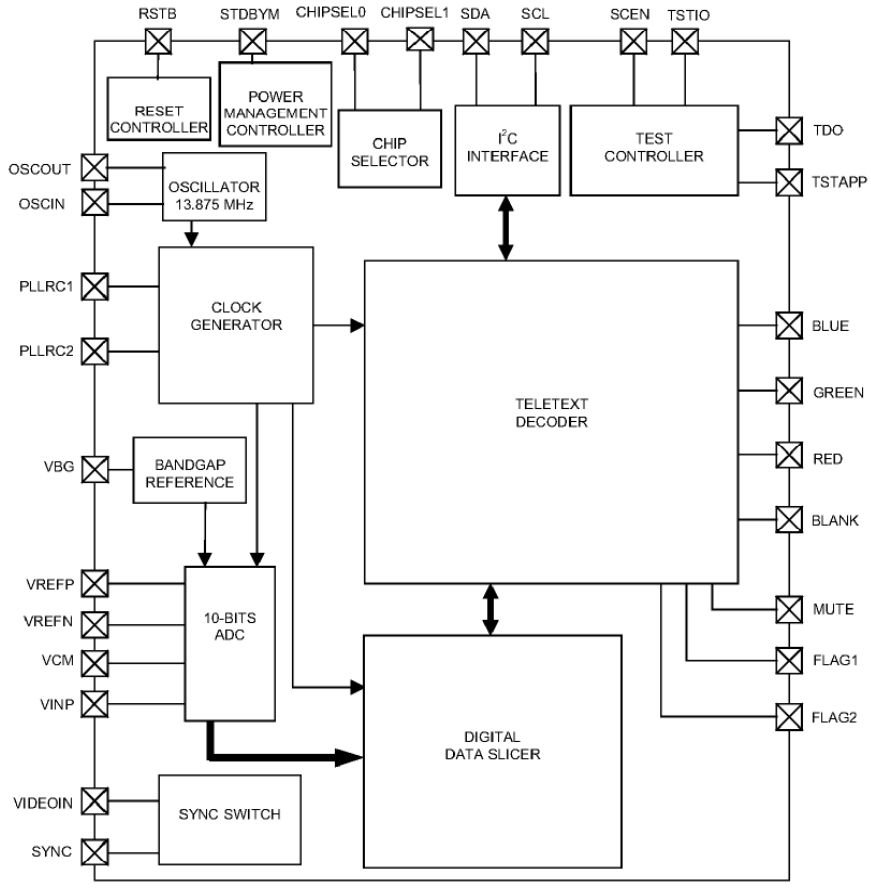
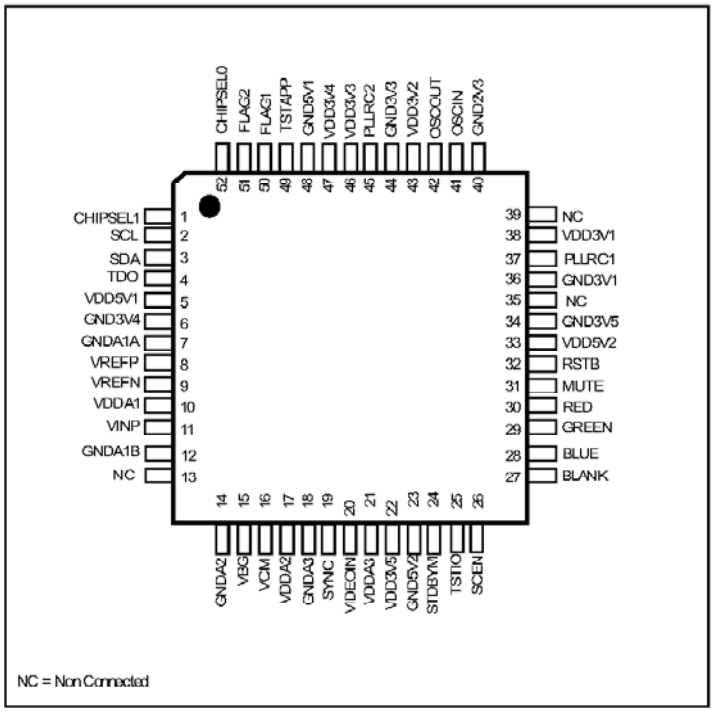


Figure 1: Internal bloc diagram

3. PINGOUT

Name	Type	Description
VDD5V1, VDD5V2	Power	Digital power supply.
VDD3V1, VDD3V2, VDD3V3, VDD3V4, VDD3V5	Power	Digital power supply.
VDDA1, VDDA2, VDDA3	Power	Analog power supply.
GND5V1, GND5V2	Power	Digital ground.
GNDA1A, GNDA1B, GNDA2, GNDA3	Power	Analog ground.
GND3V1, GND3V2, GND3V3, GND3V4, GND3V5	Power	Digital ground.
CHIPSEL0	Input	LSB of the chip select bus (see Table 9).
CHIPSEL1	Input	MSB of the chip select bus (see Table 9).
STDBYM	Input	Standby pin : active low.
RSTB	Input	Reset pin : active low. Internal pull-up to VDD5Vx
PLLRC1	Input	PLL1 input.
PLLRC2	Input	PLL2 input.
OSCIN	Input	Oscillator input.
TSTIO	Input	If TSTIO is high, RED, GREEN, BLUE, BLANK, MUTE are in high impedance state when ET-TVT0310A is in picture mode. If TSTIO is low, those outputs are active low when ET-TVT0310A is in picture mode.
SCEN	Input	Test pin. Must be always set to low.
TSTAPP	Input	Test pin. Must be always set to low.
VINP	Input	Analog input for video.
VIDEOIN	Input	Analog VIDEO input which is connected to SYNC when ET-TVT0310A is not in text mode.
SYNC	Output	Digital composite synchronization generated by ET-TVT0310A in text mode and VIDEOIN in other modes.
BLANK	Output	Blanking signal. This pin is high when teletext information is displayed on RGB lines.
BLUE	Output	Display signal.
GREEN	Output	Display signal.
RED	Output	Display signal.
MUTE	Output	Audio mute control. This signal is low when just text is display on the screen and bad video is detected. It is intended to be connected to the TV audio muting circuit.
OSCOUT	Output	Oscillator output.
TDO	Output	Test pin. Not connected.
VREFP	Output	Reference output voltage.
VREFN	Output	Reference output voltage.
VBG	Output	Reference output voltage.
VCM	Bi-directional	Input/output for common mode voltage decoupling and bypassing.
SCL	Bi-directional	I²C clock line. Open drain pin.
SDA	Bi-directional	I²C data line. Open drain pin.
FLAG1	Bi-directional	System information. User can configure this pin using the I²C commands to output Line23 flag.
FLAG2	Bi-directional	System information. User can configure this pin using the I²C commands to output ODD/EVEN field flag.

Packages top view



TEXAS INSTRUMENTS

TVP5146PFP

NTSC/PAL/SECAM 4x10-Bit Digital Video Decoder With Macrovision™ Detection, YCbCr/RGB Inputs, 5-Line Comb Filter and SCART/Digital RGB Overlay Support

Data Manual

July 2003

HPA Digital Audio Video

SLES084

1 Introduction

The TVP5146 device is a high quality, single-chip digital video decoder that digitizes and decodes all popular baseband analog video formats into digital component video. The TVP5146 device supports the analog-to-digital (A/D) conversion of component RGB and YPbPr signals, as well as the A/D conversion and decoding of NTSC, PAL, and SECAM composite and S-video into component YCbCr. This device includes four 10-bit 30-MSPS A/D converters. Prior to each A/D converter, each analog channel contains an analog circuit, which clamps the input to a reference voltage and applies a programmable gain and offset. A total of 10 video input terminals can be configured to a combination of RGB, YPbPr, CVBS, or S-video video inputs.

Component, composite, or S-video signals are sampled at 2x the square-pixel or ITU-R BT.601 clock frequency, line-locked, and are then decimated to the 1x pixel rate. CVBS decoding utilizes five-line adaptive comb filtering for both the luma and chroma data paths to reduce both cross-luma and cross-chroma artifacts. A chroma trap filter is also available. On CVBS and S-video inputs, the user can control video characteristics such as contrast, brightness, saturation, and hue via an I^2C host port interface. Furthermore, luma peaking (sharpness) with programmable gain is included, as well as a patented chroma transient improvement (CTI) circuit.

A built-in color space converter is applied to decoded component RGB data.

The following output formats can be selected: 20-bit 4:2:2 YCbCr or 10-bit 4:2:2 YCbCr.

The TVP5146 device generates synchronization, blanking, field, active video window, horizontal and vertical syncs, clock, genlock (for downstream video encoder synchronization), host CPU interrupt and programmable logic I/O signals, in addition to digital video outputs.

The TVP5146 device includes methods for advanced vertical blanking interval (VBI) data retrieval. The VBI data processor (VDP) slices, parses, and performs error checking on Teletext, closed caption, and other VBI data. A built-in FIFO stores up to 11 lines of Teletext data, and with proper host port synchronization, full-screen Teletext retrieval is possible. The TVP5146 device can pass through the output formatter 2x the sampled raw Luma data for host-based VBI processing.

The device provides the option for concurrent processing of pixel-locked CVBS and RGB/YPbPr input formats.

The main blocks of the TVP5146 device include:

- Robust sync detection for weak and noisy signals as well as VCR trick mode
- Y/C separation by 2-D 5-line (5H) adaptive comb or chroma trap filter
- Fast-switch input for pixel-by-pixel switching between CVBS and YCbCr/RGB component video inputs (SCART support)
- Fast-switch input for synchronous switching between digital RGB overlay and any video input
- Four 10-bit, 30-MSPS A/D converters with analog preprocessors (clamp/AGC)
- Luminance processor
- Chrominance processor
- Component processor
- Clock/timing processor and power-down control
- Software controlled power saving stand-by modes
- Output formatter
- I^2C host port interface
- VBI data processor

- Macrovision™ copy protection detection circuit (Type 1, 2, 3, and separate color strip detection)
- 3.3-V tolerant digital I/O ports

1.1 Detailed Functionality

- Four 30-MSPS, 10-bit A/D channels with programmable gain control
- Supports NTSC (J, M, 4.43), PAL (B, D, G, H, I, M, N, Nc, 60) and SECAM (B, D, G, K, K1, L) CVBS, S-video
- Supports analog component SD YPbPr/RGB video formats with embedded sync
- 10 analog video input terminals for multi-source connection
- User-programmable video output formats
  - 10-bit ITU-R BT.656 4:2:2 YCbCr with embedded syncs
  - 10-bit 4:2:2 YCbCr with separate syncs
  - 20-bit 4:2:2 YCbCr with separate syncs
  - 2x sampled raw VBI data in active video during a vertical blanking period
  - Sliced VBI data during a vertical blanking period or active video period (full field mode)
- HSYNC/VSYNC outputs with programmable position, polarity, and width, and FID (field ID) output
- Component video processing
  - Gain (contrast) and offset (brightness) adjustments
  - Automatic component video detection (525/625)
  - Color space conversion from RGB to YCbCr
- Composite and S-video processing
  - Adaptive 2-D 5-line adaptive comb filter for composite video inputs; chroma-trap available
  - Automatic video standard detection (NTSC/PAL/SECAM) and switching
  - Luma-peaking with programmable gain
  - Patented chroma transient improvement (CTI)
  - Patented architecture for locking to weak, noisy, or unstable signals
  - Single 14.31818-MHz reference crystal for all standards (ITU-R.BT601 and square pixel)
  - Line-locked internal pixel sampling clock generation with horizontal and vertical lock signal outputs
  - Genlock output (RTC and GLCO formats) for downstream video encoder synchronization
- Certified Macrovision™ copy protection detection

- Vertical blank interval data processor
  - Teletext (NABTS, WST)
  - Closed caption (CC) and extended data service (EDS)
  - Wide screen signaling (WSS)
  - Copy generation management system (CGMS)
  - Video program system (VPS/PDC)
  - Vertical interval time code (VITC)
  - Gemstar™ 1x/2x electronic program guide compatible mode
  - Register readback of CC, WSS (CGMS), VPS/PDC, VITC and Gemstar 1x/2x sliced data
- I^2C host port interface
- Reduced power consumption: 1.8-V digital core, 3.3-V for digital I/O and 1.8-V analog core with power-save and power-down modes
- 80-pin TQFP PowerPAD™ package

1.2 Applications

- Digital TV
- LCD TV/monitors
- DVD-R
- PVR
- PC video cards
- Video capture/video editing
- Video conferencing

1.3 Related Products

- TVP5145 NTSC/PAL/SECAM Component Digital Video Decoder With Macrovision™ Detection, Literature Number SLES029
- TVP5150 NTSC/PAL Low Power Video Decoder With Scaling, Literature Number SLES043
- TVP5150A NTSC/PAL/SECAM Very Low Power Digital Video Decoder, Literature Number TBD

1.4 Ordering Information

T_A	PACKAGED DEVICES
	80-TERMINAL PLASTIC FLAT-PACK PowerPAD™
0°C to 70°C	TVP5146PFP

Gemstar is a trademark of Gemstar-TV Guide International.
PowerPAD is a trademark of Texas Instruments.

