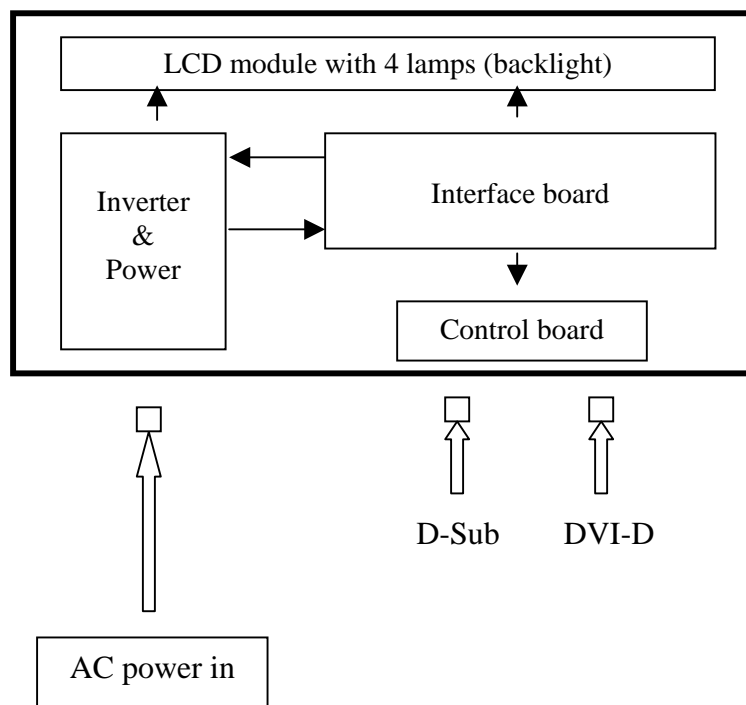


## **I. Introduction:**

The Q9C4 is a 19" SXGA (1280x1024), 16.7M colors (R/G/B 8-bit) TFT LCD monitor with multi-media function. It's a Dual (analog and digital) interface LCD monitor with a 15 pins D-sub signal cable and a 24 pins DVI-D cable. It's compliant with VESA specification to offer a smart power management and power saving function. It also offers OSD menu for users to control the adjustable items and get some information about this monitor, and the best function is to offer users an easy method to set all adjustable items well just by pressing one key, we called it "I-Key" which can auto adjusting all controlled items. Q9C4 also offer DDC2 function to meet VESA standard.

