ELECTRONIC MATERIALS
MICROELECTRONIC TECHNOLOGIES

MICROPOSIT™ S1800™ SERIES PHOTORESISTS

For Microlithography Applications

DESCRIPTION

MICROPOSIT S1800 Series Photoresists are positive photoresist systems engineered to satisfy the microelectronics industry's requirements for advanced IC device fabrication. The system has been engineered using a toxicologically-safer alternative casting solvent to the ethylene glycol derived ether acetates. The dyed photoresist versions are recommended to minimize notching and maintain linewidth control when processing on highly reflective substrates.

Table 1. Process Conditions (Refer to Figure 1)

Substrate	Silicon
Photoresist	MICROPOSIT S1813 Photoresist
Coat	12,300Å
Softbake	115°C/60 sec. Hotplate
Exposure	Nikon 1505 G6E, g-Line (0.54 NA), 150 mJ/cm²
Develop	15 +50 sec. Double Spray Puddle (DSP) @ 21°C

ADVANTAGES

Product Assurance

- Lot-to-lot consistency through state-of-the-art physical, chemical and functional testing
- Filtered to 0.2 µm absolute

Coating Properties

- Cellosolve™ acetate and xylene-free
- Striation-free coatings
- Excellent adhesion
- Excellent coating uniformity
- A variety of standard viscosities are available for single-layer processing

Exposure Properties

- Optimized for g-line exposure
- Effective for broad-band exposure
- Reflective notch and linewidth control using dyed versions

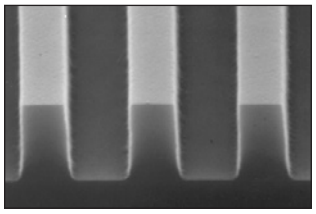
Develop Properties

- Optimized for use with the MICROPOSIT MF™-319 metal-ion-free developer family
- Compatible with metal-ion-bearing MICROPOSIT developers

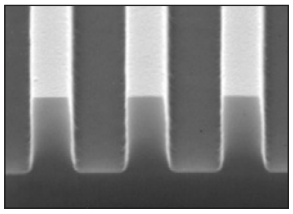
Removal Property

- Residue-free photoresist removal using standard MICROPOSIT removers

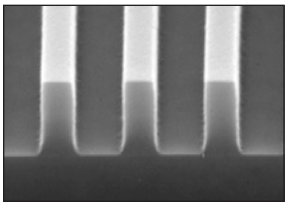
Figure 1. Masking Linearity SEMS



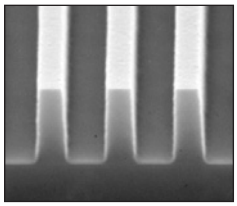
0.80 µm Lines/Spaces



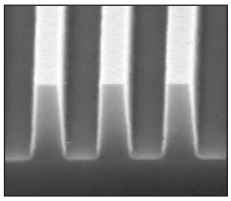
0.70 µm Lines/Spaces



0.60 µm Lines/Spaces



0.50 µm Lines/Spaces



0.48 µm Lines/Spaces

MICROPOSIT S1800 SERIES PHOTORESISTS

INSTRUCTIONS FOR USE

The following instructions cover the use of MICROPOSIT S1800 Series Photoresists for all levels of microelectronic device fabrication. Exact process parameters are application and equipment dependent.

SUBSTRATE PREPARATION

MICROPOSIT S1800 Series Photoresist work well with the hexamethyldisilazane-based MICROPOSIT Primers. Concentrated MICROPOSIT Primer is recommended when vacuum vapor priming. Diluted primer is recommended for liquid phase priming applications.

COAT

MICROPOSIT S1800 Series Photoresists provide uniform defect-free coatings over a wide range of film thicknesses. The film thickness versus spin speed plots displayed in *Figures 2 and 3* provide the information required to properly select a MICROPOSIT S1800 Photoresist version to meet process dependent thickness specifications. Maximum coating uniformity is typically attained between the spin speeds of 3,500–5,500 rpm.

