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1


2

3

1 *HMD prototype*
2 *Ultra-low power OLED microdisplay*
3 *Evaluation Kit*

ULTRA-LOW-POWER OLED MICRODISPLAY

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Battery-Saving Display for Various Applications

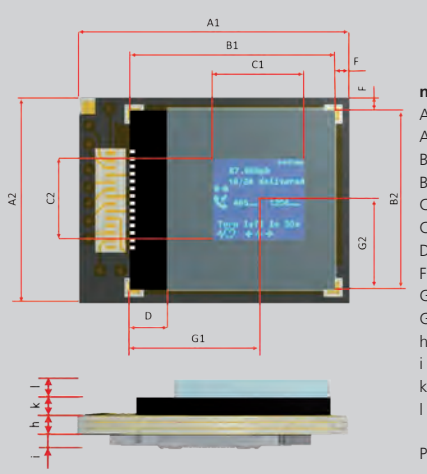
Data glasses and wearables nowadays are not just trend but also open up a wide range of applications in various sectors. As fitnesstrackers they monitor heart rate, pulse and other vital parameters or remind its user about necessary medications. In the industrial sector data glasses enable to support e.g. construction work by displaying additional information to the user, so that he is not forced to remove hands from work. In sports industry tiny displays could act as navigation systems by integrating them into the field of view or clothes. Joggers for example would no longer have to look to jiggling smartphone displays while moving.

Typically tiny microdisplays are used in data glasses to show moving video images. The problem: regardless of the image content large data volumes are transferred and processed by the system electronics and the microdisplay. This leads to a short battery runtime and a noticeable heat generation.

Moreover all necessary electronics including the battery are limitating the miniaturization of the entire system design.

In contrast to this a lot of applications focus much more on a long battery runtime and a slim and lightweight design rather than playing of HD-videos.

According to these special requirements Fraunhofer FEP has developed a novel microdisplay concept with an extremely low power consumption and simplified driving electronics.



name	metrics	description
A1	10.46 mm	PCB length
A2	7.93 mm	PCB width
B1	7.76 mm	Display length
B2	6.73 mm	Display width
C1	3.648 mm	Active area length
C2	3.072 mm	Active area width
D	1.5 mm	Spacing display – cover glass
F	600 µm	Spacing display – PCB
G1	4.62 mm	Position center active area X-axis
G2	3.38 mm	Position center active area Y-axis
h	0.8 mm	PCB thickness
i	0.85 mm	Max. height of components on backside
k	0.7 mm	Displaychip thickness
l	0.7 mm	Cover glass thickness

Production and placement tolerance:
- Chip placement: +/- 100 µm
- PCB dimensions +/-50 µm

4

5

Concept

Fraunhofer FEP has a long lasting experience in the development and manufacturing of OLED microdisplays.

These are based on the monolithic integration of organic light-emitting diodes on silicon CMOS-chips for the driving of the pixels. In contrast to modulating display technologies (LCD, LCOS, …) the self-emissive character of the OLED allows to drive only the pixels, which are intended to emit light. That paves the way for ultra low power displays with high contrast ratios of >10.000:1.

The basic idea for the reduction of the power consumption is the minimization of the necessary data transfer and – at the same time – the elimination of the normally needed refreshing cycles within the display.

Therefore the display pixels are equipped with static memory and arranged in a freely addressable matrix. Following this, only the areas of the image with changing content need to be refreshed.

The achievement is significant: Compared to microdisplays for video applications the typical power consumption of 200 mW could be reduced to 2–3 mW.

The data interface is realized by a SPI or IIC interface. In this way the realization of a minimalistic system with a simple microcontroller and without additional video sources or -processors is possible.

Technical Data

- Bright display image by OLED-technology
- Monochrome green, >1000 nits
  Further colors available on request
- Wide dimming range
- Data interface: SPI / IIC
- max. 30 fps (@refreshing of all pixels, significantly higher @ partial refreshing of image)
- Power consumption: ≈ 1–3 mW
- IO-voltage: 1.6 ... 5.5 V
- COB package 10.5 × 8 mm², other versions on request

Display Versions

UUGL1120
- 0.19" screen size
- 304 × 256 pixel, 12 µm pixel pitch
- 4 Bit grayscale
- Power supply:
  GND, Core 1.8 V, OLED cathode -5V

UUGL1220
- 0.16" screen size
- 304 × 128 pixel, 12 µm pixel pitch
- 4 Bit grayscale
- Power supply:
  GND, Core 1.8 V, OLED cathode -5V

UUGL1320
- 0.15" screen size
- 720 × 256 pixel, 5 µm pixel pitch
- 1 Bit grayscale
- Power supply:
  GND, Core 5 V, OLED cathode = GND

Our Offer

The OLED microdisplays of Fraunhofer FEP could be purchased for evaluation purposes. Therefore we offer different versions of Eval-Kits. The main component is the display (UUGL 1120, 1220 or 1320), which is chip-on-board assembled on a small PCB with a flat connector on the backside which can be lengthened to 10 cm by an included flex cable.

Eval-Kit 1
- Display on PCB, flex cable
- Breakout board
- Microcontroller eval-board
- Demo-software

Eval-Kit 2
- Display on PCB, flex cable
- Miniaturized driving unit
- Optics, case
- Demo-software

Fraunhofer FEP is ready to provide customer specific developments, prototyping and the manufacturing of small series.

Large volumes could be supplied commercially by an established manufacturing partner.

Management System ISO 9001:2015
TÜVRheinland ZERTIFIZIERT
www.tuv.com ID 9105050079

4 *Dimensions COB UUGL1120*

5 *Application scenario*

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