

I. Introduction:

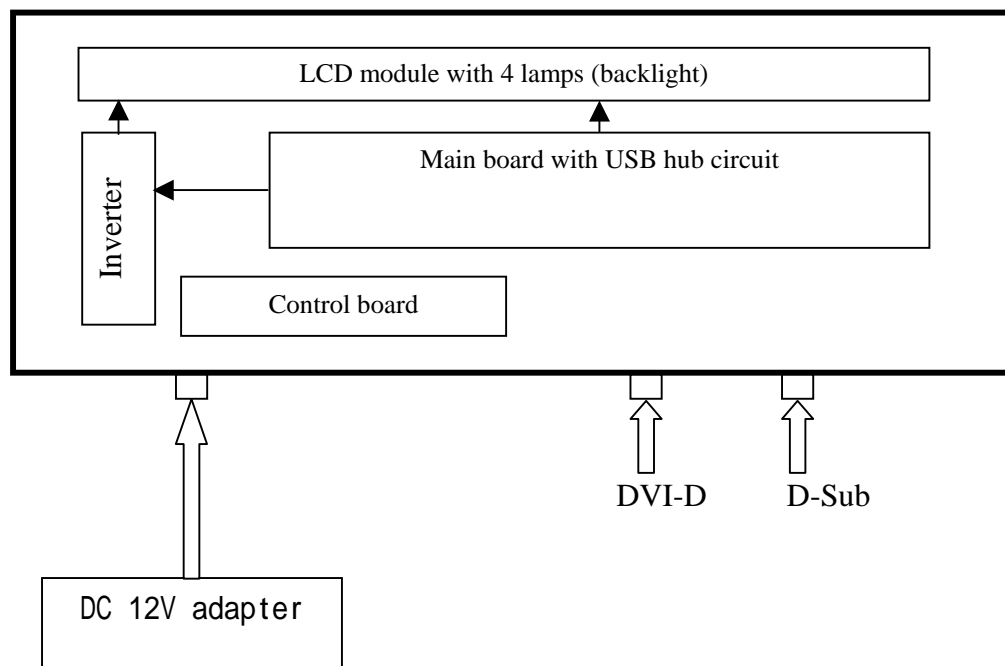
The Q7B3 is a 17" SXGA (1280x1024) , 262 K colors TFT LCD monitor with multi-media functions and offers 12V audio power output and USB 2.0 hub .

Q7B3 is a dual interface(analog and digital) LCD monitor with D-sub and DVI-D signal cables and it is 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. The best function is to offer users an easy method to set all adjustable items well done just by pressing one key, we called it "Auto key" which can auto adjusting all controlled items. Q7B3 also offer DDC2B function to meet VESA standard.