## **II. Block diagram**

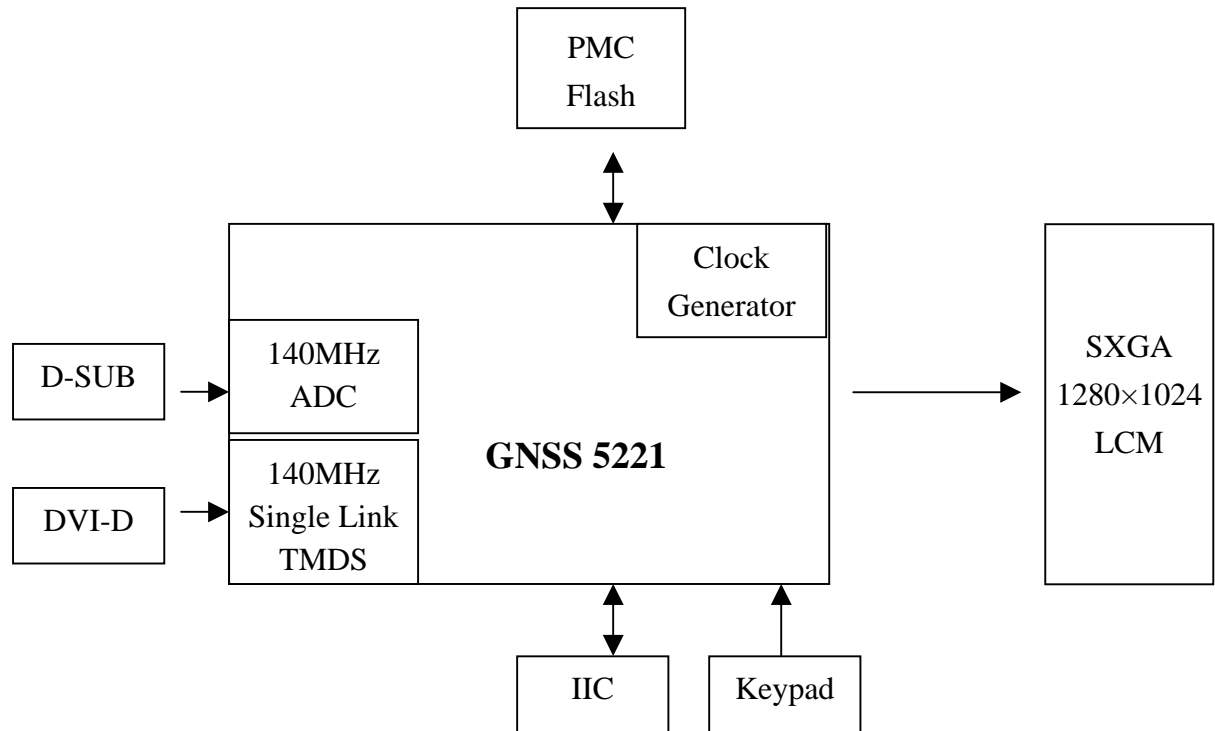
The Q9C4 consists of a head and a stand (base). The head consists of a LCD module with 4 lamps, a power board (include AC/DC, DC/DC and inverter board), a control board and an interface board. The block diagram is shown as below.



