AZ® MiR™ 701 Photoresist
Positive Tone i-line Photoresist
Data Package

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AZ MiR 701 Photoresist
Performance Summary

▶ L/S
- Smallest Processing Target of 0.30µm to 0.40µm
  - DTP ~ 190mJ/cm²
  - 1.6 µm DOF @ 0.35µm
  - 1.4 µm DOF @ 0.30µm

▶ C/H
  - DTP ~340mJ/cm²
  - 1.1 µm DOF @ 0.45µm
  - 0.9 µm DOF @ 0.40µm
AZ MiR 701 Photoresist Swing Curve

Softbake: E: 90°C for 60 Sec. (Contact)
Measurements done on the Nanometrics™ Nano 8000
AZ MiR 701 Photoresist
Spin Speed Curve

Softbake: E: 90°C for 60 Sec.(Contact)
Measurements done on the Nanometrics™ Nano 8000

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# AZ MiR 701 Photoresist

## Optical & Modeling Constants

### Refractive Index:

<table>
<thead>
<tr>
<th></th>
<th>365nm</th>
<th>405nm</th>
<th>435nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unbleached</td>
<td>1.7039</td>
<td>1.6844</td>
<td>1.6917</td>
</tr>
<tr>
<td>Bleached</td>
<td>1.7019</td>
<td>1.6751</td>
<td>1.6620</td>
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### Cauchy Coefficients:

<table>
<thead>
<tr>
<th></th>
<th>Unbleached</th>
<th>Bleached</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1.6104</td>
<td>1.6057</td>
</tr>
<tr>
<td>B</td>
<td>0.00505 [µm²]</td>
<td>0.00673 [µm²]</td>
</tr>
<tr>
<td>C</td>
<td>0.00171 [µm⁴]</td>
<td>0.00094 [µm⁴]</td>
</tr>
</tbody>
</table>

### Dill ABC bleaching parameters:

<p>| | |</p>
<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A(µm⁻¹)</td>
<td>0.7090</td>
</tr>
<tr>
<td>B(µm⁻¹)</td>
<td>0.0342</td>
</tr>
<tr>
<td>C (cm²/mJ)</td>
<td>0.0220</td>
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</tbody>
</table>
AZ® MiR™ 701 Photoresist

0.30 µm & 0.35 µm L/S Performance
AZ MiR 701 Photoresist
Process Conditions for L/S test

Processing:

Coat: TEL® Mark8 Static dispense.

T_{\text{target}} = 0.974\mu m \text{ on Si} \quad \text{or}

T_{\text{target}} = 0.940\mu m \text{ on AZ BARLi II @ 910 Å (1st minimum)}

SB: 90°C for 60 sec. (proximity mode)

Exposure: ASML /250 i-line stepper

\text{NA=0.60/} \sigma = 0.75 \text{ Conventional Illumination}

\text{NA=0.60/ OD = 0.90 , ID=0.535 Annular Illumination}

PEB: 110°C for 60 sec. (proximity mode)

Develop: TEL® Mark8 AZ 300MIF single puddle for 60 sec. @ 23°C

Analysis:

KLA8100 CD-SEM: each data point taken as the average of two measurement values. CDs measured at bottom of resist profile.

Hitachi S-4000 SEM: SEM pictures at 75° tilt & 40,000x (0.5µm CDs) or 50K (0.4µm CDs) magnification. CDs measured at bottom of resist profile

E_{\text{size}} & DOF: determined by largest focus latitude adhering to +/-10% reticle CD and CD within +/-5% of reticle CD at best focus (+0.25µm) by KLA8100
AZ MiR 701 Photoresist

Linearity / Resolution SEMs

Dense Lines on Si @ 180mJ/cm²

0.35 µm 0.34 µm 0.32 µm 0.30 µm

T_{target} = 0.974µm on Si
SB: 90°C/ 60 sec. (proximity mode ),
ASML /250 i-line stepper , NA=0.60/σ = 0.75 Conventional Illumination
PEB:110°C for 60 sec. (proximity mode)
Develop: TEL® Mark8  AZ 300MIF single puddle for 60 sec. @ 23°C
AZ MiR 701 Photoresist

