

LCOS

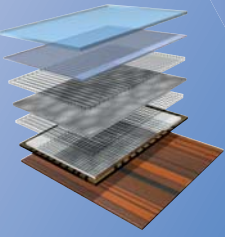
Microdisplay Technology



Pioneers in Photonic Technology

LCOS Microdisplays

LCOS (Liquid Crystal on Silicon) is a reflective microdisplay technology based on a silicon backplane. Using standard CMOS processes, microdisplays with extremely small pixels, high fill factor (pixel aperture ratio) and low fabrication costs can be realized.



LCOS microdisplays in consumer projection products typically have lifetimes >20,000 hours at operating temperatures of +10°C to + 70°C for the visible wave-band (420 - 700 nm). For single panel color projection a color field sequential (CFS) display addresses three monochromatic images corresponding to the primary colors (RGB) in a repetitive sequence and is illuminated by a triggered light source.

Applications

- ▶ Industrial Projection (Fringe/Pattern Projection - Metrology, 3D-Sensor, Rapid Prototyping, Lithography, IR-Projection)
- ▶ Industrial Imaging (Data-Displays, Medical, Simulation)
- ▶ HUDs and HMDs in automotive, airborne and defense industries
- ▶ High resolution NTE/EVF systems
- ▶ SLMs for R&D and phase applications

Microdisplays and drive ASICs

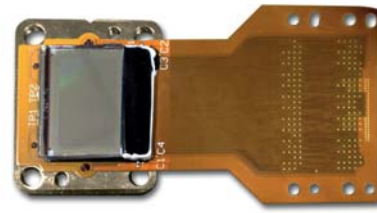
For the following LCOS microdisplays HOLOEYE offers drive ASICs and standard drive board solutions for evaluation. HOLOEYE also offers customized development of drive electronics, flex cables and display packages.

For the HED 6000 display series there are also driver solutions available based on Xilinx Zynq FPGAs.



4K Resolution - Monochrome

HED 7001 Microdisplay (4094 x 2464 Pixel) - 0.7"



Resolution:	4094 x 2464 Pixel
Device Diagonal:	0.7"
Display Mode:	VAN
Active Area:	15.32 x 9.22 mm
Aperture Ratio / Fill Factor:	90%
Pixel Pitch:	3.74 µm
Dynamic Range:	8 bit
Input Frame Rate:	24 Hz /4094 x 2464 Pixel) 30 Hz (3840 x 2160 Pixel)
Contrast Ratio:	>1000:1*
Reflectance:	65 % (typ.)

HDTV Resolution - Color

HED 4552 Microdisplay (1920 x 1080 Pixel) - 0.55" CFS



Resolution:	1920 x 1080 (HDTV)
Device Diagonal:	0.55"
Display Mode:	TN or VAN
Active Area:	12.5 x 7.1 mm
Aperture Ratio / Fill Factor:	93%
Pixel Pitch:	6.4 µm
Dynamic Range:	8 bit per color
Input Frame Rate:	60 Hz RGB /180 Hz monochrome**
Color Field Rate:	up to 720 Hz
Contrast Ratio:	>1000:1*
Reflectance:	70 % (typ.)

WXGA Resolution - Color

HED 2200 Microdisplay (1280 x 720 Pixel) - 0.26" CFS



Resolution:	1280 x 720 (WXGA)
Device Diagonal:	0.26"
Display Mode:	TN
Active Area:	5.83 x 3.24 mm
Aperture Ratio / Fill Factor:	>92%
Pixel Pitch:	4.5 µm
Dynamic Range:	8 bit per color
Input Frame Rate:	60 Hz RGB /180 Hz monochrome**
Color Field Rate:	300 Hz
Contrast Ratio:	>1000:1*
Reflectance:	67% (typ.)

HDTV Resolution - 6000 Display Series

For the HED 6000 series microdisplays (1920 x 1080 Pixel, 0.7") there are different panel and driver versions versions available.



The HED 6001 display is made for monochrome projection at the visible range and the HED 6001-NIR for monochrome projection at the IR range up to 1100 nm. The HED 6016 display version is intended for color projection. Standard driver solutions based on an ASIC or Xilinx Zynq FPGAs are available.

HED 6001 - Monochrome

HED 6001 Microdisplay (1920 x 1080 Pixel) - 0.7"

Resolution:	1920 x 1080 (HDTV)
Device Diagonal:	0.7"
Display Mode:	VAN
Active Area:	15.36 x 8.64 mm
Aperture Ratio / Fill Factor:	87% / 93%
Pixel Pitch:	8.0 µm
Dynamic Range:	8 bit (10 bit) grey level
Input Frame Rate:	60 Hz monochrome
Contrast Ratio:	>1000:1*
Reflectance:	65 % / 69% (typ.)