**III. Circuit operation theory:**

**A.) HEAD:**

**A-1.) Interface board diagram:**



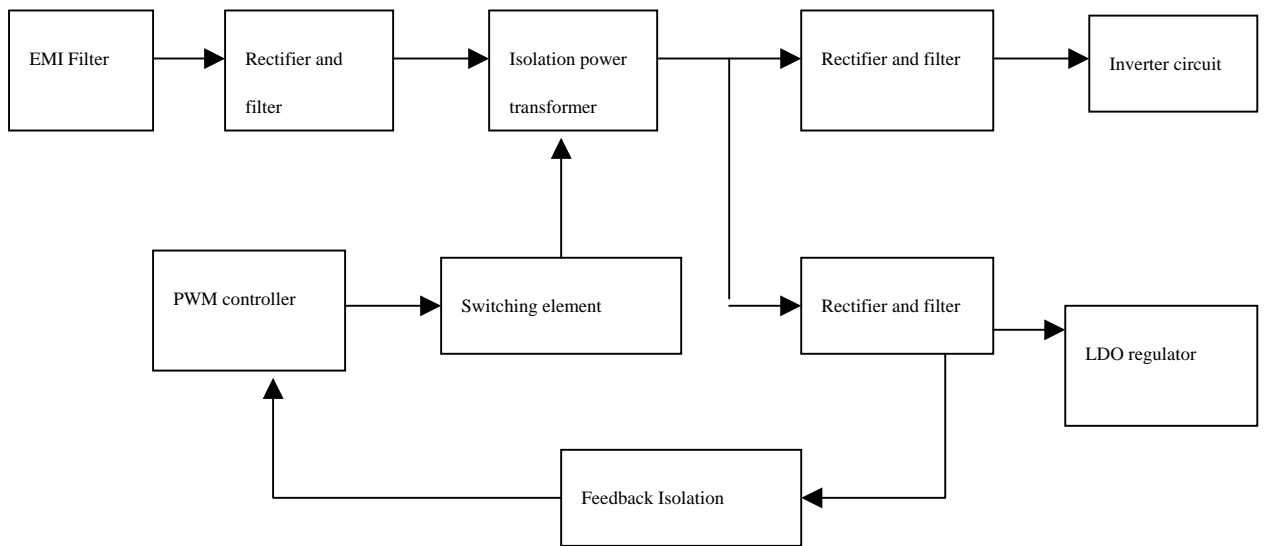
**(a) Circuit operation theory:**

A basic operation theory for the interface board is to convert input signal into digital RGB. Analog RGB signal is converted to digital signal through ADC. DVI-D signal is converted through TMDS receiver. The microprocessor GNSS 5221 receives video data and optimizes the image automatically. It also supports input source selection, 16 color from a 64k palette bitmap OSD, and keypad controlling. The output data are sent to LCD module.

**(b) IC introduction:**

- 1) DDC (Display Data Channel) function: We use DDC IC to support DDC2B function. DDC data is stored in 24C02(EEPROM). Those data related to LCD monitor specification. PC can read them by “SDA” and “SCL” serial communication for I<sup>2</sup>C communication for DDC2B.
