

# Laser Scribing and Cutting Specifications

Commonwealth Microtechnologies has an in-house CO<sub>2</sub> Laser for cutting and scribing various materials. The most common materials include, but are not limited to, ceramic (alumina) and assorted glasses and plastics. Our laser system is one of the fastest and most accurate in the industry, helping us to minimize production time and costs. With our custom CAD/CAM software we are able (in most cases) to see that a customer receives a sample of their required substrate the one business day after we receive their drawing. Our engineering staff is experienced with the many issues surrounding layout and design of a laser machined substrate and is willing to work with the customer to achieve the desired result.

Listed below, are several tolerances and preferences concerning our laser capabilities. Many of these are standard preferences and can be adjusted to fit the customer's needs and are no limitations...just suggestions. Feel free to contact our staff with any questions: [info@commonwelathmicro.com](mailto:info@commonwelathmicro.com).

## Typical Laser Tolerances Based on Substrate Thickness

Nominal Substrate Thickness (A)	Laser Pulse Depth (B)	Laser Pulse Spacing (Center to Center) (C)	Hole Diameter Tolerance (Exit Dia) (E)	Hole Taper (Entry Dia-Exit Dia) / 2 (F)
0.010" (0.254 mm)	0.004" (0.10 mm)	0.005" (0.127 mm)	± 0.002" (0.051 mm)	≤ 0.003" (0.076 mm)
0.015" (0.381mm)	0.006" (0.15 mm)	0.006" (0.152 mm)	± 0.002" (0.051 mm)	≤ 0.003" (0.076 mm)
0.020" (0.508 mm)	0.008" (0.20 mm)	0.006" (0.152 mm)	± 0.002" (0.051 mm)	≤ 0.0040" (0.101 mm)
0.025" (0.635 mm)	0.012" (0.30 mm)	0.006" (0.152 mm)	± 0.002" (0.051 mm)	≤ 0.0040" (0.101 mm)
0.030" (0.762 mm)	0.014" (0.35 mm)	0.006" (0.152 mm)	± 0.002" (0.051 mm)	≤ 0.0040" (0.101 mm)
0.035" (0.889 mm)	0.016" (0.41 mm)	0.006" (0.152 mm)	± 0.002" (0.051 mm)	≤ 0.0040" (0.101 mm)
0.040" (1.016 mm)	0.018" (0.46 mm)	0.006" (0.152 mm)	± 0.003" (0.076 mm)	≤ 0.0040" (0.101 mm)
0.050" (1.270 mm)	0.025" (0.63 mm)	0.007" (0.178 mm)	± 0.003" (0.076 mm)	≤ 0.0050" (0.127 mm)
0.060" (1.524 mm)	0.030" (0.76 mm)	0.007" (0.178 mm)	± 0.003" (0.076 mm)	≤ 0.0050" (0.127 mm)

