

GELLER MICROANALYTICAL LABORATORY

426e BOSTON ST., TOPSFIELD, MA 01983-1216
TEL 978 887-7000 FAX 978-887-6671

Certified to ISO-9001 and Accredited to ISO-17025



Certification Date: 7-July-2020
Recertification Due: _____

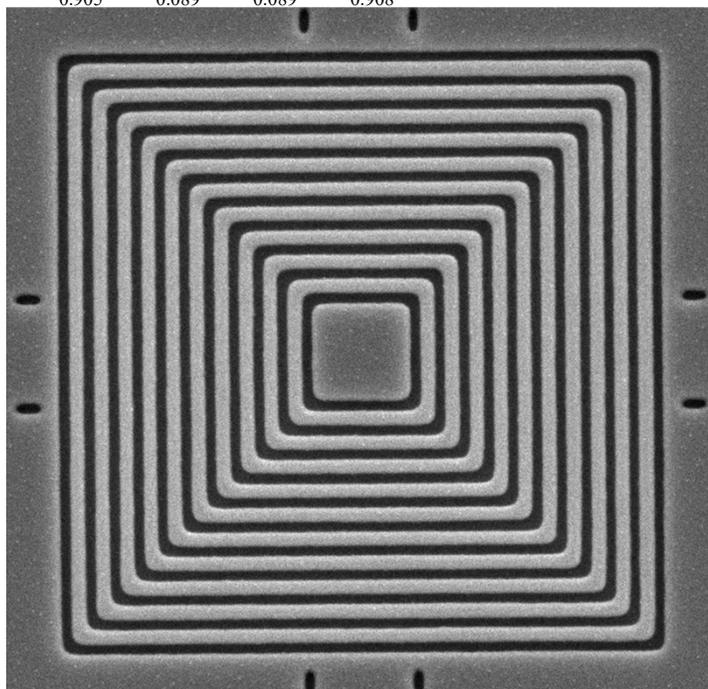
CERTIFICATION OF MEASUREMENT

MRS-6XY-4-006

2µm pitch	X-Transpose		Y-Transpose		1µm pitch	X-Transpose		Y-Transpose	
	Top	Bottom	Top	Bottom		Left	Right	Top	Bottom
1	2.000	2.009	2.013	2.017		1.001	0.995	0.992	1.003
2	2.004	1.998	2.013	1.999		0.983	0.999	1.000	0.994
3	1.992	2.009	2.010	2.014		1.016	1.003	1.002	1.000
4	2.012	2.003	2.011	2.005		0.986	0.997	0.998	0.993
5	1.938	1.993	2.013	2.009		1.001	0.995	0.999	1.014
6	2.000	1.972	1.975	2.007		1.002	1.003	1.003	0.991
7	2.014	2.004	2.001	2.007		0.986	1.002	0.994	0.992
8	2.004	1.988	2.007	2.012		0.999	0.991	1.001	1.000
9	<u>2.015</u>	<u>2.020</u>	<u>1.973</u>	<u>2.009</u>		<u>1.002</u>	<u>0.996</u>	<u>1.002</u>	<u>1.001</u>
Average	1.998	1.999	2.002	2.009	Average	0.997	0.993	0.993	0.997
2-Sigma	0.047	0.028	0.032	0.010	2-Sigma	0.021	0.008	0.008	0.014

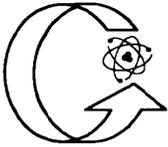
0.1µm (100nm) pitch				
1	0.1023	0.0995	0.0970	0.1042
2	0.1026	0.1025	0.0999	0.1004
3	0.1002	0.0994	0.0981	0.1006
4	0.0974	0.1006	0.1009	0.0987
5	0.0991	0.0975	0.0977	0.1028
6	0.1012	0.0993	0.1026	0.0974
7	0.1018	0.0999	0.0987	0.1023
8	0.0996	0.1019	0.1020	0.0990
9	<u>0.1007</u>	<u>0.1004</u>	<u>0.1004</u>	<u>0.1023</u>
Average	0.1005	0.1001	0.0997	0.0986
2-Sigma	0.003	0.003	0.004	0.004
Sum	0.905	0.089	0.089	0.908

