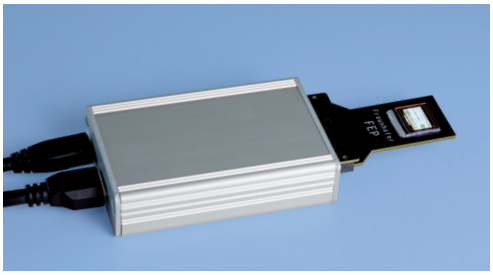
Fraunhofer IPMS

Bidirectional SVGA microdisplay

Bidirectional microdisplay

The field of mobile personal electronics has experienced enormous growth in recent years. Smartphones and tablets have turned all the traditional laws of mobile data generation, processing and consumption on their head. Despite the increase in screen sizes, the amount of information that can be displayed is limited for ergonomic reasons. The screen diagonal cannot grow indefinitely, nor can the content be reduced in size at will. There is therefore a lack of a mobile multimedia interface. This can be provided by video or data glasses, which make it possible to discreetly display information in public spaces. The first pcractical implementations of this technology are now available at Fraunhofer IPMS.

High-resolution miniaturized displays are an essential component of these glasses. Thanks to tremendous pixel densities, they are able to generate high-resolution virtual images with a large viewing angle. The display with SVGA resolution described here is based on OLED-on-silicon technology, and is therefore able to generate high-contrast images with a large color space while consuming minimal energy. Unlike solutions that are already commercially available, the display has an embedded SVGA image sensor which can be used for example for interaction with the user (e.g. eye tracking by capturing the center of the pupil).



The evaluation kit enables the microdisplay to be operated via a standard HDMI interface and the image sensor to be read out via USB3.0.

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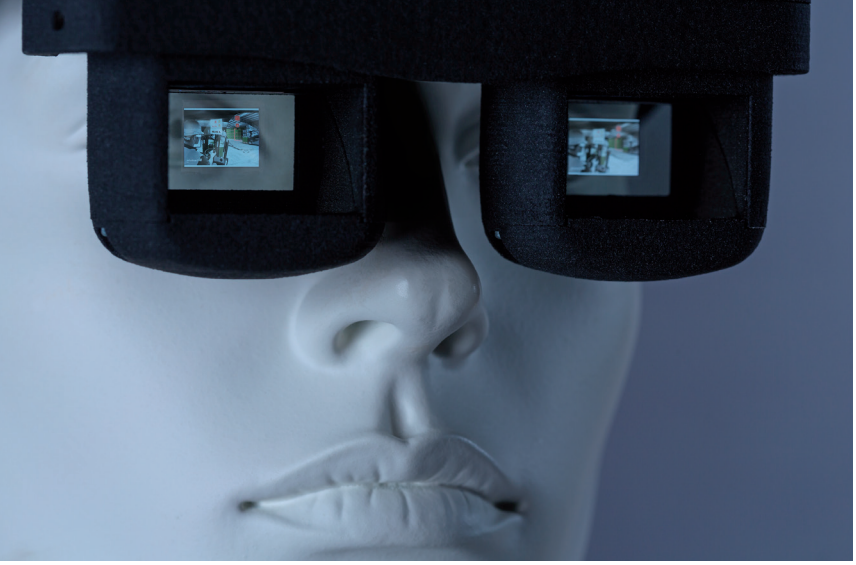
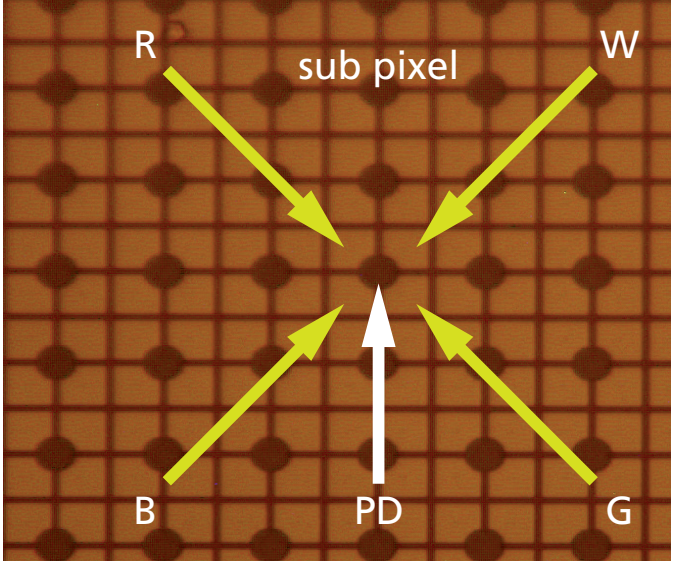


Interactive data eye glasses with bidirectional OLED microdisplay



Detailed image of nested display and camera matrix

Technical description

A bidirectional display is able to both reproduce and record images. This is made possible by a special pixel arrangement. A pixel therefore not only comprises 4 subpixels for image rendering (RGBW) but also a photo diode for light detection. This structure results in a pixel matrix consisting of two sub-matrices: a display matrix with a nested image sensor matrix.

The bidirectional microdisplay described here has a resolution of 800 x 600 pixels (SVGA). The data is provided to the display via a 24 Bit (R, G, B, 8 Bit each) parallel interface. The value of the white pixel can either be determined through an internal calculation or provided externally via an additional 8 Bit channel. Data synchronization is realized by additional signals: VS (vertical sync), HS (horizontal sync) and DE (data enable). The grayscale camera output (8 Bit) is realized over a similar parallel interface.

The microdisplay chip also has a two-wire-interface (TWI) for configuration. This interface is used to adjust the brightness of the display, the camera exposure time and the time sequence control of the camera and display. The microdisplay supports both the time sequential and parallel operation of OLED emission and image sensor detection.

A development system is available for evaluation to make it easier for users to adopt this new generation of bidirectional microdisplays. It allows to operate the microdisplay on a standard HDMI interface. The power supply and the image sensor data are provided over a standard USB3.0 interface.

Parameters	
Display resolution	800 × 600
Active area	12.8 mm × 9.6 mm
Display diagonal	0.6“
Pixel setup	RGBW + photo diode
Pixel pitch	16 µm × 16 µm
Color depth	24 Bit
Display interface	24 Bit RGB digital, parallel + synchronization signals CLK, HS, VS and DE
Display brightness	250 cd/m² (typ.)
Camera resolution	800 × 600
Camera interface	8 Bit grayscale digital, parallel + synchronization signals CLK, HS, VS and DE
Configuration interface	TWI (two-wire-interface)
I/O voltage	1.6 V … 5.5 V
Core voltage	1.6 V … 2.0 V
Temperature range	-20°C to +65°C
CMOS technology	0.18 µm