High-resolution 1'' WUXGA OLED microdisplays

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.

Motivation

Fraunhofer IPMS has many years of extensive expertise in the development and production of customised OLED microdisplays for a wide range of applications. Building on this, Fraunhofer IPMS has developed a new generation of large-area OLED microdisplays. These are focussed on both virtual and augmented reality applications.

With their new parameters, these microdisplays are predestined for use in VR data glasses, but they also find application in

other markets, such as optical metrology, optogenetics or as electronic viewfinders in cameras.

These microdisplays have a screen diagonal of 1 inch. They achieve extended full-HD resolution, i.e. 1920 × 1200 pixels (WUXGA), with a pixel density of 2300 ppi (pixel pitch = 11 μm). The refresh rate of up to 120 Hz also helps to minimize the motion sickness effects that often occur with VR glasses. Movements in the virtual world therefore appear very smooth.

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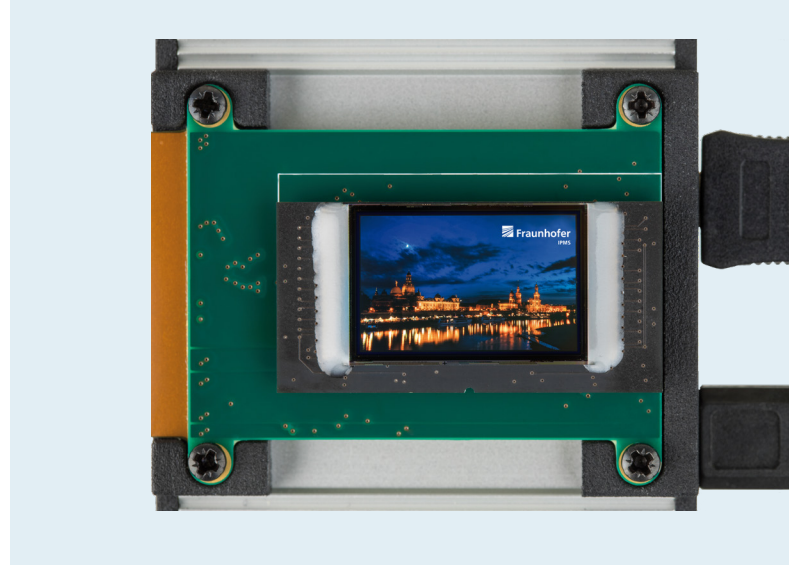ines.schedwill@
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Evaluation kit

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

Technical data

The technical parameters of the new 1'' OLED microdisplay are shown in the table. The display's parallel interface has been expanded to realise the high refresh and data rates. The current version transmits the data of 2 pixels per clock instead of the usual one pixel per clock.

This extends the interface from 24 Bits to 48 Bits in parallel (R,G,B 8 Bits per color). The pixels also have a white channel, which can either be calculated internally or transmitted externally via a further 16-bit channel (8 Bits per pixel). Thanks to special adjustments in the backplane

design, the display also has a very low power consumption. For example, the display typically requires less than 250 mW at 120 Hz. Furthermore, emit modes have been realised to reduce motion artefacts.

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''
Framrate	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
max. pixel current	700 nA subpixel, 2,3 A/an²
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 – 1000 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)
Backplane type	common cathode
Temperature range	-20 °C … +65 °C
CMOS technology	0.18 µm

Block diagram
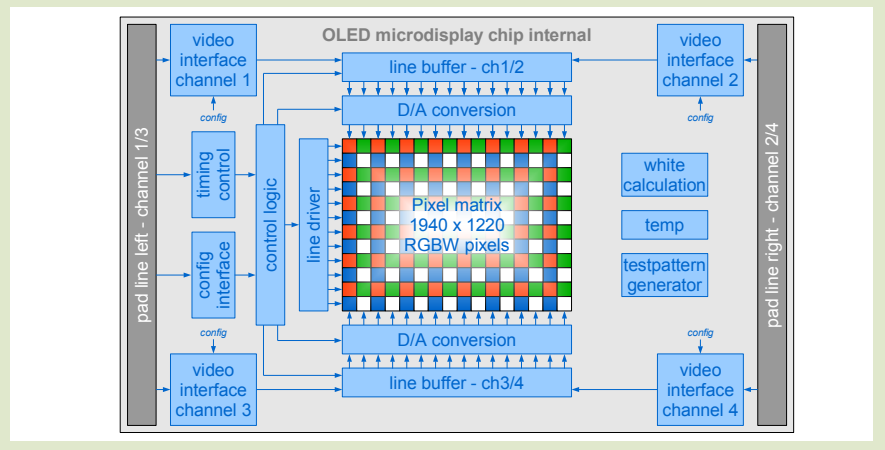
Evaluation kits

The Evaluation Kit contains a WUXGA OLED microdisplay with control electronics and is controlled via HDMI. Power is supplied via USB.

The following options are available:

JUCW 1010

- Full color display
- 24 Bit color depth

To simplify the configuration of the microdisplay, the Evaluation Kit contains a simple GUI for Windows systems and a technical documentation.

JUGL 1010 / JUAL1010

- Monochrome green display
- Monochrome amber display
- 8 Bit color depth