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Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP

High-resolution 1" WUXGA OLED microdisplays

Large-area OLED microdisplay (resolution 1920 × 1200 pixel, 120 fps, 1 Inch screen diagonal)

Motivation

Augmented Reality (AR) and Virtual Reality (VR) are topics that are increasingly conquering everyday work and private life. The number of data glasses on offer is growing rapidly, as the required technologies are now available that enable compact, powerful and comfortable data glasses for the user.

The heart of all data glasses is their display. Commercially available VR glasses usually use displays from the smartphone market or LCD- and LCOS-based microdisplays. Their disadvantage is limited resolution and insufficient pixel density. OLED microdisplays offer a new alternative that is energy-efficient and offers high contrast ratios > 100,000:1.

Fraunhofer FEP has long lasting and extensive know-how in the development and manufacture of customized OLED microdisplays for a wide variety of applications. Building on this, a new generation of large-area OLED microdisplays was developed at Fraunhofer FEP. These focus on both virtual and augmented reality applications.

With their new parameters, these microdisplays are predestined for use in VR data glasses, but also in other markets such as optical metrology, optogenetics or as electronic viewfinders in cameras.

They have a screen diagonal of one inch, achieve extended full HD resolution, i. e. 1920 × 1200 pixel (WUXGA) at a pixel density of 2300 ppi (pixel pitch 11 μm). The frame rate of up to 120 Hz also helps to minimize motion sickness effects that often occur with VR glasses. The movements in the virtual world thus appear very fluent.
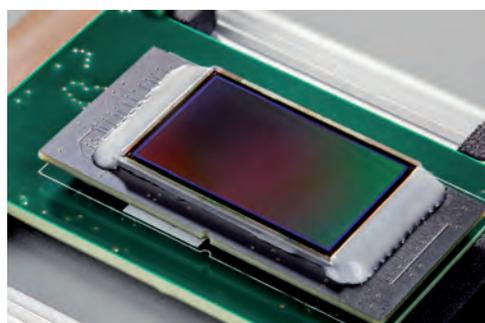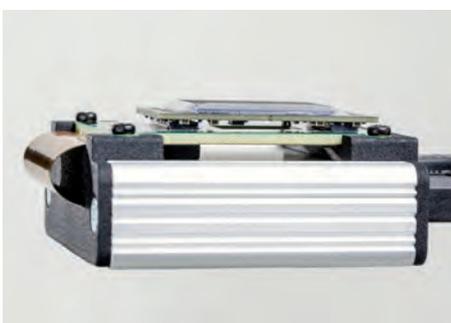
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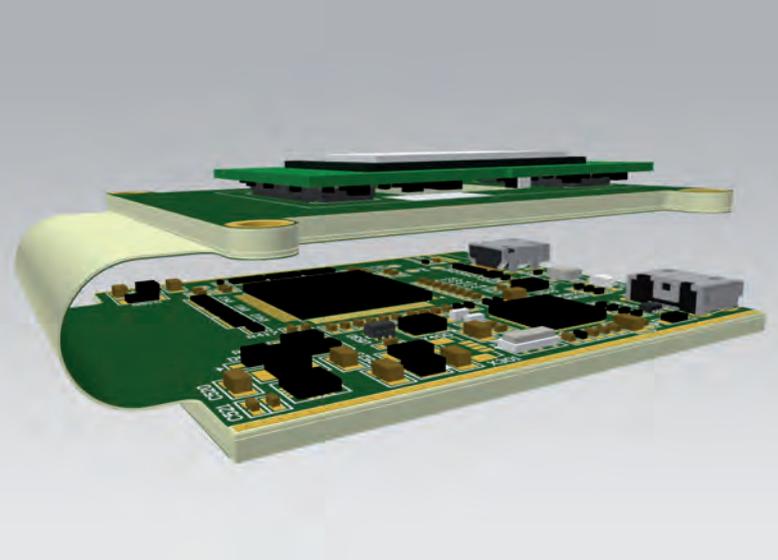ines.schedwill@fep.fraunhofer.de

