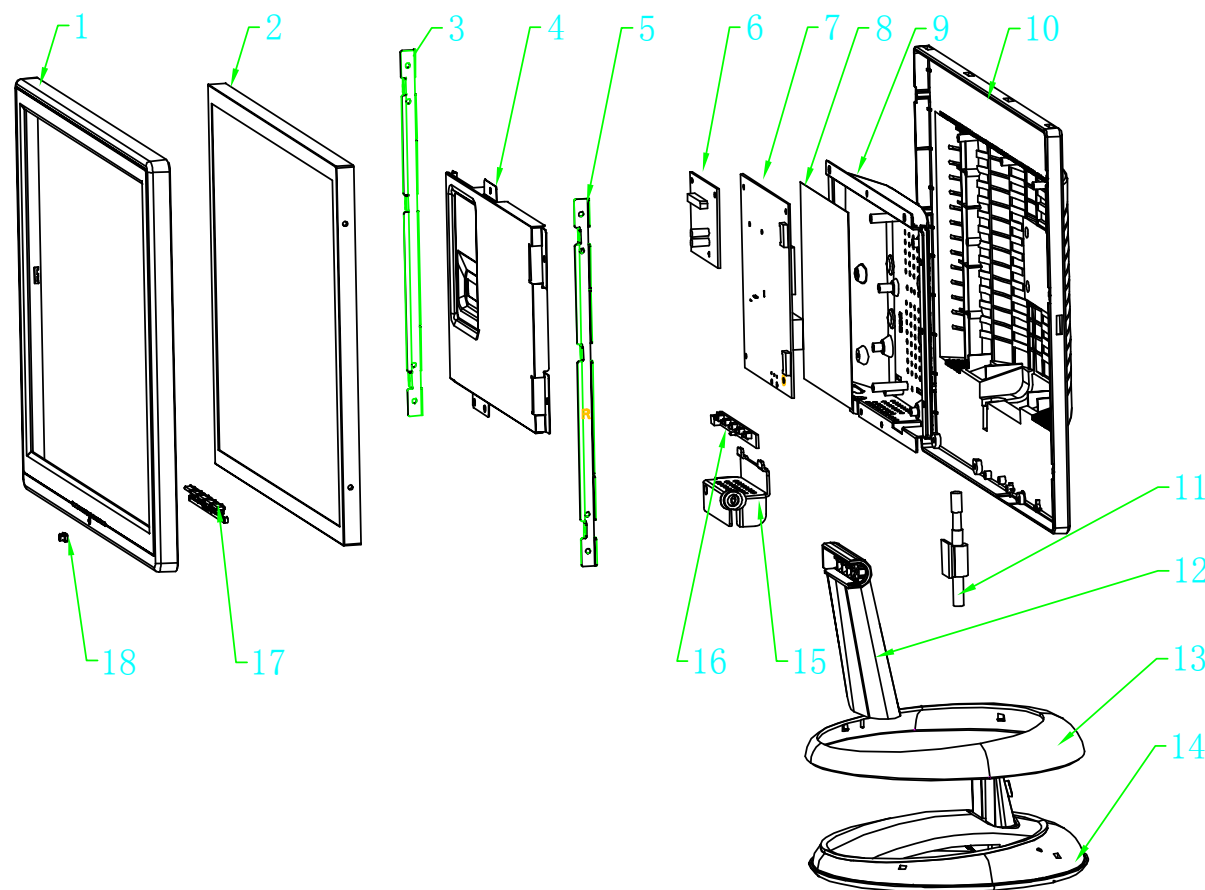


Elenberg 1790BS



18	导光柱
17	按键
16	按键板
15	转轴
14	底座底
13	底座面
12	支架
11	VGA线
10	后壳
9	五金下盖
8	绝缘PVC
7	电源板
6	A/D板
5	屏固定右支架
4	五金上盖
3	屏固定左支架
2	液晶屏
1	面框
序号	产品零件名称

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变更	变更内容	变更者	批准	日期

版本号: 1.1		惠科电子(深圳)有限公司					
TOLERANCES							
200 以上	+/-0.20	品名	H782B	料号		公差	
50-150	+/-0.15	制图		机型		比例	1/1
10-50	+/-0.10	核对		材质		处理	
0-10	+/-0.05	批准		视角		重量	

Analysis For 780A INVERTER Part Circuit

Inverter is high voltage board. It Provides the power for the Panel back light lamp. The back light lamp of Panel uses the cold cathode fluorescent lamp (CCF), this lamp's working voltage is very high, its operating voltage is 600~800V normally, but start voltage is as high as 1,500~1800V, is similar with starting in the daylight lamp with high voltage, its normal operating current is 4~9mA. Therefore Inverter needs to have the following function:

1. It can produce over the 1500V AC high-voltage, and falls to about 800V rapidly in the short time, this period of time continues 1-2S approximately, the voltage curve like chart 2-1 shows;

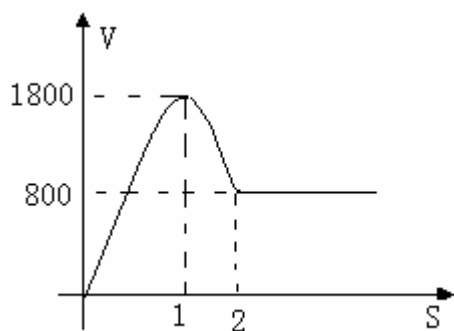


Chart 2-1 Inverter change profile of output voltage

2. Because the value of electric current is provided for Inverter influence the service life of the cold cathode fluorescent lamp, therefore the electric current outputs should be smaller than 9mA, it needs to have the over-current protection function; When brightness is adjusted, its brightness bigger, the current bigger.

3. Inverter is one kind of DC TO AC transformer, it actually with Adapter is the process which one kind of voltage inverts. Adapter transforms the alternating voltage of city electricity into the stable Direct-Current output, but Inverter transforms the 12V DC voltage output from Adapter into the high-voltage AC of high frequency; The Two parts of inverter and Adapter all adopt a common technique of Pulse-Width Modulation (PWM), its core is a PWM integration controller.

