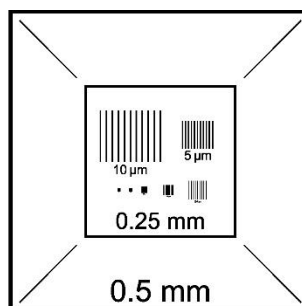
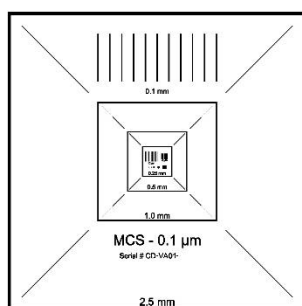


Wafer Level Certificate of Traceability for EM-Tec MCS-0.1 Magnification Calibration Standard



Product Numbers: 31-T32000-U, 31-T32000-1, 31-T32000-2, 31-T32000-6, 31-T32000-8, 31-T32000-10

Product Description: EM-Tec MCS-0.1 Magnification Calibration Standard 2.5mm to 100nm

Wafer Identifier: CD-VA01-xxx

The accuracy of these products was determined by reference comparison to working standards traceable to the National Institute of Standards and Technology (NIST), Test No. 861/280822-11.

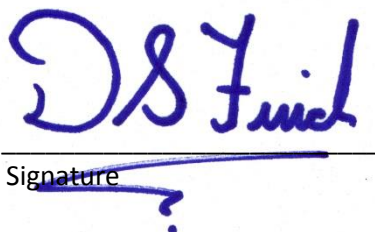
Line	Average pitch of wafer	Average pitch uniformity (1 σ uncertainty)	Total expanded uncertainty (3 σ) average pitch for wafer*
2.5 mm	2.50 mm	$\pm 2.5 \mu\text{m}$ ($\pm 0.10\%$)	$\pm 8.75 \mu\text{m}$ ($\pm 0.35\%$)
1.0 mm	1.00 mm	$\pm 1 \mu\text{m}$ ($\pm 0.10\%$)	$\pm 3.5 \mu\text{m}$ ($\pm 0.35\%$)
0.5 mm	0.500 mm	$\pm 0.5 \mu\text{m}$ ($\pm 0.10\%$)	$\pm 1.75 \mu\text{m}$ ($\pm 0.35\%$)
0.25mm	0.250 mm	$\pm 0.25 \mu\text{m}$ ($\pm 0.10\%$)	$\pm 0.9 \mu\text{m}$ ($\pm 0.35\%$)
0.1 mm	0.100 mm	$\pm 0.10 \mu\text{m}$ ($\pm 0.10\%$)	$\pm 0.35 \mu\text{m}$ ($\pm 0.35\%$)
10 μm	10.00 μm	$\pm 0.01 \mu\text{m}$ ($\pm 0.10\%$)	$\pm 0.035 \mu\text{m}$ ($\pm 0.35\%$)
5 μm	5.00 μm	$\pm 0.01 \mu\text{m}$ ($\pm 0.20\%$)	$\pm 0.035 \mu\text{m}$ ($\pm 0.70\%$)
2.5 μm	2.50 μm	$\pm 0.005 \mu\text{m}$ ($\pm 0.20\%$)	$\pm 0.0175 \mu\text{m}$ ($\pm 0.70\%$)
1 μm	1.00 μm	$\pm 0.002 \mu\text{m}$ ($\pm 0.20\%$)	$\pm 0.007 \mu\text{m}$ ($\pm 0.70\%$)
500 nm	500.4 nm	$\pm 1.00 \text{ nm}$ ($\pm 0.20\%$)	$\pm 3.50 \text{ nm}$ ($\pm 0.70\%$)
250 nm	250.5 nm	$\pm 0.50 \text{ nm}$ ($\pm 0.20\%$)	$\pm 1.75 \text{ nm}$ ($\pm 0.70\%$)
100 nm	100.2 nm	$\pm 0.20 \text{ nm}$ ($\pm 0.20\%$)	$\pm 0.70 \text{ nm}$ ($\pm 0.70\%$)

* The 3 σ uncertainty (95% confidence interval) average pitch is determined using a minimum of five die per production wafer. Each average pitch is determined using 100+ measurements on each die averaged over the stated number of lines. The total expanded uncertainty includes both Type A and Type B uncertainties corrected for sample size using an appropriate Student t-factor.

Equipment used:

Instrument	Model number	Serial #	NIST Certified CD/Recalibration	Resolution	Repeatability
FE-SEM	FEI Verios	9922557	CD-PG01-0211/June 2016	0.9nm	0.03%

Dudley S Finch
Certified by



Signature

August 20th 2015
Date

This certificate shall not be reproduced without the permission of Vof Micro to Nano.

TSB 31-T32000 Global Certificate of traceability 2015-09-02 Revision 1