High Power Inverter for LCD Backlight Driving

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Abstract

A high power inverter with 300:1 dimming capability for high luminance, one cell, Osram Planon type, plasma light source for LCD Backlight was designed and tested. It was possible to achieve 300:1 dimming control

I. Introcution

The application of the liquid crystal displays(LCD) has been increased due because the LCDs are thin, light, and easy to handle. But the luminance of the LCDs is usally low so that it is not easy to use LCDs outside. The high luminance is required as the size of LCDs become larger than 15.2". Four cold cathode fluorescent lamps(CCFL) are used to make a backlight unit for 18.1" LCDs. But the luminance at the surface of the LCDs is usually smaller than 200cd/m^2.

A new type of flat backlight will be required to increase the LCD luminance. Osram's Planon belongs to a new type of backlight other than the conventional backlight using CCFLs. Osram's Planon shows much higher luminance than that of the conventional backlight. Osram's Planon requires high power inverter because of the high luminance and low efficiency of the backlight. Therefore, it is difficult to use the conventional inverter to drive the Planon type backlight.

The high power inverter with high open voltage and large current carrying capability was developed to drive the high luminance backlight. The dimming capability was also added. The electrical characteristics of the high power inverters were measured.

II. Inverter Design

The driving frequency of 50kHz and open voltage of 1,400V$_{rms}$ was designed and fabricated. The designed inverter is composed of step-up inverter[1,2] DC/DC converter, dimming controller, and the output as shown in Fig. 1.

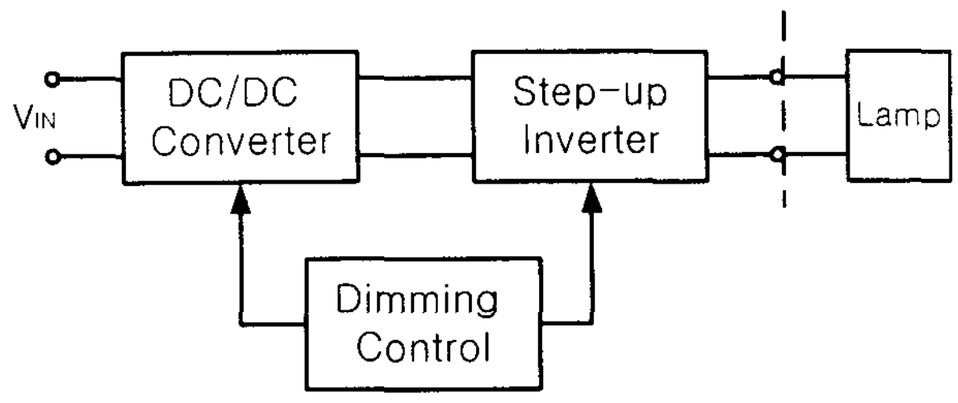

Fig. 1. Inverter block diagram

III. Experimental Results

Planon type flat backlight was used as a test panel which was fabricated at the Information Display Research Center at Dankook University. The luminance of the flat backlight was measured and the dimming capability was also tested[3].

Fig. 2 shows the waveform of the out voltage and the current of the inverter with 50kΩ resistive load. The operating frequency was 50kHz as designed.