- 2) GNSS 5221 IC: There are ADC, TMDS receiver, Scaling, Color enhance (ACC/ACM), LVDS transmitter, MCU and OSD functions in the GNSS 5221 IC. Scaling IC is revolutionary scaling engine, capable of expanding any source resolution to a highly uniform and sharp image, combined with the critically proven integrated 8 bit triple-ADC and patented Rapid-lock digital clock recovery system. It also support detect mode and DPMS control.
- 3) EEPROM: We use 24C16 to store all the adjustable data and user settings, and use two 24C02 to store Analog and DVI EDID data.
- 4) PMC 39LV020 Flash: Store program code.

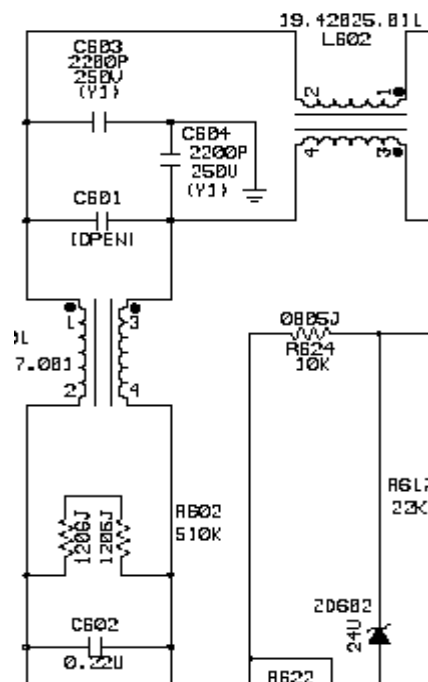
**A-2.) Power board diagram:**



**Fig.1**

**#1 EMI Filter**

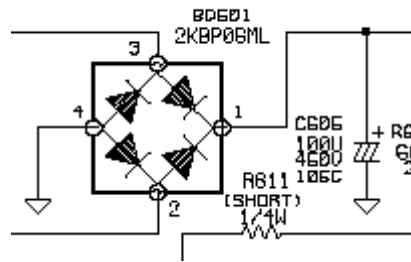
This circuit (Fig. 2) is designed to inhibit electrical and magnetic interference for meeting FCC, VDE, VCCI standard requirements.



**Fig. 2**

**#2 Rectifier and filter**

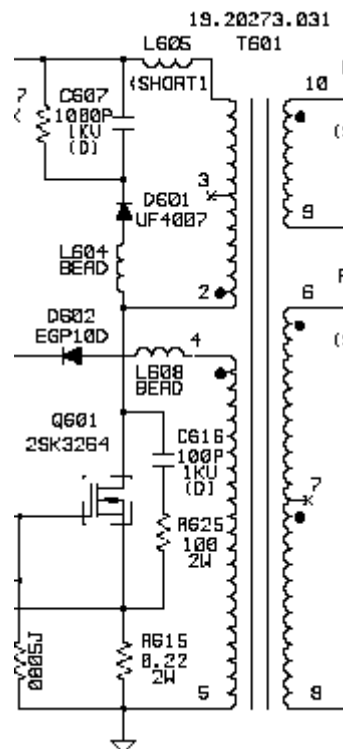
AC Voltage (90-264V) is rectified and filtered by BD601, C605 (See Fig 3) and the DC Output voltage is 1.4\*(AC input). (See Fig.3)



