



NCF MASK WRITING DESIGN RULES

A guide to help in the design and ordering of masks from CNSI's NCF



Photomask Capabilities



- The NCF offers the following masks as stock.
 - 3-5 inch .090" soda lime
 - 5 inch .090" quartz for 5x GCA
- Many other plate sizes are available but lead time is typically 2 weeks for custom plates.



Data Formats



- gdsii, dxf, gerber and cif are accepted.
- Save dxf as version <2008 if possible to avoid issues with three dimensional polygons.
- GDS specification does not include text so text must be drawn or converted to closed polygons.
- Dxf standard text is supported.
- Dxf can only include the following shapes: polygons (closed), circle. Lines are not supported, rectangles are drawn as closed polygons and are ok.
- See appendix for complete design rules.



Additional dxf Rules



1. Do not name any layers “main”.
2. Use a 100% AutoCAD compatible editor.
 - Try to load the file to AutoCAD itself and make sure, the file can be loaded.
3. Always join polylines correctly, be especially cautious, when using arcs within a polyline.
4. Only one font is provided with the dxf conversion package.
 - The dxf standard font will replace any font selected in the DXF-design.
5. Only the following attributes assigned to a text are supported: ROTATION, MIRRORING, SCALING.
6. Avoid placing structures in layer 0.



Additional dxf Rules (cont.)



7. Do not use special characters in the layer names.
8. Try to design by means of the metric system.
 - Use millimeters (mm) as the standard unit (Some design programs will not accept inches!)
9. Polylines with widths must not have a change in its widths (tapered lines).
10. Various scaling in x and y when inserting a block is not supported.
11. External blocks are not supported.
12. Try to use only the following entities: CIRCLE, POLYLINE (with or without width), and TEXT.



Mask Polarity



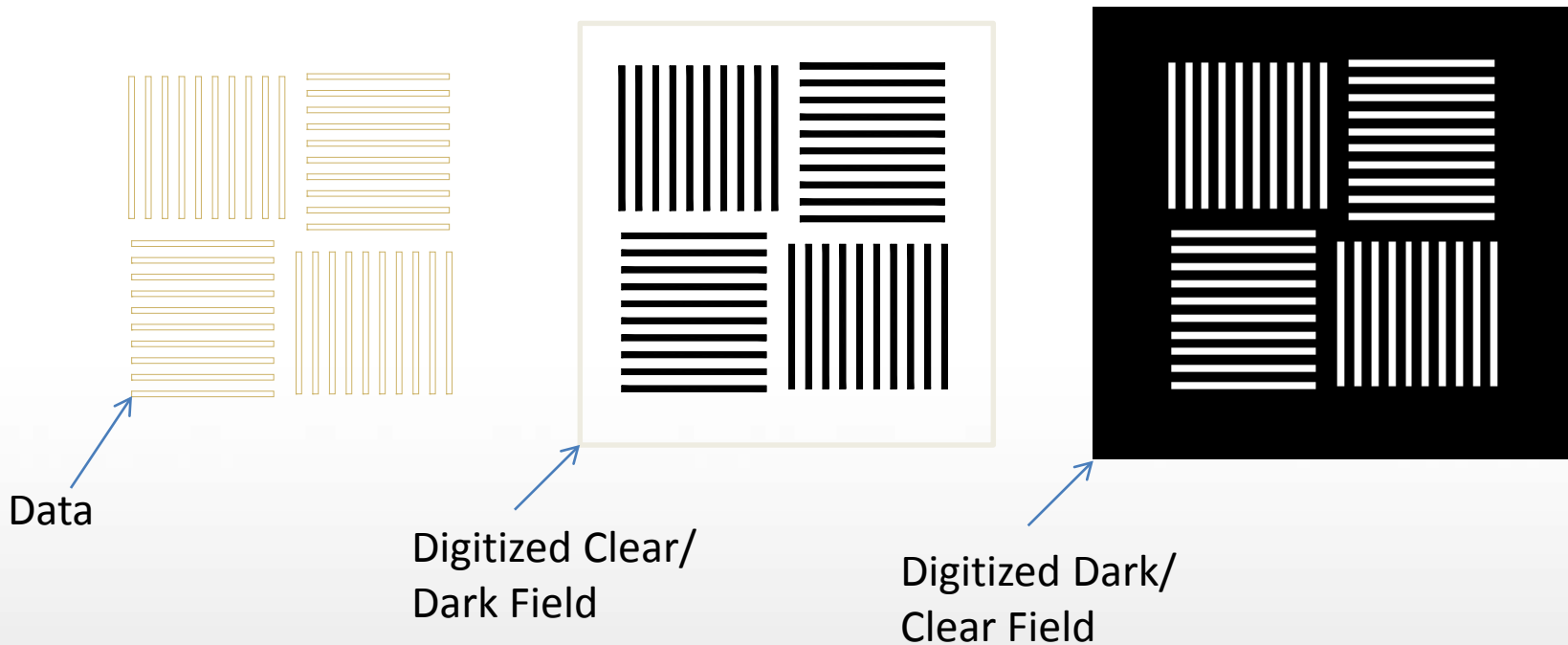
- “Digitized data” refers to the drawn areas – i.e. “closed polygons”
- Digitized clear \Leftrightarrow Dark Field mask
 - The data is clear and the field is dark (chrome)
- Digitized dark \Leftrightarrow Clear Field mask
 - The data is dark (chrome) and the field is clear
- Field is always outermost area and is important for Boolean operations such as XOR
- Job Previews are ALWAYS shown as follows:
 - Black is written area and clear/transparent on mask
 - White is chrome