Table 2. Process Conditions (Refer to Figures 2 and 3)

Substrate	Silicon
Coat	SVG 81
Softbake	115°C/60 sec. Hotplate
Measure	Nanometrics 210

The dispersion curve and Cauchy equation displayed in *Figure 4* describe how the refractive index of the photoresist film varies as a function of the wavelength of light incident upon the film. This information is required to program ellipsometric and other optically-based photoresist measuring equipment.

Table 3. Process Conditions (Refer to Figure 4)

Substrate	Silicon
Coat	13,675Å
Softbake	115°C/60 sec. Hotplate
Measure	Prometrix SM300

Figure 2. MICROPOSIT S1800 Photoresist Undyed Series Spin Speed Curves

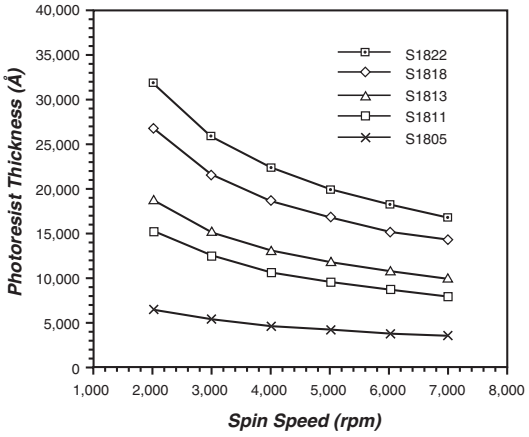


Figure 3. MICROPOSIT S1800 Photoresist Dyed Series Spin Speed Curve

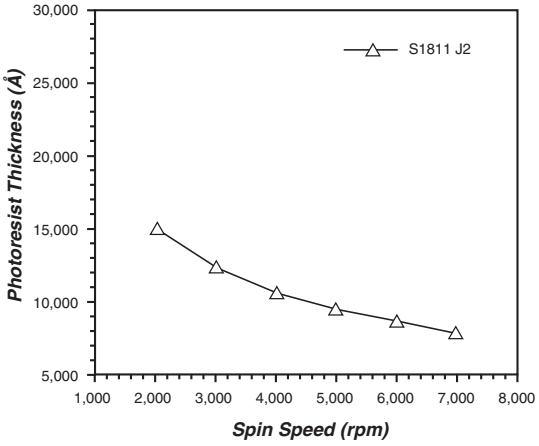
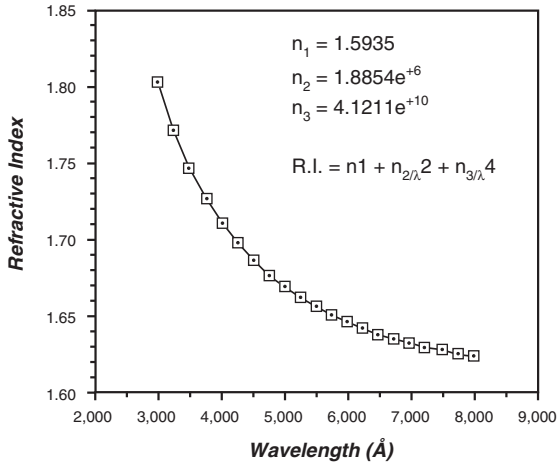


Figure 4. MICROPOSIT S1813 Photoresist Dispersion Curve



MICROPOSIT S1800 SERIES PHOTORESISTS

EXPOSURE

Proper film thickness selection is critical in order to reduce photospeed and critical dimension variability. The interference curves displayed in *Figure 5* illustrate the photospeed variability as a function of film thickness. Dyed version suppress the interference effects which are more pronounced when exposing with monochromatic light sources and when using reflective substrates.

Table 4. Process Conditions (Refer to Figure 5)

Substrate	Silicon
Coat	GCA 1006 WAFERTRAC™
Softbake	115°C/60 sec. Hotplate
Expose	GCA 8500 g-line (0.35 NA)
Develop	MF-31/10 +30 DSP @ 21°C

MICROPOSIT S1800 Series Photoresists can be exposed with light sources in the spectral output range of 350–450 nm. The exposure properties have been optimized for use at 436 nm. *Figures 6* shows the absorbance spectrums for MICROPOSIT S1813 Photoresists.

