ELECTRONIC MATERIALS
MICROELECTRONIC TECHNOLOGIES

ULTRA-*i*™ 123 I-LINE PHOTORESIST

For Microlithography Applications

DESCRIPTION

ULTRA-*i* 123 is an advanced, general-purpose, 250 nm critical i-Line photoresist with extendibility to 230 nm and below.

ADVANTAGES

Lines/Spaces

- ≥1.0 µm DoF @ 0.25 µm dense
- ≥1.1 µm DoF @ 0.23 µm semi-dense

Contact Holes

- ≥1.1 µm DoF @ 0.30 µm
- ≥1.1 µm DoF @ 0.25 µm with PSM

COAT

Figure 2 (next page) shows the relation between spin speed and resist thickness for 4-inch substrates. Nomical film thickness may vary slightly due to process, equipment and ambient conditions.

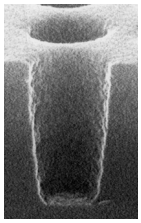
SOFTBAKE

The recommended softbake processes for reflective and non-reflective substrates are listed in *table 2* (next page). See *figure 1* for lithographic performance.

Figure 1. Lithographic Performance

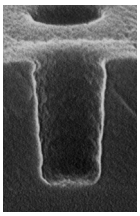
Contact Holes

300 nm 1:1 Contact Hole



535 mJ/cm²
FT: 8,650Å over BPSG
EXP: 0.57 NA, 0.85σ

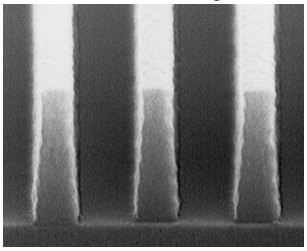
250 nm Wafer, 350 nm Mask



345 mJ/cm²
FT: 7,480Å over BPSG
EXP: 0.57 NA, 0.85σ

Dense and Semi-dense Lines/Spaces

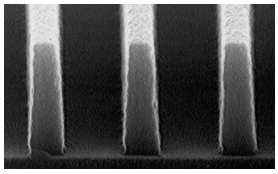
250 nm Lines/Spaces



ARL: 1,500Å XHRi over Si
FT: 7,650Å over BPSG
EXP: 0.60 NA/ 2/3 Annular

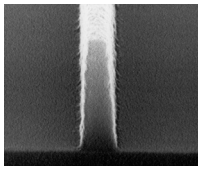
Isolated Lines/Spaces

230 nm 1:1.5 Lines/Spaces



225 mJ/cm²

230 nm Isolated Lines



235 mJ/cm²

ARL: 1,500Å XHRi over Si
FT: 7,620Å
EXP: 0.60 NA, 0.75σ

Table 1. Recommended Process Conditions*

	Contact Holes	Lines/Spaces and Isolated Lines
Thickness	6,000–12,000Å	6,000–12,000Å
Softbake	85°C/90 sec. Proximity Hotplate	90°C/90 sec. Proximity Hotplate
PEB	120°C/90 sec. Proximity Hotplate	110°C/90 sec. Proximity Hotplate
Developer	MEGAPOSIT™ MF™-26A or MEGAPOSIT MF CD-26 @ 21°C, 60 sec. single puddle	MEGAPOSIT MF-26A or MEGAPOSIT MF CD-26 @ 21°C, 45 sec. single puddle

*All data shown within this data sheet used the process conditions listed above unless otherwise stated.

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Figure 2. Spin Speed Curve

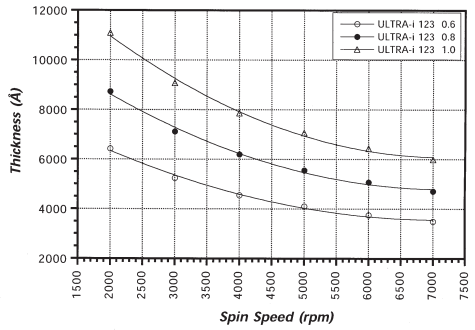


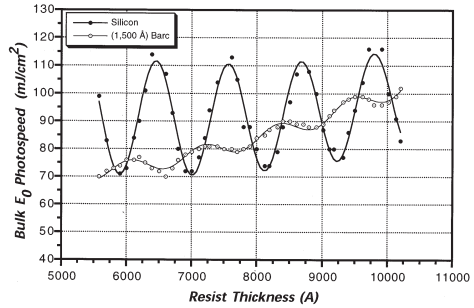
Table 2. Softbake Process Conditions		
	Contact Holes and Trenches	**Lines/Spaces and Isolated Lines**
Temperature	90°C	85°C
Time	90 sec. Proximity Hotplate (150 µm)	90 sec. Proximity Hotplate (150 µm)

