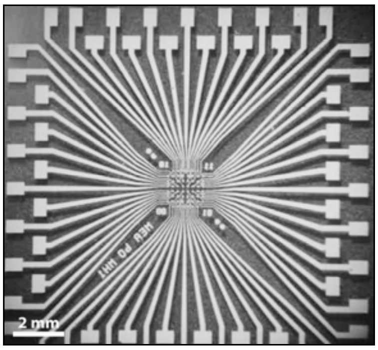
# GCM 3060

**Conductive** SU8-negative tone photo-epoxy
For thin layers

## Technical Datasheet



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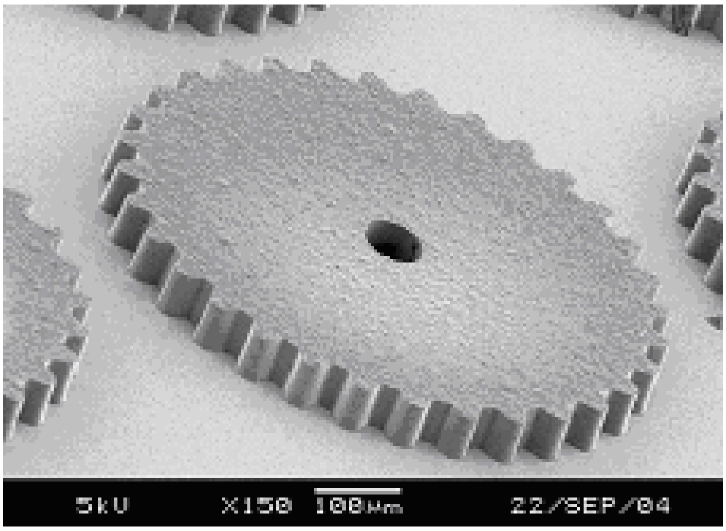
## General information

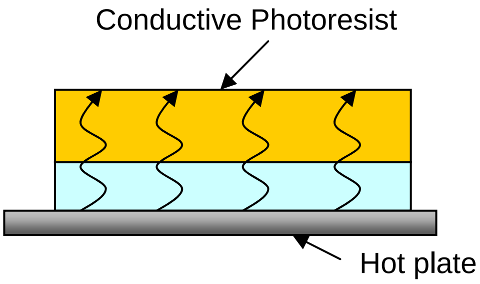


SU-8 is an epoxy based, chemically amplified resist system with excellent sensitivity and high aspect ratios. The primary applications are Micro-fabricated mechanical structures (MEMS) and other Microsystems needed non conductive properties.

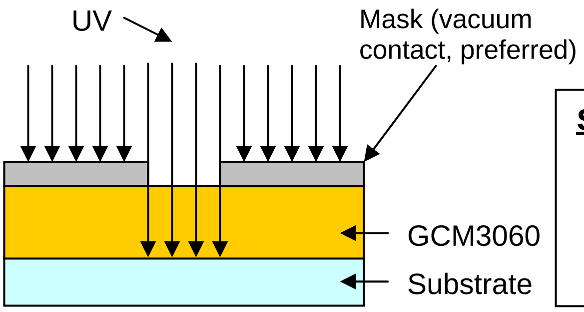
Adding metallic particles in the SU-8 photoresist results in an enhancement of its electrical conductivity. GCM 3060 offers an electrical conductivity of about $10^{1-3}$ S.cm$^{-2}$

### *Datasheet parts…*

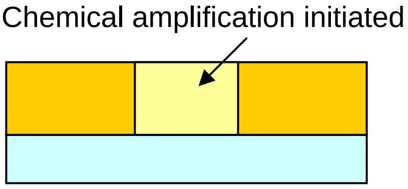
# 1 / Schematics of the process



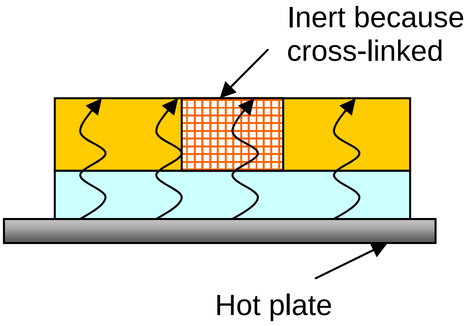
**Step 1:**
- Spread the conductive photoresist
- Pre Bake to evaporate solvent (GBL)



