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AZ HiR 1075 Photoresist
Process Conditions

Processing:
Substrate: AZ BARLi II (1300A) on Silicon
Coat: TEL® Mark8 Static dispense. Ttarget = 0.765um Emax
Softbake: 90°C for 60 sec. - proximity mode
Exposure: ASML /250 i-line stepper (Dark Field Image)
  Conventional Illumination; NA=0.60  σ = 0.75
  Annular Illumination; NA=0.60  OD / ID = 0.75 / 0.495
Post Exposure Bake :110°C for 90 sec. - proximity mode
Develop: TEL® Mark8  AZ 300MIF single puddle for 60 sec. @ 23°C with agitation

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 taken by cross-section
AZ HiR 1075 Photoresist
Optical & Modeling Constants

Refractive Index :
Unbleached

<table>
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<tr>
<th></th>
<th>365nm</th>
<th>405nm</th>
<th>436nm</th>
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<tr>
<td>n</td>
<td>1.703</td>
<td>1.682</td>
<td>1.649</td>
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<tr>
<td>k</td>
<td>0.020</td>
<td>0.031</td>
<td>0.019</td>
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Bleached

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<tr>
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<tbody>
<tr>
<td>n</td>
<td>1.688</td>
<td>1.659</td>
<td>1.649</td>
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<tr>
<td>k</td>
<td>0.0007</td>
<td>0.0009</td>
<td>0.0012</td>
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Cauchy Coefficients

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<tr>
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<th>Unexposed Film</th>
<th>Exposed Film</th>
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<tbody>
<tr>
<td>A</td>
<td>1.6087</td>
<td>1.5896</td>
</tr>
<tr>
<td>B [µm²]</td>
<td>0.0059</td>
<td>0.0109</td>
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<tr>
<td>C [µm⁴]</td>
<td>0.0015</td>
<td>0.0001</td>
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</table>

Dill ABC bleaching parameters

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<tr>
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<tr>
<td>A(µm⁻¹)</td>
<td>0.681</td>
<td>0.040</td>
<td>0.018</td>
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</table>

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AZ HiR 1075 Photoresist Spin Speed Curve

Spin Speed Curve

AZ HiR 1075 Photoresist Spin Speed Curve

Spin Speed (rpm)
AZ HiR 1075 Photoresist Swing Curve
AZ HiR 1075 Photoresist
Thermal Stability

No Bake | 115°C | 120°C | 125°C | 130°C | 135°C

1.0µm

10.0µm
AZ HiR 1075 Photoresist
Linearity / Resolution SEMs (Annular)

FT: 0.765um on AZ BARLi II Coating
SB: 90C for 60sec proximity, ASML Annular  NA=0.60 / 0.75/0.495 ID/OD sigma
PEB: 110° for 90sec proximity
Develop: AZ 300 MIF Developer/ Single puddle with agitation for 60 sec @ 23°C

210 mJ/cm² (DTP for 0.30um l/s)
AZ HiR 1075 Photoresist

0.30μm Dense Lines on AZ BARLi II Coating (Annular)

FT: 0.765um on AZ BARLi II Coating
SB: 90C for 60sec proximity, ASML Annular
PEB: 110° for 90sec proximity
Develop: AZ 300 MIF Developer/ Single puddle with agitation for 60 sec @ 23°C
AZ HiR 1075 Photoresist
Depth of Focus @ 0.30um (Annular)

Dense Lines @ 190 mJ/cm²

FT: 0.765um on AZ BARLi II Coating
SB: 90C for 60sec proximity, ASML Annular  NA=0.60 / 0.75/0.495 ID/OD sigma
PEB: 110°for 90sec proximity
Develop: AZ 300 MIF Developer/ Single puddle with agitation for 60 sec @ 23°C
AZ HiR 1075 Photoresist
0.28um Dense Lines on AZ BARLi II Coating (Annular)