Polarity Examples



- For consistency – examples are shown as job previews with black as clear and white as chrome





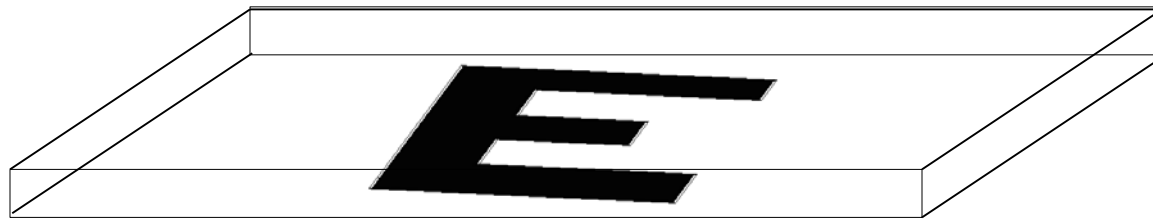
Orientation



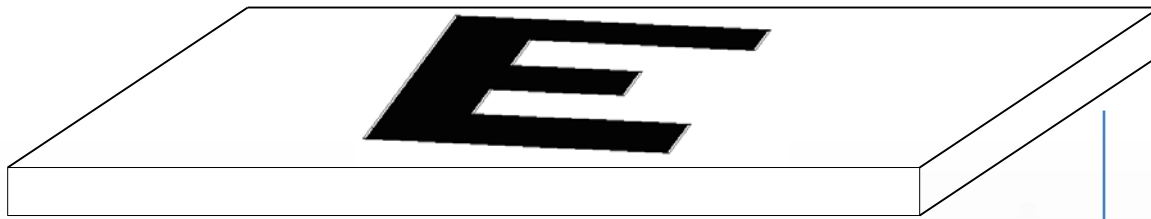
- Chrome Down is the orientation for most UCSB aligners with the only exception being backside alignment.
- Right Reading Chrome Down results in the drawing reading as drawn on the wafer.
- Right Reading Chrome Up – results in a mirror image on the wafer – typically for backside patterning