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Display driver electronics
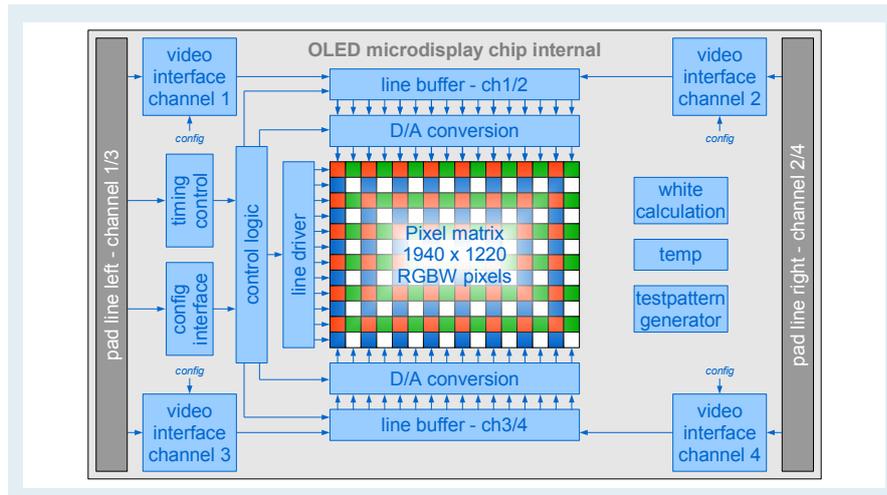

Evaluation Kit

Technical Data

The technical parameters of the new 1" OLED microdisplay are shown in the table below. The parallel interface of the display was extended to implement the high refresh and data rates. The current version transmits the data of 2 pixels per clock cycle instead of the usual one

pixel per clock clycle. This extends the interface from 24 bit to 48 bit parallel (R,G,B 8 bit per color). The pixels also have a white channel which can either be calculated internally or transmitted externally via another 16 bit channel (8 bit per pixel). Due to special adaptations in the

backplane design, the display also has a very low power consumption. The display typically requires less than 250 mW at 120 Hz. Furthermore, emit modes have been implemented, which allow a reduction of motion artifacts.

Parameter	Value
Nominal Display Resolution	1920 × 1200 (WUXGA)
Total Display Resolution	1940 × 1220
Number of Subpixels	9.47 million
Active Area	21.1 mm × 13.2 mm
Chip Size	24.68 mm × 15.2 mm
Display Diagonal	1''
Frame Rate	60 Hz, 75 Hz, 90 Hz, 120 Hz
Contrast Ratio	> 100,000:1
Uniformity	> 95%
Pixel Setup	RGBW
Pixel Pitch (RGBW)	11 µm × 11 µm
Pixel Pitch (subpixel)	5.5 µm × 5.5 µm
Color Depth	24 bit (32 bit incl. white)
Display Interface	48 bit RGB digital, parallel + sync. signals CLK, VS, HS and DE
Display Brightness	300 cd/m² (typ.)
Configuration Interface	TWI (two-wire-interface)
I/O Voltage	3.3 V (1.6 V … 5.5 V)
Core Voltage	1.8 V
Cathode Voltage	-3 V…-6.5 V (depending on OLED)
Temperature Range	-20°C … +65°C
CMOS Technology	0.18 µm

Block diagram

Evaluation Kit

The Evaluation Kit contains a WUXGA OLED microdisplay with control electronics and is controlled via HDMI. Power is supplied via USB.
To simplify the configuration of the microdisplay, the Evaluation Kit contains a simple GUI for Windows systems and a technical documentation.

The following variants are available:

JUCW1010
- full color display
- 24 bit color depth

JUGL1010
- monochrome green display
- 8 bit color depth

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