FT: 0.765um on AZ BARLi II Coating
SB: 90C for 60sec proximity, ASML Annular  NA=0.60 / 0.75/0.495 ID/OD sigma
PEB: 110°for 90sec proximity
Develop: AZ 300 MIF Developer/ Single puddle with agitation  for 60 sec @ 23°C

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AZ HiR 1075 Photoresist
Depth of Focus @ 0.28um (Annular)

Dense Lines @ 190 mJ/cm²

FT: 0.765um on AZ BARLi II Coating
SB: 90C for 60sec proximity, ASML Annular
PEB: 110° for 90sec proximity
Develop: AZ 300 MIF Developer/ Single puddle with agitation for 60 sec @ 23°C
AZ HiR 1075 Photoresist

Linearity / Resolution SEMs (Conventional)

0.50 um
0.40 um
0.38 um
0.36 um
0.35 um
0.34 um
0.24 um @ 210mJ
0.26 um
0.28 um
0.30 um

180 mJ/cm² (DTP for 0.30um l/s)

FT 0.765um on AZ BARLi II Coating
SB : 90°C for 60sec proximity, ASML Conventional  NA=0.60 / 0.75sigma
PEB : 110°for 90sec proximity
Develop: AZ 300 MIF Developer/ Single puddle with agitation  for 60 sec @ 23°C
AZ HiR 1075 Photoresist

0.30µm Dense Lines on AZ BARLi II Coating (Conventional)

FT 0.765µm on AZ BARLi II Coating
SB : 90C for 60sec proximity, ASML Conventional  NA=0.60 / 0.75sigma
PEB : 110°for 90sec proximity
Develop: AZ 300 MIF Developer/ Single puddle with agitation  for 60 sec @ 23°C
AZ HiR 1075 Photoresist
Depth of Focus @ 0.30um (Conventional)

Dense Lines @ 180 mJ/cm²

FT: 0.765um on AZ BARLi II Coating
SB: 90C for 60sec proximity, ASML Conventional \textbf{NA=0.60 / 0.75sigma}
PEB: 110° for 90sec proximity
Develop: AZ 300 MIF Developer/ Single puddle with agitation for 60 sec @ 23°C
AZ HiR 1075 Photoresist
0.28um Dense Lines on AZ BARLi II Coating (Conventional)

FT: 0.765um on AZ BARLi II Coating
SB: 90C for 60sec proximity, ASML Conventional NA=0.60 / 0.75sigma
PEB: 110°for 90sec proximity
Develop: AZ 300 MIF Developer/ Single puddle with agitation for 60 sec @ 23°C
AZ HiR 1075 Photoresist
Depth of Focus @ 0.28um (Conventional)

- 0.80 um
- 0.60 um
- 0.40 um
- 0.20 um
- 0.0 um
- -0.20 um

FT: 0.765µm on AZ BARLi II Coating
SB: 90°C for 60sec proximity, ASML Conventional NA=0.60 / 0.75sigma
PEB: 110°C for 90sec proximity
Develop: AZ 300 MIF Developer/ Single puddle with agitation for 60 sec @ 23°C

Dense Lines @ 180 mJ/cm²
AZ HiR 1075 Photoresist
Process Conditions

Processing:
Coat: FSI® Polaris 2100 Static dispense.
Softbake: 90°C for 60 sec. - proximity mode
Exposure: ASML /400 i-line scanner (Dark Field Image)
   Conventional Illumination NA=0.65/σ = 0.85
   Annular Illumination NA=0.65/ OD/ID = 0.85/0.55
Post Exposure Bake: 110°C for 90 sec. - proximity mode
Develop: FSI® Polaris 2100 0.261N TMAH single puddle for 60sec @ 21°C

Analysis:
Hitachi S-4000 SEM: SEM pictures taken by cross-section
AZ HiR 1075 Photoresist