FILM THICKNESS MEASUREMENT

Cauchy coefficients are listed in *Table 3*. Resist thicknesses of 6,000–11,000Å were used to characterize ULTRA-*i* 123. *Figure 3* displays the E_0 interference curves for silicon and ARC™ XHRi-16.

Table 3. Cauchy Coefficients	
n_1	1.532
n_2	1.1886e+06
n_3	5.4959e+12

Figure 3. Interference Curve - Bulk E_0



EXPOSE

Table 4 lists the dill parameters for ULTRA-*i* 123.

Table 4. Dill Parameters	
Dill A Value	0.789
Dill B Value	0.039

POST-EXPOSURE BAKE

The recommended PEB conditions for ULTRA-*i* 123 on reflective and non-reflective substrates are listed in *Table 5*.

Table 5. Post-exposure Bake Process Conditions		
	Contact Holes and Trenches	**Lines/Spaces and Isolated Lines**
Temperature	120°C	110°C
Time	120 sec. Proximity Hotplate (150 µm)	90 sec. Proximity Hotplate (150 µm)

DEVELOP

ULTRA-*i* 123 photoresist is optimized for 0.26N developers. MF CD-26 is the recommended developer. A 45-second single puddle with no pre-wet is recommended for most applications, including dense lines/spaces, semi-dense lines/spaces, and isolated lines. A 60 second single puddle with no-pre wet is recommended for contact hole applications.

Figures 4, *5*, and *6* show the focus latitude for 230 nm 1:2 lines/spaces and isolated lines. *Figure 7* shows the focus latitude for 300 nm 1:1 contact holes and 250 nm contact holes (PSM).