Linearity / Resolution SEMs

<table>
<thead>
<tr>
<th>Linearity</th>
<th>Resolution</th>
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<tbody>
<tr>
<td>0.35 µm</td>
<td>0.32 µm</td>
</tr>
<tr>
<td>0.34 µm</td>
<td>0.30 µm</td>
</tr>
<tr>
<td>0.28 µm</td>
<td>0.26 µm</td>
</tr>
</tbody>
</table>

Dense Lines on AZ BARLi II @ 200mJ/cm²

$T_{\text{target}} = 0.940\mu\text{m on AZ BARLi II @ 910 Å (1st minimum)}$

SB: 90°C/ 60 sec. (proximity mode )

ASML /250 i-line stepper, NA=0.60/ OD = 0.90 , ID=0.535 Annular Illumination

PEB: 110°C/ 60 sec. (proximity mode)

Develop: TEL® Mark8  AZ 300MIF single puddle for 60 sec. @ 23°C
AZ MiR 701 Photoresist
Linearity / Resolution SEMs

Isolated Lines on Silicon @ 180mJ/cm²

<table>
<thead>
<tr>
<th>Line Width</th>
<th>SEM Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.35 µm</td>
<td><img src="image1.png" alt="Image" /></td>
</tr>
<tr>
<td>0.34 µm</td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td>0.32 µm</td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
<tr>
<td>0.30 µm</td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
<tr>
<td>0.28 µm</td>
<td><img src="image5.png" alt="Image" /></td>
</tr>
</tbody>
</table>

\( T_{\text{target}} = 0.974\mu m \text{ on Si} \)
SB: 90°C/ 60 sec. (proximity mode ),
ASML /250 i-line stepper, NA=0.60/\( \sigma = 0.75 \) Conventional Illumination
PEB:110°C for 60 sec. (proximity mode)
Develop: TEL® Mark8  AZ 300MIF single puddle for 60 sec. @ 23°C
AZ MiR 701 Photoresist
Linearity / Resolution SEMs

Isolated Lines on AZ BARLi II @ 200mJ/cm²

- 0.35 µm
- 0.34 µm
- 0.32 µm
- 0.30 µm
- 0.28 µm
- 0.26 µm

\[ T_{\text{target}} = 0.940 \mu m \text{ on AZ BARLi II @ 910 Å (1st minimum)} \]
SB: 90°C/ 60 sec. (proximity mode)
ASML /250 i-line stepper, NA=0.60/ OD = 0.90 , ID=0.535 Annular Illumination
PEB: 110°C/ 60 sec. (proximity mode)
Develop: TEL® Mark8  AZ 300MIF single puddle for 60 sec. @ 23°C
AZ MiR 701 Photoresist

Bossung Plot for 0.30µm Dense L/S on Silicon

\[ T_{\text{target}} = 0.974\mu m \text{ on Si} \]
SB: 90°C/ 60 sec. (proximity mode ),
ASML /250 i-line stepper , NA=0.60/\( \sigma \) = 0.75 Conventional Illumination
PEB:110°C for 60 sec. (proximity mode)
Develop: TEL® Mark8  AZ 300MIF single puddle for 60 sec. @ 23°C
AZ MiR 701 Photoresist

Bossung Plot for 0.30µm Dense Lines on AZ BARLi II

$T_{\text{target}} = 0.940\mu\text{m on AZ BARLi II} @ 910 \text{ Å (1st minimum)}$

SB: 90°C/ 60 sec. (proximity mode)

ASML /250 i-line stepper, NA=0.60/ OD = 0.90 , ID=0.535 Annular Illumination

PEB: 110°C/ 60 sec. (proximity mode)

Develop: TEL® Mark8  AZ 300MIF single puddle for 60 sec. @ 23°C
AZ MiR 701 Photoresist

Depth of Focus @ 0.30µm

Dense Lines on Silicon @ 180mJ/cm²

\[ T_{\text{target}} = 0.974\mu m \text{ on Si} \]
SB: 90°C/ 60 sec. (proximity mode),
ASML /250 i-line stepper , NA=0.60/\sigma = 0.75 Conventional Illumination
PEB:110°C for 60 sec. (proximity mode)
Develop: TEL® Mark8  AZ 300MIF single puddle for 60 sec. @ 23°C
AZ MiR 701 Photoresist