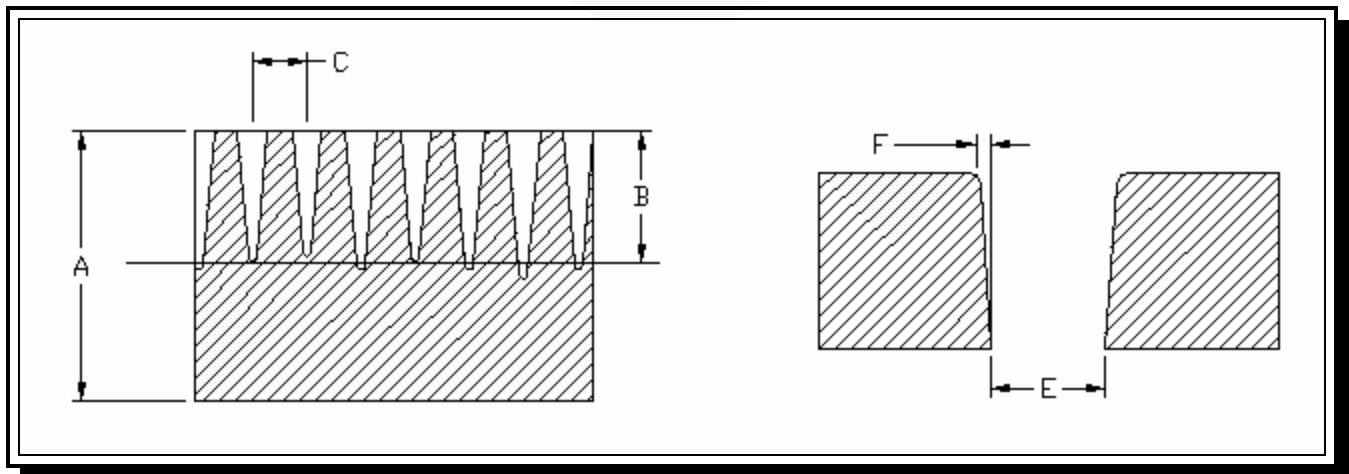


Figure 1: Cross Sections of Laser Scribe Line (left) and Laser Cut (Right)

## Laser Dimension Tolerances Not Based on Substrate Thickness

- F. Feature Location tolerance (center to center or edge to edge)..... $\pm 0.002''$
- G. Feature Location tolerance (From As Fired Edge)..... $\pm 0.003''$
- H. Kerf Width (Measured at Exit Side)..... $0.004'' \pm 0.001''$
- I. Minimum Cut/Slot Width (Due to Kerf Width)..... $0.004'' \pm 0.001''$
- J. Minimum Inside Cut Radius (Due to Kerf Width)..... $0.002''$
- K. Minimum Gap between Cut Features and/or Substrate Edge..... $> \text{Substrate Thickness}$

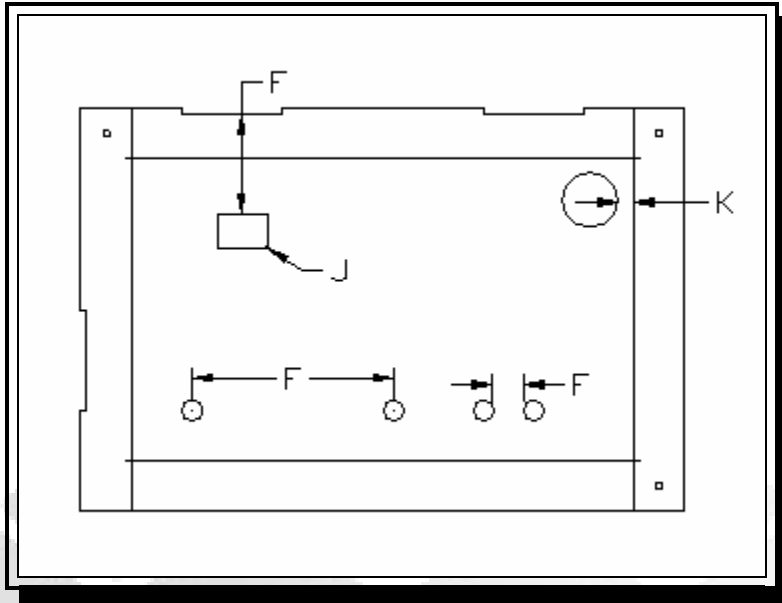


Figure 2: Examples of Typical Substrate Feature

## **Ceramic Substrate Layout Design Considerations**

- Scribe lines that are too close to a through cut can cause the substrate to break away from the intended scribe line.
- When an array has interstitial scrap strips, avoid widths smaller than  $0.10''$ , as they are difficult to remove when singulating.
- A border of scrap material is recommended for easy handling. This border also provides a good location for part identification.
- Adding registration flats utilizing a cut rather than a scribed edge should be used whenever possible, since the cut provides a much more reliable edge to reference from.
- A chamfer on one corner of the substrate helps to ensure proper orientation.
- Always specify internal corner radii as opposed to sharp  $90^\circ$  corners to prevent micro-cracking that can lead to further fracturing.
- Add alignment holes to the substrate. Laser cut holes are better for aligning the print to the ceramic and for front-to-back alignment. A square hole with a square printed around it helps an operator to recognize a theta alignment error in the print while examining a part under magnification.