Figure 4. Focus Latitude, 230 nm 1:2 Lines/Spaces

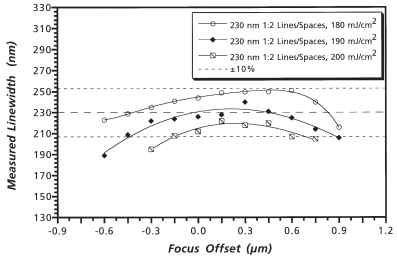


Figure 5. Focus Latitude, 230 nm Isolated Lines

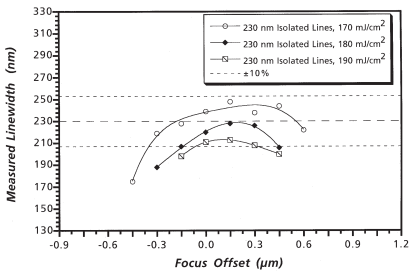


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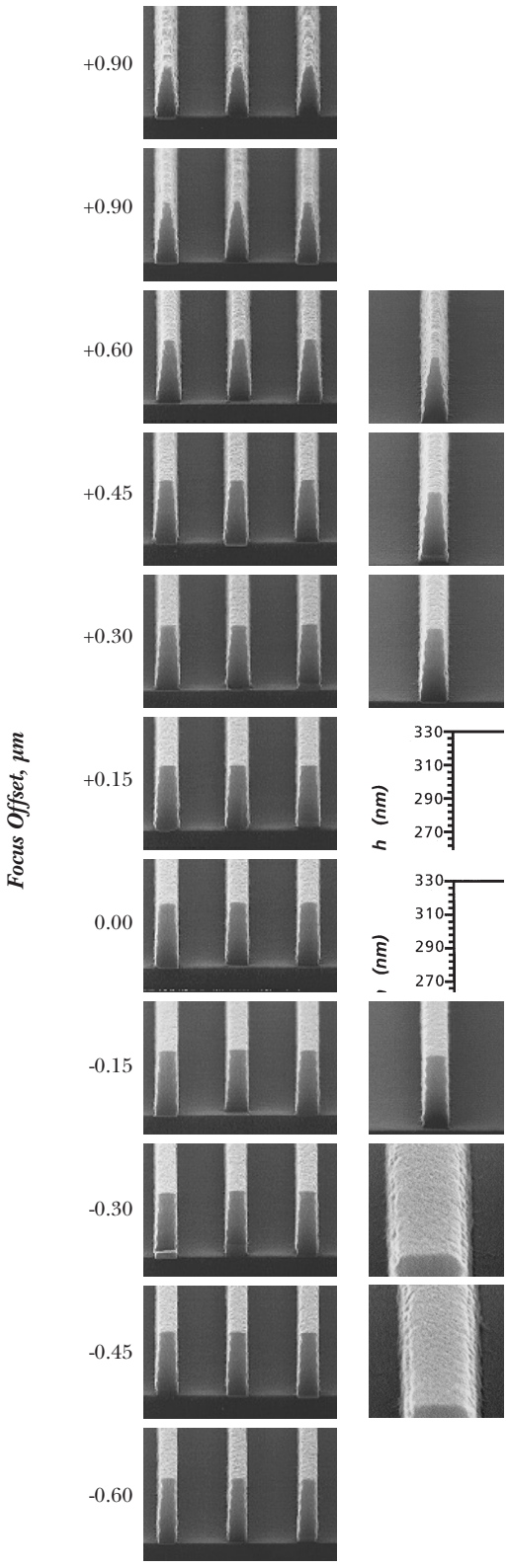
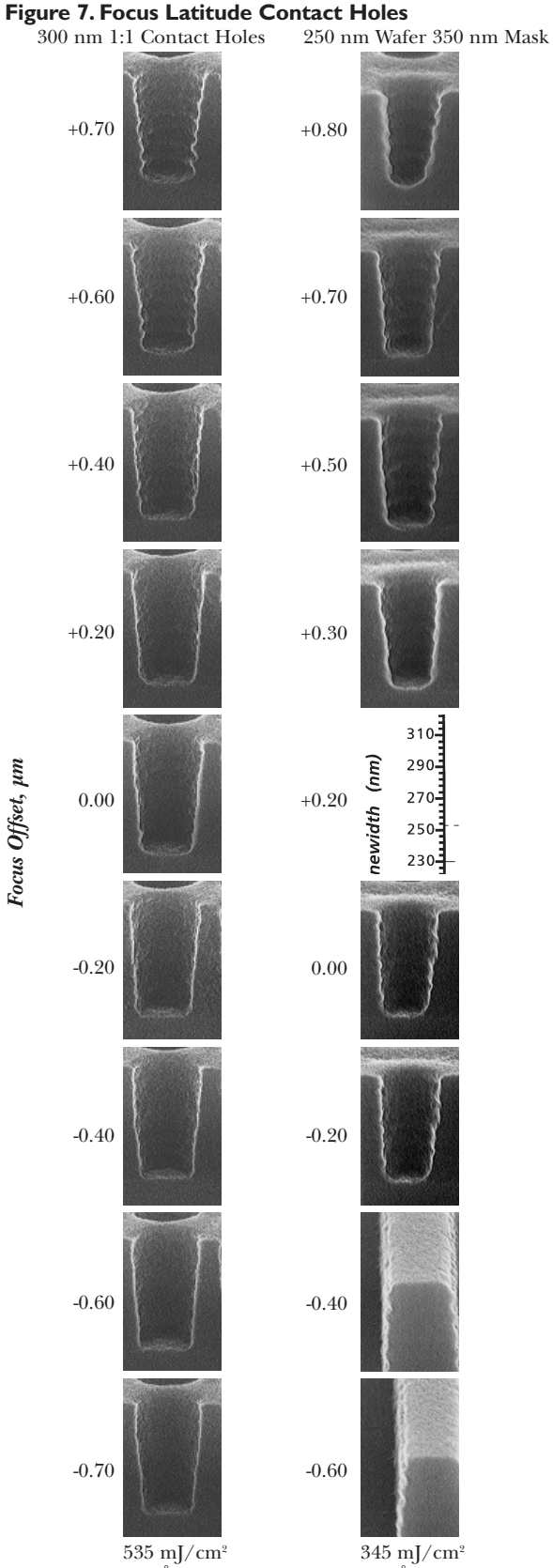
Figure 6. Focus Latitude, 230 nm 1:2 Lines/Spaces and Isolated Lines