Pitch	Uncertainty	Traceable to:
2µm	±0.031µm	MRS-4 S/N R23-169
1µm	±0.030µm	MRS-4 S/N R23-169
XY Working Standard: MRS-4 S/N R24-171		
0.1µm	±0.003µm	MRS-6 S/N 1-012



100nm #4 Pitch Pattern of
MRS-6XY-4-006

Certified by
Joseph Geller



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AC-1236

Certification of Measurement

MRS-6 Magnification Reference Standard - Date: _____ Inv#: _____

<p><u>As Received Condition:</u></p> <p><input type="checkbox"/> New</p> <p><input type="checkbox"/> Like New</p> <p><input type="checkbox"/> Contaminated (needs cleaning)</p> <p><input type="checkbox"/> Damaged (comments below)</p> <p><input type="checkbox"/> Cannot be certified (comments below)</p> <p>Comments: _____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p><u>Returned Condition:</u></p> <p><input type="checkbox"/> New</p> <p><input type="checkbox"/> Recertified as New</p> <p><input type="checkbox"/> Cleaned</p> <p><input type="checkbox"/> Rejected (cannot be certified, comments below)</p> <p>Comments: _____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>
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Test Method: (in compliance with ISO-17025)

All measurements are performed in vacuum with a modified scanning electron microprobe, and a field-emission SEM. The traceable 2µm, 1µm and 100nm pitch measurements are made between the horizontal and vertical tracks through the center of the pattern. There are four 100nm patterns; measurements are made through the center of the northwest pattern. For each pattern, horizontal measurements start at the left edge of the first bar on the left, proceeding toward the center, then from the right edge of the first bar on the right side of the center, continuing to the right. The vertical measurements are made the same way starting at the top of each pattern. The value for each pitch is the average of approximately 100 scan lines between the tracks. Measurements are made through direct comparison with a MRS that has been measured by the National Physical Laboratory (NIST counterpart in the U.K.) using a calibrated atomic force microscope (AFM) with a sharpened tip, thereby establishing an unbroken link of traceability. Each measurement is reported as a "pitch" value, which is the sum of an adjacent bar and space (edge-to-edge) on the pattern. For the 100nm pattern, edge-to-edge pitches are traced to a mean peak-to-peak value established by NPL. The standard was measured in vacuum. For usage: 25°C ± 10°C, humidity <90%.

Notice:

Results reported here relate only to the specific device measured. Physical damage to, or contamination of the device incurred after calibration may invalidate the reported measurements. This certification shall not be reproduced except in full, without prior written approval of Geller MicroAnalytical Laboratory.

Handling Instructions:

1. If ordering without a mount- handle by tweezers being careful not to contact the top surface. The silicon die is highly stressed and chips easily. The standard can be returned to us for cleaning and recoating for a nominal fee. To clean the MRS-6, use an ultrasonic bath at low power with solvents such as DI water, isopropanol, methanol, ethanol or acetone for a short time. Preferably, cleaning can be done using a plasma cleaner with 80% N₂ and 20% O₂ taking care to use a low power setting and not letting the temperature exceed 100°C. Do not "scrub" the surface. After either procedure the standard may then need recoating. Please only use carbon (about 10nm thickness. It has been reported that oil immersion techniques can be used when followed by solvent cleaning.
2. For SEM applications, beam current should be appropriate for high resolution imaging, never exceeding 1 X 10⁻⁹ amperes beam current in a stationary & focused beam!

Please be sure to return your registration form. We will advise you of product updates as they become available. If you have any questions about MRS applications, don't hesitate to call.