Process flow title:	**Pt100 Thin-Film RTD Process**	**Revision:**	**Rev 0.1**
Contact email:	jephin@dtu.dk	Contact name:	Jeppe Hinrichs
Contact phone:	Not applicable		
LabManager group:	Not applicable	Batch name:	TBD
Date of creation:	2025-09-29	Date of revision:	2025-09-29

Process Overview

A process flow for fabricating a Pt100 resistance temperature detector (RTD) on oxidized silicon, using Ti/Pt thin films patterned by lift-off.

Key Specifications

- Substrate: p-type silicon, <100>, with thermal oxide isolation
- Insulating layer: 200 nm thermal SiO_2
- Adhesion layer: 10 nm Ti
- Sensing layer: 100 nm Pt, patterned in meander geometry
- Nominal resistance: 100 Ω at 0 °C (Pt100)

Critical Safety

- **HF handling:** Apron + gloves, face shield, no lone working, no glass beakers!
- **Solvents:** Acetone, IPA, resist remover: Use fume hood and PPE.
- **Sputter/evaporation:** Pt/Ti target change requires care; follow target handling SOP
- **Anneal:** Use thermal gloves for > 300 °C operations

1 Starting Material

Substrate	Specification	Thickness	Box Name	Qty
Silicon	p-type <100>, 6", 1 Ω cm to 10 Ω cm	500 µm ± 20 µm	SP632	5

2 Critical Layers

Layer	Material	Thickness
Insulating oxide	Thermal SiO_2	200 nm
Adhesion layer	Ti	10 nm
Resistive element	Pt	100 nm
Optional pad metallization	Ni/Au	20 nm Ni + 200 nm Au

3 Core Process Flow

Table 1: Pt100 RTD Process Flow

Step	Process	Equipment	Parameters	Comment
1	**Wafer Prep and Oxide**			
1.1	Incoming inspection	4-point probe + thickness tool	Measure resistivity, bow, thickness	Verify starting wafer specs.
1.2	Pre-oxidation clean	RCA bench	Standard RCA clean	Required prior to oxidation.
1.3	Thermal oxide growth	Furnace: E1 oxidation	Target: 200 nm Recipe: DRY1100	Provides electrical isolation.
1.4	Inspection	Ellipsometer		Verify oxide thickness.
2	**Lithography**			
2.1	Resist coat	Spin Coater: Gamma UV	Resist: AZ 5214E Spin: 3000 rpm, 35 s Target thickness: 2 µm Softbake: 110 °C, 60 s	Provides base resist film.
2.2	Pattern exposure	Maskless Aligner: MLA2	Mask: RTD layout Dose: 60 mJ/cm^2 Wavelength: 375 nm	Expose regions that should remain after lift-off.
2.3	Image reversal bake	Hotplate	120 °C, 60 s	Crosslinks initially exposed resist (becomes insoluble).
2.4	Flood exposure	Maskless Aligner: MLA2	No mask, blanket exposure Dose: 500 mJ/cm^2	Reverses tone: unexposed areas become soluble.
2.5	Develop	TMAH UV-lithography	Developer: AZ 726 MIF Time: 60 s to 75 s, gentle agitation Rinse: DI water, 30 s	Creates undercut profile for lift-off.
3	**Metal Deposition**			

Continued on next page

Table 1: Pt100 RTD Process Flow (Continued)

Step	Process	Equipment	Parameters	Comment
3.1	Chamber prep	Temescal e-beam evaporator	Base pressure $\leq 1 \times 10^{-6}$ mbar	Lift-off friendly.
3.2	Ti deposition	Temescal	10 nm Ti @ 0.5 Å/s to 1 Å/s	Adhesion layer.
3.3	Pt deposition	Temescal	100 nm Pt @ 1 Å/s to 2 Å/s	Resistive layer.
4	**Lift-off**			
4.1	Lift-off	Solvent bath (acetone)	Soak + ultrasonic assist if needed	Leaves Ti/Pt meander.
4.2	Rinse/Dry	IPA + N2 gun		Inspect for clean edges, no flakes.
5	**Post-processing (optional)**			
5.1	Optional anneal	C3 Furnace: N_2 ambient	400 °C, 1 h	Stabilizes Pt resistance.
5.2	Optional pad metallization	Lithography + evaporator	Ni/Au stack	Improves bondability.
5.3	Final inspection	Optical microscope + 4-point probe	Measure sheet R, continuity	Target $R = 100\,\Omega$ at 0 °C.

4 Critical Checks

Step	QC Verification
1.3	Oxide thickness: 200 nm ± 10 nm (ellipsometer)
2.2	Lithography: line/space ± 1 µm (optical inspection)
3.3	Pt thickness: 100 nm ± 5 nm (Dektak XTA stylus profiler)
4.1	Lift-off complete, no bridging (microscope)
5.1	Sheet resistance stable within 1% after anneal (4-point probe)

5 Process Flow Diagram

Figure 1: Process flow diagram for Pt100 RTD fabrication.

6 Required Figures

Table 2: Cross-sectional illustrations of key process steps in the Pt100 RTD fabrication flow.

ID	Step	Description
1	1.3	Thermal oxide isolation
2	2.2	Lithography defines meander
3	3.3	Ti/Pt deposition
4	4.1	Lift-off completed
5	5.1	Optional anneal / pad metallization