1.5 Functional Block Diagram

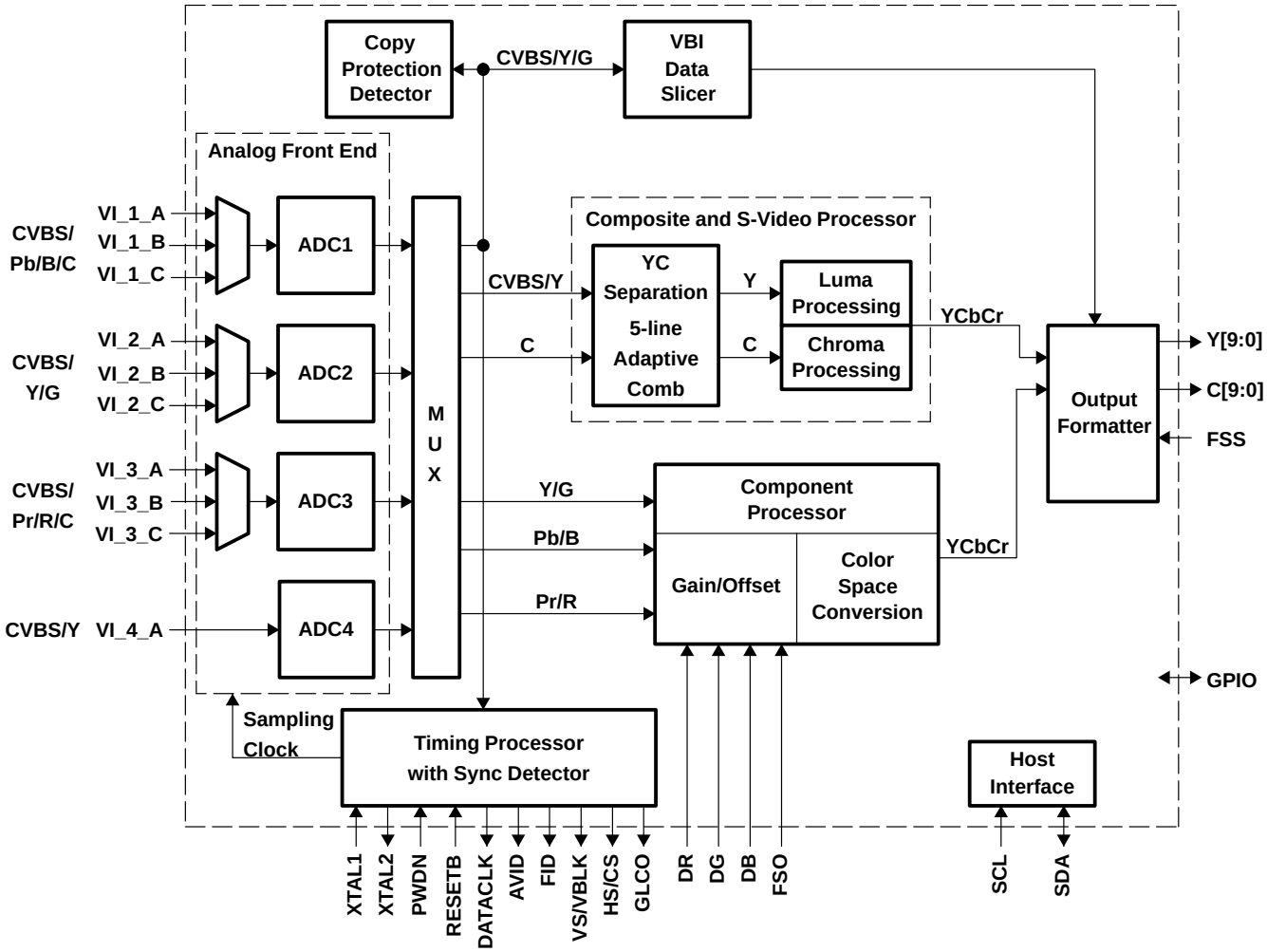


Figure 1–1. Functional Block Diagram

1.6 Terminal Assignments

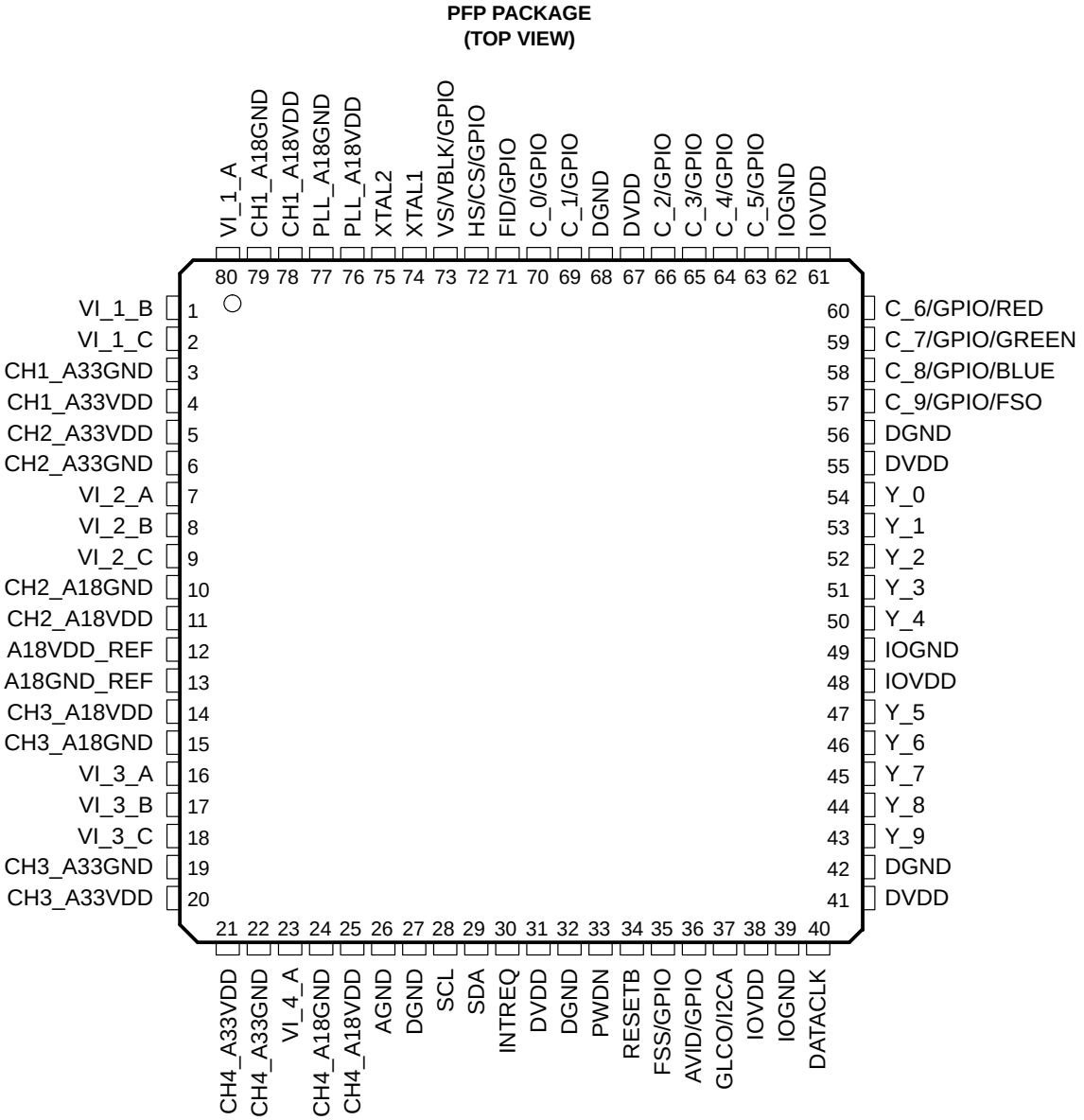


Figure 1–2. Terminal Assignments Diagram

1.7 Terminal Functions

Table 1–1. Terminal Functions

TERMINAL NAME	TERMINAL NUMBER	I/O	DESCRIPTION
Analog Video			
VI_1_A VI_1_B VI_1_C VI_2_A VI_2_B VI_2_C VI_3_A VI_3_B VI_3_C VI_4_A	80 1 2 7 8 9 16 17 18 23	I	VI_1_x: Analog video input for CVBS/Pb/B/C VI_2_x: Analog video input for CVBS/Y/G VI_3_x: Analog video input for CVBS/Pr/R/C VI_4_A: Analog video input for CVBS/Y Up to 10 composite, 4 S-video, and 2 composite or 3 component video inputs (or a combination thereof) can be supported. The inputs must be ac-coupled. The recommended coupling capacitor is 47 nF. The possible input configurations are listed in the input select register at I^{2}C subaddress 00h (see Section 2.10.1).
Clock Signals			
DATACLK	40	O	Line-locked data output clock.
XTAL1	74	I	External clock reference input. It may connected to an external oscillator with a 1.8-V compatible clock signal or a 14.31818-MHz crystal oscillator.
XTAL2	75	O	External clock reference output. Not connected if XTAL1 is driven by an external single-ended oscillator.
Digital Video			
C[9:0]/ GPIO[9:0]	57, 58, 59, 60, 63, 64, 65, 66, 69, 70	O	Digital video output of CbCr, C[9] is MSB and C[0] is LSB. Unused outputs can be left unconnected. Also, these terminals can be programmable general-purpose I/O.
D_BLUE	58	I	Digital BLUE input from overlay device
D_GREEN	59	I	Digital GREEN input from overlay device
D_RED	60	I	Digital RED input from overlay device
FSO	57	I	Fast-switch overlay between digital RGB and any video
Y[9:0]	43, 44, 45, 46, 47, 50, 51, 52, 53, 54	O	Digital video output of Y/YCbCr, Y[9] is MSB and Y[0] is LSB.
Miscellaneous Signals			
FSS/GPIO	35	I/O	Fast-switch (blanking) input. Switching signal between the synchronous component video (YPbPr/RGB) and the composite video input. Programmable general purpose I/O
GLCO/I2CA	37	I/O	Genlock control output (GLCO). Two Genlock data formats are available: TI format and real time control (RTC) format. During reset, this terminal is an input used to program the I^{2}C address LSB.
INTREQ	30	O	Interrupt request
PWDN	33	I	Power down input: 1 = Power down 0 = Normal mode
RESETB	34	I	Reset input, active low

Table 1–1. Terminal Functions (Continued)