II. Block diagram

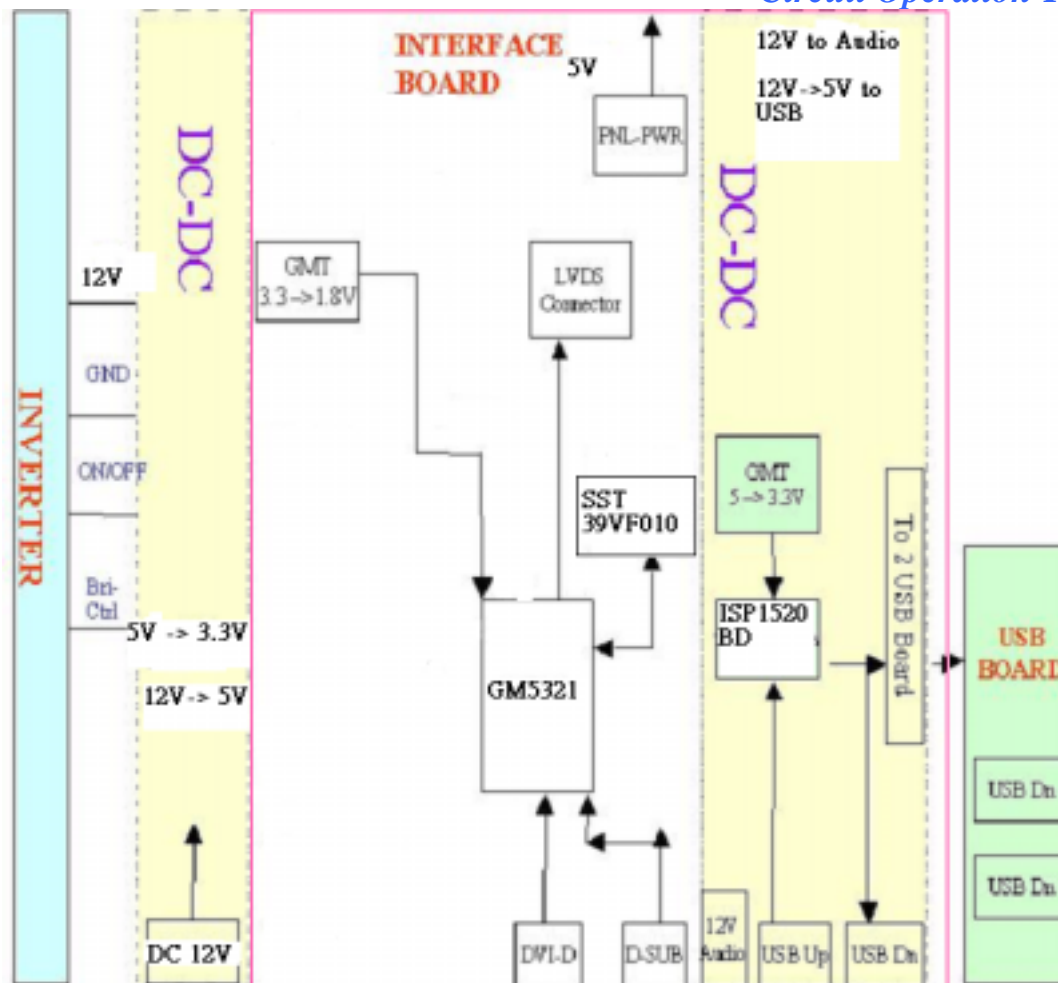
The Q7B3 consists of a LCD module with 4 lamps, an inverter board, a control board ,an USB BD and interface BD.

The block diagram is shown as below.



III. Circuit operation theory:

A-1.) Interface board diagram:

**(a) Circuit operation theory:**

A basic operation theory of the interface board is to convert input signal into digital RGB or YUV data.

Analog RGB and digital TMDS differential input are converted to digital RGB by ADC and TMDS receiver which are embedded in scaler IC .

The scaler GM5321 receives graphic data and optimizes the image automatically. It also support input source selection, 16 color from a 64k palette bitmap OSD, and keypad controlling. The output data are sent to LCD module through a embedded LVDS transmitter.

EEPROM is stored DDC data, OSD common data and user mode data. Flash-Rom is stored the source code which is accessed by MCU to run program.

There are two additional functions in Q7B3 . One is 12V output for audio stick and the other is USB 2.0 hub .

(b) IC introduction:

