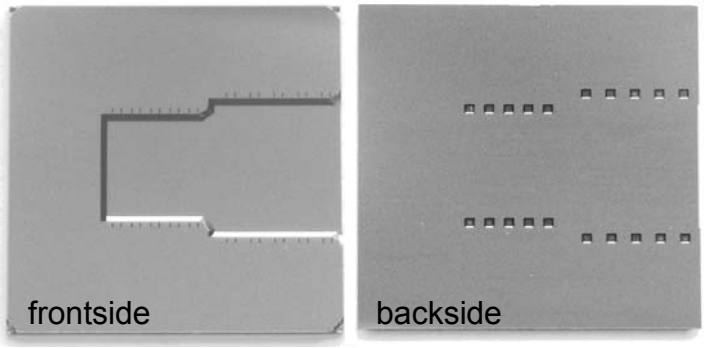
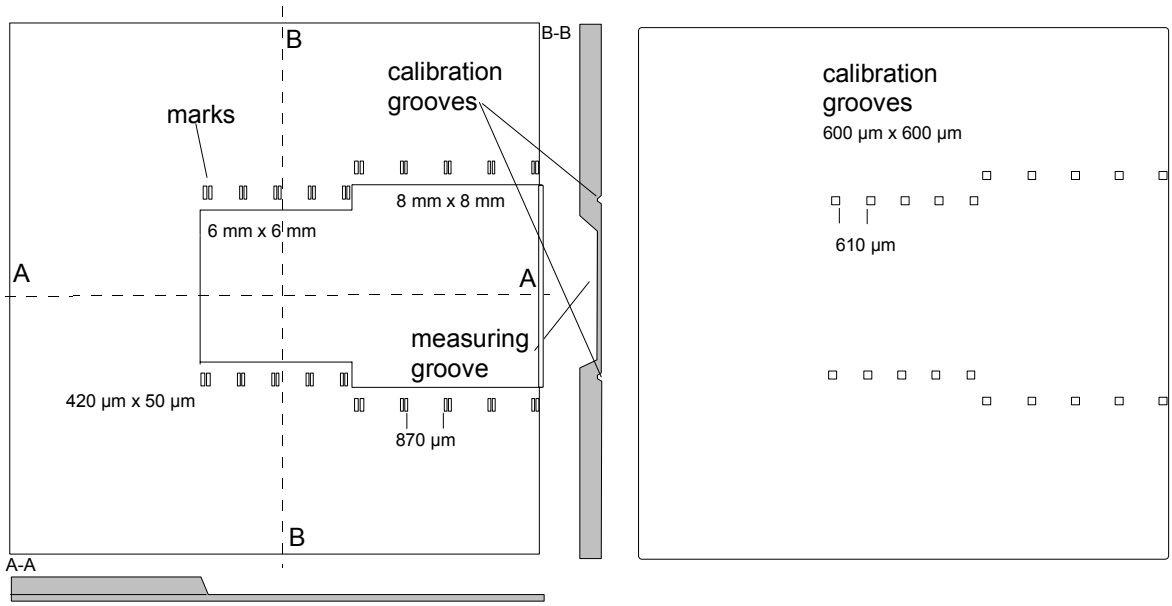


Thickness Standard TS

1. Structure

The standard provides a silicon membrane of very constant thickness like a gauge block. Because of the small thickness the membrane is mechanically stabilised by a frame. Especially, the standard is developed to serve the calibration of instruments for thickness measurements based on two fronting focusing lenses or tactile sensors. The U-shaped frame allows to inch the membrane into the narrow slit between the lenses or sensors.
The thickness standard consists of a fusion bonded silicon wafer stack composed of a 525 µm thick wafer for the frame and a thin wafer for the membrane The structures are anisotropically wet etched. At the frame side (front) the grooves (6 mm x 6 mm and 8 mm x 8 mm) are etched until reaching the bond oxide. Along the grooves 2 × 5 pairs of V-grooves serve as marks for calibration. Congruent to these marks at the backside the equal number of quadratic calibration grooves are etched up to the bond oxide, too. After removing the etch masks the bond oxide is removed at the frontside (membrane), while at the backside the bond oxide at the bottom of the calibration marks is obtained.
The standards with a size of 21 mm x 21 mm are made out of Si wafers of {100}-orientation. Different thicknesses are available.

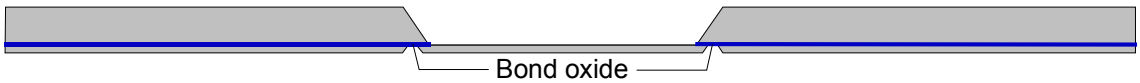


frontside

backside

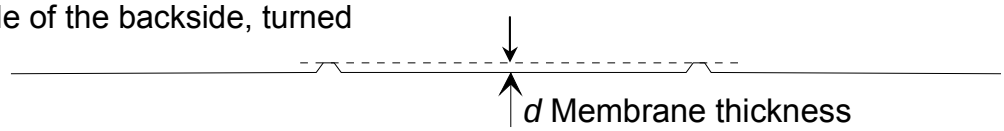
2. Calibration Procedure

The calibration of the thickness of the membrane is performed by two series of profile measurements using a tactile method.

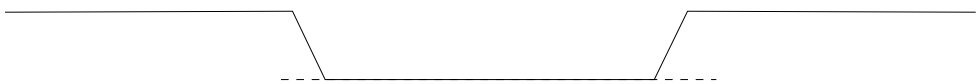


First, the profiles on the backside across the calibration grooves have to be measured. The two Pt-values in the calibration grooves represents the thickness of the membrane in these positions.
Across both regions of the membrane five profiles each have to be measured. Differences of the Pt-values describe the taper of the membrane contributing to the uncertainty. Another contribution to the uncertainty results from a slightly thinned oxide in the calibration grooves conditioned by technological processes.
Second, a series of profiles can be measured at the frame side along a virtual line between fronting pairs of V-grooves.
Comparing congruent front and backside profiles by superposing along the dotted lines, differences of the membrane thickness between the calibration grooves can be detected. These differences provide a third contribution to the uncertainty.

1. Profile of the backside, turned



2. Profile of the frontside



Concerning the thickness the standard is available with a calibration certificate of the PTB (PTB: Physikalisch-Technische Bundesanstalt, the national metrology institute of Germany). The region for certification can be chosen.

3. Packaging, Handling and Cleaning

The standards are stored in a membrane box. Do not touch the membrane, it is very sensitive. Use suitable (plastic) tweezers for handling, only grip the frame.
For cleaning the thickness standards please contact SiMETRICS for a cleaning process.

4. Assortment and Specification

Type	Nominal thickness of membrane (µm)	Uncertainty (µm)
TS 50	50	≤ 0.10
TS 100	100	≤ 0.10
TS 200	200	≤ 0.10