TECHNICAL DATA

Riston® DI6100
Data Sheet and Processing Information
Riston® Photopolymer Films

PRODUCT FEATURES/ APPLICATIONS

- Negative working, aqueous processable dry film photoresist
- Suitable for pattern plating application
- Suitable on 405nm and 375-405nm dual band LDI exposure machine

PRODUCT DESCRIPTION (Physical Parameters)

- Available Thickness: 25, 30 µm
- Unexposed Color in Yellow Light: Transparent
- Exposed Color in Daylight: Dark Blue/Purple
- Exposed Color in Yellow light: Purple
- Print-Out (Phototropic) Image: Strong
- Contrast to Copper: Strong
- Odor: Low

SAFE HANDLING

Note safety and industrial hygiene precautions. Consult the Safety Data Sheet (SDS) of any chemical used. SDS's for Riston® dry film photoresists are available.

STORAGE AND OPERATION CONDITIONS

Please keep the product at a dark, cool, and dry place. Validity period of the product is 30 days after manufacture under 5 ~ 21°C and 30-70%RH (at 20°C) storage condition.
Temperature: 5-21°C (40-70°F)
Relative Humidity: 30 - 70%

This Data Sheet documents specific process information for Riston® DI6100. For more background on general Riston® processing see the General Processing Guide.

GENERAL CHARACTERISTICS

Main general characteristics of DI6125 are shown in Table 1. These data are not guaranteed data but one of our experimental data.

Table 1. Main General Characteristics of DI6125 on Orbotech Fine 10 (One of our data)

Dry film resist			DI6125
Substrate (Ra)			ED Cu (Ra=0.28)
Resist thickness (μm)			25
Minimum developing time (sec)			19
Developing time (sec)			38
Exposure Machine, offset			Orbotech Fine 10, -5 offset (375/405nm=33%/67%)
Exposure energy (mJ/cm^2)		SST=20/41	63
Adhesion (μm)	L/S=x/3x	SST=20/41	11.25
Resolution (μm)	L/S=x/x	SST=20/41	11.25
Stripping time (20% SC60, beaker test)		SST=20/41	30

COPPER SURFACES AND SURFACE PREPARATION

Substrates:

- Spray microetching (8wt% SPS in 5% H_2SO_4 aqueous solution, 35ºC) on ED Cu

Control Tests:

- Water Break Test: > 30 seconds
- Ra: 0.28 μm on ED Cu substrate

Chemically Cleaned Copper

Spray microetchant (e.g. 8wt% SPS in 5% H_2SO_4 aqueous solution, 35ºC) for conversion coating (chromate) and/or copper oxide removal (about 1μm). A 5% sulfuric acid spray may be used to help with the conversion coating removal at 30 ºC. To remove residual salts after microetching from the copper surface, an acid rinse or efficient water spray rinsing have been employed successfully. In-line systems for prelamination cleaning may not require an antitarnish treatment after chemical preclean to preserve the cleaned surface. Non-in-line systems with hold times of several hours will require antitarnish.

LAMINATION

Lamination Conditions

• Pre-Heat:	Optional
• Seal Bar Temp.:	80 ± 10°C
• Lam. Roll Pressure:	3.0-5.0 bar
• Lamination Temp.:	110 ±10°C
• Seal Time:	1-4 seconds
• Seal Bar Pressure:	3.0-5.0 bar
• Lamination Speed:	1.5-3 m/min (5-10 ft/min)

Post-Lamination Hold Time

- Panels may be exposed immediately after lamination; however, allow enough time for panels to cool to room temperature before lamination (about 30 minutes; use accumulator in in-line systems).
- Minimize hold time for best tenting/resolution performance.
- Hold times should be determined empirically based on the temperature and relative humidity of the storage area.

Panel Handling/Racking/ Stacking

Preferred: Vertical racking in slotted racks
Less desirable: Stacking

To minimize adverse effects: stack on edge vertically after cooling; avoid dust and dirt trapping between panels; insert unlaminated panel between stack support and first laminated panel to protect laminated panel. Unlaminated support panel should be at least as big as the laminated panels. Thin flexible innerlayers usually cannot be racked. Preferred techniques: hanging panels vertically or stacking on edge after cool down. If innerlayers are stacked horizontally in trays, the stack height should be limited especially for panels with thin photoresist and fine circuitry.

PERFORMANCE ON FLEXIBLE SUBSTRATES

DI6100 can be used successfully on thin core laminate and flexible substrates.

EXPOSURE

Resolution (Lines & Spaces)

- In Optimized Production Environment (hard contact, high intensity exposure and specific compensation, good development and rinse control): 11.25 µm L/S for 25 µm resist (Fine 10)

Exposure Energy vs "Steps Held" For Recommended Exposure Range

Riston® DI6100	Optimum (Fine 10, 33%/67%)
375/405nm LDI mJ/cm^2	56-70
SST (x/41)	18-21

- Steps held can vary by +/-1 RST depending on the development breakpoint used. The exposure energy was test based on Lab testing results.

Post-Exposure Hold Time

- At least 30 minutes post-exposure hold time is required for panels developed.
- Maximum post-exposure hold time as a guideline is up to 1 day (24 hrs).