HED 6001-NIR - Monochrome for IR

HED 6001-NIR Microdisplay (1920 x 1080 Pixel) - 0.7"

Resolution:	1920 x 1080 (HDTV)
Device Diagonal:	0.7"
Display Mode:	VAN
Active Area:	15.36 x 8.64 mm
Aperture Ratio / Fill Factor:	93%
Pixel Pitch:	8.0 µm
Dynamic Range:	8 bit grey level
Input Frame Rate:	60 Hz monochrome
Contrast Ratio:	1000:1 (@ 1064 nm)
Reflectance:	78 % (@ 1064 nm)
Wavelength Range:	650 - 1100 nm

HED 6016 - Color Field Sequential

HED 6016 Microdisplay (1920 x 1080 Pixel) - 0.7" CFS

Resolution:	1920 x 1080 (HDTV)
Device Diagonal:	0.7"
Display Mode:	VAN
Active Area:	15.36 x 8.64 mm
Aperture Ratio / Fill Factor:	>93%
Pixel Pitch:	8.0 µm
Dynamic Range:	8 bit per color (spatial dithering)
Input Frame Rate:	60 Hz RGB / 180 Hz monochrome**
Color Field Rate:	up to 360 Hz
Contrast Ratio:	>1000:1*
Reflectance:	69 % (typ.)

HOLOEYE Services

HOLOEYE specializes in custom designs using LCOS to meet the requirements of industrial customers. We offer design, prototyping and manufacturing services.

- ▶ Custom microdisplays (LC design and packaging)
- ▶ Drive board design, firmware programming, drive sequence programming
- ▶ Prototyping and mechanical assembly
- ▶ Management of development projects
- ▶ Product qualification for speciality markets (e.g. medical, avionics, telecommunication)
- ▶ Application based test systems
- ▶ Secure supply for long life products (medical, telecommunication, avionics, defense)
- ▶ LCOS based optics design support for imaging and non-imaging applications

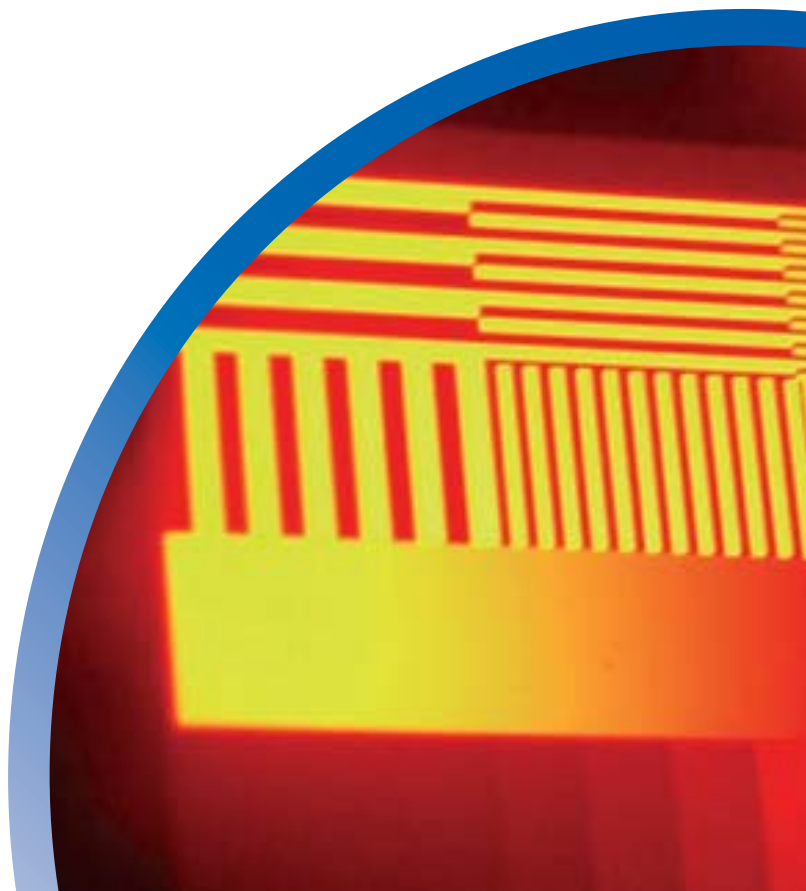
LCOS Phase Applications

HOLOEYE also successfully managed developments for phase modulation based LCOS products:

- ▶ Telecommunication (WDM, optical interconnection, switching)
- ▶ Holographic security systems, data storage
- ▶ Microscopy applications and interferometry
- ▶ Wave front sensing

*The TN LCOS devices show a contrast in CFS mode >1000:1 using compensators like trim retarders or QWP's, whereas in monochrome applications the sequential contrast could be above 3000:1, even higher with VAN-type LCOS in normally black mode also with compensator optics.

**Color field sequential displays can also be addressed with monochrome grayscale images using the RGB channels at 3 x 60 Hz -> 180 Hz.



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