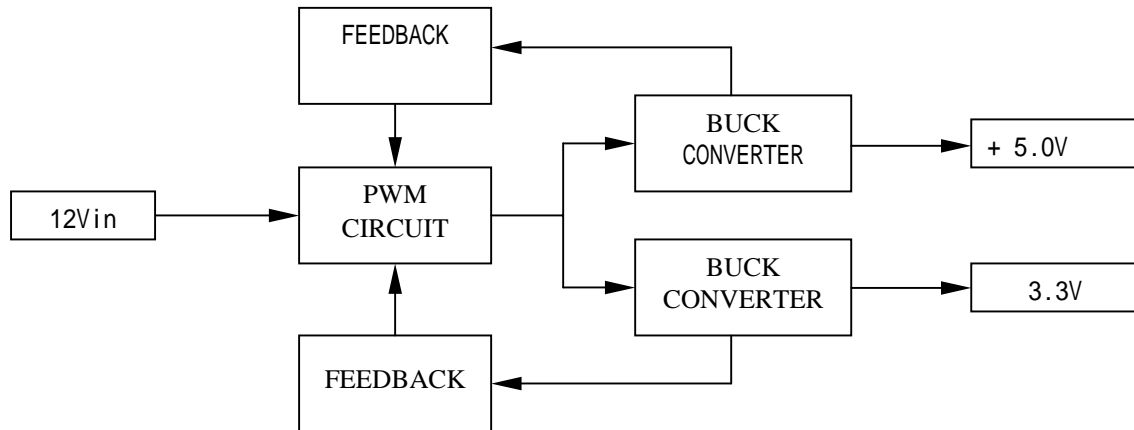
- 1.) DDC (Display Data Channel) function: 24C02 is used to support DDC2B function in both D-SUB and DVI ports. EDID data used for D-SUB and DVI are stored in different 24C02's respectively
- 2.) Gm5321 IC: There are ADC, TMDS receiver , LVDS transmitter ,Scaling, OSD, and MCU functions in the gm5321 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. MCU control unit, it controls all the functions of this interface board, just like the OSD display setting, the adjustable items, adjusted data storage, the external IIC communication, support DDC2B.
- 3.) EEPROM: We use 24C16 to store all the adjustable data and user settings.
- 4.) FLASH ROM: To stored the source code which is accessed by MCU to run program.
- 5.) ISP1520BD : it is USB 2.0 hub controller which supports up to 4 downstream ports .

A-2.) Control board introduction:

There are 6 keys for user's control which includes “Power”, “Enter”, “Up/Plus”, “Down/Minus” , “Exit”, and “iKey” . The following descriptions are the introduction of these keys.

- (1) Power key: to turn/off power of monitor
- (2) “Enter” key: to enter sub-menus or select items.
- (3) “Up/Plus key: to select previous and to increase adjustment
- (4) “Down/Minus” key: to select next and to decrease adjustment
- (5) “Exit” key: to back to previous menu, or leave OSD (auto save)
- (6) “iKey”: to perform auto adjustment

(c) **LED:** It indicates the DPMS status of this LCD monitor; green light means DPMS on (Normal operating condition). Amber light means DPMS off (Powersaving).