4. 780A Inverter adopt BA9741 the Pulse-Width Modulation

1), adopting symmetrical working of the double channel

2), operating voltage 3.6V-35V

3), output voltage 2.5V-35V

4), operating frequency 10-800KHz

In BA9741 it is equipped with an error amplifier, a regulator, a oscillator, a PWM generator, a low voltage of protection circuit and the short-circuit protection circuit and so on.

Below is the BA9741 pins definition:

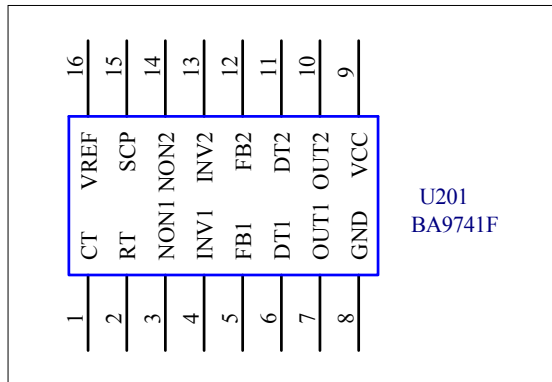


Chart 2-2

Pin1:CT(External timing capacitor)
Pin2:RT(Exetrnal timing resistor)
Pin3:NON1(Positive input for error amplifer1)
Pin4:INV1(Negative input for error amplifer 1)
Pin5:FB1(Error amplifer 1 output)
Pin6: DT1(Output 1 dead time /soft start setting)
Pin7:Out1(Output1)
Pin8 GND (Groud)
Pin9:VCC (Power supply)
Pin10:OUT2 (output2)
Pin11:DT2(Output 2 dead time /soft start setting)
Pin12:FB2(Error amplifer 2 output)
Pin13:INV2(Negative input for error amplifer 2)
Pin14:NON2(Positive input for error amplifer2)
Pin15:SCP (Time latch setting)
Pin16:Vref (Reference voltage output 2.5V)

1. BA9741 controller:

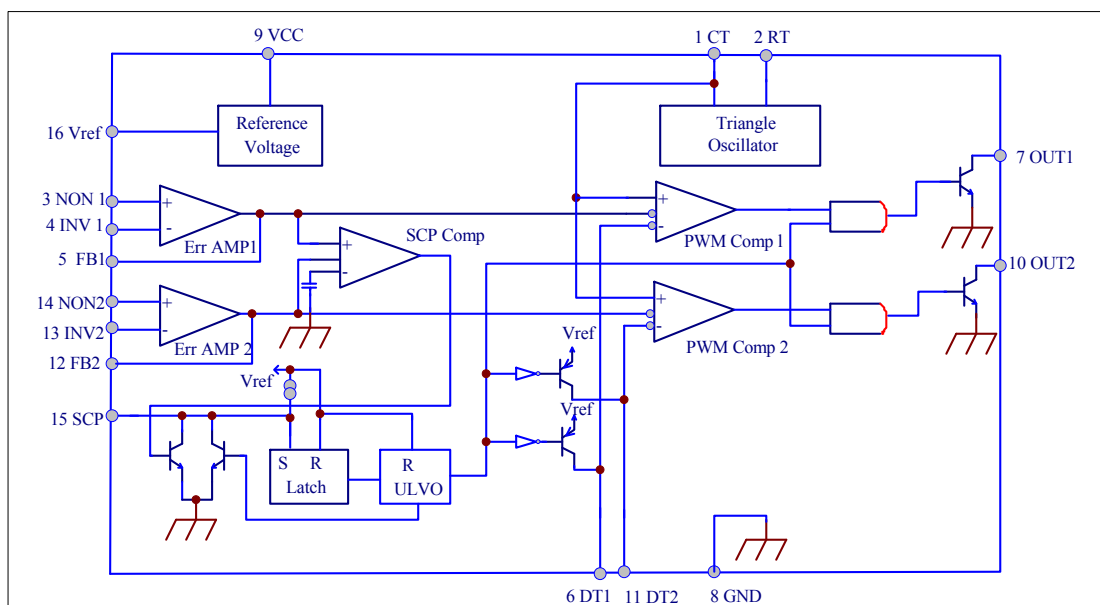


Chart 2-3 BA9741 interior schematic diagram

5, It is the circuit diagram of working Inverter. Below is a brief analysis of its principle of work.

The chart 2-4 is the Inverter diagram of principle of work:

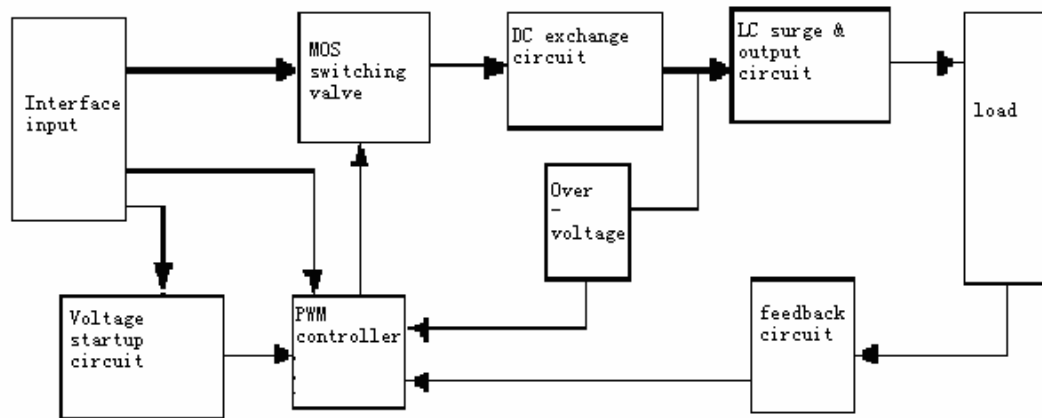


chart 2-4 Inverter principle of work diagram

6、 Inverter input interface and control section:

The input part of Inverter has 3 kinds of signal, such as 12V DC inputs VIN、 switch voltage ON/OFF and current control signal DIM of Panel. 12V DC is provided by the power circuit; Switch voltage ON/OFF is provided by MCU on motherboard, its value is 0V or 3.2V, when ON/When OFF=0V, Inverter does not work, but When ON/OFF=3.2V, Inverter works normally; But the DIM voltage is provided by MCU, which is between 0V and 5V (According to the corresponding request that its scope of voltage value is allowed), and provide the different feedback value of DIM for the PWM feedback controller, and the current from Inverter is different which will provide to the load, DIM value bigger, the Inverter current output bigger.

