

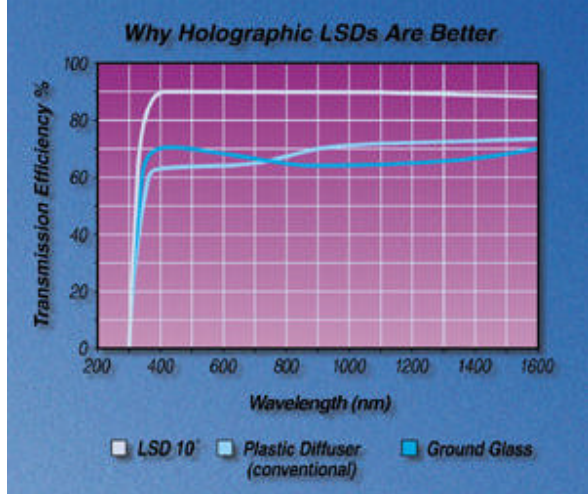
General Characteristics Of An LSD®

Holographic **Light Shaping Diffusers®** or LSD® are a holographically recorded, randomized surface structures which enables:

High Transmission Efficiency- 92 %

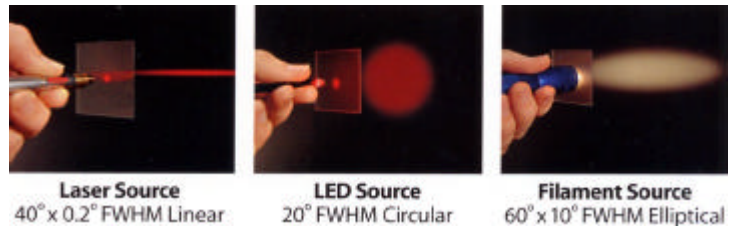
POC's holographic Light Shaping Diffusers offer superior optical transmission between 365 nm and 1600 nm. Depending on the angle of distribution, LSDs will achieve between 85% and 92% transmission efficiency. The low back-scatter of LSD structures are anti-reflective in nature and utilize light that would otherwise be wasted due to Fresnel loss.

A clear piece of polycarbonate substrate is 89% transmissive. With LSD, transmission improves to 92%. Note: POC measures transmission utilizing an integrated sphere with the LSD structure incident to the light source. Listed are the transmission efficiencies of a 10° LSD measured at the following wavelengths: 532 nm-90%, 632 nm-90%, 850 nm-89%, 980 nm-89%, 1064 nm-89%, 1550 nm-88%.



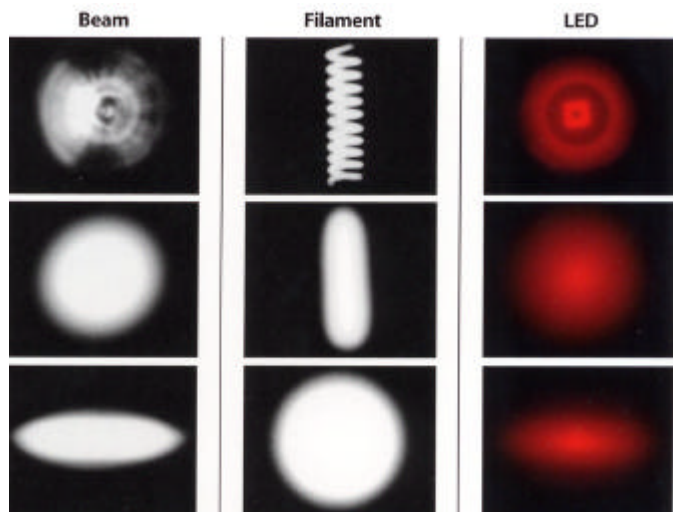
Beam Shaping

LSDs precisely shape, control and distribute light. The patented holographic master recording process, allow a variety of circular or elliptical light patterns. Standard circular angles range from 0.5° to 80° FWHM. A wide variety of standard elliptical angles are available from 0.2° x 10° to 95° x 35°. Contact POC for custom angles.