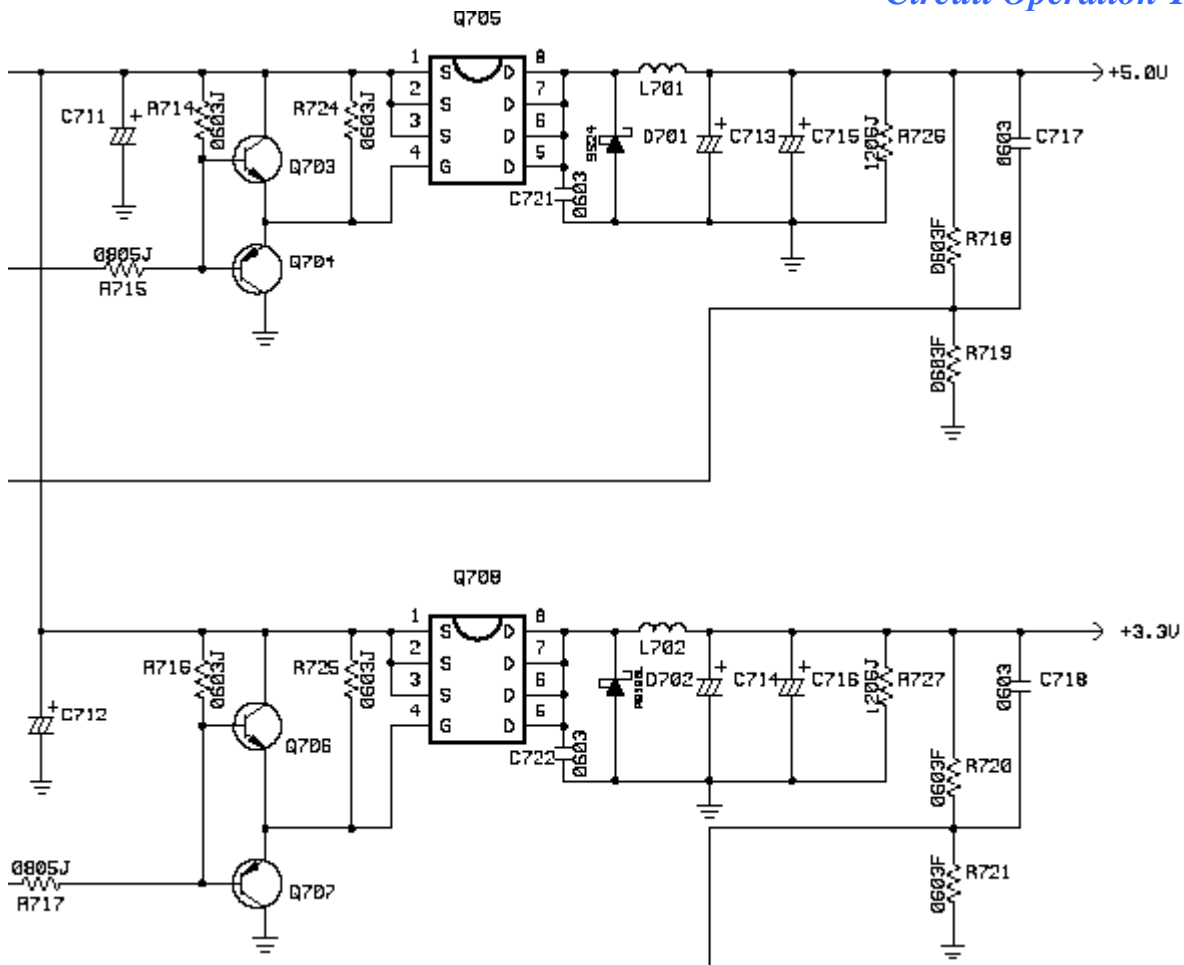
A-3.) power board diagram: power supply operation theory**A-2-1.) DC-DC operation theory****1) DC-DC Block Diagram****2) General Specification**