**Fig. 3**

### #3 Switching element and Isolation power transformer

When the Q601 turns on, energy is stored in the transformer. During Q601 turn-off period, the stored energy is delivered to the secondary of transformer. R607, C607 and D601 is a voltage-snubber circuit. R615 is current sense resistor to control output power. (See Fig.4)



**Fig. 4**

#### #4 Rectifier and filter

D701 and C703 C704 are to produce DC output. (See Fig.5)

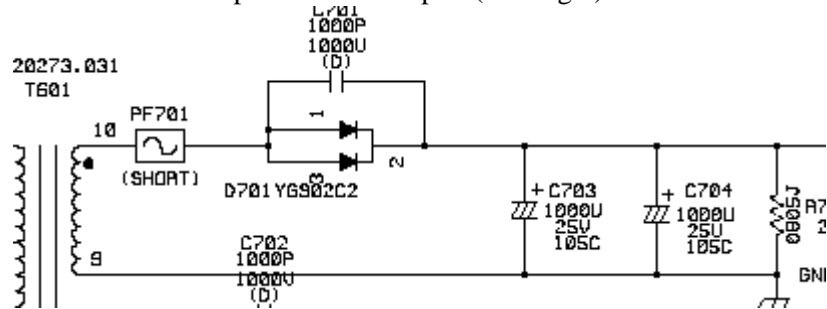


Fig. 5

#### #5 PWM Controller

The PWM controller NCP1200A implements a standard current mode architecture. With an internal structure operating at a fixed 40KHz. Where the switch time is dictated by the peak current setting-point. When the current setting-point falls below a given value. The output power demand diminish, the IC automatically enters the so-called skip cycle mode and provides excellent efficiency.

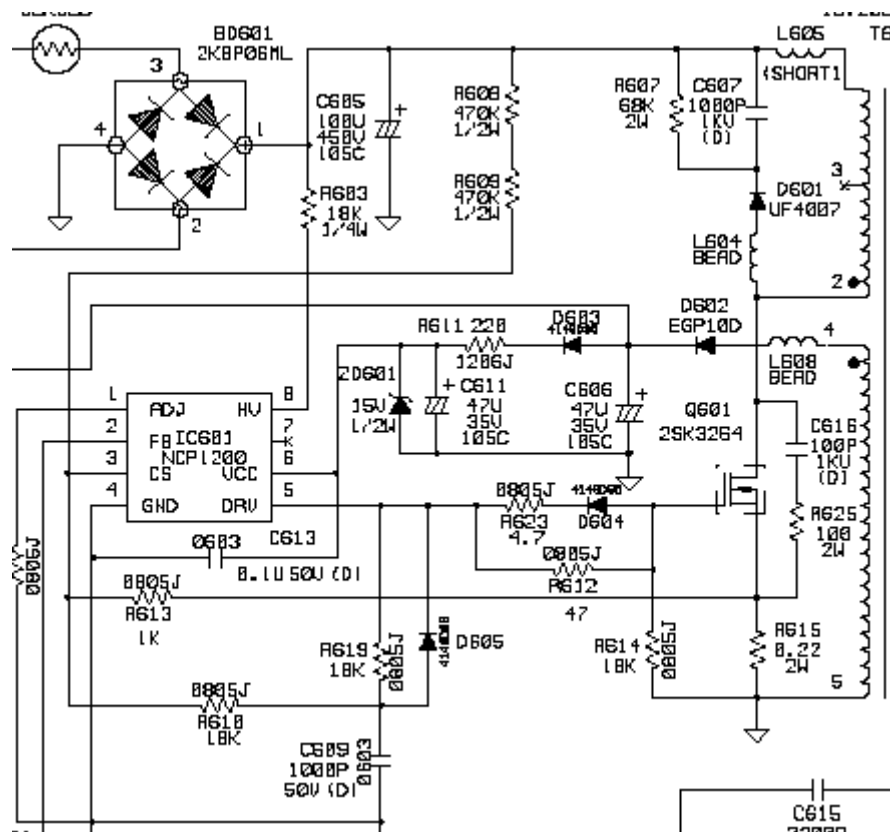
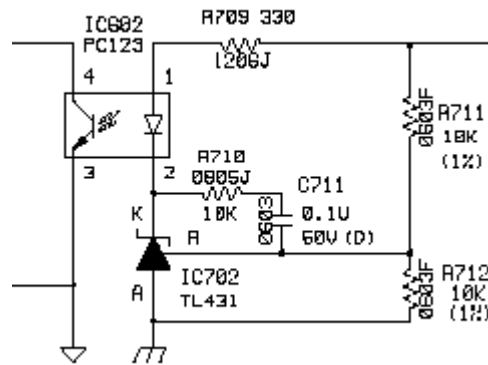