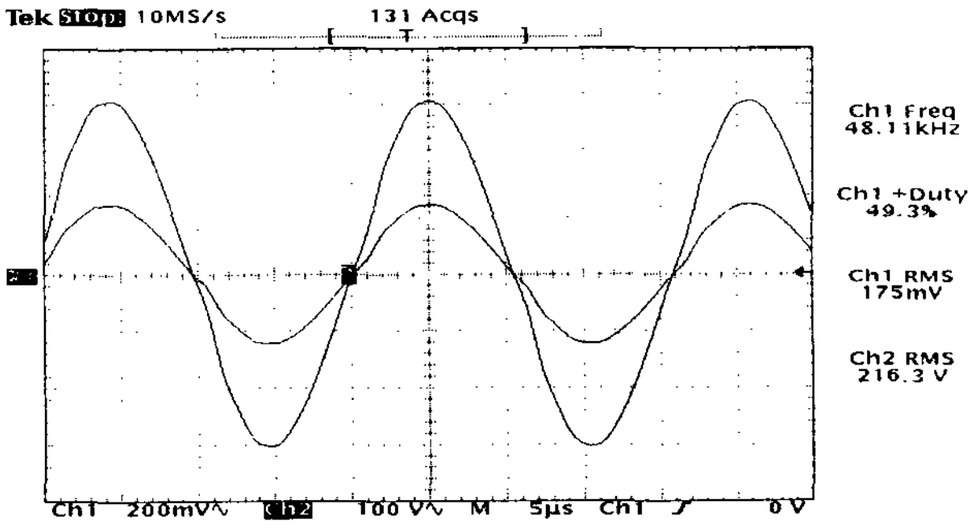

Fig. 2. Voltage and current waveform

Fig. 3 shows the voltage waveforms of the flat backlight and the ballast capacitor.

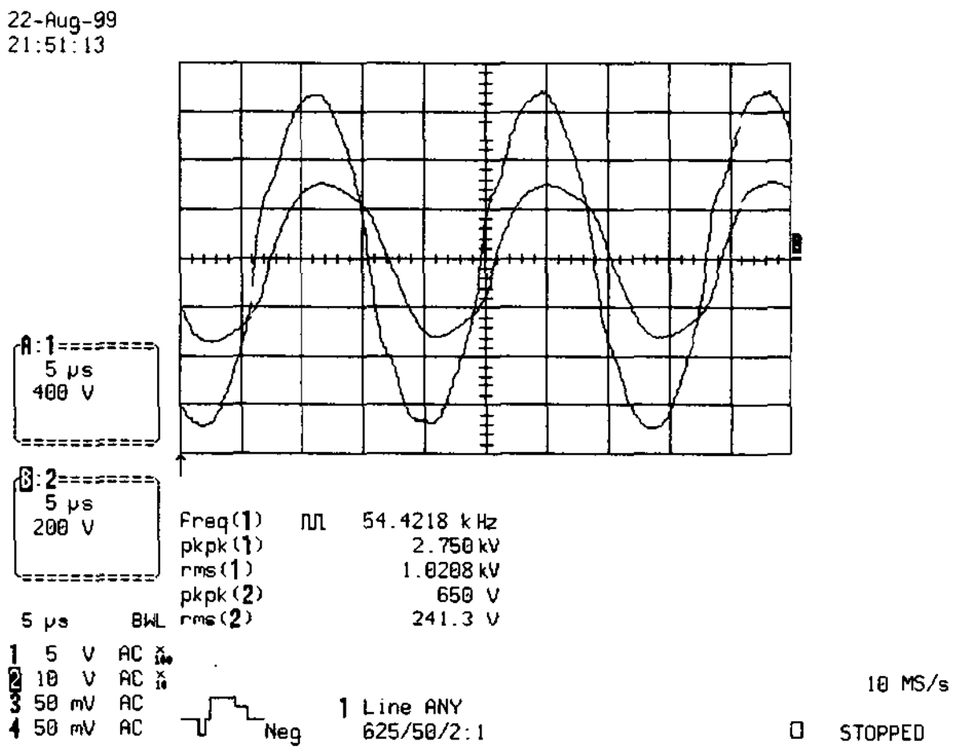

Fig.3. Voltage waveform of backlight and C_{BAL}

Fig. 4 shows the waveform applied to the input of the dimming controller. The luminance as a function of the duty ratio of the dimming controller is shown in Fig. 5.