Output Voltage : 5.0V $\pm 5\%$

Output Voltage : 3.3V $\pm 5\%$

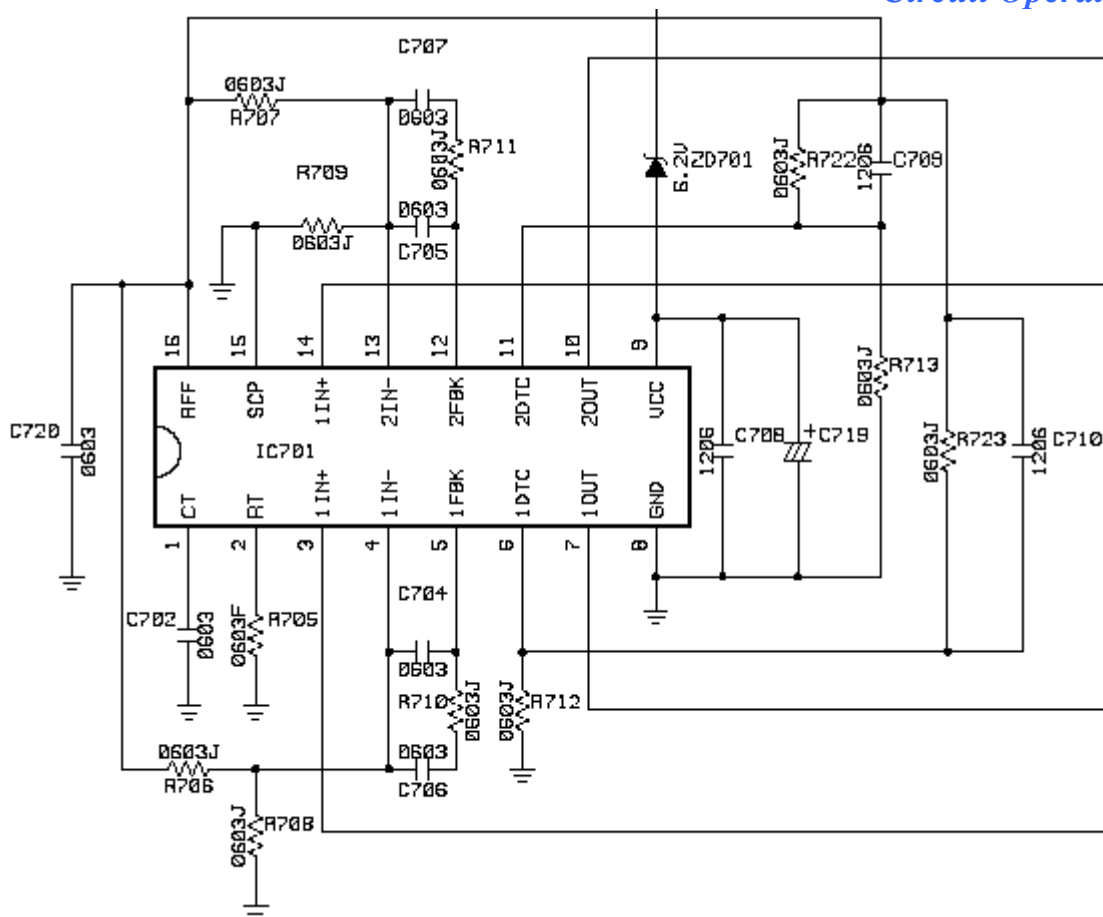
3) Circuit Operation Theorem**3.1 Switching Regulator Circuit**

This circuit was designed to support +5.0V, and +3.3V. The totem pole was combined by Q703, Q704, R714, and R715. The other was combined by Q706, Q707, R716, and R717. They could improve PWM driver. Q705, and Q708 are P-channel power switch. D701 and D702 are catch rectifiers. The power switch and catch rectifier play an important role in buck converter. The LC (L701, C713, and L702, C714) of buck converter circuit was a low pass filter. Output +5.0V was decided by R718, and R719. Output +3.3V was decided by R720, and R721.



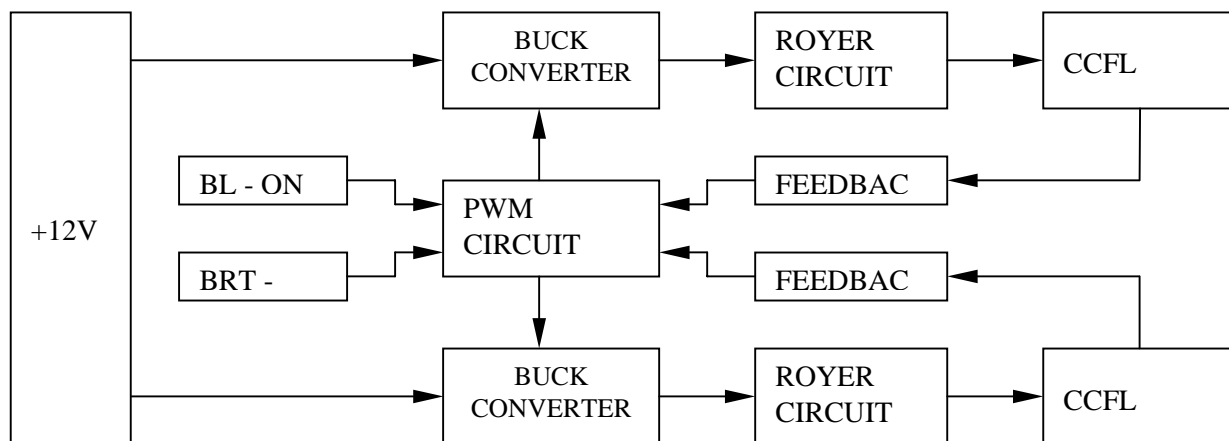
3.2 PWM Circuit

The IC701 (TL1451) is two-channel switching regulator controllers that use the PWM method. Both circuits can be used for DC-DC buck converter. And the capacitor C703 is set for the short-circuit protection. The soft start timings is decided by C710, R7121 and C709, R713. The loop compensation is consisted of C705, C707, R711 and C704, C706, R710. The circuit control systems can be stabilized. The resistor R706, R708 and R707, R709 provide the reference voltage to the error amplifier.