Fig. 6

#### #6 Feedback circuit

PC123 is a photo-coupler and TL431 is a shunt regulation. They are used to detect the output voltage change and be the primary and secondary isolation. When output voltage changes, the

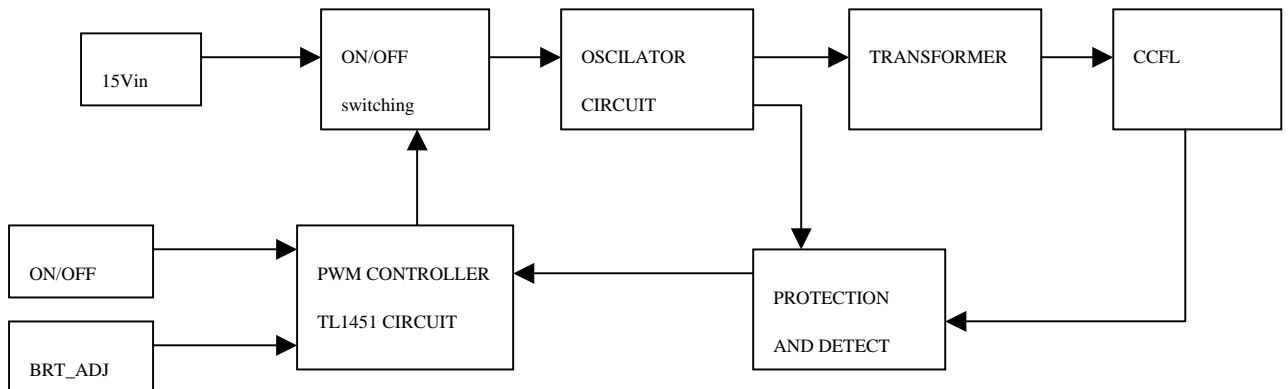
feedback voltage will be compared and duty cycle will be decided to control the correct output voltage. (See Fig.7)



**Fig.7**

### A-3.) Inverter diagram:

#### 1.Block Diagram



#### 2. General Specification

Input Voltage: 14.5V

Input Current: 2A max.