Linearity / Resolution SEMs

0.30 µm 0.25 µm 0.22 µm

Dense Lines @ 190 mJ/cm²

@ DTP for 0.30um l/s
- darkfield reticle

FT: 0.66µm on 1300Å AZ BARLi II Coating
SB: 90°C/60 sec proximity, Annular NA: 0.65 Sigma Outer/Inner: 0.85/0.55
PEB: 110°C/90 sec proximity
0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C
AZ HiR 1075 Photoresist
Depth of Focus @ 0.30µm

0.75 µm  0.60 µm  0.45 µm  0.15 µm  0.00 µm

Dense Lines @ 190 mJ/cm²

-0.15 µm

-0.90 µm  -0.75 µm  -0.60 µm  -0.45 µm  -0.30 µm

FT: 0.66µm on 1300Å AZ BARLi II Coating
SB: 90°C/60 sec proximity, Annular NA: 0.65 Sigma Outer/Inner: 0.85/0.55
PEB: 110°C/90 sec proximity
0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C

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AZ HiR 1075 Photoresist
Depth of Focus @ 0.25µm

Dense Lines @ 200 mJ/cm²

FT: 0.66µm on 1300Å AZ BARLi II Coating
SB: 90°C/60 sec proximity, Annular NA: 0.65 Sigma Outer/Inner: 0.85/0.55
PEB: 110°C/90 sec proximity
0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C

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AZ HiR 1075 Photoresist

Depth of Focus @ 0.22µm

Dense Lines @ 220 mJ/cm²

Assumption:
~0.7µm DOF
@ 0.22µm dense l/s
if using B.F. reticle

FT: 0.66µm on 1300Å AZ BARLi II Coating
SB: 90°C/60 sec proximity, Annular NA: 0.65 Sigma Outer/Inner: 0.85/0.55
PEB: 110°C/90 sec proximity
2.38% TMAH Developer/ Single puddle for 60 sec at 21.0°C

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AZ HiR 1075 Photoresist
Linearity / Resolution SEMs

Pitch: 1:1.5 @ 170 mJ/cm²
@ DTP for 0.30µm

FT: 0.66µm on 1300Å AZ BARLi II Coating
SB: 90°C/60 sec proximity, Annular NA: 0.65 Sigma Outer/Inner: 0.85/0.55
PEB: 110°C/90 sec proximity
0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C

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AZ HiR 1075 Photoresist
Depth of Focus @ 0.30µm

Pitch: 1:1.5 @ 170 mJ/cm²

FT: 0.66µm on 1300Å AZ BARLi II Coating
SB: 90°C/60 sec proximity, Annular NA: 0.65 Sigma Outer/Inner: 0.85/0.55
PEB: 110°C/90 sec proximity
0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C
AZ HiR 1075 Photoresist
Depth of Focus @ 0.25µm

0.60 µm 0.45 µm 0.30 µm 0.15 µm 0.00 µm

Pitch: 1:1.5 @ 170 mJ/cm²

FT: 0.66µm on 1300Å AZ BARLi II Coating
SB: 90°C/60 sec proximity, Annular NA: 0.65 Sigma Outer/Inner: 0.85/0.55
PEB: 110°C/90 sec proximity
0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C

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AZ HiR 1075 Photoresist
Depth of Focus @ 0.22µm

Depth of Focus:
- 0.60 µm
- 0.45 µm
- 0.30 µm
- 0.15 µm

Pitch: 1:1.5 @ 170 mJ/cm²

Additional Information:
FT: 0.66µm on 1300Å AZ BARLi II Coating
SB: 90°C/60 sec proximity, Annular NA: 0.65 Sigma Outer/Inner: 0.85/0.55
PEB: 110°C/90 sec proximity
0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C
AZ HiR 1075 Photoresist
Linearity / Resolution SEMs

Dense Lines @ 215 mJ/cm²

@ DTP for 0.30µm l/s
- darkfield reticle

FT: 0.88µm on 1300Å AZ BARLi II Coating
SB: 90°C/60 sec proximity, Conventional NA: 0.65 Sigma: 0.85
PEB: 110°C/90 sec proximity
0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C

