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Abstract
LCDs (Liquid-Crystal Displays) is one of the most popular electronic products in the information age. It is the reason why there are so many display manufactures devoting many resources into it. However, there are two important issues are always a concern to the display industry, that is luminance and luminance uniformity of a display. It is continuous challenge faced by the backlight manufacturers to improve luminance and luminance uniformity of its products under continuous cost-down pressure in today's fiercely competing market.
In direct-type backlight units (BLUs), the lamps are aligned parallelly with even (or uneven) spacing. This results in "lamp mura", luminance non-uniformity. Additional, the technical trend, thinness and lightweight, in LCD backlight industry, worsen this problem. In this work, we propose a new concept, beamsplitting going with diffusing, to tackle the problem of luminance non-uniformity in direct-type BLUs. With the implementation of this idea, we expect that the numbers of optical films can be further reduced. The goal of cost-down, thinness, and luminance uniformity can be achieved at one time.
In this study, experimental work has been performed by using beam splitters or reflection films with beansplittering capability (DVR and ESR) that will split light proportionally according to specified design case, as well as other optical films (such as up diffuser, bottom diffuser and prism lens) to create a novel direct-type BLU structure. Luminance measurements and analysis are carried out to determine the optimal design parameters for beamsplitters and the other optical film(s).
In conclusion, the issue of luminance uniformity had been solved and the goal of thinness is achieved. Two major structures are proposed. For general use, a combination of a beam splitter and a diffuser film will meet the specification. For high-luminance products, instead of beamsplitter, DVR is applied as well as other optical films, including bottom diffuser, prism lens, and up diffuser, to meet the demand in luminance.
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