Enhanced Heat Sink Method for Smart Display Devices with Slim Bezel

Junil Kim[1] and Taehyun Jeon[1†]

[1] Seoul National University of Science and Technology,
Dept. of Electrical and Information Engineering,
232 Gongneung-ro, Nowon-Gu
139-743 Seoul, Korea
{yasoo93, thjeon}@seoultech.ac.kr

Abstract. As the display device becomes thinner and supports high resolution quality the heat dissipation is a major issue which could be generated by display driver integrated circuit (IC) embedded in the device. One of the reasons for this issue is the reduced the edge areas of the display for the big screen display as well as portable mobile devices applicable in many fields. In this paper an enhanced heat sink method is proposed to reduce the exothermic problem caused by the LCD driver ICs to maintain the stability of the IC operation and to protect the circuits inside the device. The proposed method has advantages over the conventional ones in terms of the unit production price and the arrangement of the IC.

Keywords: LCD driver IC, heat sink, slim-bezel

1 Introduction

The LCD device has been adopted in flat televisions and achieved great success over the conventional CRT TV [1]. This success is mainly due to the explosive progress in information technology coupled with massive demands for the high quality multimedia data such as high definition broadcasting, 3D video, smart TV and video streaming through mobile internet access. Demands for high quality data anytime and anywhere can be spread out of the office and home area due to the nationwide deployments of the cellular wireless networks and the efficient data infra structure through mobile cloud computing. One of ways to realize the high area efficiency of the display is keeping the frame of the device as slim as possible which is often called a bezel.

Decrease of the extra areas other than actual display purpose is translated into the reduction of the area where the related circuits are located. This could cause highly squeezed circuit board design upon which the drive ICs are mounted. As the required performances are increased while the size of ICs is kept constant or even smaller new problems of heat generation are created from the driver ICs installed at the edge of the display. This limitation requires highly efficient heat dissipation method which can

† Corresponding Author

© SERSC 2013

overcome the location and formation of the circuit board and the ICs. Without the proper solution for the exothermal problem, the semiconductor chips embedded in the display device is likely to fall into functional disorder. In this paper an enhanced heat dissipation method is proposed which can be applicable for super slim bezel display device with an enhanced flexibility in terms of geometrical position for the installation. In the next section the proposed method is described compared with the conventional one. Experimental results are followed which are obtained through laboratory measurements. Conclusions are drawn at the end.

2 Proposed Method

The heat dissipation sheet is conventionally used for heat sink of the LCD driver IC. This is a cost effective method and the sheet is installed on the IC at the manufacturing stage. The sheet combines the heat sink and the thermal conductive substance which were previously handled separately in the manufacturing process [2-3]. However, there are some disadvantages with this method when it is applied to the various types of device sizes because of the related equipment and material costs which eventually results in the increase of the manufacturing cost.

The proposed method compensates those problems by spraying an exothermic reduction substance above or below berth of the driver IC [4]. In order to implement the proposed heat sink package the exothermic reduction material is applied on the unfilled insulating layer and base film surface which protects the upper part of the chip on film type packaged IC. This method has more flexibility in term of the shape of the application target and relatively simple process to implement compared with the conventional method.

3 Results

For the experiment, driver ICs are tested on the big screen LCD panel. They are grouped into two sets: one group of IC packages is applied with the proposed heat dissipation method and the other group has no other extra heat sink. Measurement results show over 20% of temperature drop with the samples of proposed scheme compared with the non applied cases.

4 Conclusion

In this paper, an enhanced heat dissipation method is proposed for the driver IC packages adopted in LCD device. Laboratory tests show that the method is effective in terms of cost reduction of unnecessary materials and the related equipment for processing which eventually result in manufacturing costs increase. The enhanced flexibility covering any geometrical shapes is also expected to be quite suitable for

recent or upcoming advanced types of slim bezel display device which gets more and more important in ubiquitous information infra structure environments.

References

1. Hirohisa Kawamoto: The history of Liquid-Crystal Displays, Proc. of IEEE, vol. 90, no. 4, 460--500 (2002)
2. F. P. Incropera, D. P. Dewitt, T. L. Bergman, A. S. Lavine: Introduction to heat transfer 5th ed., Wiley, Hoboken (2006)
3. Tanaka Yasuhiko: Semiconductor device and electronic apparatus, Japan Patent P4014591 (2007)
4. Junil Kim, Sungjin Kim: Heat releasing semiconductor package, Method for manufacturing the same, and display apparatus including the same, Korea Patent 10-1214292 (2012)