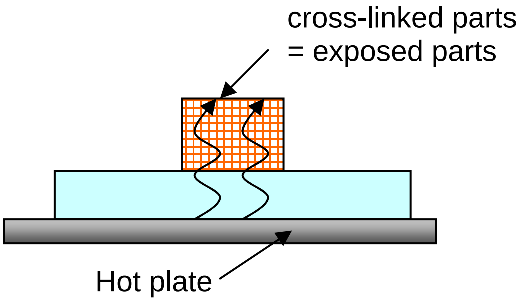
**Step 2:**
- Exposure in front side if the film **thickness is less than 5 µm.**
- The back side mode is recommended by using UV transparent substrate



**Result of Step 1:** exposure has only initiated chemical amplification, but this process is really slow at room temperature, and so need a PEB or Post Exposure Bake.



**Step 3:** exposure has only initiated chemical amplification, but this process is really slow at room temperature, and so need a PEB or Post Exposure Bake.



**Step 4:**
- Development with PGMEA + Rinse with Isopropanol
- Possible Hard Bake to improve from 1 decade the electrical conductivity

## 2 / Process description

### A typical process consists of

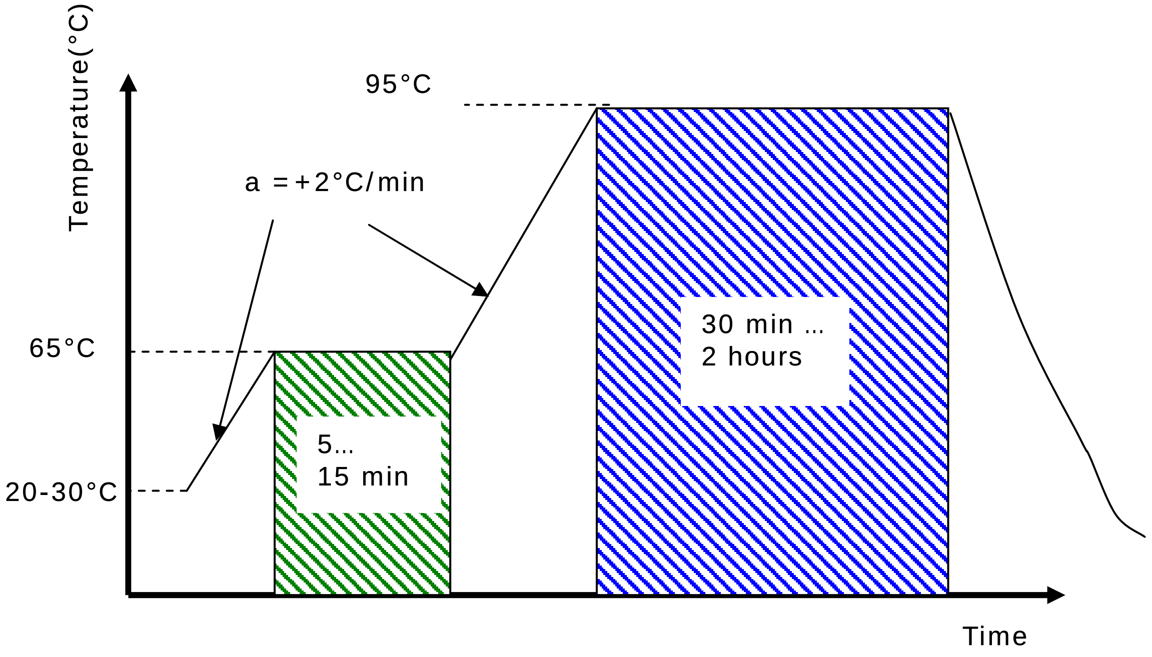
- Substrate preparation
- Spin-coating
- Relaxation time to improve the surface uniformity
- Soft Bake
- Exposure to initiate the cross-linking
- Post Exposure bake (PEB), to cross link exposed regions.
- Development
- Rinse & dry
- Hard Bake (or curing-optional)
- Imaged material (optional: in case of moulding)
- Remove (optional: in case of moulding)

(in chronological order)

- ❑ Put the **substrate** on a furnace / oven at a minimum of 130 °C for 20 minutes to remove adsorbed water from the substrates surface.
  Alternatively use oxygen plasma for 7min at 500 Watts in a Microwave plasma reactor. This should increase the temperature inside the plasma chamber above 80°C after the 2 firsts minutes.

- ❑ **Spread** the resist after cooling down the substrates, with a scrapper or by using screen printing method.