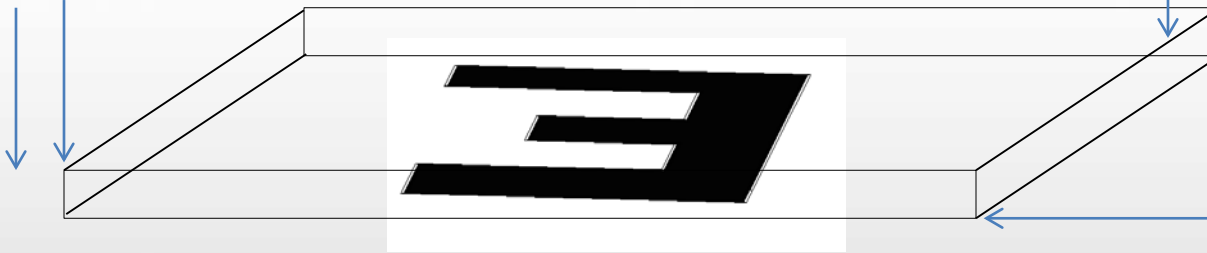
Orientation Examples



Right Reading
Chrome Down



Right Reading
Chrome Up

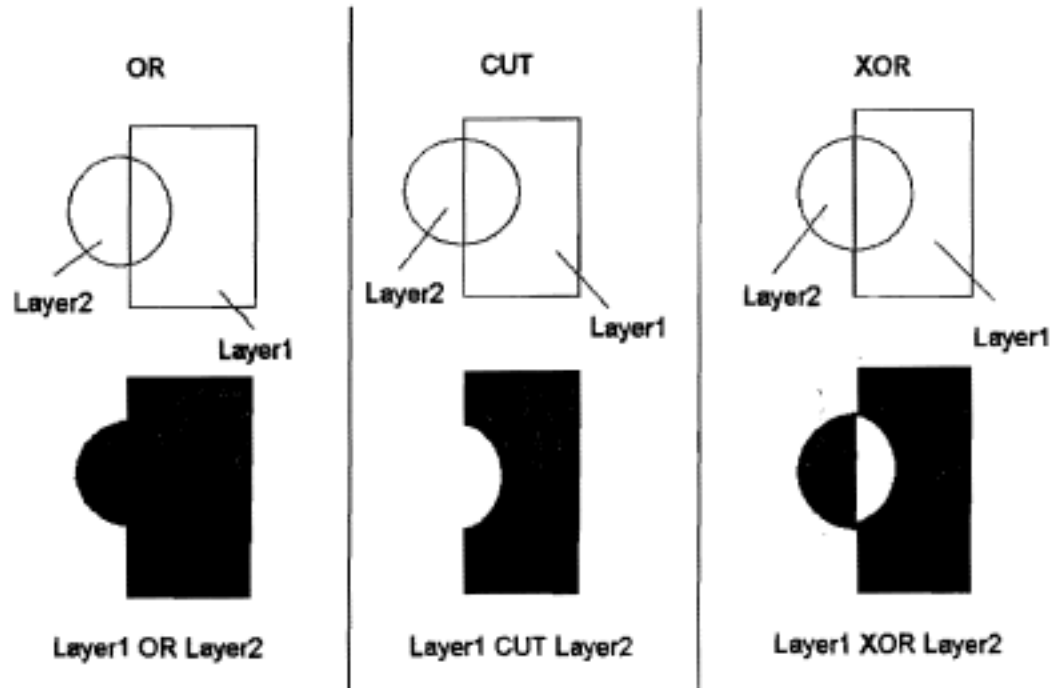


Becomes

Mirrored when
Used.



Boolean Operation Examples

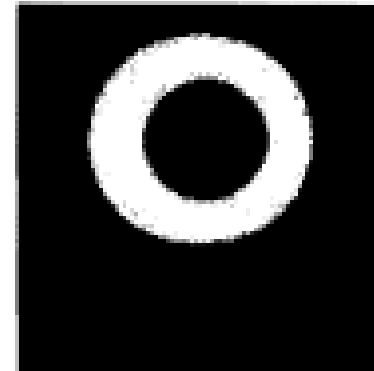
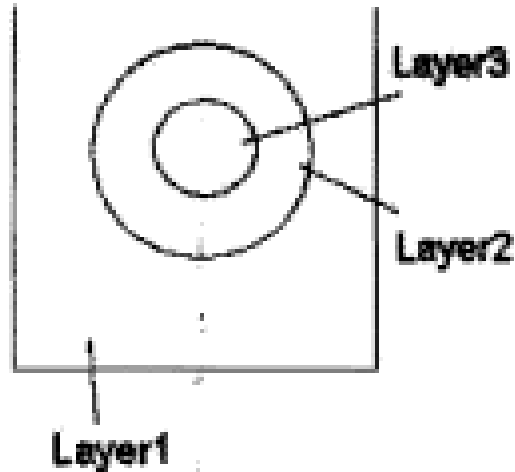


- **OR** results in a true merging of the structures,
- **CUT** subtracts the a layer from the previous layer,
- **XOR** leads to a cutting only in the overlap region, while elsewhere both structures remain intact.

Only the **CUT** operation is dependent on the order of operation.



Boolean Operation Examples Cont.



Layer1 CUT Layer2 XOR Layer3
or
Layer1 XOR Layer2 XOR Layer3

In this example, the desired result can even be obtained by two different combinations of operations, as the XOR and the CUT operation are identical when the second structure is completely within the first one.