Voltage **startup** circuit:

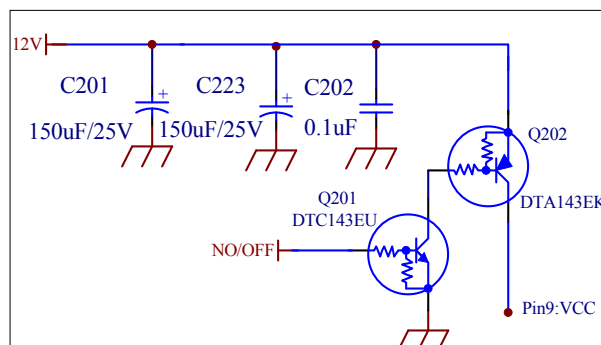


Chart 2-5 power control circuit

The chart 2-5 circuit is the commonly power control circuit, is composed of one PNP and one NPN transistor, it has two working stages: First, when ON/OFF voltage is the low level (0V), Q201 is at the closure condition, therefore Q202 also closure, at this time the DC voltage of Q202 C electrode cannot be allowed to BA9741 Pin9: The VCC input but not working, OUT1/2 has no pulse, therefore the entire Inverter does not work; Second, when ON/OFF is the high level, the transistor Q201 is saturate and conducted, Q202 B electrode is lower, because Q202 is the type of PNP, its C electrode also has 12V DC voltage, therefore Q202 conduction, the 12V voltage is provided for the Pin9 on IC power pin, and then IC starts to work, the pulse from OUT1/2 output to control the switching valve, so Inverter is working normally, the high voltage output to light the back light lamp on Panel.

7、Direct current transformation

The circuit of voltage transformation is composed of the MOS switching valve and the inductance for storing energy L201(L202) and D201(D202), the output pulse from BA9741 makes the MOS valve working for switch, which passes through the amplifier composed of Q205, Q207 (Q206, Q208). It makes L201 (L202) charge and discharge with the DC voltage, then the AC voltage input from another port on L201(L202), which showed on the chart 2-6.



Chart 2-6 inductance output voltage waveform ($f=100\text{KHz}$)

Because in circuit MOS switching valve Q203 (Q204) adopt the P Channel of **field effect tube**, therefore when BA9741 output pulse is the low level, the L201 (L202) charge, when high level Q203 (Q204) cuts off, L201 (L202) discharges. Q203 (Q204) outputs pulse waveform like chart 4-9. In chart the amplification electric circuit is composed of Q205, Q207 (Q206, Q208) the amplification, which perform an ampliative function. Because the current of BA9741 output pulse is small, it can't directly drive MOS manage Q203 (Q204) to work, therefore it must added the amplification electric circuit to perform.

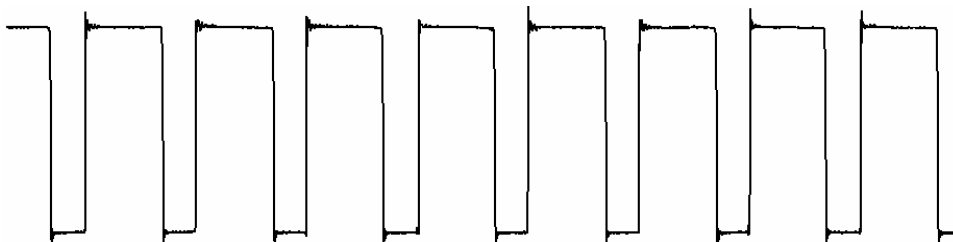


Chart 2-7 Q203 (Q204) output voltage waveform ($f=190\text{KHz}$)

9、over-voltage protection circuit:

an over-voltage protection circuit can be composed of the dead area controlling circuit on the 6th(11) pin of BA9741, its principle of work (As chart 2-8): When L1 voltage output is over, and the D203 (D204) value

of voltage stabilization is over 11V, D203 (D204) diode could be breakdown, its high voltage pass through R221 and R223 (R220 and R222) ,and the partial pressure enhance the voltage on BA9741 6th (11) pin, which passes through electric circuit of over-voltage protection and on the closure transistor outputs .

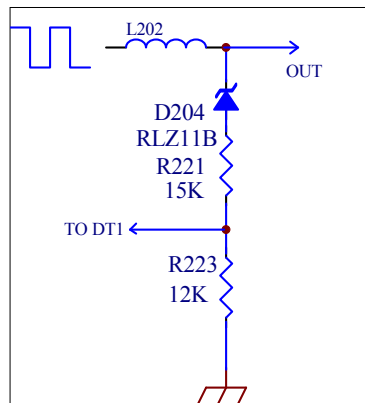


Chart 2-8 over-voltage protection electric circuit

10、LC surge and output circuit:

the LC surge is composed of the primary coil C213 (C214) and PT201 (PT202) composes, PUSH-PULL (push-pull type) circuit is composed of Q209, Q210 (Q211, Q212), they are alternation of operating mode, R224, R225, R226, R227 (R228, R229, R230, R231) are the resistance for startup. As chart 2-9 shows, it's working waveform. In chart It might be seen the voltage output from Q209, Q210 (Q211, Q212) superposition on PT201 (PT202), which passes through the surge and then produce the high-pressured sine AC output.

