# Specifications for mask ordering from Compugraphics

When ordering photo masks one must specify the polarity and orientation in respect to the location of the chromium on the mask to get the desired result after a lithographic step. The description of how the mask should be fabricated is especially important in cases of dual-sided designs, one pattern must then be mirrored to the other to make sense. The mirroring is easier to specify in the mask fabrication specifications than in the design layout file. When ordering masks it is important to specify the polarity so it matches the manufacturer jargon.

**Orientation:** Chrome down (CD) and right reading (RR) will transfer the mask to the wafer as you have drawn it in the layout file, so letters and numbers is readable on the wafer as well when looking through the mask plate with the chromium downwards. Chrome up (CU) and wrong reading (WR) will give the same result because one always have chrome down towards the wafer when exposing. For simplicity, we always specify the reading with the chromium down.

**Polarity:** at Compugraphics a drawn structure eg a closed polygon ordered as dark field will result in a glass plate with chromium in the drawn closed structure. If one order the same pattern as clear field or bright field, the drawn pattern will be transparent in the final mask. On figure 1 this is illustrated.

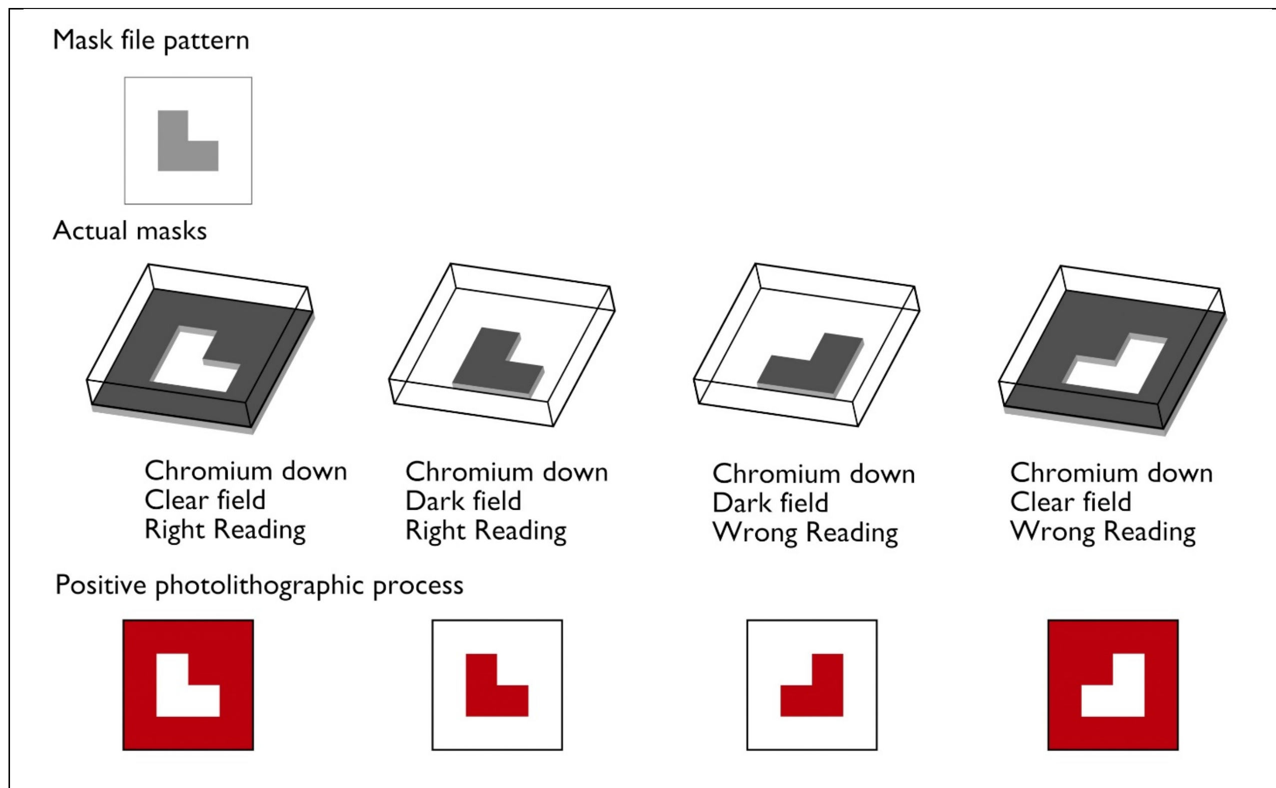


*Figure 1: Explanation of the mask polarity and orientation attributes for mask ordering. The mask file pattern is drawn in CleWin or L-Edit and the actual mask depends on the specified polarity (clear or dark) and the orientation ("right reading" or "wrong reading"). Note that chrome down/right reading is the same as chrome up/wrong reading and can be used depending on what is most convenient.*

To visualize why the orientation is a useful tool, have a look at figure 2. Here is shown a simplistic design where one mask is supposed to be used on the back of the wafer and the other on the front side (a) well aligned to one another. In figure 2(b) the masks are shown as one would like them, notice that the reading is different but the orientation of the chrome is the same. The alternative is to draw one of the masks mirrored, but that is very tiresome and prone to generate errors.