TERMINAL NAME	TERMINAL NUMBER	I/O	DESCRIPTION
Host Interface			
SCL	28	I	I^2C clock input
SDA	29	I/O	I^2C data bus
Power Supplies			
AGND	26	I	Analog ground. Connect to analog ground.
A18GND_REF	13	I	Analog 1.8-V return
A18VDD_REF	12	I	Analog power for reference 1.8 V
CH1_A18GND CH2_A18GND CH3_A18GND CH4_A18GND	79 10 15 24	I	Analog 1.8-V return
CH1_A18VDD CH2_A18VDD CH3_A18VDD CH4_A18VDD	78 11 14 25	I	Analog power. Connect to 1.8 V.
CH1_A33GND CH2_A33GND CH3_A33GND CH4_A33GND	3 6 19 22	I	Analog 3.3-V return
CH1_A33VDD CH2_A33VDD CH3_A33VDD CH4_A33VDD	4 5 20 21	I	Analog power. Connect to 3.3 V.
DGND	27, 32, 42, 56, 68	I	Digital return
DVDD	31, 41, 55, 67	I	Digital power. Connect to 1.8 V.
IOGND	39, 49, 62	I	Digital power return
IOVDD	38, 48, 61	I	Digital power. Connect to 3.3 V or less for reduced noise.
PLL_A18GND	77	I	Analog power return
PLL_A18VDD	76	I	Analog power. Connect to 1.8 V.
Sync Signals			
HS/CS/GPIO	72	I/O	Horizontal sync output or digital composite sync output Programmable general-purpose I/O
VS/VBLK/GPIO	73	I/O	Vertical sync output. (for modes with dedicated VSYNC) or VBLK output Programmable general-purpose I/O
FID/GPIO	71	I/O	Odd/even field indicator output. This terminal needs a pulldown resistor. Programmable general-purpose I/O
AVID/GPIO	36	I/O	Active video indicator output Programmable general-purpose I/O

7.5 LM4950

7.5W Mono-BTL or 3.1W Stereo Audio Power Amplifier

General Description

The LM4950 is a dual audio power amplifier primarily designed for demanding applications in flat panel monitors and TV's. It is capable of delivering 3.1 watts per channel to a 4Ω single-ended load with less than 1% THD+N or 7.5 watts mono BTL to an 8Ω load, with less than 10% THD+N from a $12V_{DC}$ power supply.

Boomer audio power amplifiers were designed specifically to provide high quality output power with a minimal amount of external components. The LM4950 does not require bootstrap capacitors or snubber circuits. Therefore, it is ideally suited for display applications requiring high power and minimal size.

The LM4950 features a low-power consumption active-low shutdown mode. Additionally, the LM4950 features an internal thermal shutdown protection mechanism along with short circuit protection.

The LM4950 contains advanced pop & click circuitry that eliminates noises which would otherwise occur during turn-on and turn-off transitions.

The LM4950 is a unity-gain stable and can be configured by external gain-setting resistors.

Key Specifications

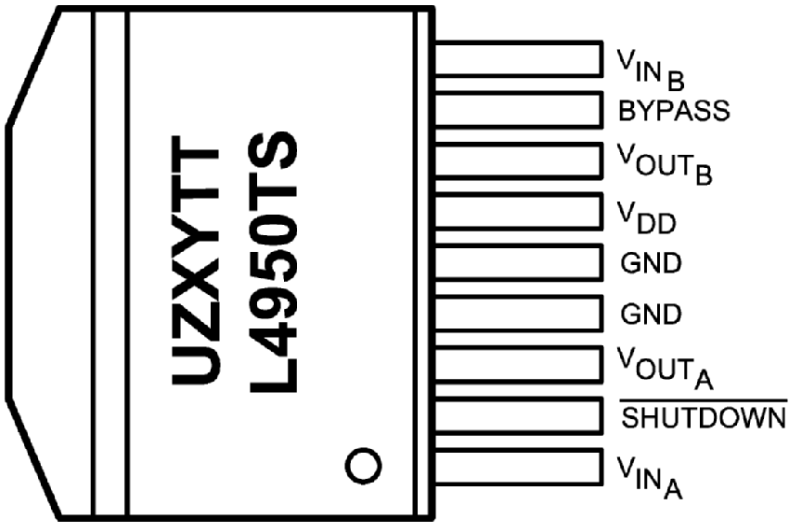
- Quiscent Power Supply Current 16mA (typ)
- P_{OUT} (SE)
  V_{DD} = 12V, R_L = 4Ω, 1% THD+N 3.1W (typ)
- P_{OUT} (BTL)
  V_{DD} = 12V, R_L = 8Ω, 10% THD+N 7.5W (typ)
- Shutdown current 40µA (typ)

Features

- Pop & click circuitry eliminates noise during turn-on and turn-off transitions
- Low current, active-low shutdown mode
- Low quiescent current
- Stereo 3.1W output, R_L = 4Ω
- Mono 7.5W BTL output, R_L = 8Ω
- Short circuit protection
- Unity-gain stable
- External gain configuration capability

Connection Diagrams

Plastic Package, TO-263



20047070

Top View
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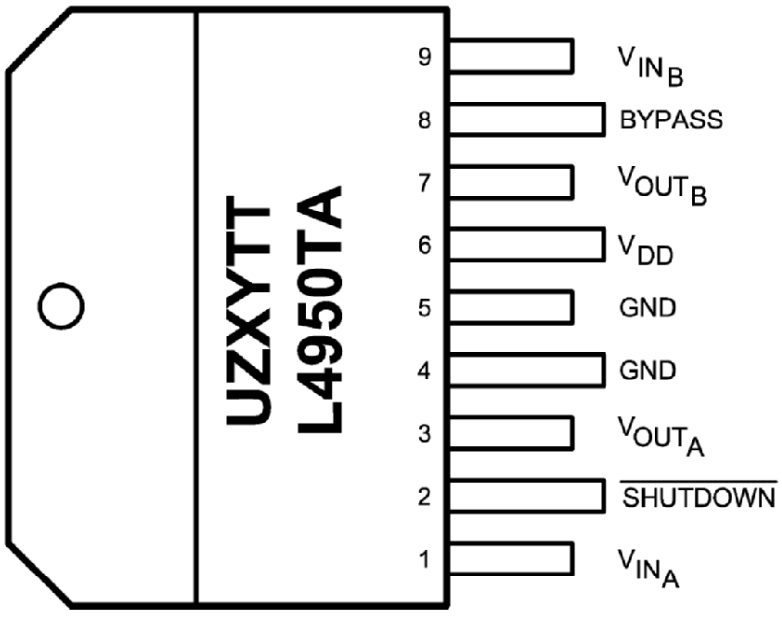
Z = Assembly Plant Code
XY = Date Code
TT = Die Traceability
Order Number LM4950TS
See NS Package Number TS9A

Plastic Package, TO-220



20047071

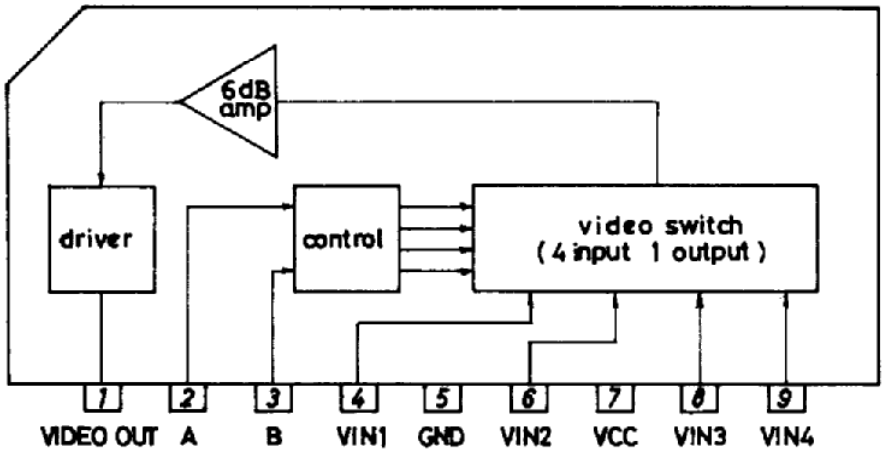
Top View
U = Wafer Fab Code
Z = Assembly Plant Code
XY = Date Code
TT = Die Traceability
Order Number LM4950TA
See NS Package Number TA09A

7.6 LA7952
Video Switch for TV/VCR Use

Features

- On-chip driver with 4 inputs, 1 output, 75Ω termination.
- On-chip 6dB amplifier.
- Excellent crosstalk characteristic.
- Wide band.
- Input with DC restoration circuit.

Equivalent Curcuit Block Diagram



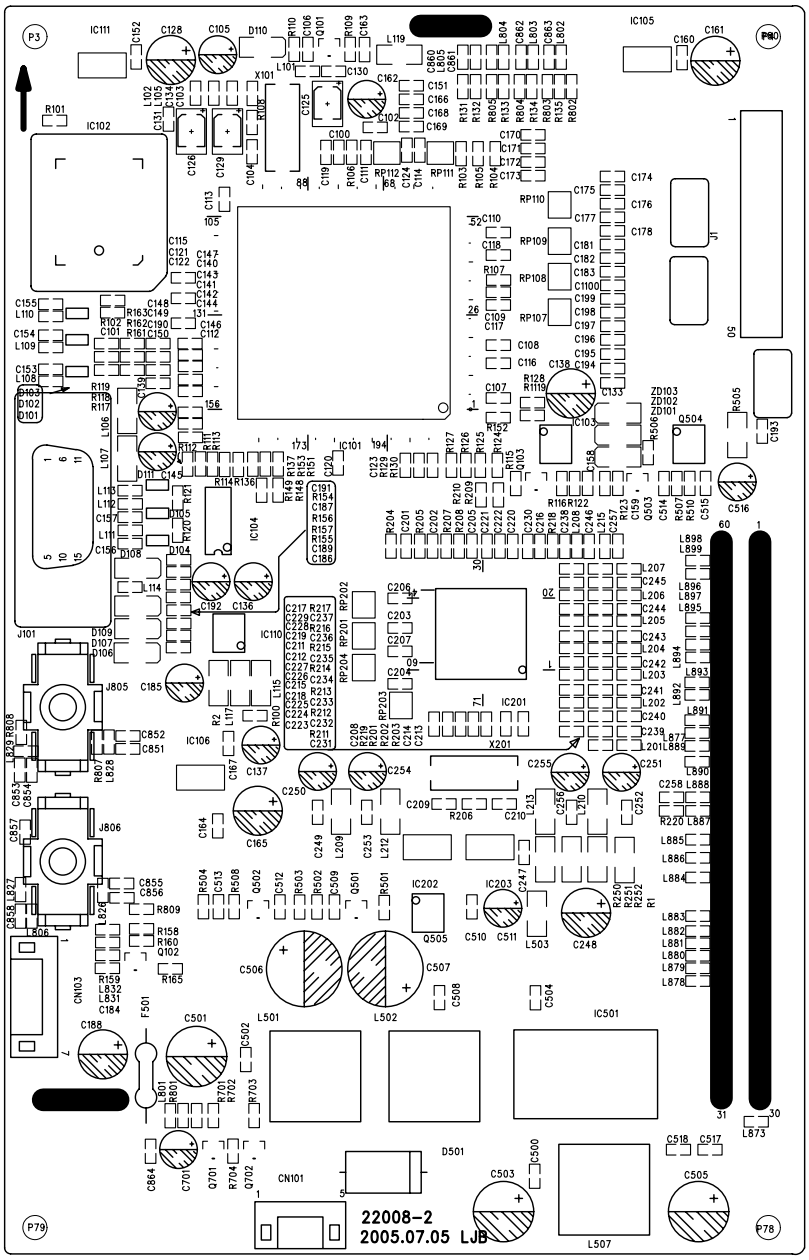
Video Switch Truth Table

S2 (Pin 2)	S3 (Pin 3)	V_{IN1} (Pin 4)	V_{IN2} (Pin 6)	V_{IN3} (Pin 8)	V_{IN4} (Pin 9)
H	H	ON	OFF	OFF	OFF
L	H	OFF	ON	OFF	OFF
H	L	OFF	OFF	ON	OFF
L	L	OFF	OFF	OFF	ON

Note 1 : Refer to this Truth Table and make measurements by switching S2, S3.