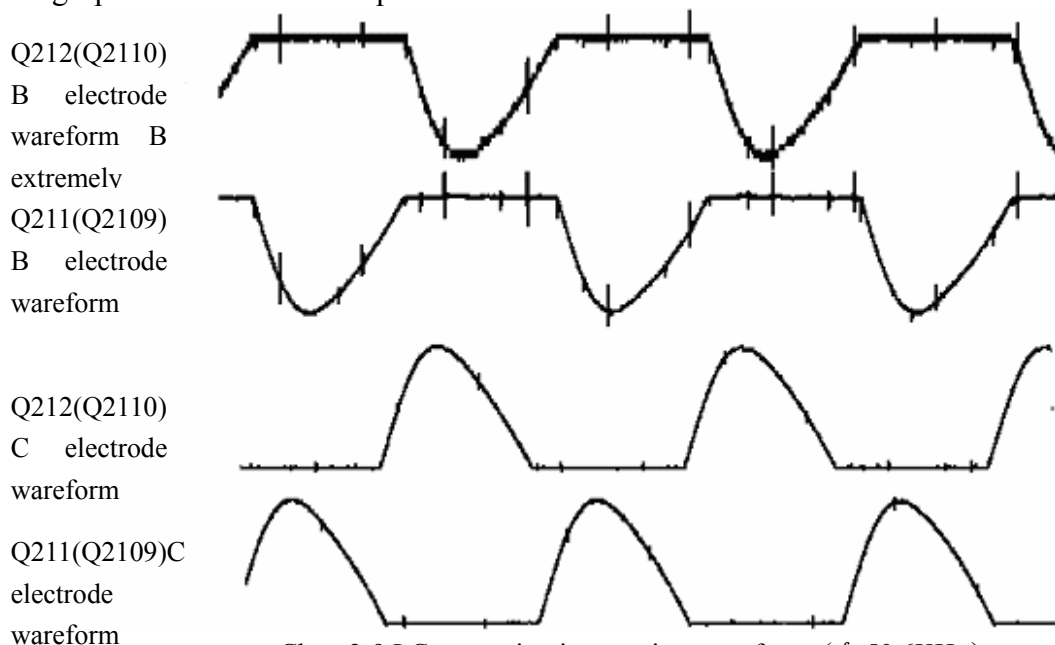


Chart 2-9 LC suger circuit operating waveform ($f=50.6\text{KHz}$)

In the output aspect, C215, C216 (C217, C218) are the coupling partial pressure capacitor. When the load Panel lamp is lightened, the output circuit has not conduction, the 1600V high-voltage is produced by PT1 to the load through the capacitive coupling, so it satisfied the startup condition for cold cathode fluorescent lamp, the

fluorescent lamp can be lightened. This time the output circuit passed, the electric current passes the capacitor, because of the resistance in capacitor, the beginnings and ends of capacitor have the voltage drop, the capacitor parameter value makes the voltage that passes through the load between the poles about 800V after the voltage drop.

11、 output voltage feedback:

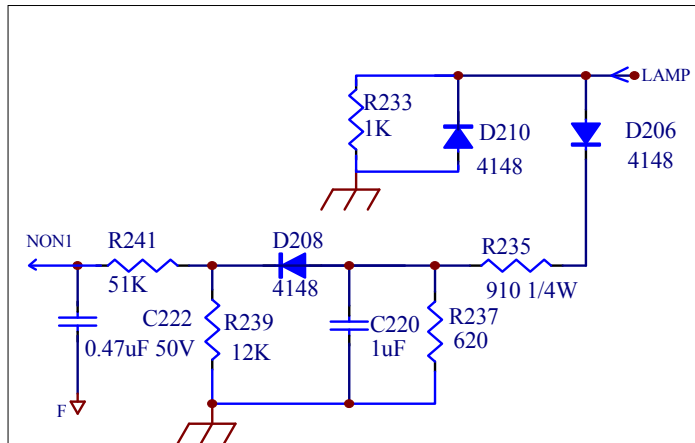


Chart 2-10 output voltage feedback circuit

When the load works, As chart 2-10 in R233, D210 the alternating voltage existence between the poles, after this voltage rectification filter of the D3, R235, R237, C220, D208, It obtains the sampling DC voltage. This voltage feedback for BA9741 Pin3(13), which feed back to control the duty ratio of BA9741 output pulse, performing an function of the stable Inverter output.

Analysis for 780A power part

LCD works with low voltage, but generally city provides with the electric power transmission system is 110V or 220V alternating voltage, therefore which need to be transformed 12V and 5V DC ,780A adopt a built-in board that gather a board Namely the power and the high voltage .And it is provided the 12V power supply for INVETTER and AUDIO, At the same time A/D board is provided the 5V MCU power supply. In order to omit an item outside, the power supply of the A/D board needs to change 12V to 5V power supply.

It adopts switching power supply design method is the pulse-duration modulation (PWM) in the LCD Monitor Power circuit. The features of PWM switching power supply is that it can change pulse width to adjust the spatial ratio. This function is to the steady voltage output. Its basic principle of work: the 110V or 220V input voltage change the DC voltage after the bridge type of rectification filter circuit, and then stored energy switch of power transformer will be done by the MOS tube, after the power transformer secondary transmission magnetic ,it obtains the high frequency square-wave voltage, then obtaining the DC output voltage that needs passes through the bridge rectifier and filter.

The principle of work as follows:

1、Power functional block diagram:

This circuit belongs to instead the stirring up converter, instead stirs up is refers when the MOS tube leads passes,rectification diode D912, the D910 closure, the electrical energy stores up in the power transformer primary inductance coil; When the MOS power tube shuts off D912, D910 lead passes, in the primary coil electrical energy transmits gives an extremely winding, and after D912, D910 output.

the chart 1-1 Below is this electric circuit principle of work.