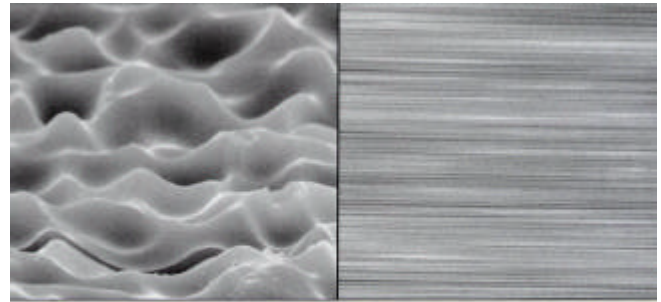
Homogenized Light

"Hotspots" and uneven light distribution are common problems with filament, arch, LED, CCFL, fiberoptic and laser light sources. LSDs greatly smooth and homogenize sources while providing uniform light in critical applications such as LCD backlights, LED displays, machine vision, automotive lighting and viewing screens. The energy distribution from an LSD closely approximates a "flat top" distribution. Large angle LSDs produce the greatest degree of homogenized light.



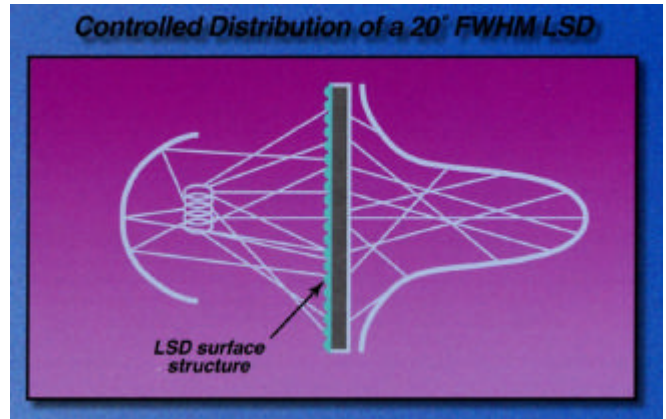
How Holographic LSD®s Work

- LSD surface relief holograms are replicated from a holographically recorded master.
- The completely random, non-periodic structures can be thought of as randomized micro lenslets.
- LSDs are non-wavelength dependent and will work in white, monochromatic, coherent or incoherent light.
- LSDs diverge light, emulating a negative lens.
- LSDs work best in collimated light but will work well in non-collimated light.
- The randomized structures eliminate Moiré and color diffraction.
- Incoming light is precisely controlled within well defined areas. Light does not escape these boundaries for greater control and utilization of light, thus maximizing photon utilization.
- LSDs provide greater photon density, as compared to other diffusers, making LSDs very suitable for high ambient or highly efficient light conditions.

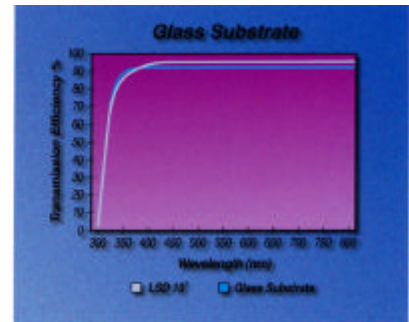
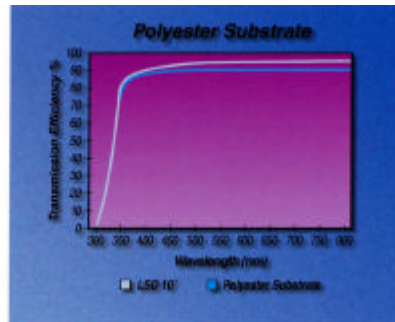
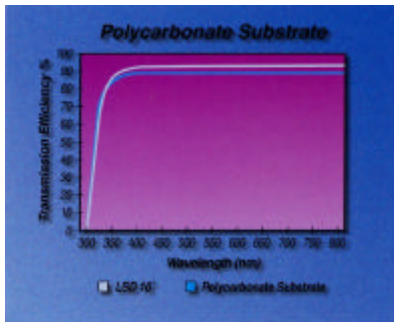