7. SCHEMATIC & P.C.B

VIDEO BOARD:



SILKSCREEN TOP SIDE

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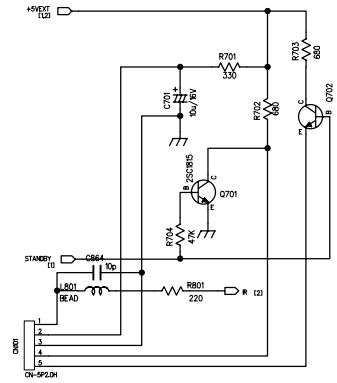

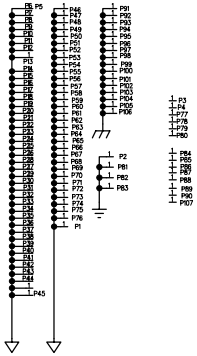

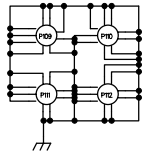

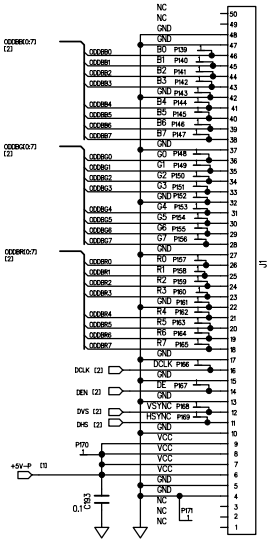

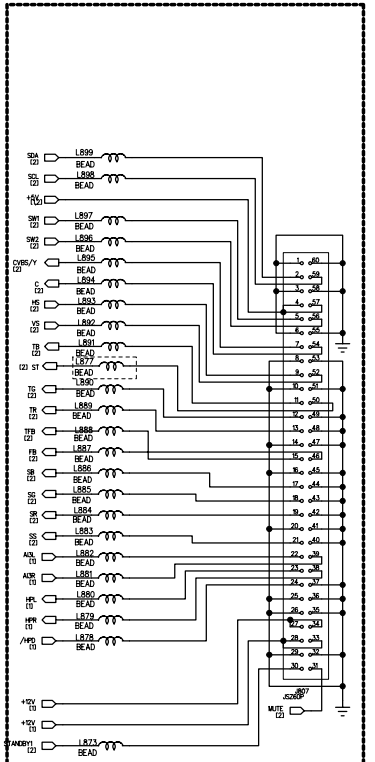

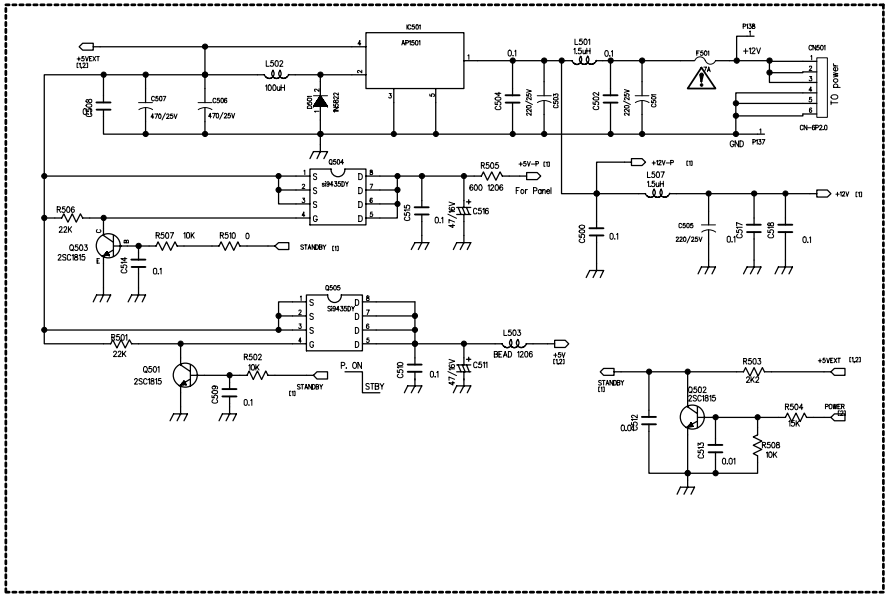

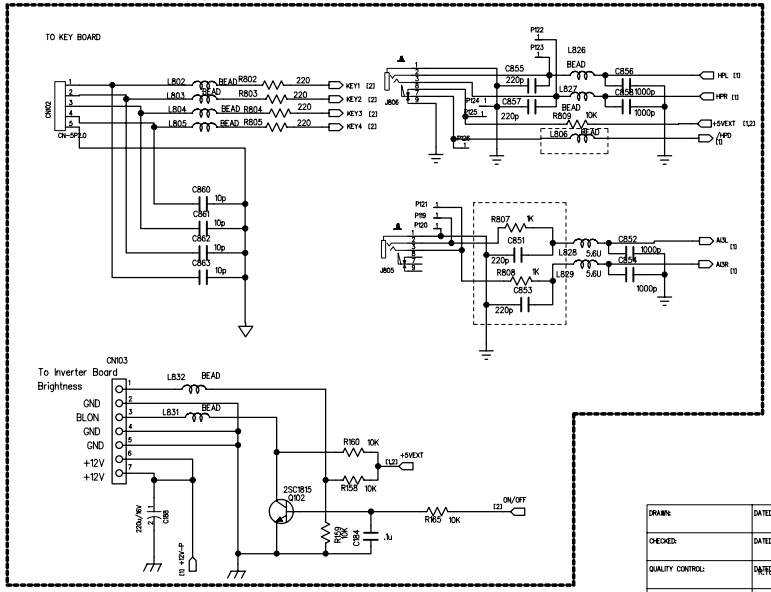

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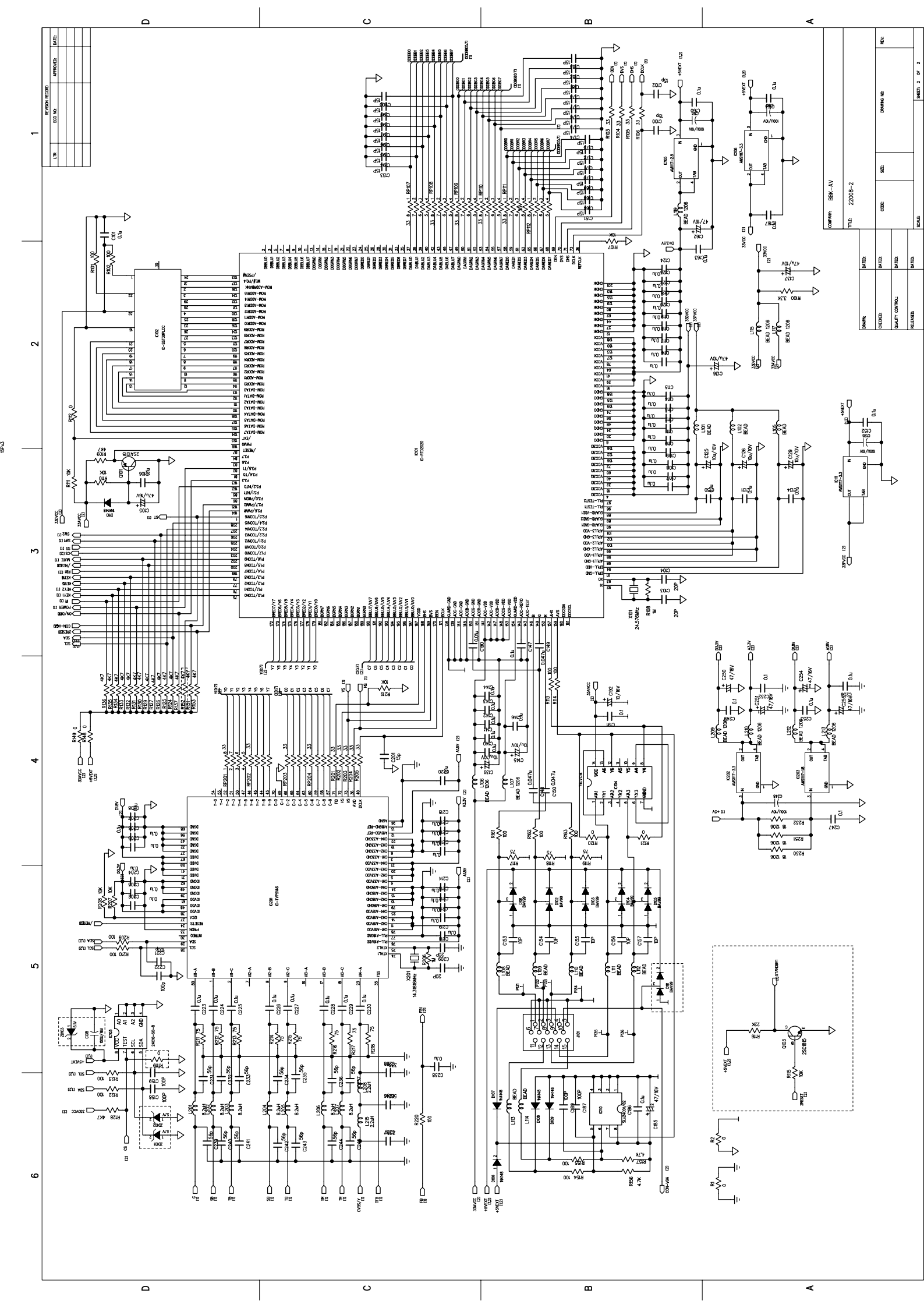

