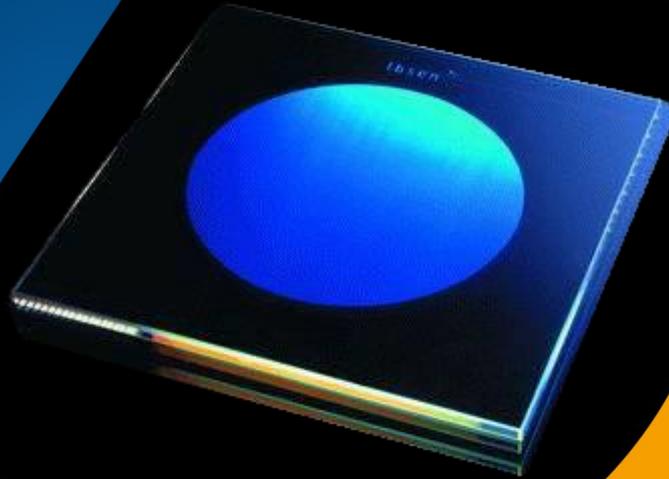


**Enabling volume manufacturing of gratings on semiconductor wafers and integrated optics with very low periods down to 260 nm, high accuracy and large grating areas**

**l b s e n**   
p h o t o n i c s

Holographically produced NFH Phase masks combined with a mask aligner provides volume manufacturing of very small grating periods. Ibsen's period accuracy of  $\pm 0.1$  Ångström and large grating areas further enhance customer manufacturing performance and yield.

Optional NFH services can kick-start process automation at customers, while clear on-mask identification leads to straightforward handling in manufacturing environment.



## **NFH Phase Mask**

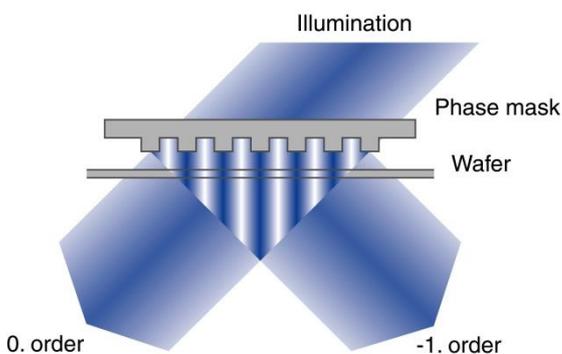
**0/-1 order principle**

# NFH Phase Mask

## 0/-1 order principle

Features
Holographically produced in 100% cleanroom environment
Very low periods down to 260 nm
Period accuracy and uniformity of +/- 0.01 nm
High fringe visibility
Low defect count
Clear on-mask identification

Applications
DFB lasers
DBR lasers
Integrated planar optics
Sensors
Biochips

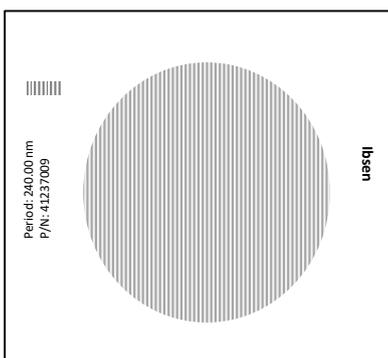


## The principle behind 0/-1 order Phase masks

The 0/-1 order Phase mask is optimized to diffract Bragg angle incident light equally into the zero and minus first orders. Self-interference between the two orders creates an interference pattern with a period equal to the

Phase mask period. When the criteria of sustainability (below) is fulfilled, the 0/-1 order Phase mask completely eliminates unwanted orders.

## Clear on-mask identification



Product Range and Specifications	
Grating periods	200 nm – 600 nm
Illumination wavelengths	193 nm – 1065 nm
Material	Fused Silica
Period accuracy	+/- 0.01 nm
Period uniformity	+/- 0.01 nm
Fringe visibility	>98%

## Options

- Custom specifications

Standard Grating and Substrate Sizes	
Grating size	Substrate size
Ø2"	3" x 3" x 2 mm
Customized	5" x 5" x 90 mil

# NFH Phase Mask

## 0/-1 order principle



### Criteria of sustainability

In order to ensure a high fringe visibility the zero order and minus first order – and only these two orders – must exist. This can be translated to a necessary relationship between Phase mask period  $\Lambda$  and illumination wavelength  $\lambda$ :

$$\frac{2}{3} \cdot \Lambda \leq \lambda \leq 2 \cdot \Lambda$$

Calculation of Bragg angle:  $\sin \theta_B = \lambda / (2 \cdot \Lambda)$

Specifications are subject to change without prior notice.