Depth of Focus @ 0.30µm

Dense Lines on AZ BARLi II @ 200mJ/cm²

\[ T_{\text{target}} = 0.940\mu m \] on AZ BARLi II @ 910 Å (1st minimum)
SB: 90°C/60 sec. (proximity mode)
ASML /250 i-line stepper, NA=0.60/OD = 0.90 , ID=0.535 Annular Illumination
PEB: 110°C/60 sec. (proximity mode)
Develop: TEL® Mark8 AZ 300MIF single puddle for 60 sec. @ 23°C

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AZ MiR 701 Photoresist

Bossung Plot for 0.30µm Isolated Lines on Silicon

$T_{\text{target}} = 0.974\mu\text{m on Si}$
SB: 90°C/60 sec. (proximity mode),
ASML /250 i-line stepper, NA=0.60/$\sigma = 0.75$ Conventional Illumination
PEB:110°C for 60 sec. (proximity mode)
Develop: TEL® Mark8  AZ 300MIF single puddle for 60 sec. @ 23°C
AZ MiR 701 Photoresist

Bossung Plot for 0.30µm Isolated Lines on AZ BARLi II

Target = 0.940µm on AZ BARLi II @ 910 Å (1st minimum)
SB: 90°C/60 sec. (proximity mode)
ASML /250 i-line stepper, NA=0.60/ OD = 0.90 , ID=0.535 Annular Illumination
PEB: 110°C/60 sec. (proximity mode)
Develop: TEL® Mark8 AZ 300MIF single puddle for 60 sec. @ 23°C
AZ MiR 701 Photoresist

Depth of Focus @ 0.30µm

-0.40µm  -0.20µm  -0.00µm  0.20µm  0.40µm

Isolated Lines on Silicon @ 180mJ/cm²

\[ T_{\text{target}} = 0.974\mu m \text{ on Si} \]
SB: 90°C/ 60 sec. (proximity mode ),
ASML /250 i-line stepper , NA=0.60/\( \sigma \) = 0.75 Conventional Illumination
PEB:110°C for 60 sec. (proximity mode)
Develop: TEL® Mark8  AZ 300MIF single puddle for 60 sec. @ 23°C

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AZ MiR 701 Photoresist

Depth of Focus @ 0.30µm

Isolated Lines on AZ BARLi II @ 200mJ/cm²

\[ T_{\text{target}} = 0.940\mu\text{m on AZ BARLi II @ 910 Å (1st minimum)} \]
\[ \text{SB: 90°C/ 60 sec. (proximity mode)} \]
\[ \text{ASML /250 i-line stepper, NA=0.60/ OD = 0.90, ID=0.535 Annular Illumination} \]
\[ \text{PEB: 110°C/ 60 sec. (proximity mode)} \]
\[ \text{Develop: TEL® Mark8 AZ 300MIF single puddle for 60 sec. @ 23°C} \]
AZ MiR 701 Photoresist

Bossung Plot for 0.35µm Dense Lines on Silicon

\[ T_{\text{target}} = 0.974 \mu\text{m on Si} \]
SB: 90°C/ 60 sec. (proximity mode),
ASML /250 i-line stepper , NA=0.60/\(\sigma\) = 0.75 Conventional Illumination
PEB:110°C for 60 sec. (proximity mode)
Develop: TEL® Mark8 AZ 300MIF single puddle for 60 sec. @ 23°C
AZ MiR 701 Photoresist

Bossung Plot for 0.35µm Dense Lines on AZ BARLi II

\[ T_{\text{target}} = 0.940\mu m \text{ on AZ BARLi II @ 910 Å (1st minimum)} \]
SB: 90°C/ 60 sec. (proximity mode )
ASML /250 i-line stepper, NA=0.60/ OD = 0.90 , ID=0.535 Annular Illumination
PEB: 110°C/ 60 sec. (proximity mode)
Develop: TEL® Mark8 AZ 300MIF single puddle for 60 sec. @ 23°C