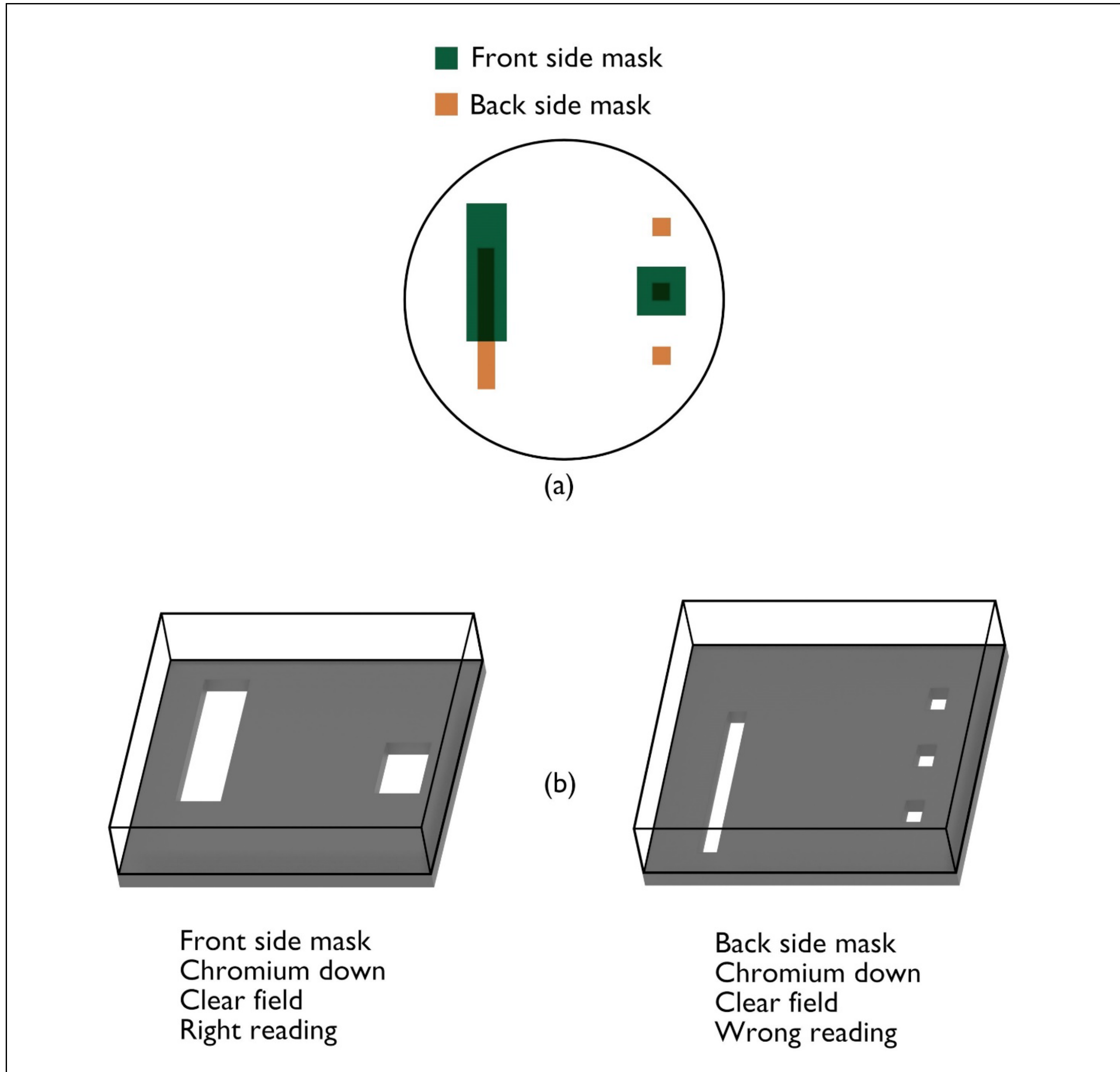


*Figure 2: Why reading becomes important for dual sided mask sets. A simplified mask set is shown in (a). Here there is a front side and a back side mask, which each has their own color, with the overlapping structures having a third color. One correct way of reproducing this mask layout as photomasks is shown in (b).*

**A complete specification for a 5” mask must include following information:**

**Common for all layers in the design:**

All Layers:

5" chromium mask

Fracture limits ((-50000, -50000),(50000, 50000))

Dark periphery

Chromium down

Filename: write the name of the cif or gds file with the design (eq. Microneedles_v1.gds)

Top cell: state the mask level that you want to fabricate (usually Wafer or MainSymbol)

**For each layer (mask) in the design one must specify:**

Layer: unique name or number for each layer in the design (for GDS files, one must specify a unique GDS number for each layer in the design file as well)

Mask Type: state which polarity (Dark Field / Clear field) and orientation (Right reading / Wrong reading) the mask should have

Text: write a text of max 30 characters for identifying the mask. The text will be written at the edge of the mask, outside the wafer area, could for instance be: init-2019-Nitride-etch

**Template files for 5” and 7” mask can be found on Inside.**