60° LSD
SEM Structure 1500x

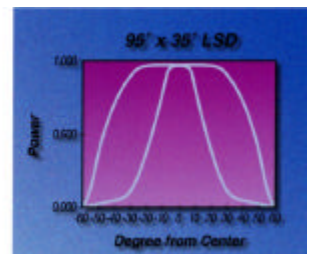
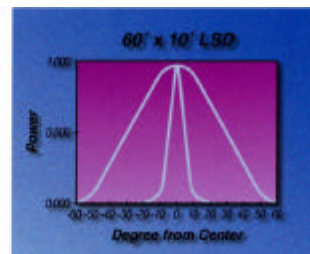
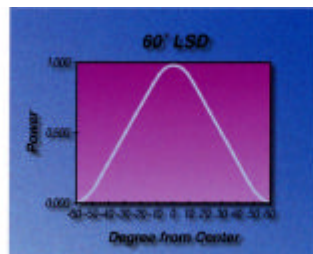
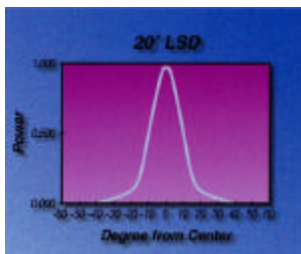
0.2° x 40° LSD
SEM Structure 75x



LSD Transmission Plots



LSD Transmission Plots



Holographic Light Shaping Diffusers®

What You Need To Know

1. All LSD angles are FWHM.
2. Large angle LSDs when placed at the image plan make excellent high resolution viewing screens.
3. LSDs can be combined with polarizers, the holographic surface structure does not affect polarization.
4. LSD can be combined with other optical components such as lenses, Fresnels, and prismatic material.
5. In selecting LSD angles, location and light sources must be considered. Call for assistance.
6. Effective angular output $\approx \sqrt{(\text{light source angle})^2 + (\text{LSD angle})^2}$

Mass Production



Mass Production

LSD Angle Range FWHM	Circular: 0.2° to 80° Elliptical: minor 0.2° to 60° major: 10° to 95°	Humidity	95% ± 5% RH @ 24 hrs
Transmission Efficiency	Circular (0.5° to 20°) ≥ 90% Circular (20° to 80°) ≥ 85% Elliptical ≥ 85%	Refractive Index	PC=1.586; PE=1.640; AC=1.494; Epoxy=1.586
Angle Tolerance	≤ 10° ± 1° > 10° ± 10%	Pencil Hardness	>6H
Transmission Spectral Range	365nm to 1600nm	Yellow Index	0.3% glass exposure (600 hrs) 2.6% direct exposure (600 hrs)
Brightness Uniformity	≥ 85%	Adhesion	100%-Crosshatched adhesion test ASTM-D3359
Cosmetic Defects	Not to exceed 100 µm	Laser Damage	GL=8.1 J/cm²; PC=0.22 J/cm²; PE=0.2 J/cm²; AC=0.17 J/cm² @ 1064 nm, 10 ns pulse
Temperature Range	-30°C to 100°C @ 240 hrs	Solvent Resistance	LSD surfaces are resistant to acetone, methanol, MEK, Windex®, gasoline, methylene chloride and chlorine bleach
		Cleaning Procedure	DI water rinse followed by forced air drying, wipe gently with lens paper soaked with methanol, followed with forced clean air or nitrogen drying.

Note: Data and properties shown may vary with application

LSD Applications

- LCD Backlighting
- LED Display
- Machine Vision
- Front Projection Screens
- Rear Projection Screen
- Workstation Screens
- Projection Systems
- PMLCD Reflectors
- Automotive Lighting
- Barcode Scanner
- Optical Sensors
- Inspection Systems
- Flashlight Illumination
- Microscope Illumination
- Fiberoptic Illumination
- Medical instrumentation
- GPS Units
- Architectural Lighting
- Exit Signs & Displays

POC Holographic/Optical Products

- LSD® Beam Shaping
- LSD® Homogenizer
- DDS™ Digital Display Screen
- LORST™ Lights On Reflection Screen
- CTR™ Circle To Rectangle
- DTF™ Directional Turning Film
- LCD Backlights
- Optical Ray Tracing & Design
- Variable Angle Diffusers
- LSD® Combinations: Lenses, Fresnel, Prismatic Film, Polarizer
- Holographic Light Guide