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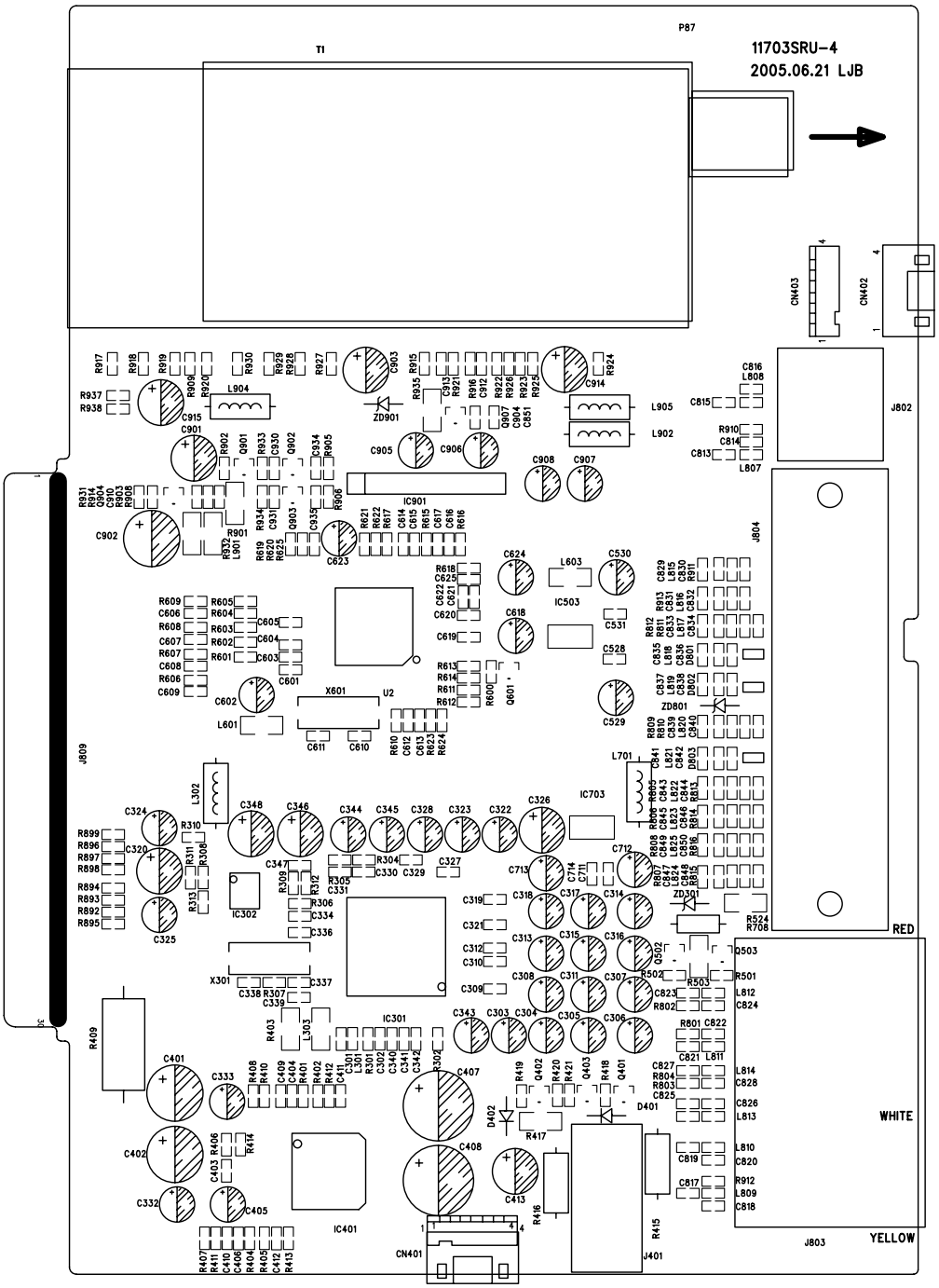
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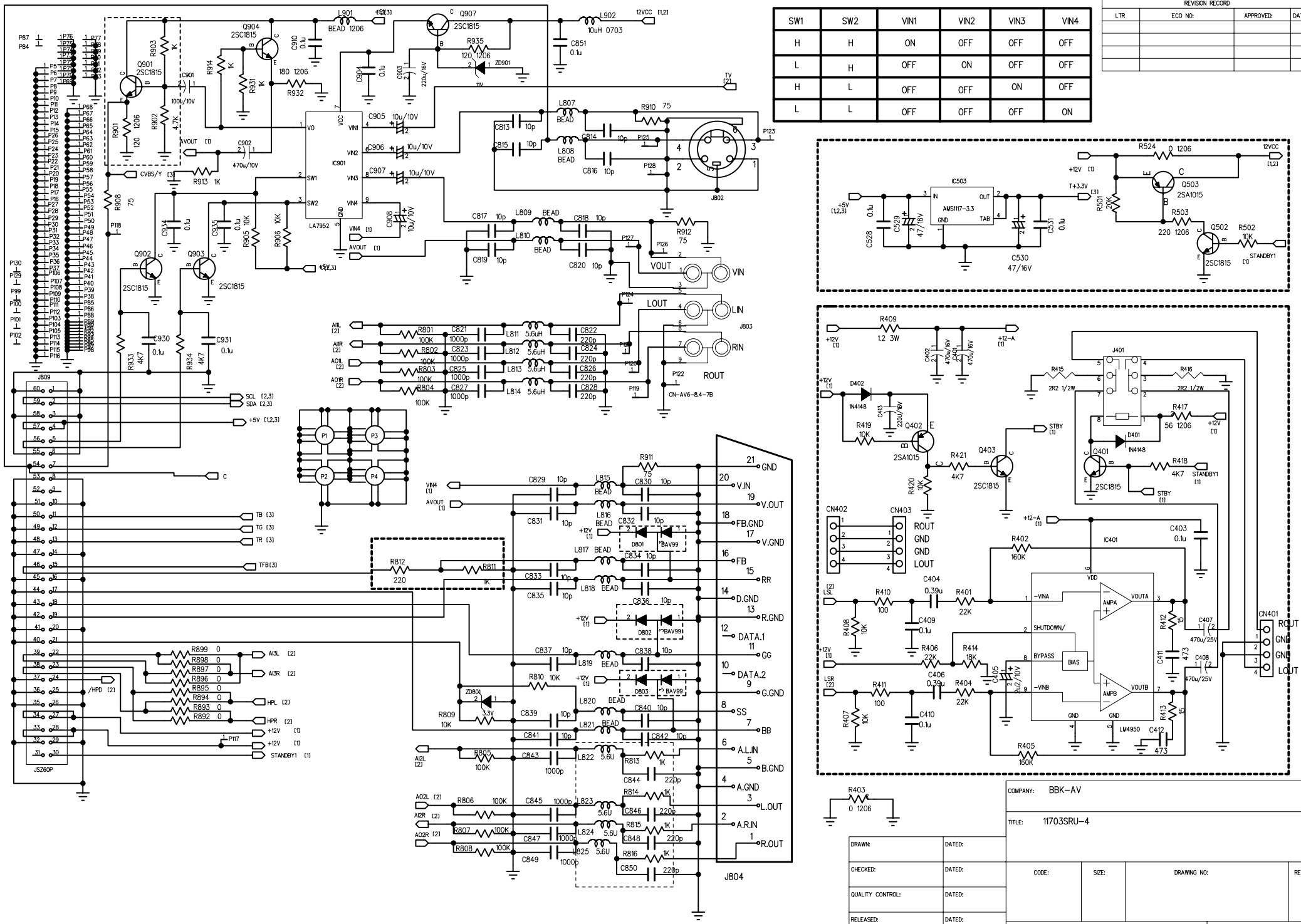

SW1	SW2	VIN1	VIN2	VIN3	VIN4
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L	H	OFF	ON	OFF	OFF
H	L	OFF	OFF	ON	OFF
L	L	OFF	OFF	OFF	ON

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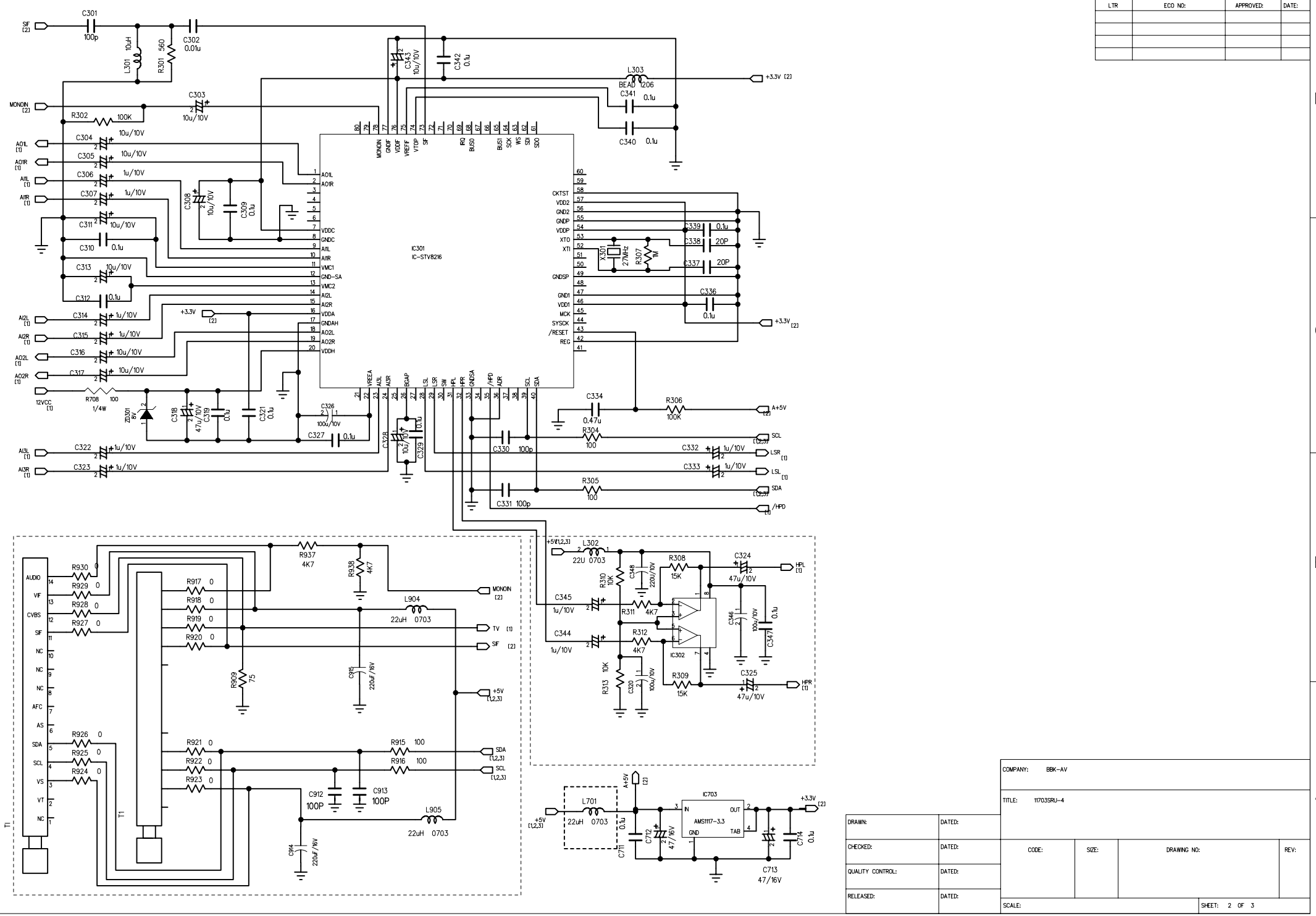
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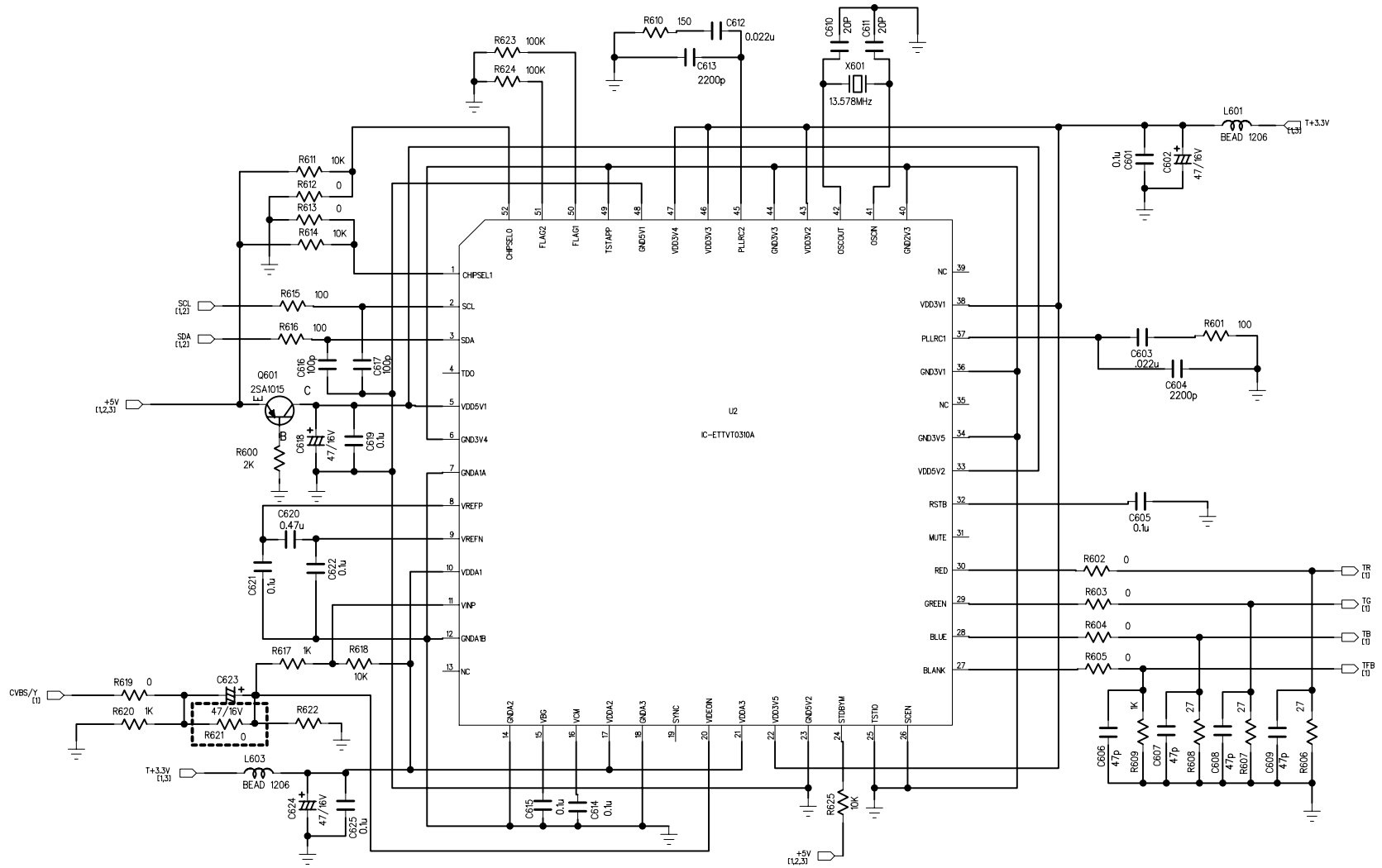