A-2-2) Inverter operation theory :

1) Inverter Circuit Block Diagram



2) Output Requirement:

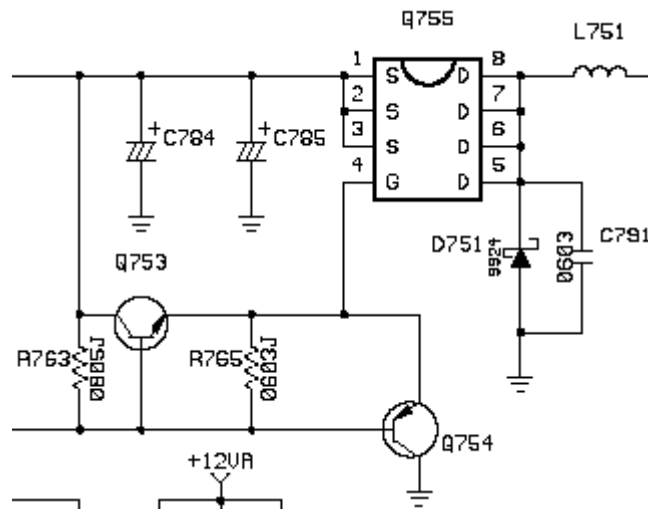
Max. Output Current: 8mA/lamp.

Min. Output Current: 2.5mA/lamp

Lamp Working Voltage: 625Vrms typ.

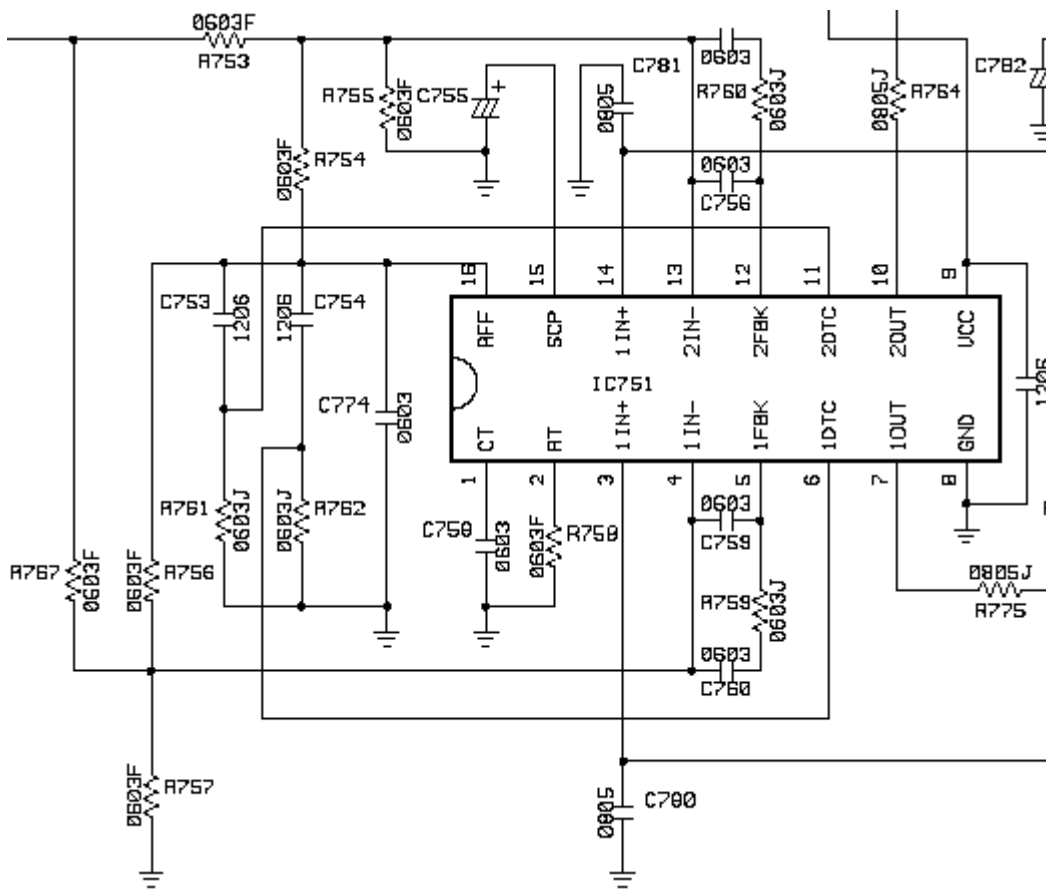
Open Lamp Voltage: 1300Vrms min.

