

# P-212: A 0.83" Full HDTV Liquid Crystal On Silicon Component with In-Pixel Memory and 450Hz Refresh Rate

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## Abstract

*In the frame of the EC IST European funded project called LCOS4LCOS<sup>1</sup>, a consortium of six European partners has developed a new 0.83inch 1920 x 1080 pixels liquid crystal on silicon display device mainly targeting single LCOS HDTV rear projection but also usable for other applications like goggles or viewfinders. We describe in this paper the original device architecture and performances inside a color sequential single panel projection system.*

## 1. Introduction

To face the fierce competition of plasma and LCD technologies, the strategy of MD RPTV manufacturers consists in designing full HDTV, slimmer and lower cost products featuring a higher picture quality level especially in terms of motion rendering. Today's single panel solutions for consumer RPTV applications are based on sequential color DLP concepts. The associated optical cores are compact enough to enable slim cabinet design. Nevertheless full HDTV resolution (1920 x 1080) is only achievable by implementing complex optical architectures based on spatial wobulation, which makes the complete system not sufficiently attractive to the consumer in terms of price. Furthermore, new kinds of artifacts are generated on moving objects through this technique.

On the other hand, the LCOS technology applied to sequential color single panel concepts offers true full HD resolution and low manufacturing cost, but still suffers from non adequate system performances. Several companies in the past tried to build single LCOS panel architectures. Unlike preceding attempts, the

LCOS4LCOS consortium strategy was based on using low cost standard CMOS technology to manufacture the chip. Furthermore, it was decided to integrate a memory cell under each pixel that could enable a latch of the complete image at the same time on the pixel electrodes in order to avoid black segments on the color wheel. Consequently, a brightness level higher than some competitive approaches can be achieved. Another challenge was to find the right Liquid Crystal material and mode that would feature both a high contrast level and very fast response times that are mandatory for color sequential addressing modes. Finally, a LC assembly process has been defined, an optical engine and an electronics controller have been designed and a 1080p HDTV RPTV demonstrator is available and fully functional.

The following paragraphs present the main achievements of this European research project.

## 2. Single Panel Projection system requirements

Based on targets listed in Table1, a top-down specification approach has been applied from system to components:

Flux	>300lm
Contrast	>1000:1
T on + T off	<1ms
Frame Frequency	>360Hz

**Table 1 : System requirements**

To get a 300lm flux, optical simulations showed that a LCOS size bigger than 0.8" was needed as well as a high Spectral Reflectivity (>70%) and a 150W 1,0mm arc size lamp to increase system efficiency and light output. A memory under each pixel is necessary to mask the addressing time and to get rid of "black

<sup>1</sup> LCOS4LCOS : Liquid Crystal On Silicon For Low Cost Optical System

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