ON/OFF Voltage: 3.3V

#### Output Requirement:

Max. Output Current: 7.5mA

Min. Output Current: 3mA

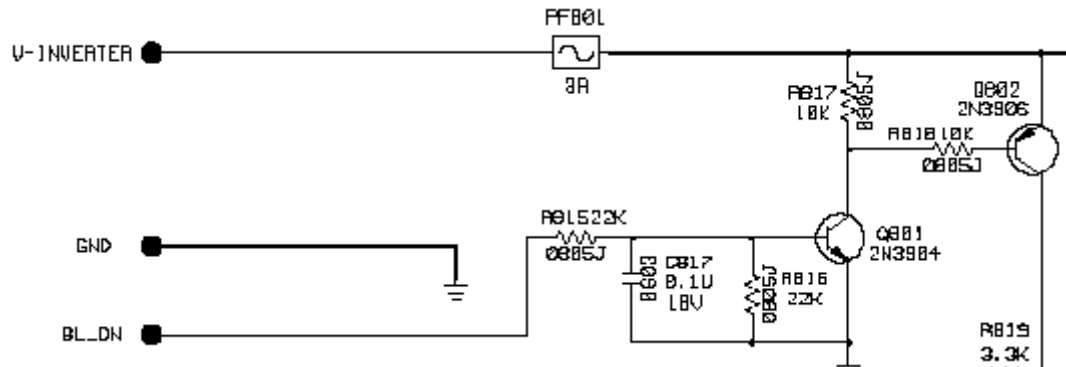
Lamp Working Voltage: 700Vrms

Open Lamp Voltage: 1700Vrms

Frequency: 40-60KHz

### 3.Circuit Operation Theorem

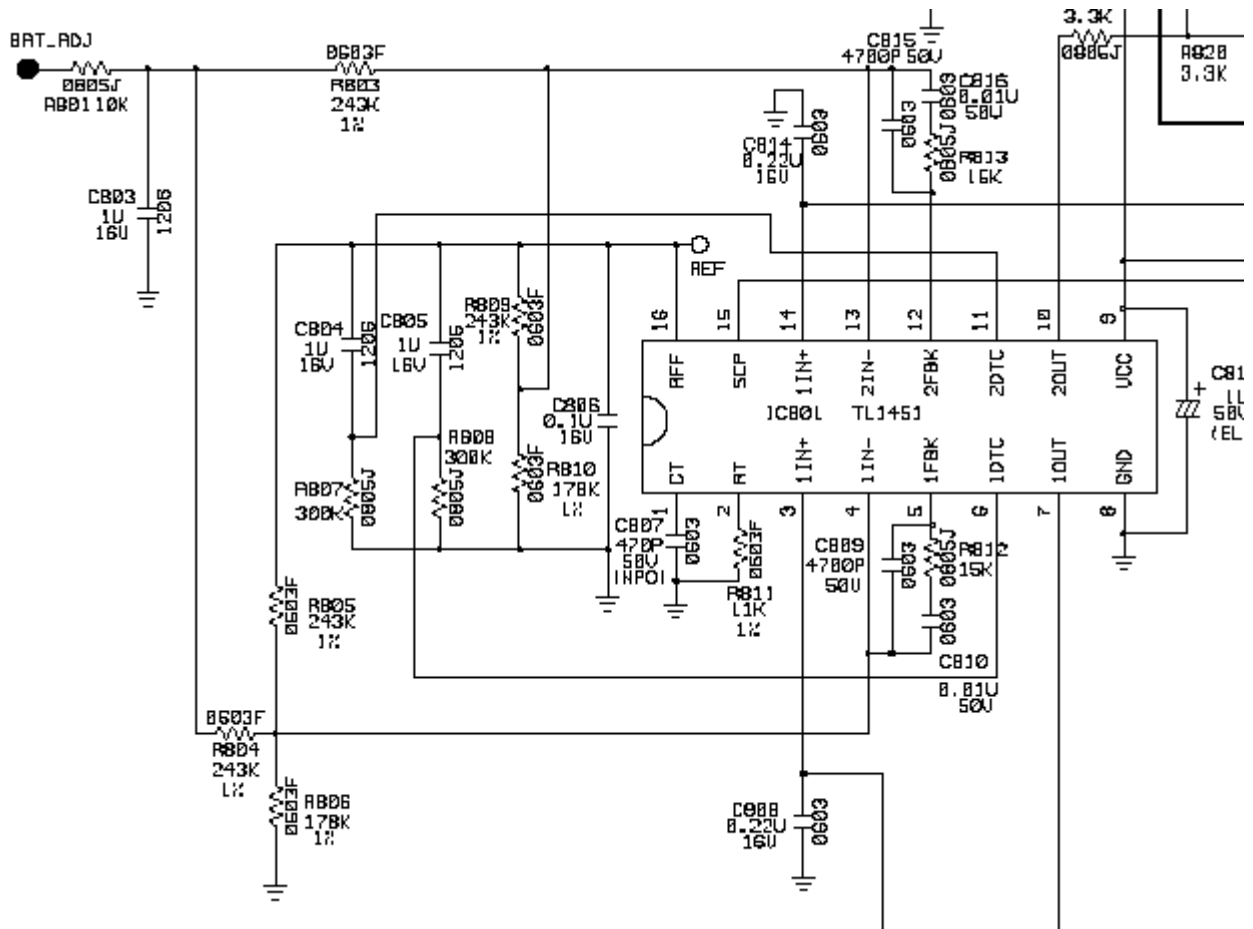
#### 3.1 ON/OFF SWITCH



The turn-on voltage was controlled by R815 and R816. The inverter was turned on or off by the switching transistors Q801 and Q802. Also regulator IC801 is controlled by Q801 and Q802 to decide supply 12.5V to inverter part or instead.