Frequency: 47KHz typ.

3) Operation Theorem**3.1 Buck Converter**

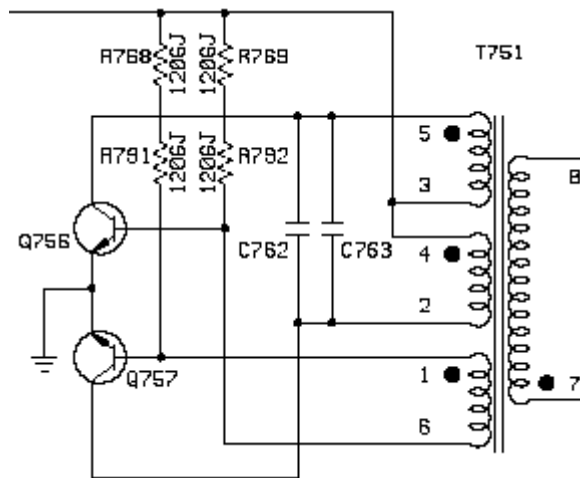
The Q755 is a switching device, and Q753, Q754 are the totem pole which get enough drive ability to drive P-MOS. When the Q753 gate is low level, Q755 turns on. at high level, Q755 turns off. So, pulse waveform will appear at Drain-terminal of Q755. L751 and D751 will transfer the energy to Royer circuit.

3.2 PWM Duty



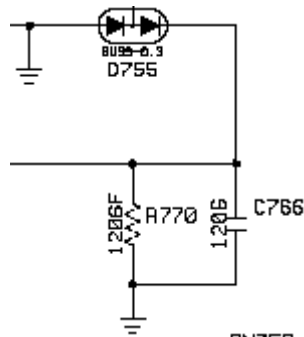
The TL1451AC incorporates on a single monolithic chip all the functions required in the construction of two pulse-width modulation control circuits. Designed primarily for power supply control, the TL1451AC contains an on-chip 2.5V regulator two error amplifiers, an adjustable oscillator, two dead-time comparators, undervoltage lockout circuitry, and dual common-emitter output transistor circuits. The uncommitted output transistors provide common-emitter output capability for each controller. The internal amplifiers exhibit a common-mode voltage range from 1.04V to 1.45V. The dead-time control comparator has no offset unless externally altered and can provide 0% to 100% dead time. The on-chip oscillator can be operated by modulating RT and CT. During low Vcc conditions, the undervoltage lockout control circuit feature locks the outputs off until the internal circuitry is operational.

3.3 Royer Circuit



Royer circuit uses the characteristic of transformer saturation to oscillate. When the DC power inject, Q756 or Q757 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 T751 will get a Sin Wave to turn on CCFL.

3.4 Feed-back Circuit



It get the voltage of Lamp-Current to be the feedback signal and PWM IC (IC751) will adjust the duty-cycle according to the signal to control the lamp brightness.