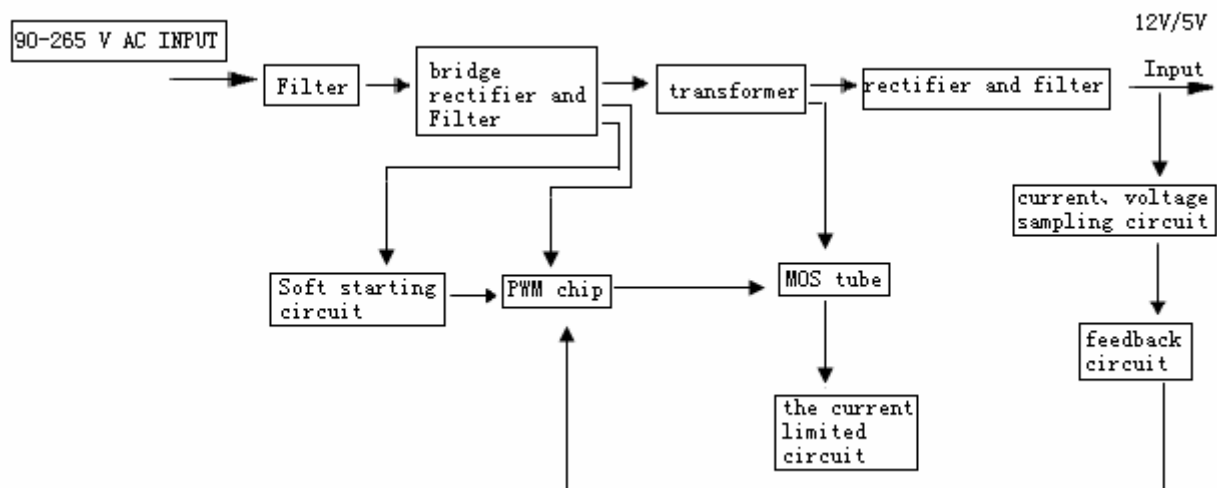


Chart 1-1 circuit principle of work diagram

2、exchange filter Input

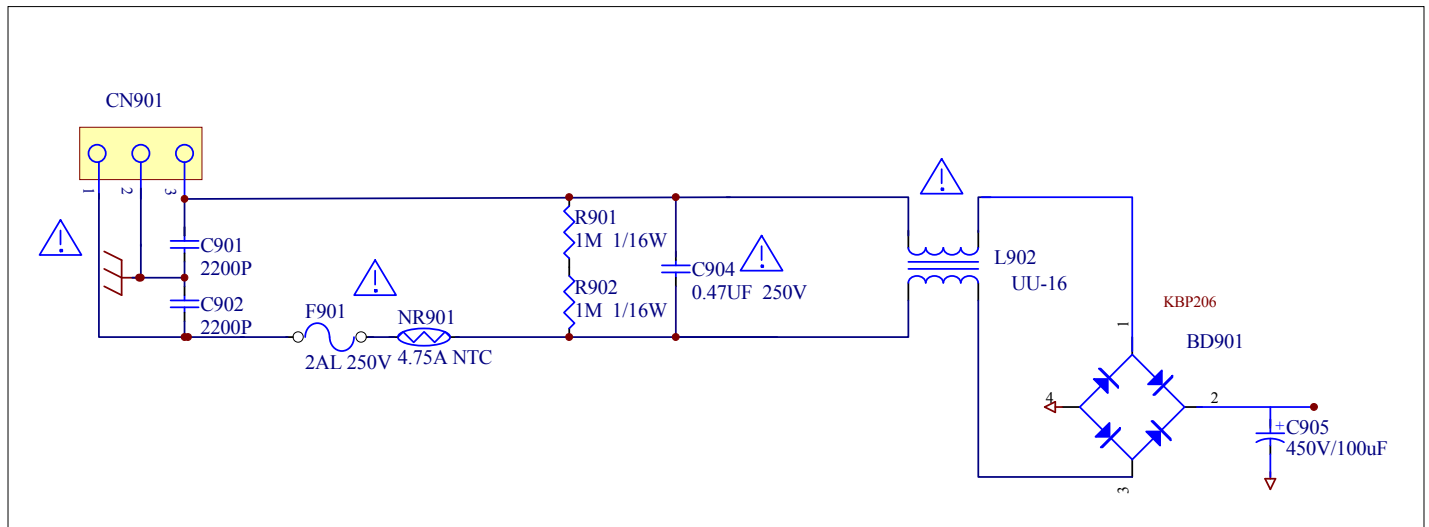


Chart 1-2

One of this part mainly effects is to prevent some noise from the exchanged input line , two is to suppress the disturbance which pass through the power interior to feed back the input line in the electrical network. This filter circuit also is called the filter circuit to electromagnetic Interference (EMI), it contains Y capacitor C901, C902, X capacitor C904, the share mold inductance L902 .

The R901, R902 1M 1/4W resistance is used to the discharge in the capacitor when the power is getting or not.

3、bridge rectifier and filter

After the 110V/220V AC input becomes DC voltage passes through the bridge rectifier and passes through the electric capacity C905 to filter ,and then that is 1.414VAC input.

4、Soft starting circuit

The value of Resistance R906, R907 is very big, so its operating current is very small. When just starting switch power, the operating voltage of SG6841D is provided by R906, R907. When Pin 3 is +15V Vcc power supply pin. Then it has realized the soft start. Once the electric circuit is in the normal working mode .in the self-feed coil voltage passes through R908, D902, C907, C908 to filter, which is the operated voltage of SG6841D. At the same time the current in R906, R907 electric circuit is very small so that could not provide the operated voltage for SG6841D (namely soft start process conclusion).