- ❑ **Softbake** the coated substrate in two steps. All the temperature ramps should be about 2°C/min. Firstly increase the temperature from room temperature up to 65°C. Then let the substrates at 65°C from 5 to 15min (depend on the resist thickness). You can then increase up to 95°C where you should let your wafers as much time as necessary that, when holding them with some tweezers there are not printed on the SU8 layer! Then you can switch off the power or decrease temperature until they reach the room temperature.



- **Expose** the coated substrate with the mask in front side mode for very thin films (less than 5 µm). Back side mode is preferentially recommended with the use of an integrated mask between the substrate and the conductive photoresist.
  The exposure dose ranges between 400 and 600 mJ.cm$^{-2}$, depending on the structure geometry and thickness. More the dose is, more the lateral resolution will be affected.

  Note: Exposure doses refer to i-line (365nm). A standard mask aligner with a 250W Hg light source has approx. 6-15 mW/cm$^2$ i-line intensity, while in many cases 20-30 mW/cm$^2$ are measured meeting the total (g-, h- and i-line) intensity!

  *Ideally* you should try some multiple exposure around the given exposure dose given in Exposure curve. In fact your results may not be exactly the same because of the UV lamp parameters. So they have to optimise this exposure dose parameter, simply because your mask aligner is probably not the same.

- **Post Exposure Bake (PEB):** after the delay bake the coated substrate at the same temperature profile than for the Soft Bake. (Because this step is very temperature critical furnace baking is not recommended).
  This step accelerates the cross-linking of the exposed areas making them insoluble in the developer.

- **Develop** in PGMEA. When the structure is through-developed (cleared), add another 10% of the time in a cleaned bath of the total development time to finalize the side wall profile.

  **Rinse** with Isopropanol. Once there is not any more white traces the development is then finished. Unfortunately, if you add even more than a minute, you would increase the composite layer that should unstuck from the substrate.

  **Dry** the wafers just letting them at the ambient air, on a wet bench with an appropriate air flow (exhaust).

- **Hard-bake:** use the same temperature profile than for the Soft Bake, with a final temperature of 120 °C. The electrical conductivity will be enhanced by one decade.

# 3 / Processing GCM3060 - Overview

| | |
|---|---|
| **1 / Substrate preparation** | Oxygen plasma at 500 W for 7 min (for some cleaned wafers yet) |
| **2 / Spread** | With a scrapper or by screen printing |
| **Resist thickness (µm)** | Up to 10 µm in back side mode |
| **3 / Pre-bake or Soft-bake** | Temperature ramps…<br>- 20-35°C to 65°C at 2°C/min<br>- Stay at 65°C for 5…15min<br>- Go from 65°C to 95°C at 2°C/min<br>- Stay at 95°C for 30 min…2 hours<br>- Decrease up to room temp. (about 2°C/min)<br>Time dependent on resist thickness and substrate shape. |
| **4 / Exposure Broadband or g, h, i (mJ/cm$^2$)** | i-line (365 nm) exposure dose |
| **Typical Exposure dose* (mJ/cm$^2$)** | 400 … 600<br>Dose dependent on resist thickness and substrate shape |
| **5 / Post Bake Time (Hot plate Temperature)** | Temperature ramps…<br>- 20-35°C to 65°C at 2°C/min<br>- Stay at 65°C for 5…15min<br>- Go from 65°C to 95°C at 2°C/min<br>- Stay at 95°C for 30 min…2 hours<br>- Decrease up to room temp. (about 2°C/min) |
| **6 / Developer** | - PGMEA, used in baths with time of 1min…5min<br>Time dependent on resist thickness and substrate shape.<br>- + Isopropanol to clean<br>- Evaporation of Isopropanol at the ambient air |
| **7 / Hard Bake (optional)** | 120°C in an oven for 2 hours<br>ramps should be…<br>- relatively progressive to go up to 120°C: about 10 min<br>- about 3 hours to decrease up to room temperature. |

* i-line (365 nm) exposure dose. A standard mask aligner with a 350W Hg source has approx. 6-15 mW/cm2 i-line intensity, in many cases 20-30 mW are measured meeting the total (g-, h- and i-line) intensity!

All our test have been done with a MA6 mask aligner from Karl Suss with a 250W Hg lamp and, with intensity of 10.0 mW at the wafer emplacement.

# 4 / Troubleshooting

- **White traces after development**: This is only because there is still some unexposed SU8 not totally developed. In fact unexposed SU8+Isopropanol makes a white complex that you can find on your wafers.
  In the other side, just pay attention to not develop to much time. Otherwise you could unstuck the composite layer from the substrate.