Table 5. Process Conditions (Refer to Figures 6 and 7)

Substrate	Quartz
Coat	12,300Å
Softbake	115°C/60 sec. Hotplate
Expose	Oriel Scanning Wedge
Develop	Hewlett Packard 8450A Spectrophotometer

Table 6 summarizes the Dill parameters for each MICROPOSIT S1800 Series Photoresist version. Dill parameters are used in optical exposure models such as SAMPLE and PROLITH.

Table 6. Dill Parameters

	365 nm		436 nm	
Photoresist	**A (μm^{-1})**	**B (μm^{-1})**	**A (μm^{-1})**	**B (μm^{-1})**
S1813	1.07	0.31	0.61	0.08
S1813 J2	1.07	0.49	0.59	0.61
S1813 J1	1.06	0.42	0.57	0.37

Figure 5. MICROPOSIT S1813 Photoresist Interference Curve

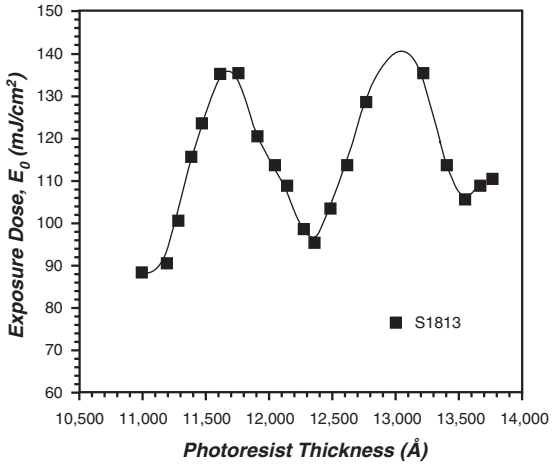


Figure 6. MICROPOSIT S1813 Photoresist Absorbance Spectrum

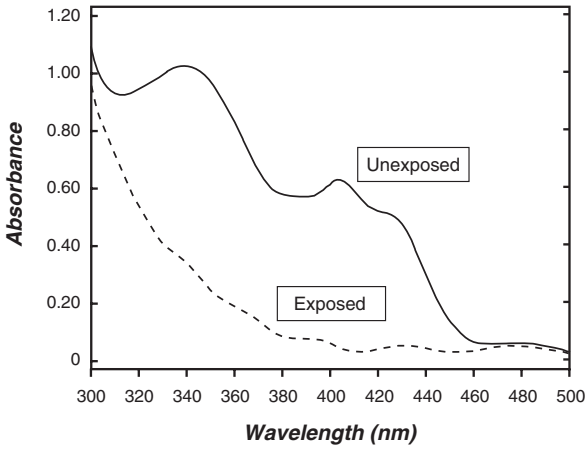


Figure 7 displays a contrast curve for MICROPOSIT S1813 Photoresist developed with MICROPOSIT MF-321 Developer. In general, high contrast values correlate to higher angle wall profiles.

Figure 7. MICROPOSIT S1813 Photoresist Contrast Curve

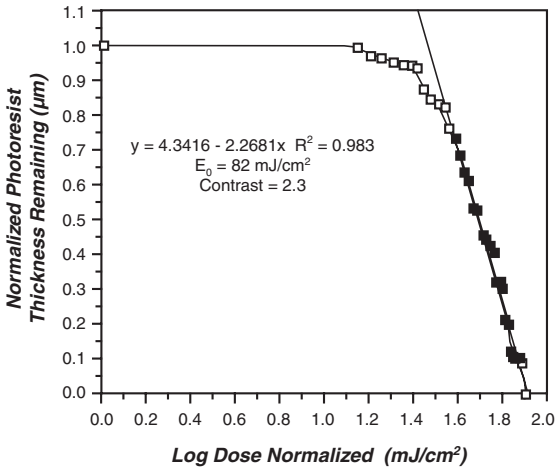


Table 7. Process Conditions (Refer to Figure 8)	
Substrate	Silicon
Coat	12,300Å
Softbake	115°C/60 sec. Hotplate
Expose	GCA 8500 g-line (0.35 NA)
Develop	MF-321/10 +30 DSP @ 21°C

DEVELOP

MICROPOSIT S1800 Series Photoresists are compatible with both metal-ion-free (MIF) and metal-ion-bearing (MIB) developers. A photoresist and developer system is dependent upon specific application requirements. Contact your local Rohm and Haas Electronic Materials Technical Sales Representative for additional product information.

