High-resolution, ultra-bright SXGA OLED microdisplays on high-voltage CMOS backplane

Augmented reality (AR) and virtual reality (VR) are becoming increasingly important in both our professional and private lives. The development of compact and powerful data glasses is progressing rapidly, with displays playing a central role. Commercial VR glasses often use smartphone displays or LCD and LCOS-based microdisplays, which are limited in terms of resolution and pixel density. OLED microdisplays offer a promising alternative, as they are energy-efficient and offer contrast ratios of over 100,000:1. Fraunhofer IPMS has extensive expertise in the development of custom-fit OLED microdisplays and is presenting a new generation that is specially optimized for AR and VR applications.

The SXGA microdisplay is characterized by high luminance and low power consumption (backplane without OLED below 150 mW). With a screen diagonal of 0.62 inches, an SXGA resolution of 1280 × 1024 pixels, and an impressive pixel density of 2,644 ppi (pixel pitch 9.6 µm), they are ideally suited for high-voltage OLED applications. In addition, a refresh rate of up to 120 Hz ensures smooth movements in the virtual world and minimizes motion sickness effects, which often occur with VR glasses.

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Technical data (see also table)

An innovative pixel cell design has been developed that enables a voltage swing of over 10 volts and is therefore capable of operating multiple stacked, upward-emitting OLED layers. Depending on the number of stacked units, the maximum emission can be multiplied, achieving high current efficiency while maintaining a constant current density. This approach enables full color maximum brightness levels of over 10,000 cd/m² while maintaining service life and reliability..
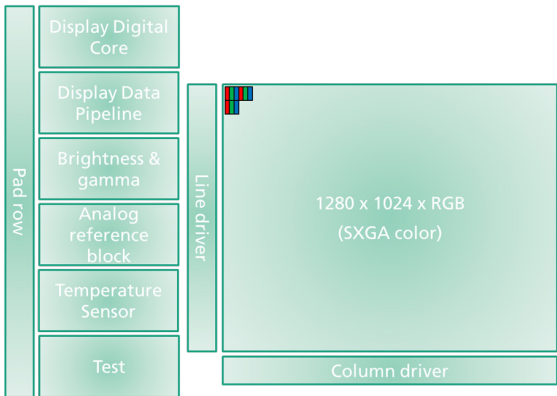
Block diagram

Parameters	Value
Nominal display resolution	1280 x 1024 (SXGA)
Total display resolution	1296 x 1040
Number of subpixels	4,04 Millionen
Active area	12.29 x 9.83 mm²
Chip size	15.457 mm x 12.030 mm
Screen diagonal	0.62''
Refresh rate	60 Hz, 75 Hz, 85 Hz, 120 Hz
Contrast ratio	> 100.000:1
Uniformity	> 95 %
Pixel setup	RGB-vertical-stripe
Pixel pitch (RGB)	9.6 µm x 9.6 µm
Pixel pitch (Subpixel x-direction)	3.2 µm
Pixel pitch (Subpixel y-direction)	9.6 µm
Color depth	24 bit 24 Bit RGB digital, parallel
Display interface	+ Synchronization signals CLK, VS, HS und DE
Display brightness	< 80knit (dependent on OLED)
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…-25 V (dependent on OLED)
Backplane type	common cathode
Temperature range	-40 °C … +65 °C
CMOS technology	0,18 µm
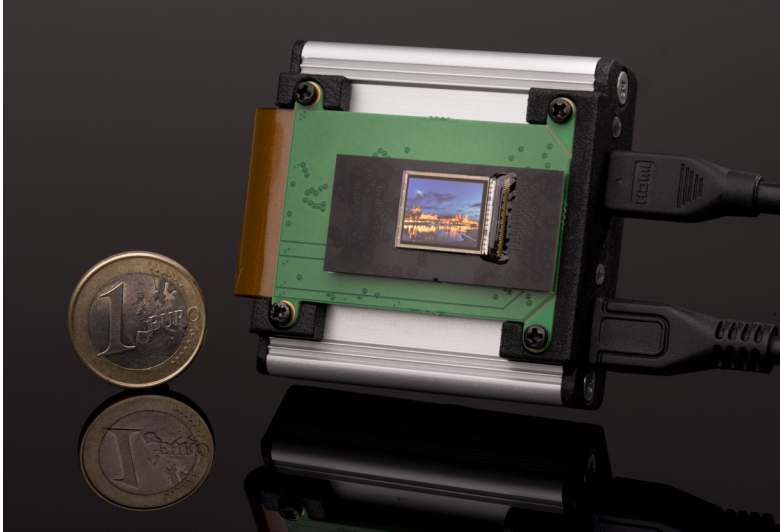
Evaluation Kits

Our evaluation kits contain an SXGA microdisplay with USB power supply and are controlled via HDMI. To simplify the configuration of the microdisplay, the evaluation kits include a simple GUI for Windows systems and technical documentation.

The following display variants are available:

MUCL1010
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Full-color display, 8-bit color depth per channel

MUAL1010 (high brightness)
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Monochrom, amber with
- HDMI driver electronics
- UDDC driver electronics (3G-SDI, LVDS, MIPI)