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AZ MiR 701 Photoresist

Depth of Focus @ 0.35µm

-1.00µm

-0.80µm

-0.60µm

-0.40µm

-0.20µm

Dense Lines on Silicon @ 180mJ/cm²

1.00µm

0.80µm

0.60µm

0.40µm

0.20µm

0.00µm

$T_{\text{target}} = 0.974\mu m$ on Si
SB: 90°C/ 60 sec. (proximity mode ),
ASML /250 i-line stepper , NA=0.60/σ = 0.75 Conventional Illumination
PEB:110°C for 60 sec. (proximity mode)
Develop: TEL® Mark8  AZ 300MIF single puddle for 60 sec. @ 23°C
AZ MiR 701 Photoresist

Depth of Focus @ 0.35µm

Dense Lines on AZ BARLi II @ 200mJ/cm²

$T_{\text{target}} = 0.940\mu\text{m}$ on AZ BARLi II @ 910 Å (1st minimum)

SB: 90°C/ 60 sec. (proximity mode )

ASML /250 i-line stepper, NA=0.60/ OD = 0.90 , ID=0.535 Annular Illumination

PEB: 110°C/ 60 sec. (proximity mode )

Develop: TEL® Mark8  AZ 300MIF single puddle for 60 sec. @ 23°C

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AZ MiR 701 Photoresist

Bossung Plot for 0.35µm Isolated Lines on Silicon

$T_{\text{target}} = 0.974\mu m$ on Si
SB: $90^\circ C / 60$ sec. (proximity mode),
ASML /250 i-line stepper , NA=0.60/σ = 0.75 Conventional Illumination
PEB:110°C for 60 sec. (proximity mode)
Develop: TEL® Mark8  AZ 300MIF single puddle for 60 sec. @ 23°C
AZ MiR 701 Photoresist

Bossung Plot for 0.35µm Isolated Lines on AZ BARLi II

T\textsubscript{target} = 0.940µm on AZ BARLi II @ 910 Å (1st minimum)
SB: 90°C/ 60 sec. (proximity mode)
ASML /250 i-line stepper, NA=0.60/ OD = 0.90 , ID=0.535 Annular Illumination
PEB: 110°C/ 60 sec. (proximity mode)
Develop: TEL® Mark8  AZ 300MIF single puddle for 60 sec. @ 23°C
**AZ MiR 701 Photoresist**

**Depth of Focus @ 0.35µm**

-0.80µm  -0.60µm  -0.40µm  -0.20µm  0.00µm

**Isolated Lines on Silicon @ 180mJ/cm²**

0.20µm

1.00µm  0.80µm  0.60µm  0.40µm

\[ T_{\text{target}} = 0.974\mu m \text{ on Si} \]

SB: 90°C/ 60 sec. (proximity mode),

ASML /250 i-line stepper , NA=0.60/\(\sigma\) = 0.75 Conventional Illumination

PEB:110°C for 60 sec. (proximity mode)

Develop: TEL® Mark8  AZ 300MIF single puddle for 60 sec. @ 23°C

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AZ MiR 701 Photoresist

Depth of Focus @ 0.35µm

-0.60µm  -0.40µm  -0.20µm  0.00µm

Isolated Lines on AZ BARLi II @ 200mJ/cm²

0.20µm  0.60µm  1.00µm

T_{target} = 0.940µm on AZ BARLi II @ 910 Å (1st minimum)
SB: 90°C/60 sec. (proximity mode)
ASML/250 i-line stepper, NA=0.60/OD = 0.90, ID=0.535 Annular Illumination
PEB: 110°C/60 sec. (proximity mode)
Develop: TEL® Mark8 AZ 300MIF single puddle for 60 sec. @ 23°C

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AZ® MiR™ 701 Photoresist

0.4 µm & 0.45 µm C/H Performance
AZ MiR 701 Photoresist
Process Conditions for C/H test

Processing:
Substrate: Silicon
Coat: TEL® Mark8 Manual static dispense. $T_{\text{target}} = 0.974 \mu\text{m}$ $E_{\text{max}}$
SB: 90°C for 90 sec. – proximity mode
Exposure: ASML /250 i-line stepper
Conventional Illumination $N_A=0.60$ $\sigma = 0.45$
PEB: 110°C for 90 sec. – proximity mode
Develop: TEL® Mark8 AZ 300MIF single puddle for 60 sec. at 23.0°C

Analysis:
KLA 8100 CD-SEM:
Each data point taken as the average of two measurement values. CD’s measured at bottom of resist profile.