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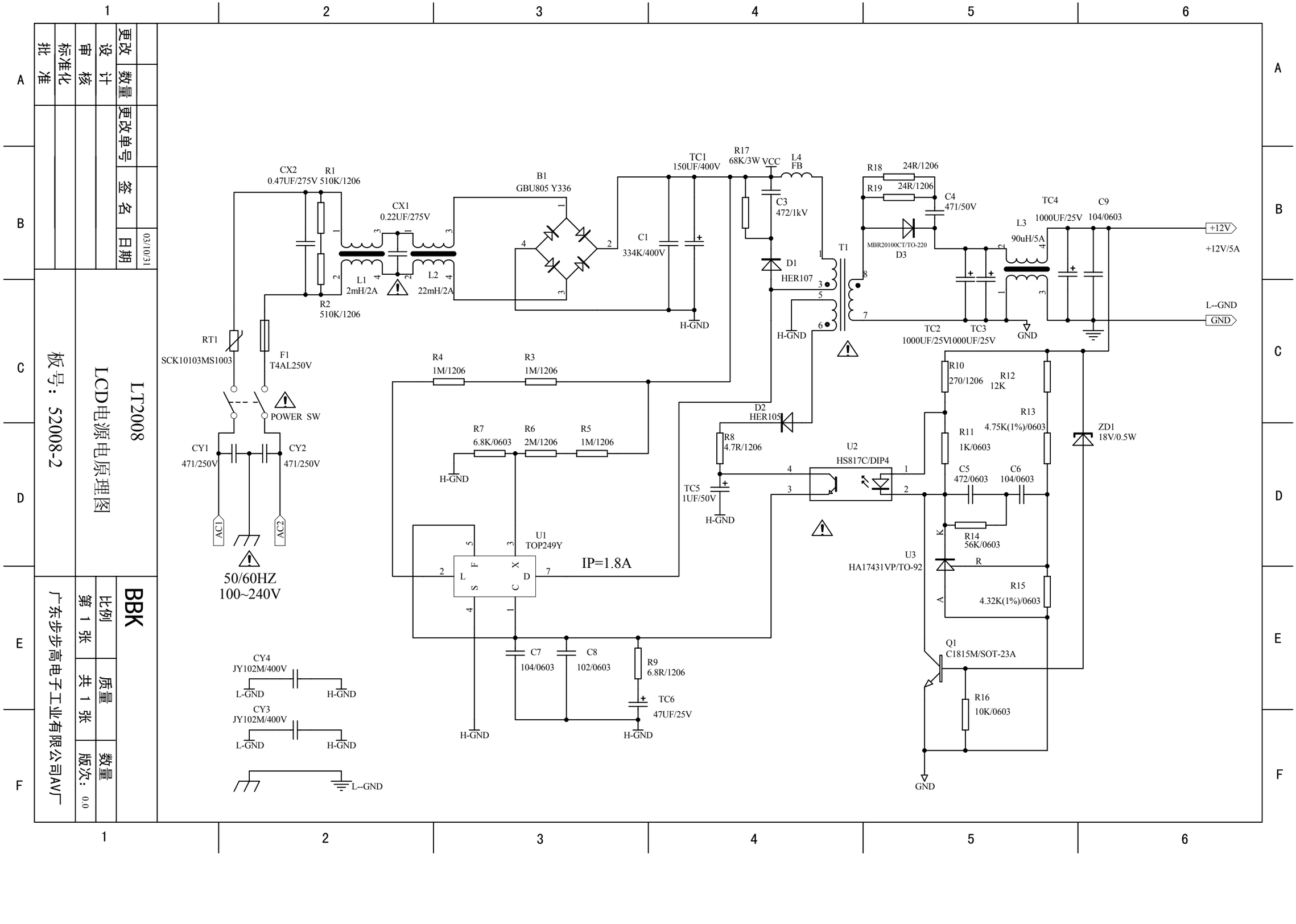
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L2 22mH/2A
R2 510K/1206
B1 GBU805 Y336
TC1 150UF/400V
C1 334K/400V
H-GND
R17 68K/3W
VCC
L4 FB
C3 472/1kV
D1 HER107
T1
H-GND
R18 24R/1206
R19 24R/1206
C4 471/50V
MBR20100CT/TO-220
D3
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C9 104/0603
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+12V/5A
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GND
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TC3 1000UF/25V
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POWER SW
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CY2 471/250V
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AC2
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R3 1M/1206
R7 6.8K/0603
R6 2M/1206
R5 1M/1206
H-GND
D2 HER105
R8 4.7R/1206
U2 HS817C/DIP4
TC5 1UF/50V
U1 TOP249Y
IP=1.8A
C7 104/0603
C8 102/0603
R9 6.8R/1206
TC6 47UF/25V
R10 270/1206
R12 12K
R13 4.75K(1%)/0603
R11 1K/0603
C5 472/0603
C6 104/0603
ZD1 18V/0.5W
R14 56K/0603
U3 HA17431VP/TO-92
R15 4.32K(1%)/0603
Q1 C1815M/SOT-23A
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L--GND

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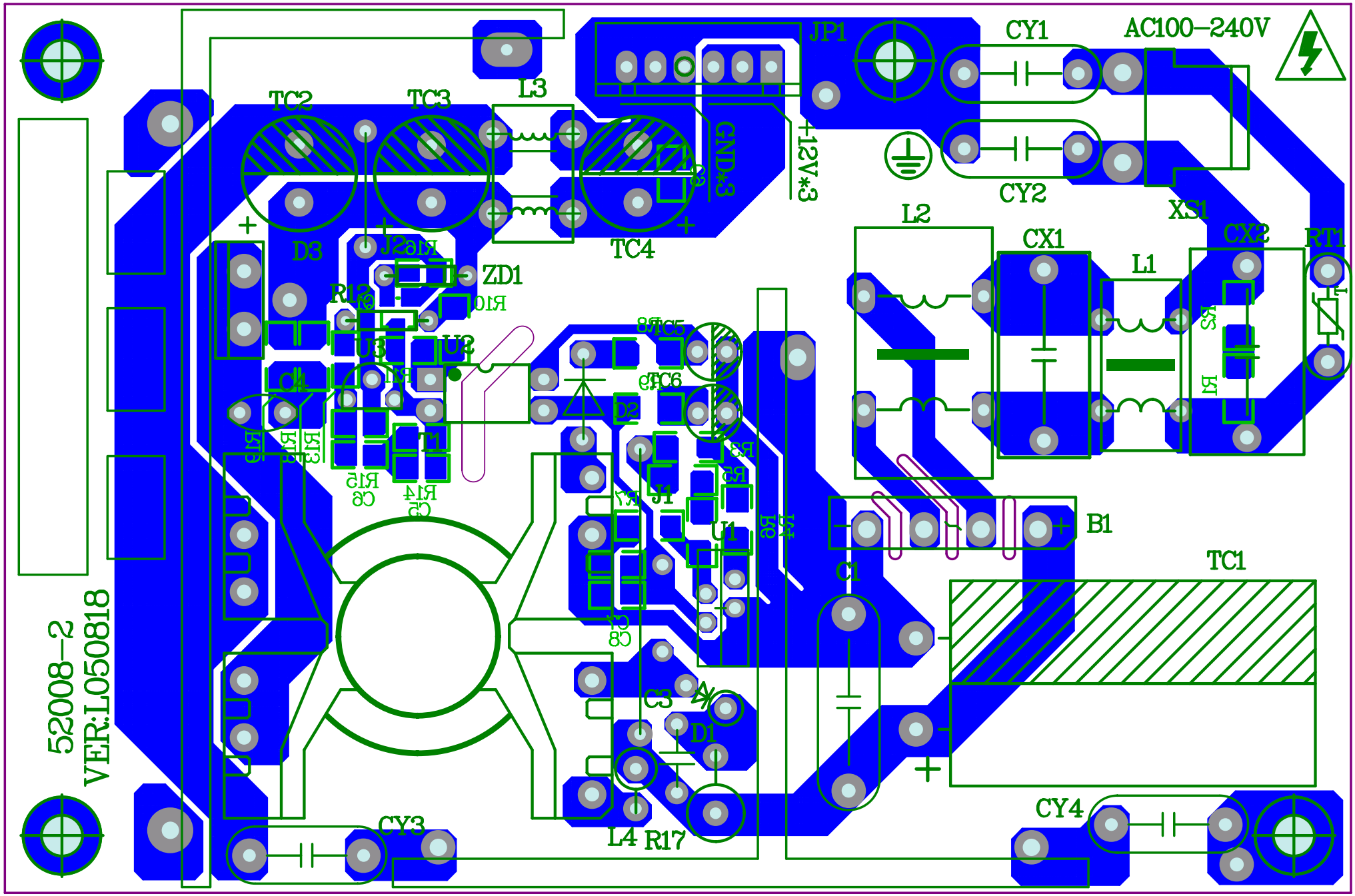
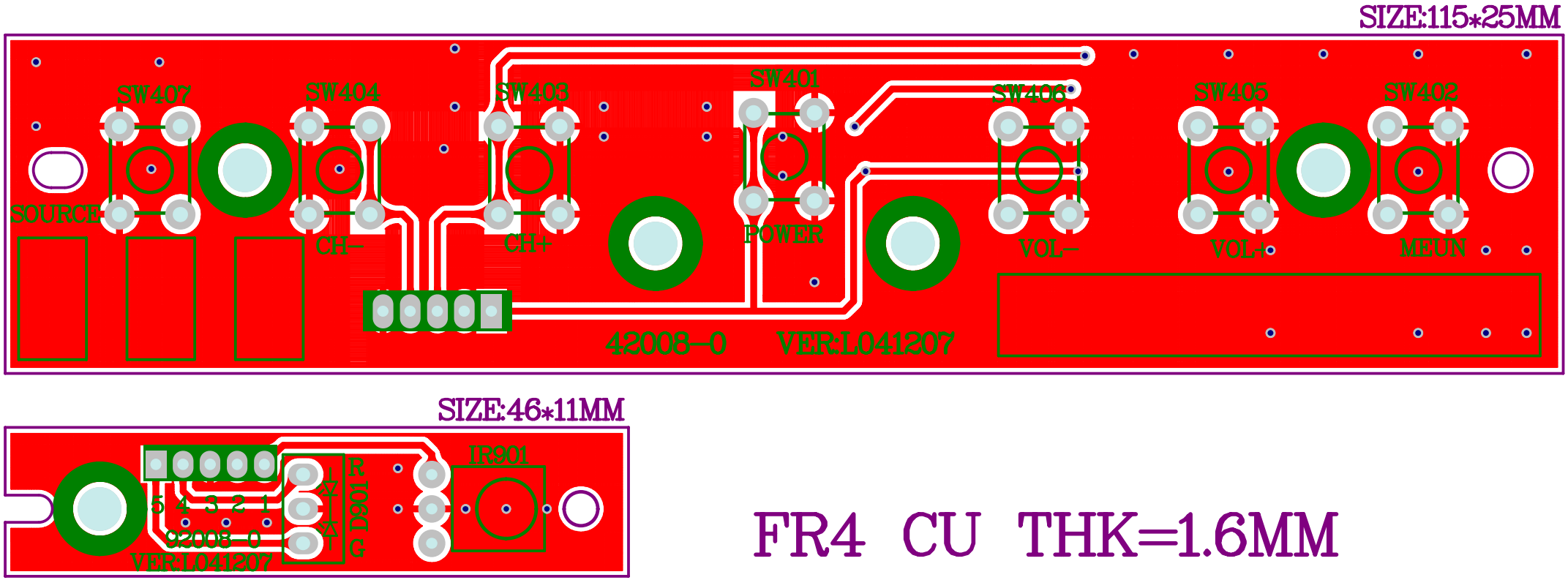