5、The pulse width Modulation IC is the core part of the switching power supply of the pulse-duration modulation (PWM), it can produce driving signal with the fixed frequency which a pulse width may move, by controls the MOS tube to pass breaks the time the length condition, adjusts the output voltage the height, by achieves the constant voltage the goal

Pin function:

Pin1:GND Pin2:FB(feedback)

Pin3:VIN(start-up) Pin4:RI(reference setting)

Pin5:RT(temperature protection) Pin6: SENSE(current sense)

Pin7:VDD(power supply) Pin8 OUT (diver output)

Below SG6841D has the characteristic:

- 1)、Conforms to TC0 99 and the TC0 03 environmental protections energy conservation request, is in the province electricity and waits for an opportunity when is smaller than the 3W request, About actual 1W.
- 2)、Low initial firing current: 30uA

3)、Low operating current: 3mA

4)、When low voltage knock off

5、) Maximum output voltage 18V

Approximately principle of work: When Opening machine after R906, R907 to Pin3(because its resistance number is big, it must initial firing current slightly, therefore starts small its consumption after it power quite to be also small) the soft start to enter the normal work, its IC power supply provides by the transformer to Pin7. Its PWM width by

Pin2: FB and Pin6: SENSE decided, Pin4: RI decides the oscillation frequency, besides meets the resistance bigger its operating frequency to be lower.

Computational method:

$$F_{pwm} = (1690KHz) / RiK \Omega$$

The present value is 24K Ω , therefore its frequency about 64K. Pin5 is the warm protection circuit, the common this foot meets the negative temperature coefficient NTC resistance to the place outside, when the high temperature situation NTC resistance reducing, its resistance pressure drop drops to the fixed limiting value closes the PWM output. (This electric circuit has not presently performed to use).

6、Overvoltage protection circuit

When electrical network voltage magnification surpasses the maximum value, the self-feed coil output voltage also will elevate. This voltage will be able to surpass 21V, this time ZD901 is penetrated, will add after R912 to Q902, Causes Q902 to lead to the place passes passes through D903 again the Pin4 voltage clamp about 0.8. The prompt generation time short-circuit current, causes SG6841D rapidly to shut off the pulse output. Therefore the power source live pressure also does not have the voltage output, achieves the high pressure protective function.

a) The MOS tube and the current limits circuit

The SG6841D Pin8 foot outputs the pulse wave which a like chart 1-3 shows, this pulse frequency is 64.5kHz, occupies the spatial ratio is about approximately 10%. This pulse control power tube Q903 carries on the switch movement according to its operating frequency. Such transformer starts to work, the electric current leaks the polar current from Q903 to the source extremely, produces the voltage on R919. R919 is the electric current examination resistance, produces the voltage by it to add to SG6841D the class to examine the comparator directly the synchronism input end, so long as this voltage surpasses $(V_{fb}-1.0) / 3$ o'clock, will make the SG6841D interior the electric current protection circuit to start, causes Pin8 to close, it has done the protection. This limits the principle of work of the electric circuit.

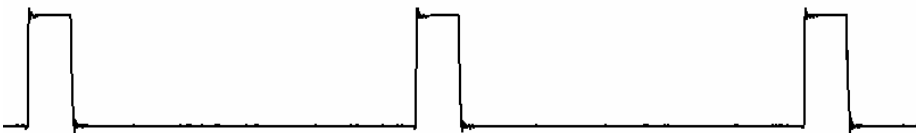
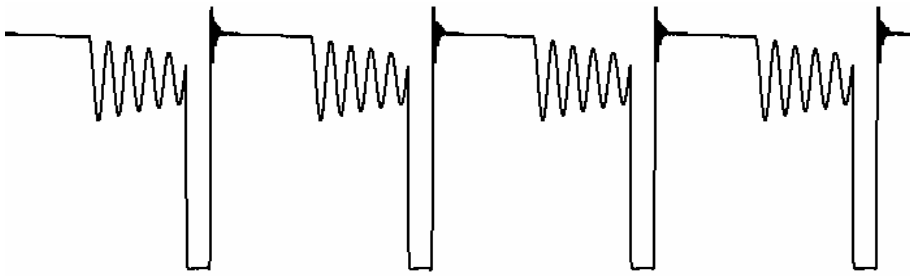


图 1-3 SG6841D pulse input

b) Direct current transformation loop (transformer T901)

When SG6841D output Q903 D outputs like the chart 1-4 profile extremely, Q903 makes the switch condition, its operating frequency is 64.5kHz, occupies the spatial ratio is about 10%. SG6841D starts to work, leads in high level Q903 passes, the T901 primary coil has the electric current to flow, produces on the under negative voltage under, then secondarily has on negative induced electromotive force, by now secondary on diode D910, D912 closure, this stage for stored energy stage; When low level, the switching valve cuts off, in the primary coil electric current in

instantaneous becomes 0, the primary electromotive force for under on negative, in on is secondary induces on the under negative electromotive force, at this time D910, D912 lead to pass, live output. After again passes through the rectification filter then to output.



Chat 1-4 Q903 voltage wave form ($f=64.5\text{KHz}$)

May see this voltage waveform to have the big surge voltage and the ringing phenomenon, its surge voltage this is shuts off by MOS tube oneself when produces with internal diode reverse restores the surge voltage which the characteristic produces to produce. The gatekeeper machine-hour T901 primary coil also has the electric current, this time Q901 has cut off, D901, R903, C906 namely discharges form circuit, at the same time C906 also has filters the high frequency overtone the function.

c) rectification filter loop Output

D910, C922, L903, C924, D912, C925, L904, C926 constituted the electric capacity and the LC filter. Causes the output is 12V and the 5V DC voltage to INVERTER and A/D board power supply. On the T901 secondary out-port diode has connected in parallel fashion RC (R920, R922, C921, C920) circuit, uses in surge voltage which on absorber diode D910, D912 produces.

7. Voltage sample and feedback circuit

Like the chart 1-5 shows the circuit diagram is, electric current, voltage sample and feedback circuits. In chart IC903 is the TL431 chip.