HITACHI S4700 SEM:
Cross section pictures of contact holes.
AZ MiR 701 Photoresist

Linearity / Resolution for Dense Contact Holes

340 mJ/cm² (DTP for 0.45 µm dense contact holes)

Film Thickness: 0.974 µm

SB : 90°C/90 sec proximity, ASML/250 Conventional NA=0.60 sigma= 0.45

PEB : 110°C /90 sec proximity

Develop: AZ 300MIF / Single puddle for 60 sec at 23.0°C
AZ MiR 701 Photoresist
Linearity/Resolution, Dense Contact Holes

Film Thickness: 0.974 µm
SB : 90°C/90 sec proximity, ASML/250 Conventional NA=0.60 sigma= 0.45
PEB : 110°C/90 sec proximity
Develop: AZ 300MIF / Single puddle/ 60 sec at 23.0°C

340 mJ/cm² (DTP for 0.45µm dense contact holes)
AZ MiR 701 Photoresist

Exposure Latitude, 0.40 µm Dense Contact Holes

350 mJ/cm², 33% Exposure Latitude

SB : 90°C/ 90 sec proximity, ASML/250 Conventional NA=0.60 sigma= 0.45
PEB : 110°C /90 sec proximity
Develop: AZ 300MIF / Single puddle for 60 sec at 23.0°C

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AZ MiR 701 Photoresist

Exposure Latitude 0.40 µm Dense Contact Holes

Film Thickness: 0.974 µm
SB : 90°C/ 90 sec proximity, ASML/250 Conventional NA=0.60 sigma= 0.45
PEB : 110°C / 90 sec proximity
Develop: AZ 300MIF / Single puddle for 60 sec at 23.0°C

260 mJ/cm²  280 mJ/cm²  300 mJ/cm²  320 mJ/cm²  340 mJ/cm²

420 mJ/cm²  400 mJ/cm²  380 mJ/cm²  360 mJ/cm²
AZ MiR 701 Photoresist

Depth of Focus 0.40 µm Dense Contact Holes

Film Thickness: 0.974 µm
SB : 90°C/90 sec proximity, ASML/250 Conventional NA=0.60 sigma= 0.45
PEB : 110°C/ 90 sec proximity
Develop: AZ 300MIF / Single puddle for 60 sec at 23.0°C
AZ MiR 701 Photoresist

Depth of Focus 0.40 μm Dense Contact Holes

Film Thickness: 0.974 μm
SB : 90°C / 90 sec proximity, ASML/250 Conventional NA=0.60 sigma= 0.45
PEB :  110°C / 90 sec proximity
Develop: AZ 300MIF / Single puddle for 60 sec at 23.0°C
AZ MiR 701 Photoresist

Exposure Latitude, 0.45µm Dense Contact Holes

Film Thickness: 0.974 µm
SB : 90°C / 90 sec proximity, ASML/250 Conventional NA=0.60 sigma= 0.45
PEB : 110°C /90 sec proximity
Develop: AZ 300MIF / Single puddle for 60 sec at 23.0°C
AZ MiR 701 Photoresist

Exposure Latitude, 0.45µm Dense Contact Holes

Film Thickness: 0.974 µm
SB : 90°C / 90 sec proximity, ASML/250 Conventional NA=0.60 sigma= 0.45
PEB : 110°C / 90 sec proximity
Develop: AZ 300MIF / Single puddle for 60 sec at 23.0°C

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AZ MiR 701 Photoresist

Depth of Focus 0.45 µm Dense Contact Holes

Film Thickness: 0.974 µm
SB : 90°C / 90 sec proximity, ASML/250 Conventional NA=0.60 sigma= 0.45
PEB : 110°C /90 sec proximity
Develop: AZ 300MIF / Single puddle for 60 sec at 23.0°C

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AZ MiR 701 Photoresist

Depth of Focus 0.45µm Dense Contact Holes

Film Thickness: 0.974 µm
SB : 90°C / 90 sec proximity, ASML/250 Conventional NA=0.60 sigma= 0.45
PEB : 110°C / 90 sec proximity
Develop: AZ 300MIF / Single puddle for 60 sec at 23.0°C
AZ MiR 701 Photoresist
Thermal Stability (10 µm & 1 µm)