Figures 8–10 (this page and next) illustrate the lithographic functionality of MICROPOSIT S1813 Photoresist using process parameters designed to maximize resolution while maintaining excellent exposure and focus latitude (refer to SEM photographs in *Figure 9*). The functional lithographic responses are summarized in *Table 9*.

Figure 8. MICROPOSIT S1813 Photoresist Masking Linearity Plot

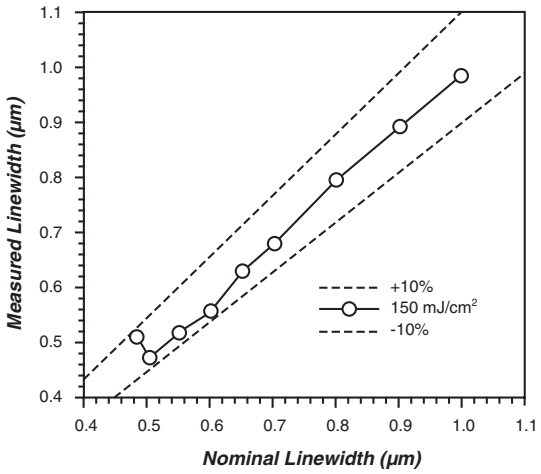


Table 8. Process Conditions (Refer to Figure 9)	
Substrate	Silicon
Coat	12,300Å
Softbake	115°C/60 sec. Hotplate
Expose	Nikon 1505 G6E g-Line (0.54 NA)
Develop	MF-321/10 +30 DSP @ 21°C

Table Lithographic Responses Summary		
Sizing Energy	150 mJ/cm² (1.3 E_0)	
Resolution	0.48 µm	
Masking Linearity (±10% CD)	0.50 µm	
	1.0 µm L/S	0.60 µm L/S
Exposure Latitude (±10% CD)	65%	45%
Focus Latitude (±10% CD) ≤85° Wall Angle	2.25 µm	1.25 µm

Figure 9. MICROPOSIT S1813 Photoresist Exposure Latitude Plot

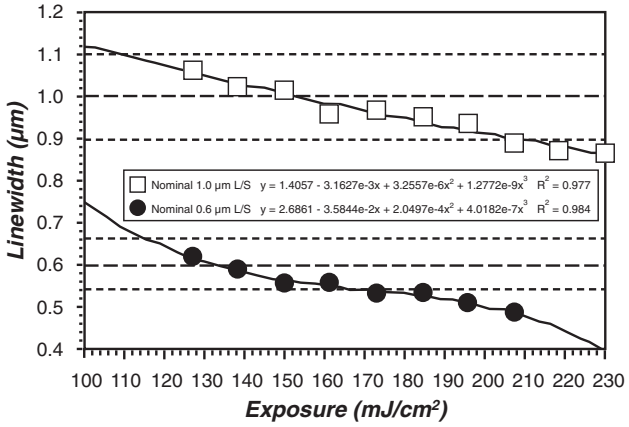
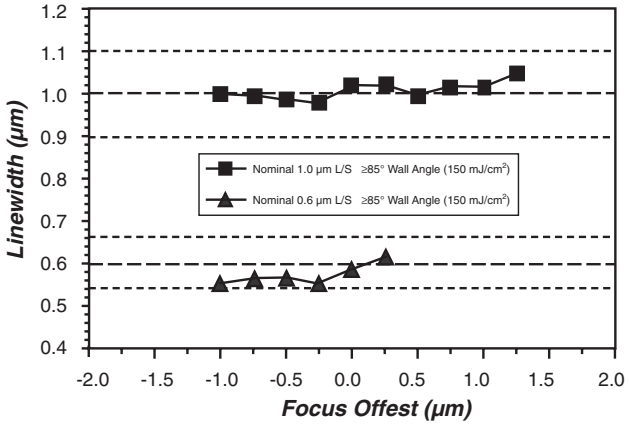


Figure 10. MICROPOSIT S1813 Photoresist Focus Latitude Plot



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.

ELECTRONIC MATERIALS

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Flat Panel Display Technologies

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