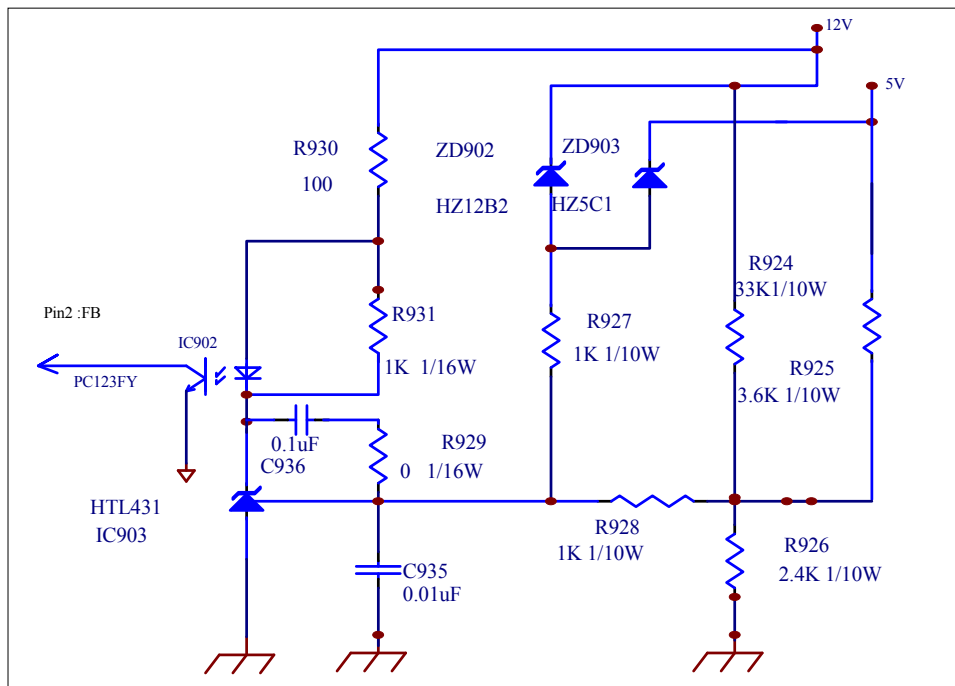


Chart 1-5 voltage, electric current sample and feedback circuit

Its internal schematic diagram like chart 1-6 shows. Its interior has a voltage comparator, this

voltage comparator opposition termination input interior datum voltage, this datum voltage provides a datum the comparison voltage, this voltage is $2.495V \pm 2\%$. This comparator synchronism termination input external control voltage, the comparator output is used to actuate the NPN transistor, causes the transistor to be passed, so the electric current can pass through Anode from

the Cathode. The 12V DC voltage pass through R924、 R926 dividing voltage, the 5V DC voltage pass through R925、 R926 dividing voltage, the voltage produced on R926 is added directly to the R termination of TL431, As this voltage is known by resistance parameter on the electric circuit that can cause TL431 to pass. So the electric current need to pass throught the light diode, and then

photoelectricity coupler IC903 start to work. It completes the voltage sample.

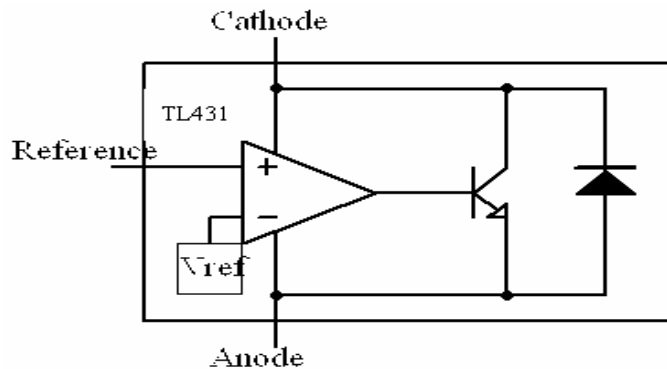
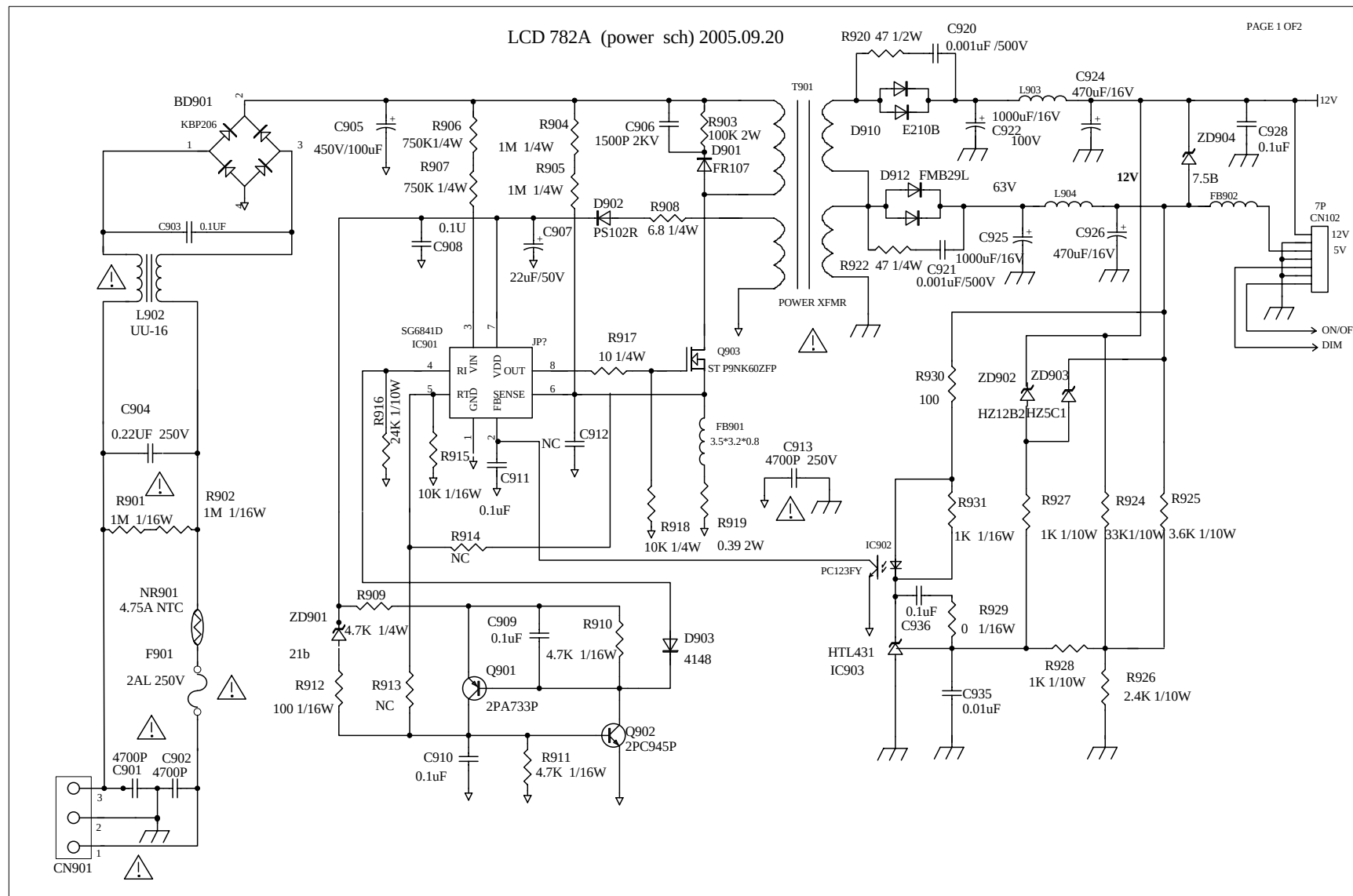