DEVELOPMENT

Development conditions

- Spray Pressure: 1.0-2.0 bar
- Spray Nozzles: high impact direct-fan nozzles preferred; a combination of cone and fan nozzles may be preferred if film tent breakage is experienced.
- Chemistry:
  Na_2CO_3: 0.8-1.2 wt%.; 1.0 wt% preferred
- Temperature: 27-35°C (80-95°F); 30°C (85°F) preferred

Dwell Time

- Breakpoint: 40-60 %
- Time in Developer (Dwell Time), at 1.4 bar spray pressure, 50% breakpoint. 30°C, fresh developer solution at recommended carbonate concentrations

Riston® DI6125: 38 seconds

NOTE: Total time in developer = Time to clean divided by Breakpoint

- Time to Clean (time in developer to wash off unexposed resist): 19 seconds for DI6125 depending on conditions.
- Shorter times to clean are achieved at higher temperatures, higher carbonate concentrations, and higher pressures.
- If developer conveyor speed is too fast for match with other in-line equipment: lower soda ash concentration down as far as 0.5wt%. Consider lowering temperature. Do not lower spray pressure below recommended levels.

Rinsing & Drying Recommendations

- Rinse water: hard water (150-250 ppm $CaCO_3$ equivalent) and DI water. Softer water can be hardened by the addition of calcium chloride or magnesium sulfate.
- Rinse temperature: 15-25°C (60-80°F)
- Rinse spray pressure: 1.4-2.4 bar. Use high impact, direct-fan nozzles.
- Effective Rinse Length: 1/3-1/2 of length of developer chamber; >1/2 preferred.

• Drying: blow dry thoroughly; Hot air preferred

Controls:

• For batch processing: adjust conveyor speed to maintain desired breakpoint; dump developer solution when development time has become 50% longer than for fresh solution.
• Developer conveyor speed: see "**Dwell Time**".
• Feed & Bleed: to keep loading at about 5 µm-m^2 liter (200 µm-ft^2/gal), activate addition of fresh developer at pH 10.5; stop addition when pH 10.7 is reached.

ELECTROPLATING

The product is recommended to use acidic plating bath, such as copper sulfate ($CuSO_4$) plating solution, for electrolytic copper plating.

STRIPPING

Aqueous Organic Type Conveyorized Stripping

• Stripping Times (seconds) at 55°C (130°F), 1.7 kg/cm^2, over recommended exposure range:

	DI6125
20% SC60	30 sec

Note:
Data from lab testing result
• High caustic concentrations produce larger skin sizes and higher loading capabilities.

• Solubility of Stripped Particles: Non-Soluble
• Physical Characteristics of Stripped Particles (e.g. Stickiness): Non sticky

• Higher stripping temperature increases the stripping rate.
• Stripping rate can be increased with higher impact sprays. Use higher pressures and/or high-impact spray nozzles. Avoid low impact deflector nozzles.
• Time to strip increases with white light exposure. A 20% increase in strip time over 8 day's exposure is not unusual.
• Higher levels of exposure increase Time-to-Strip: Slightly

Defoamers

Additives for foam control may not be required depending on equipment design and operation. However, if defoamer is needed, use DuPont FoamFREE™ 940 at 0.8 ml/ liter (3 ml/gallon) for resist loading up to 15 µm-m^2/liter (625 µm-ft^2/gal).

Controls/ Solution Maintenance:

- Preferred: Continuous replenishment (feed & bleed) using board count.
  Maintain resist loading at ≤ 10 µm-m^2/liter (≤ 125 µm-square feet/ gallon).
- Batch: up to 12.5 µm-m^2/liter (500 µm-square feet/ gallon). Maintain breakpoint at ≤50% by lowering conveyor speed or by starting batch stripping with a lower breakpoint and changing the solution once breakpoint moves above 50%. However, low breakpoints can lead to attack of solder on plated work, or cause copper oxidation.

- Filtration Systems

Spray stripping equipment should contain a filtration system to collect and remove resist skins to avoid nozzle clogging, to extend stripper life, and to avoid resist skins from reaching the rinse chamber. The most effective filter systems collect the stripper skins immediately after they were generated, before entering recirculation pumps, and they feature continuous removal of skins from the stripper solution.

SAFE LIGHTING

- Protect photoresist through lamination and development steps from UV radiation and visible light up to 450 nm by use of yellow, amber or gold fluorescent “safe lights”.
- High intensity (≤ 70 footcandles) yellow “safe light” causes a change in steps held and should be avoided.

WASTE DISPOSAL

For questions concerning disposal of photoresist waste refer to the latest DuPont literature and Federal, State, and Local Regulations.

EXAMPLE OF APPLICATION (PROCESS CONDITION)

Table 2. Example of Application of DI6100

Process	Condition
Substrate	17 µm ED copper on 1.0 mm CCL
Pretreatment	Microetching: 8wt% SPS in 5% H_2SO_4 aqueous solution, 35ºC) on ED Cu, 25ºC Acid Rinse: 5% H_2SO_4 aqueous solution, 25ºC
Lamination	Roll temperature: 120 ºC; Roll pressure: 0.4MPa; Roll speed: 1.8mpm
Holding	Temperature: 22ºC; Time: 1 hour
Exposure	Machine: Orbotech Fine 10; wavelength: 375/405nm=33/67; offset: -5 µm
Holding	Temperature: 22ºC; Time: 1min
Post exposure bake	Roll temperature: 80ºC; Roll pressure: 0.4MPa; Roll speed: 1.5mpm
Holding	Temperature: 22ºC; Time: 0.5 hour
Development	Developer: 1wt% Na_2CO_3 aqueous solution, 30ºC Spray pressure: 0.18-0.19MPa Break point: 50% Kind of water: DI water
Stripping	Beaker test Solution (aqueous type): 20% SC60 Solution temp: 55ºC 30mm×30mm pattern dipping in beaker

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