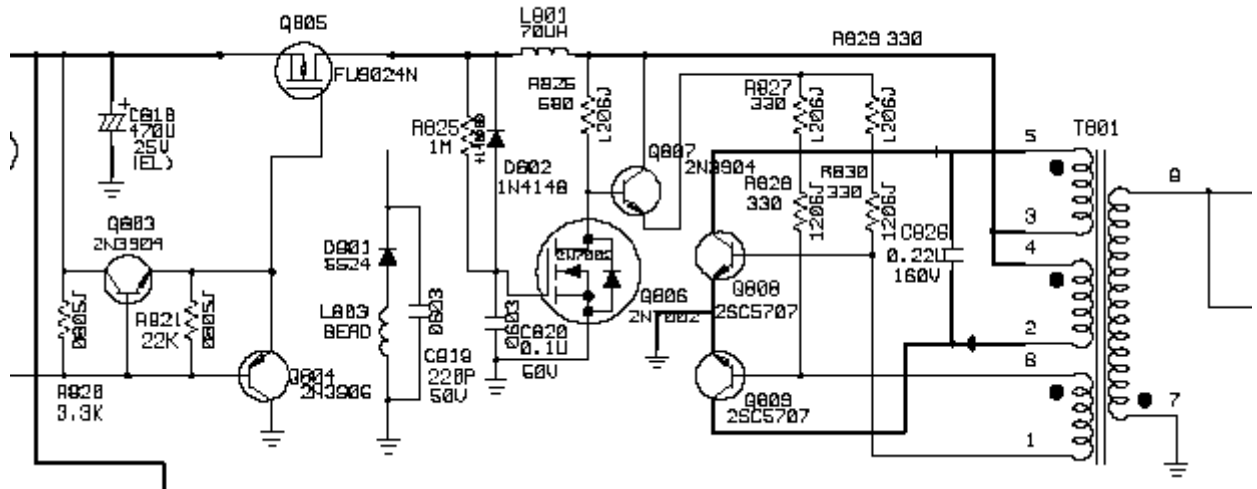


### 3.2 PWM Control circuit



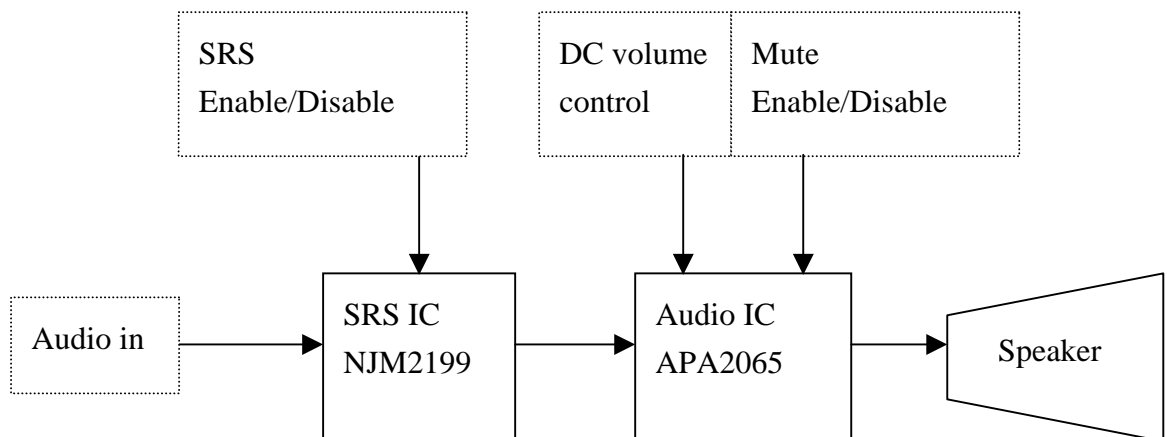
TL1451 is a dual PWM controller. C807 and R811 decide the working frequency. BLT\_ADJ signal is from control board, control pulse width then decide how much energy delivery to CCFL also decide CCFL brightness. Q803 and Q804 be the buffer to rise the drive capability and the totem poles circuit can improve a capable of driving for Q805. C813 decide the striking time delay.

### 3.3 Oscillator Circuit



Royer circuit uses the characteristic of transformer saturation to oscillate. When the DC power inject, Q808 or Q809 will turns on, and the current  $I_c$  increases. After a period, the transistor will leave the saturation status and  $V_{ce}$  increase. The result causes the voltage of primary coil get lower. Finally the transistor turn off, and another transistor turn on. These statuses are repeated and the pin7 and pin8 of T801 will get a Sin Wave to turn on CCFL.

#### A-4.) Audio block diagram:



The audio block consists of an audio board and dual speaker drivers. The speaker drivers are using 100 x 34 x 16 mm<sup>2</sup> audio box (rated 3W/CH) with DC volume control, power is supplied by power board and audio input is from PC audio output (Line Out).

**1.Processor IC:** Use JRC Process IC NJM2199 which is a SRS 3D surround audio processor regenerating the 3D surround sound with two speakers.

**2. Audio Power Amplifier IC:** Use ANPEC POWER IC APA2065 which is stereo ClassAB BTL output amplifiers with DC volume control. The devices are designed for use in TV and monitor. Use +5.3V from power board and connect speaker drivers to offer 2W/CH.

- 3. DC Power Input:** To supply +5.3V for Processor IC NJM2199 and Amplifier IC APA2065 power source.
- 4. Audio Input:** Connect with PC audio output in 3.5mm to 3.5mm signal line.
- 5. Speaker driver:** Use 4 ohm / 100 x 34 x 16 mm<sup>2</sup> speaker driver (rated 3W/CH).
- 6.SRS Enable/Disable:** +3.3V SRS enable (from MCU)
- 7. DC Volume Control:** The voltage range is 0 ~ 3.3V (from MCU).

**A-5.) Control board introduction:**

The main parts of the control board are a push button, and a LED.

- (a) Push button:** It's a simple switch function. Pressing it for "ON" to do the auto adjustment, select (unselect) adjustment or adjusting bar.
- (b) LED:** It indicates the DPMS status of this LCD monitor; blue light means DPMS on (Normal operating condition), amber light means DPMS off (Power off condition).