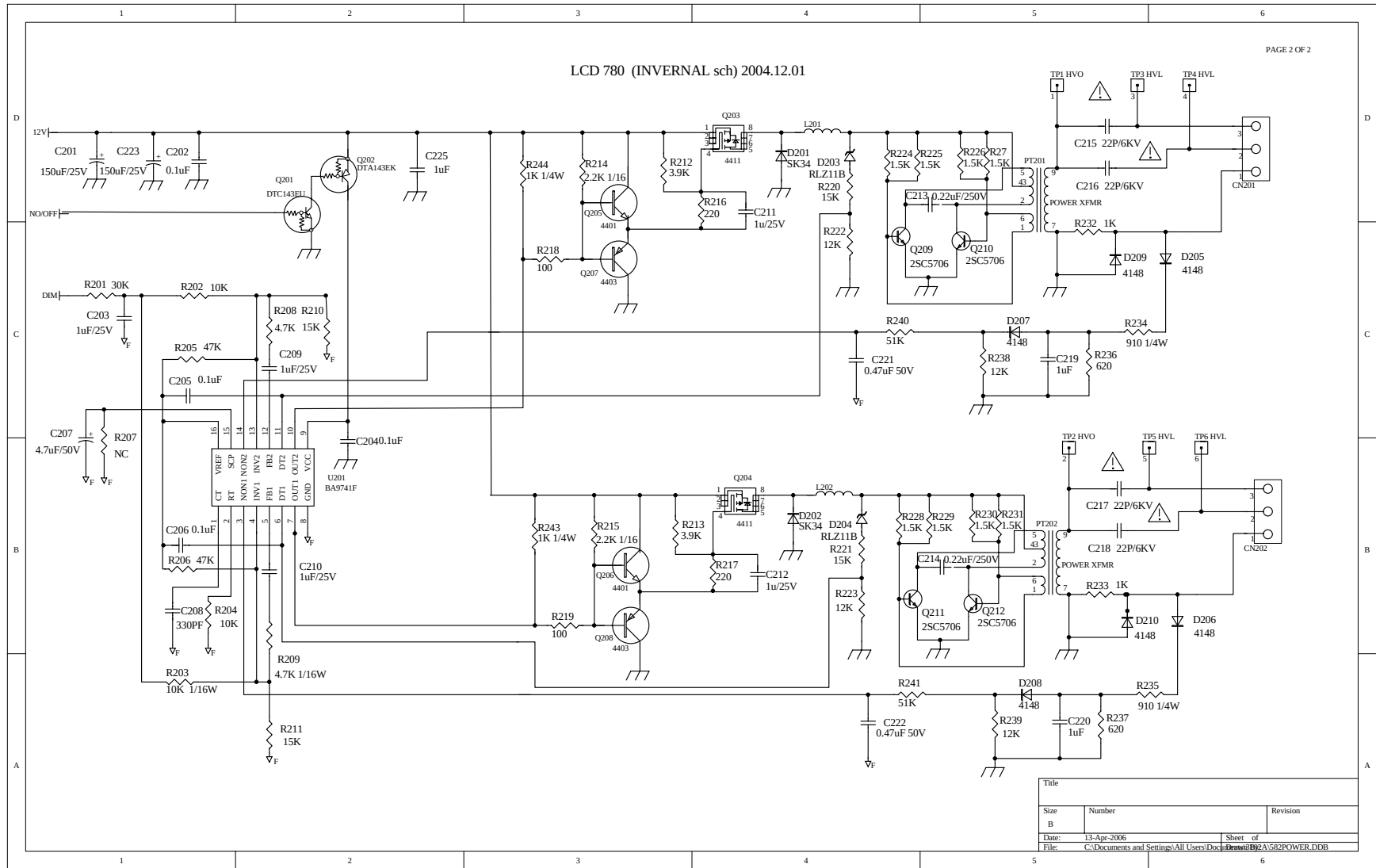
Chart 1-6 TL431 schematic diagram

If it boost electrical network voltage causes the output voltage to be higher, and then the voltage of the IC902 photoelectricity also to be higher, the interior light tube of photoelectricity coupler is more brightly, the photosensitive triode resistance is smaller, then the higher voltage feeds back to the FB pin, Thus it controls the spatial ratio of the pulse output form SG6841D and reduces the voltage output. So it constituted the feedback circuit with over-voltage output, the function is that can be passed through ,the output voltage regulation to be about 12V.



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