94V0 CU THK=1.6MM

KEY BOARD:



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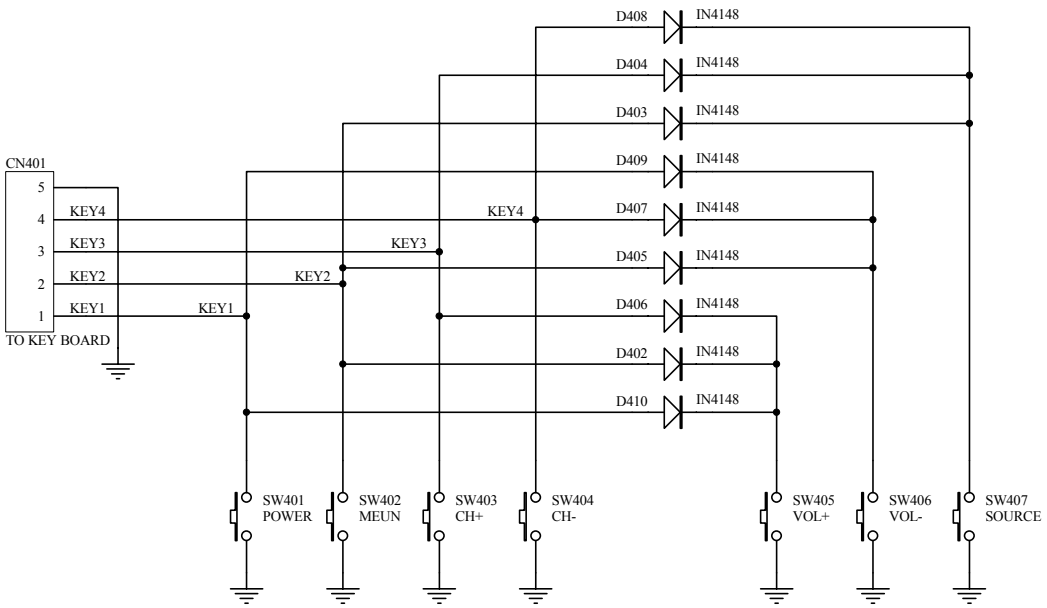

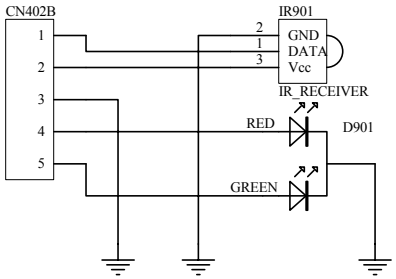

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8. MATERIAL LIST

BOM OF VIDEO BOARD

SMD RESISTOR	1/16W 100Ω ±5% 0603	R122,R123,R101,R102,R220,R154,R155,R161,R162,R163,R113,R114
SMD RESISTOR	1/16W 0Ω ±5% 0603	R149,R510,R159,L201
SMD RESISTOR	1/16W 22Ω ±5% 0603	R210,R209
SMD RESISTOR	1/16W 2.2K ±5% 0603	R124,R125,R116,R100
SMD RESISTOR	1/16W 4.7K ±5% 0603	R109,R126,R127,R129~R135,R137,R151,R153,R156,R157,R503,R128
SMD RESISTOR	1/16W 75Ω ±5% 0603	R117~R119,R211,R212,R214,R216,R218
SMD RESISTOR	1/8W 0Ω ±5% 1206	L503
SMD RESISTOR	1/4W 18Ω±5% 1206	R250~R252
SMD RESISTOR	1/16W 10Ω ±5% 0603	R203
SMD RESISTOR	1/16W 15K ±5% 0603	R504
SMD RESISTOR	1/16W 1MΩ ±5% 0603	R206, R108
SMD RESISTOR	1/16W 33Ω ±5% 0603	R201,R202,R204,R103~R105,R106,R205
SMD RESISTOR	1/16W 220Ω ±5%	R801~R805,R213,R215,R217
SMD RESISTOR	1/16W 1K ±5% 0603	R807,R808
SMD RESISTOR	1/16W 330Ω ±5% 0603	R701
SMD RESISTOR	1/16W 680Ω ±5% 0603	R702 ,R703
SMD RESISTOR	1/16W 47K ±5% 0603	R704
SMD RESISTOR	1/16W 22K ±5% 0603	R501,R506
SMD RESISTOR	1/16W 10K ±5% 0603	R107,R110,R111,R158,R160,R208,R809,R502, R507,R219,R165,R115
SMD RESISTOR NETWORKS	1/16W33Ω ±5% 8P	RP201~RP204 ,RP107~RP112
SMD INDUCTOR	8.2uH±10% 1608	L202~L207
SMD INDUCTOR	2.2UH±10% 1608	L215,L208
VERTICAL SCREEN SHIELD FILTERING INDUCTOR	100uH ±20% 3A SMD	L502
CHOKE COIL	VERTICAL 1.5uH ±20% 7A 6mm	L501,L507
SMD MAGNETIC BEADS	19Ω/100mHZ ±25% 1608	L108~L114,L878~L899,L801~L805
SOCKET	5P 2.0mm STRAIGHT FLEX	CN101
SMD MAGNETIC BEADS	600Ω/100MHZ±25% 1608	L101,L102,L105,L873,L832,L831,L806,L828,L829,L826,L827
SMD MAGNETIC BEADS	600Ω/100MHZ±25% 3216	L107,L106,L209,L210,L212,L213,L115,L117,L119,R505

SMD CAPACITOR	50V 101 ±5% NPO 0603	C158,C159,C222,C221,C189,C187
SMD CAPACITOR	50V104 ±20% 0603	C202~C208,C258,C211~C219,C101,C106~C124,C130,C131,C134,C160,C163,C164,C167,C247,C249,C152,C253,C252,C256,C186,C140~C144,C146,C509,C510,C504,C502,C515,C184,C508,C514,C191,C500,C518,C517,C193
SMD CAPACITOR	16V 104 ±10% 0603	C147,C220,C223~C230
SMD CAPACITOR	50V 56P ±5% NPO 0603	C231~C237,C239~C245
SMD CAPACITOR	50V 561 ±10% X7R 0603	C246
SMD CAPACITOR	50V 331 ±5% NPO 0603	C257,C238
SMD CAPACITOR	50V 15P ±5% NPO 0603	C201,C100,C102,C133,C194~C199,C1100,C168~C178,C181~C183,C151,C166
SMD CAPACITOR	50V 20P ±5% NPO 0603	C209,C210,C103,C104
SMD CAPACITOR	50V 10P ±5% NPO 0603	C153~C157,C860~C864
SMD CAPACITOR	10V 474 ±10% X5R 0603	C148~C150
SMD CAPACITOR	50V 221 ±5% NPO 0603	C851,C853,C855,C857
SMD CAPACITOR	50V 102 ±10% 0603	C856,C858,C852,C854
SMD CAPACITOR	50V 103 ±10% 0603	C512,C513,C190
CD	CD11 16V47U±20%5×11 2	C105,C192
CD	CD11 16V10U±20%5×11 2	C701
CD	CD11C 16V47U±20%5×7 2	C139,C145
CD	CD11C 16V100U±20%6×7 2.5	C248,C161,C165,C128,C162,C250,C251,C254,C255,C185,C516,C511,C136,C137,C138
SMD CD	16V10U±20%4×4×5.4	C125,C126,C129
CD	CD112 105℃ 25V220U ± 20% 8×12 3.5	C501,C503,C505
CD	CD112S 105℃25V220U±20% 8×12 3.5	C501,C503,C505
CD	CD288T 25V470U±20%10×12 5	C507,C506
SMD DIODE	1N4148	D106~D110
SCHOTTKY DIODE	1N5822 SHAPED 15	D501
SMD TRIODE	BAV99LT1 SOT-23	D101~D103,D111
SMD TRIODE	2SA1015	Q101
SMD TRIODE	C1815	Q102,Q103,Q501~Q503,Q701,Q702
SMD CRYSTAL OSCILLATOR	24.576MHz 49-S	X101
SMD CRYSTAL OSCILLATOR	14.31818MHZ 49-S	X201
CABLE SOCKET	50P 0.5mm SMD,NEXT MEET WITH CLASP	J1

FLAT CABLE	5P 270 2.0 T2 5P SHIELD,WITH NEEDLE,THE SAME DIRECTION,WELD PIECE	视频板 CN102TO 按键板 CN401
FLAT CABLE	6P100 2.0/2.5 2 PIN,WITH NEEDLE,THE SAME DIRECTION	视频板 CN501TO 电源板 JP1
SOCKET	7P 2.0mm RIGHT-ANGLE	CN103
VGA SOCKER	15P VERTICAL,WITH BOLT	J101
PCB BOARD-TO-BOARD LINKER	2×30P 2.54mm WITHOUT AURIS DUAL REED	J807
EARPHONE SOCKET	ST-417-060-100-FM STRAIGHT INSERT,WITH CUPRUM COVER	J806,J805
FUZE	125V 7A	F501
IC	9435M SO8	Q504,Q505
IC	FDS9435A SOP	Q504,Q505
IC SOCKET	32P PLCC	IC102
IC	RTD2010 PQFP	IC101
IC	LM1117MP-1.8 SOT-223	IC203
IC	AK18 SOT-223	IC203
IC	24C16 SOP	IC103
IC	LVC14A SOP	IC104
IC	74LVC14A SOP	IC104
IC	AK33 SOT-223	IC106,IC202,IC111
IC	AK25 SOT-223	IC105
IC	AC1501 TO263-5L	IC501
IC	TVP5146M1 PQFP	IC201
PCB	22008-2	

BOM OF AUDIO BOARD

SMD RESISTOR	1/16W 100Ω ±5% 0603	R915,R916,R615,R616,R601
SMD RESISTOR	1/16W 1.5K ±5% 0603	R410,R411
SMD RESISTOR	1/4W 1.2K ±5% 1206	R503
SMD RESISTOR	1/4W 180Ω±5% 1206	R932
SMD RESISTOR	1/4W 120Ω±5% 1206	R935,R901
SMD RESISTOR	1/16W 10K ±5% 0603	R407,R408,R905,R906,R810,R809,R310, R313,R419,R420,R618,R502,R600,R625
SMD RESISTOR	1/16W 2.2K ±5% 0603	L811,L812,R418
SMD RESISTOR	1/16W 15Ω ±5%	R412,R413
SMD RESISTOR	1/16W 18K ±5% 0603	R414
SMD RESISTOR	1/16W 15K ±5% 0603	R308,R309,R801,R802
SMD RESISTOR	1/16W 220Ω ±5%	R812,R606~R608