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AZ HiR 1075 Photoresist
Depth of Focus @ 0.30µm

Dense Lines @ 215 mJ/cm²

FT: 0.88µm on 1300Å AZ BARLi II Coating
SB: 90°C/60 sec proximity, Conventional NA: 0.65 Sigma: 0.85
PEB: 110°C/90 sec proximity
0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C
AZ HiR 1075 Photoresist
Depth of Focus @ 0.25µm

0.75 µm  0.60 µm  0.45 µm  0.30 µm

Dense Lines @ 230 mJ/cm²

FT: 0.88µm on 1300Å AZ BARLi II Coating
SB: 90°C/60 sec proximity, Conventional NA: 0.65 Sigma: 0.85
PEB: 110°C/90 sec proximity
0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C
AZ HiR 1075 Photoresist
Linearity / Resolution SEMs

<table>
<thead>
<tr>
<th>Pitch: 1:1.5 @ 185 mJ/cm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>@ DTP for 0.30µm</td>
</tr>
</tbody>
</table>

FT: 0.88µm on 1300Å AZ BARLi II Coating
SB: 90°C/60 sec proximity, Conventional NA: 0.65 Sigma: 0.85
PEB: 110°C/90 sec proximity
0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C

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AZ HiR 1075 Photoresist
Depth of Focus @ 0.30µm

Depth of Focus @ 0.30µm

Pitch: 1:1.5 @ 185 mJ/cm²

-0.15 µm

FT: 0.88µm on 1300Å AZ BARLi II Coating
SB: 90°C/60 sec proximity, Conventional NA: 0.65 Sigma: 0.85
PEB: 110°C/90 sec proximity
0.238 N TMAH Developer/ Single puddle for 60 sec at 21.0°C

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AZ HiR 1075 Photoresist

Depth of Focus @ 0.25µm

Pitch: 1:1.5 @ 195 mJ/cm²

FT: 0.88µm on 1300Å AZ BARLi II Coating
SB: 90°C/60 sec proximity, Conventional NA: 0.65 Sigma: 0.85
PEB: 110°C/90 sec proximity
0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C
AZ HiR 1075 Photoresist
Depth of Focus @ 0.22µm

0.60 µm  0.45 µm  0.30 µm  0.15 µm

Depth of Focus @ 0.22µm

Pitch: 1:1.5 @ 195 mJ/cm²

-0.60 µm  -0.45 µm  -0.30 µm  -0.15 µm

FT: 0.88µm on 1300Å AZ BARLi II Coating
SB: 90°C/60 sec proximity, Conventional NA: 0.65 Sigma: 0.85
PEB: 110°C/90 sec proximity
0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C
AZ HiR 1075 Photoresist
Linearity / Resolution SEMs

Pitch: 1:3 @ 185 mJ/cm²
@ DTP for 0.30µm

FT: 0.88µm on 1300Å AZ BARLi II Coating
SB: 90°C/60 sec proximity, Conventional NA: 0.65 Sigma: 0.85
PEB: 110°C/90 sec proximity
0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C
AZ HiR 1075 Photoresist

Depth of Focus @ 0.30µm

FT: 0.88µm on 1300Å AZ BARLi II Coating
SB: 90°C/60 sec proximity, Conventional NA: 0.65 Sigma: 0.85
PEB: 110°C/90 sec proximity
0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C

Pitch: 1:3 @ 185 mJ/cm²
AZ HiR 1075 Photoresist
Depth of Focus @ 0.25µm

0.60 µm 0.45 µm 0.30 µm 0.15 µm

Pitch: 1:3 @ 185 mJ/cm²

FT: 0.88µm on 1300Å AZ BARLi II Coating
SB: 90°C/60 sec proximity, Conventional NA: 0.65 Sigma: 0.85
PEB: 110°C/90 sec proximity
0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C

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