Frequency Synchronization for LCD TV Backlight

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Abstract

The frequency of inverters for driving multi-lamp backlights for LCD TV was synchronized to reduce noise from lamps and noise generated from PWM dimming.

1. Introduction

Size of large size LCD TV has been increasing due to the start of digital broadcasting and the efforts to share LCD markets. Large size LCD TV needs large size backlight unit(BLU). Differential driving inverters are now widely used to drive many lamps in BLU and many inverters are used to drive the lamps in BLU.

Unwanted noises, water fall, or PWM noise can usually be observed if the operating frequency of each inverter is different due to interference. It is very important to remove the unwanted characteristics to improve the quality of LCD TV.

It was found that the frequency synchronization of inverters in the BLU could improve the unwanted characteristics such as waterfall noise or audio noises.

2. Design of Inverter

One master inverter and three slave inverters were designed for large size LCD TV BLU and the operating frequency was synchronized.

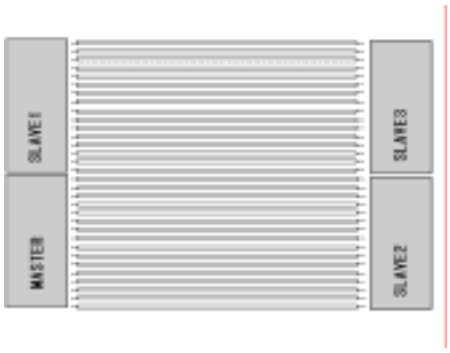

Fig.1 BLU of large size LCD TV

Two blocks of 18 lamps were operated by using two inverters / block. Hot-hot driving method was used. Four inverters was used to drive total 36 lamps. The inverters used were designed by using full-bridge driving IC by O2micro.

Fig. 2 shows the operating frequency of each inverter used.

Master : 51.5kHz

Slave1 : 53.2kHz

Slave2 : 52.6kHz

Slave3 : 53.2kHz

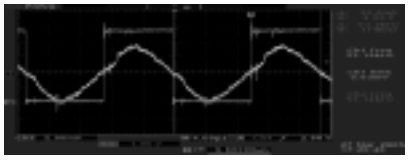

Fig. 2 Frequency of inverters of master and slaves.

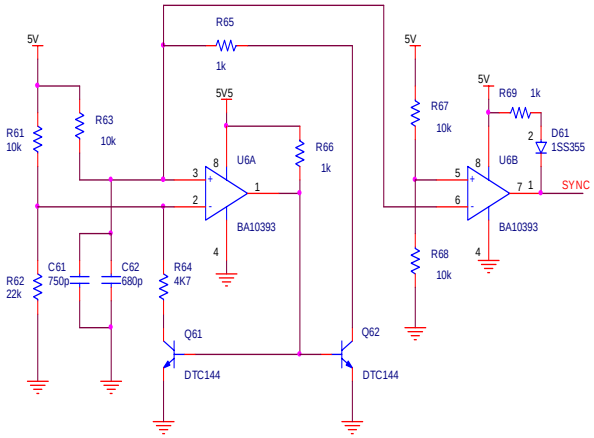

Fig. 3 Circuit for inverter frequency synchronization

Slave1 and slave3 showed the same operating frequency of 53.2kHz and stable operation. But the master frequency was 51.5kHz and slave2 frequency was 52.6kHz and the micro flickering of the lamps and the transformer noise during PWM dimming were observed.

The synchronization circuits using the circuit in Fig. 3 was designed. The 52.6kHz generated from the circuit was distributed to each inverter so the frequency of all the inverter was synchronized. The audio noise generated from PWM dimming and the flicker from the lamps all disappeared. The waveform as shown in Fig.4 showed the stable waveform after synchronization.

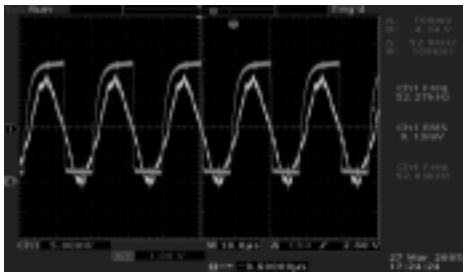

Fig. 4 Stable waveform after frequency synchronization of inverters

3. Result and Discussions

The CCFLs in the large size LCD TV backlights as shown in Fig. 5vwere operated by the inverter designed. Differential mode inverters with frequency synchronization circuit was designed and fabricated to drive LCD TV backlight with 36 CCFLs. Four hot-hot type inverters used generated some flickers and noises from transformer during PWM dimming. The frequency synchronization circuit was introduced to remove those problems successfully.

Fig. 5 LCD TV backlight using designed inverters

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