SMD RESISTOR	1/16W 4.7K ±5% 0603	R311,R312,R421,R933,R934,R937,R902
SMD RESISTOR	1/16W 75Ω ±5% 0603	R908~R912
SMD RESISTOR	1/16W 1MΩ ±5% 0603	R307
SMD RESISTOR	1/16W 150Ω ±5% 0603	R610
SMD RESISTOR	1/16W 360K ±5% 0603	R402,R405
SMD RESISTOR	1/16W 22K ±5% 0603	R406,R501,R622
SMD RESISTOR	1/16W 27K ±5% 0603	R401, R404
SMD RESISTOR	1/16W 1K ±5% 0603	R913,R914,R931,R811,R813~R816,R617, R609,R602~R604,R903
SMD RESISTOR	1/16W 560Ω ±5% 0603	R301,R304,R305
SMD RESISTOR	1/16W 0Ω ±5% 0603	R892,R894,R896,R898,R924~R930,R605, R619,R612,R613
SMD RESISTOR	1/8W 0Ω ±5% 1206	R403
SMD RESISTOR	1/16W 100K ±5% 0603	R306,R302,R803~R808,R623,R624
SMD RESISTOR	1/4W82Ω±5% 1206	R417
CARBON FILM RESISTOR	1/4W100Ω±5% SHAPED 10	R708
METAL OXIDE FILM RESISTOR	1/2W 2.2Ω±5% R 12.5×7	R415,R416
METAL OXIDE FILM RESISTOR	3W 1.2Ω±5% FLAT 20×10	R409
INDUCTOR	10uH ±20% 350mA 0307	L902
INDUCTOR	22uH ±20% 350mA 0307	L904,L905,L701,L302
SMD INDUCTOR	10uH ±5% 1608	L301
SMD INDUCTOR	5.6uH±10% 1608	L813,L814,L822~L825
SMD MAGNETIC BEADS	19Ω/100mHZ ±25% 1608	L807~L810,L816~L819,L821
SMD MAGNETIC BEADS	600Ω/100MHZ±25% 1608	L815, L820
SMD MAGNETIC BEADS	600Ω/100MHZ±25% 3216	L303,L901,L603,L601
SMD CAPACITOR	50V 101 ±5% NPO 0603	C301,C330,C331,C912,C913,C617,C616
SMD CAPACITOR	50V 222 ±10% 0603	C604,C613
SMD CAPACITOR	50V 223 ±10% 0603	C603,C612
SMD CAPACITOR	50V 103 ±10% 0603	C302,C409,C410
SMD CAPACITOR	50V 33P ±5% NPO 0603	C610,C611
SMD CAPACITOR	50V 20P ±5% NPO 0603	C338,C337
SMD CAPACITOR	50V 10P ±5% NPO 0603	C813~C820,C829~C842
SMD CAPACITOR	50V 102 ±10% 0603	C821,C823,C825,C827,C843,C845,C847, C849
SMD CAPACITOR	50V 47P ±5% NPO 0603	C606~C609
SMD CAPACITOR	50V 221 ±5% NPO 0603	C822,C824,C826,C828,C844,C846,C848, C850
SMD CAPACITOR	50V104 ±20% 0603	C340~C342,C310,C312,C309,C319,C321, C327,C329,C403,C711,C714,C910,C904, C531,C528,C930,C931,C934,C935,C851, C347,C336,C339,C619,C621,C622,C625, C614,C615,C601,C605

SMD CAPACITOR	25V 334 +80%-20% Y5V 0603	C404,C406
SMD CAPACITOR	50V 332 ±10% X7R 0603	R938
SMD CAPACITOR	10V 474 ±10% X5R 0603	C334,C620
SMD CAPACITOR	50V 473 ±10% 0603	C411,C412
CD	CD11 50V1U±20%5×11 2	C306,C307,C314,C315,C322,C323,C332, C333,C344,C345
CD	CD110 25V10U±20%5×11 2	C343,C303~C305,C311,C313,C316,C317, C308,C328,C905~C908
CD	CD11C 10V100U±20%5×7 2	C901,C346,C326,C320
CD	CD11 16V470U±20%8×123.5	C401,C402,C902
CD	CD288T 25V470U±20%10×12 5	C407,C408
CD	CD11 16V220U±20%6×12 2.5	C915,C914,C903,C348,C413
CD	CD11 16V47U±20%5×11 2	C712,C713,C529,C530,C318,C324,C325, C618,C624,C602,C623
CD	CD11 50V2.2U±20%5×11 2	C405
VOLTAGE REGULATOR DIODE	8.2V ±5% 1/2W	ZD301
VOLTAGE REGULATOR DIODE	3.3V ±5% 1/2W	ZD801
VOLTAGE REGULATOR DIODE	11V ±5% 1/2W	ZD901
DIODE	1N4148	D401,D402
SMD TRIODE	2SA1015	Q402,Q503,Q601
SMD TRIODE	C1815	Q901~Q904,Q907,Q401,Q403,Q502
SMD TRIODE	BAV99LT1 SOT-23	D801~D803
SMD CRYSTAL OSCILLATOR	27.00MHz 49-S	X301
SMD CRYSTAL OSCILLATOR	13.875MHZ±20PPM 49-S	X601
RELAY	HJR-2CL-12VDC	J401
TUNER	JS-6B2/121	T1
SCART SOCKET	CS-102 STRAIGHT INSERT	J804
TERMINAL SOCKET	S TERMINAL,STRAIGHT INSERT,WITH SHIELD	J802
TERMINAL SOCKET	AV6-8.4-7 STRAIGHT INSERT,WITH SHIELD	J803
SOCKET	4P 2.5mm STRAIGHT CURVING	CN402
IC	STV8216 TQFP	IC301
IC	TDA1308 SOP	IC302
IC	LM4950 TO-263	IC401
IC	ET-TVT0310A PQFP	U2
IC	AK33 SOT-223	IC503,IC703
IC	LA7952 SIP	IC901

FLAT CABLE	4P 180 2.5 T2 2×1P SHIELD,WITH NEEDLE,THE SAME DIRECTION	音频板 CN401TO 音频板 CN403
PCB	11703SRU-4	

BOM OF POWER SUPPLY

SMD RESISTOR	1/8W510K±5% 1206	R1,R2
SMD RESISTOR	1/8W 1MΩ±5% 1206	R3,R4,R5
SMD RESISTOR	1/8W2MΩ±5% 1206	R6
SMD RESISTOR	1/8W6.8K±5% 1206	R7
SMD MAGNETIC BEADS	B29RH Φ3.5×9	L4
SMD RESISTOR	1/8W 6.8Ω±5% 1206	R9,R18,R19
SMD RESISTOR	1/8W4.7Ω±5% 1206	R8
SMD RESISTOR	1/8W270Ω±5% 1206	R10
METAL OXIDE FILM RESISTOR	2W68K±5%	R17
SMD RESISTOR	1/10W 1K ±5% 0805	R11,R16
PRECISION SMD RESISTOR	1/10W 4.75K ±1% 0805	R13
PRECISION SMD RESISTOR	1/10W 4.32K ±1% 0805	R15
SMD RESISTOR	1/10W 56K ±5% 0805	R14
CARBON FILM RESISTOR	1/6W12K±5%	R12
HEAT SENSITIVITY RESISTOR	NTC 5Ω(4A)±20% 10D 6	RT1
SMD CAPACITOR	50V 104 ±20% 0805	C6,C8,C9
SMD CAPACITOR	50V 472 ±10% X7R 0805	C5
SMD CAPACITOR	50V 102 ±10% X7R 0805	C7
CERAMIC CAPACITOR	1000V 472±10% 7.5mm	C3
PORCELAIN CAPACITOR	50V 102 ±10% 5mm	C4
METAL POLYESTER FILM CAPACITOR	CL21 400V 334±10% 15	C1
CERAMIC CAPACITOR	CT81 250VAC 102±20% 10mm	CY3,CY1,CY2,CY4
ANTI-JAMMING CAPACITOR	MKP61 X2 275VAC 474±10% 15	CX2
ANTI-JAMMING CAPACITOR	MKP61 X2 275VAC 224±10% 15	CX1
CD	KF151 400V150U±20%18×35.5 7.5	TC1
CD	GZ 25V1000U±20% 10×20 5	TC2,CT3,TC4
CD	CD11 50V1U±20%5×11 2	TC5
CD	CD11 25V47U±20%5×11 2	TC6
COMMON MODE	VERTICAL 22mH2AΦ18×Φ	L2

CHOKE	10×8 10	
COMMON MODE CHOKE	VERTICAL 2mH 2A Φ16×Φ9×5	L1
COMMON MODE CHOKE	VERTICAL 90UH 5A Φ9×Φ5×4	L3
SWITCH POWER TRANSFORMER	PQ32-081	T1
VOLTAGE REGULATOR DIODE	18V ±5% 1/2W SHAPED 7.5	ZD1
SOCKET	2P 8.0mm STRAIGHT FLEX	XS1
SMD TRIODE	C1815	Q1
DIODE	FR103	D2
DIODE	HER107 SHAPED VERTICAL 5mm	D1
SCHOTTKY DIODE	MBR20100CT320XC TO-220	D3
MAGNETISM RING	ϕ3.5×ϕ3×1.5 BLACK	D3
SILICON BRIDGE	GBU805 Y336	B1
IC	HA17431VP TO-92	U3
IC	MIK431C TO-92	U3
PHOTOELECTRIC COUPLER	HS817	U2
LEAD	24#35mm YELLOW,DECORTICATE 5mm	J1
CONNECTED CORDS	Φ0.6 SHAPED 10mm	J2
GREY GLUE	TF-608G	R17,C3,D1,L4 之间 J1,TC3,TC2,TC4 之间 TC5,TC6 之间 TC1 之下 D3,J1 两端 接地线固定
MACHINE TAPPING SCREW	PM3×8H WHITE NICKEL	D3,U1
SILICONE GREASE HEAT CONDUCT OIL	LYCAL304	D3,U1
INSULATED SPACER SET	HOLE ϕ3 WHITE AK080	D3,U1
INSULATED PAD	19×13.2×0.3 HOLE ϕ3.2	D3,U1
IC	TOP249Y GOLD SEALED TO-220	U1
SOCKET	6P 2.5mm	JP1
PCB	@52008-2 UL	
GREEN GLUE	VA-450	
HEAT RADIATION PIECE	LT2008 L	

HEAT RADIATION PIECE	LT2008 T	
NUT	M3 WHITE NICKEL	

POWER ON-OFF BOARD

POWER SUPPLY SOCKET	0717-1(WITH ON-OFF/FUSE TUBE）	SW1
FLAT CABLE	3P 230 3.96 2 PIN,THE SAME DIRECTION,2 CORD,18# CORD	CN1 与电源板 XS1
LEAD	18# 70mm YELLOW GREEN,WITH WELD PIECE,HOLEΦ4.3	接地线
SOCKET	2P 8.0mm STRAIGHT FLEX	CN1
FUSE	T4AL 250V	
PCB	A2008-1	

REMOTE CONTROL RECEIVE BOARD

2RG59PC RED AND GREEN 2×4.5×4	2.5RG59HW-A×5 RED AND GREEN	D901
IR SENSOR	HS0038B	IR901
FLAT CABLE	5P 250 2.0 T1 5P SHIELD WITH WELD PIECE 28# CORD	音频板 CN101TO 遥控接受板 CN402B
SOFT SPONGE SPACER	7×6×4 DOUBLE-FACED,HARD	遥控接受头
PCB	92008-0	

KEY-PRESS BOARD

SMD DIODE	1N4148	D402~D408,D409,D410
LIGHT TOUCH RESTORE SWITCH	VERTICAL TSAC-2	SW401~SW407
SOCKET	5P 2.0mm	CN401
PCB	42008-0	

REMOTE CONTROLLER

SMD CAPACITOR	50V 151 ±5% NPO 0603	C802,C803
SMD RESISTOR	1/10W 1Ω ±5% 0805	R801
EMISSION PIPE	TSAL4400	LED801
EMISSION PIPE	LTE-4206	LED801
SMD DIODE	1N4148	D801~D803
SMD TRIODE	STC3265	Q801
SMD TRIODE	UTC 8050S（D9-D）	Q801
SMD TRIODE	8050D	Q801
IC	HT6222 SOP	U801
IC	PT2222 SOP	U801
CERAMIC RESONATOR	455E	X801
PCB	81703SRU-0	

SURFACE CASING OF REMOTE CONTROL	RC019-01 GREY	
REMOTE CONTROL BOTTOM CASING	RC019-01 GREY	
BATTERY CASE DOOR OF REMOTE CONTROL	RC019-01 GREY	
SURFACE STICKER OF REMOTE CONTROL	LT2008(RU) SILVER GREY	
ANODE SPRING	RC019-01 3#	
CATHODE SPRING	RC019-01 3#	
ANODE CATHODE SPRING	RC019-01 3#	
CONDUCT GLUE OF REMOTE CONTROL	LT1703S(RU)	