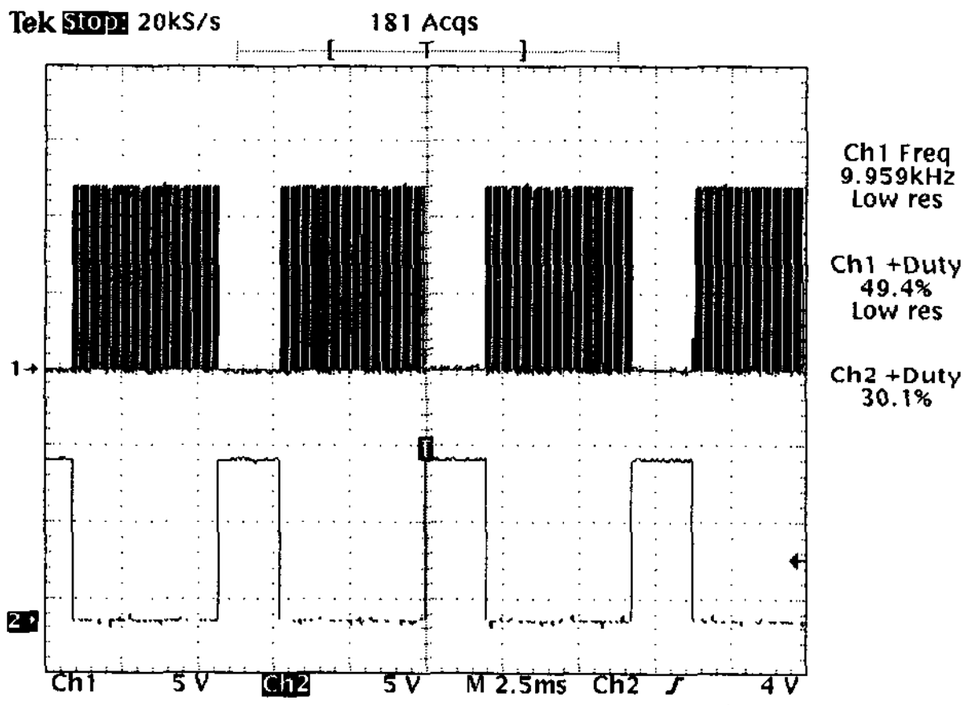

Fig. 4. Dimming waveform

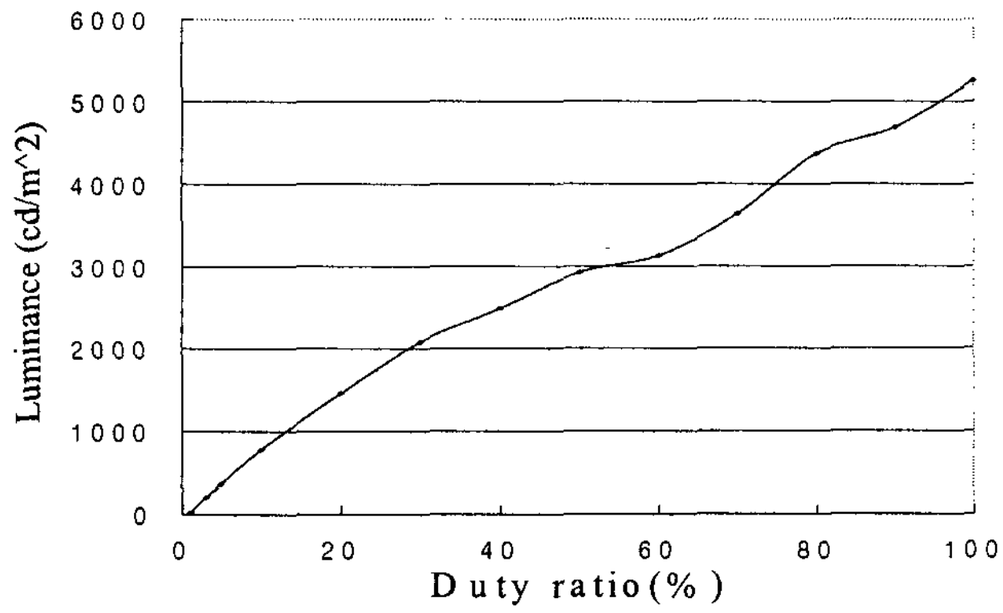

Fig. 5. Luminance dependency on dimming duty ratio

IV. Conclusion

A high power inverter was designed, fabricated and tested to drive an Osram type flat backlight. The 5,000cd/m^2 of surface luminance was obtained by driving the flat backlight by the high power inverter developed. The dimming ratio of 300 : 1 was easily achieved by the high power inverter developed. The newly developed inverter can be used as inverters for driving the Osram type, high luminance backlight for the large size monitor application.

References

[1] Abraham I. Pressman, Switching Power Supply Design, McGraw-Hill, Inc. 1991

[2] Jim Williams, High Power CCFL Backlight Inverter for Desktop LCD Displays, Application Note 164, Linear Technology, 1997

[3] Dipl.-Ing, Arndt Wagner Robert Bosch GmbH, Leong, Germany, Development of an Inverter with frequency variation dimming, Euro Display Proceeding 1999, Germany