190 mJ/cm² 170 mJ/cm²
EXP: 0.60 NA, 0.75σ outer/0.49σ inner

Figure 7. Focus Latitude Contact Holes



535 mJ/cm²
FT: 8,600Å over BPSG
EXP: 0.57 NA, 0.86σ

345 mJ/cm²
FT: 7,480Å over BPSG
EXP: 0.60 NA, 0.55σ
8%Attenuated PSM

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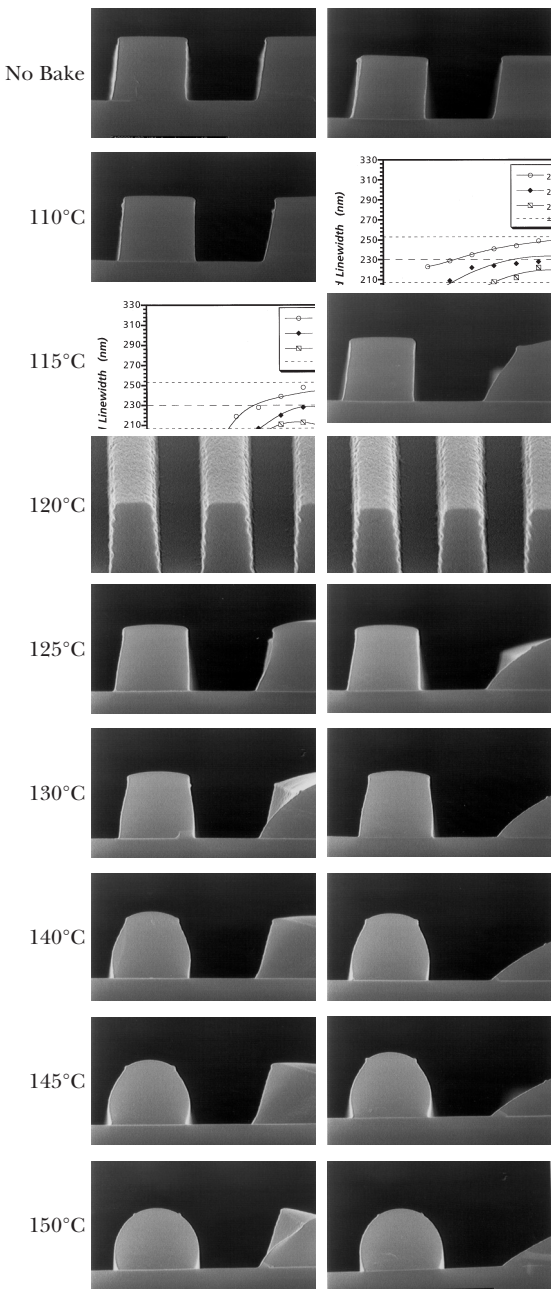
Figure 8. Thermal Flow Characteristics



HARDBAKE

Figure 8 (previous page) displays the thermal flow characteristics of ULTRA-i 123.

PHOTORESIST REMOVAL

ULTRA-i 123 photoresist can be removed with MICROPOSIT REMOVER 1165. A two-bath process is recommended with each bath at a temperature of 80°C. The first bath removes the bulk of the photoresist and the second removes residual traces of photoresist. Please consult specific remover data sheet for additional information.

HANDLING PRECAUTIONS

Before using this product, consult the Material Safety Data Sheet (MSDS)/Safety Data Sheet (SDS) for details on product hazards, recommended handling precautions and product storage.

CAUTION! Keep combustible and/or flammable products and their vapors away from heat, sparks, flames and other sources of ignition including static discharge. Processing or operating at temperatures near or above product flashpoint may pose a fire hazard. Use appropriate grounding and bonding techniques to manage static discharge hazards.

CAUTION! Failure to maintain proper volume level when using immersion heaters can expose tank and solution to excessive heat resulting in a possible combustion hazard, particularly when plastic tanks are used.

STORAGE

Store products in tightly closed original containers at temperatures recommended on the product label.

DISPOSAL CONSIDERATIONS

Dispose in accordance with all local, state (provincial) and federal regulations. Empty containers may contain hazardous residues. This material and its container must be disposed in a safe and legal manner.

It is the user's responsibility to verify that treatment and disposal procedures comply with local, state (provincial) and federal regulations. Contact your Rohm and Haas Electronic Materials Technical Representative for more information.

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