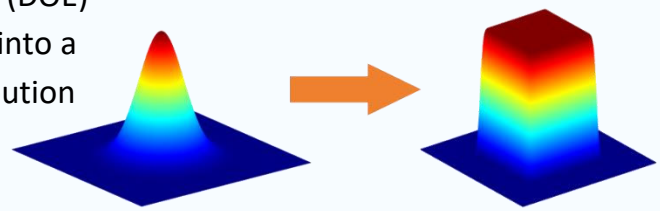
Beam Shaping

Beam Shaping Elements are diffractive optical elements (DOE) used to transform a nearly-Gaussian laser beam profile into a unique well-defined 2D shaped uniform intensity distribution and sharp edges in a specific work plane.



FEATURES

- Flat-Top output intensity profile
- Any desired shape including round, square, line, rectangle or custom
- High efficiency
- High-power threshold
- Wavelengths from UV to IR
- Optional AR/AR coating

APPLICATIONS

Material Processing applications:

- Laser cutting
- Laser Scribing
- Laser Ablation

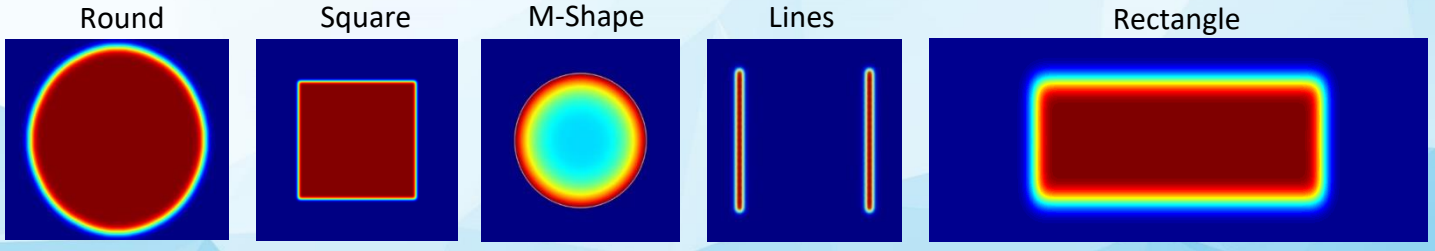
Illumination:

- Wafer inspection
- Lithography

DOEs can generate unique optical functions that are not possible by conventional reflective or refractive optical elements, providing greater flexibility in system configuration. Among the few advantages are: small footprint, fast/high throughput thanks to simultaneous processing, tailored energy distribution, etc. The operational principle is quite straightforward; from a collimated input beam, the output beams exit the DOE with a predesigned spot size and shape at a specific distance. Several examples are presented in Fig.1.

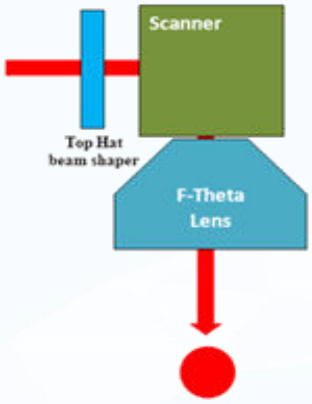
Beam Shaping a Gaussian beam into a flat profile provides higher quality of the process and enables more flexibility in the system configuration. For example, it allows system designers to increase laser pulse energy without increasing the processed spot area or line width.

Figure 1 Examples of Top-Hat Beam Shaping DOEs at the focal plane.



USE IN SCANNERS

1. To use a flat top beam shaper in a scanning setup, the optical designer needs to pay attention the following points:
   - 1.1. Use a collimated laser beam with DOE.
   - 1.2. Place the DOE before the scanning head
   - 1.3. Use a scanner lens (i.e. F-Theta lens) in order to achieve a well-focused spot at a certain distance, for all scanning angles, as shown in Fig.2.
   - 1.4. Make sure Scanner and F-theta aperture are at least 2.2 times beam diameter.
   - 1.5. Make sure the F-theta gives diffraction limited performance over the entire scan range.



2. Energy distribution can be any non-uniform distribution required by the application.

SPECIFICATION RANGE

Materials	Fused Silica, ZnSe
Wavelength range	193 nm to 10.6 um
Full angle	Large range of full angles
Doe design	2-level (binary) to 16-level
Diffraction efficiency	86% - 96%
Element size	Few mm to 100 mm
Coating (optional)	AR/AR coating
Custom design	Almost any size and intensity profile