TECHNICAL DATASHEET

Ronascreen™

SPSR 5900 SP / HL-3

Aqueous Developable PHOTOIMAGEABLE SOLDERMASK

PRODUCT DESCRIPTION

SPSR 5900 SP / HL-3 is a negative-working, photoimageable soldermask for the production of high density, rigid printed circuit boards.

Product features:

- 'Universal' soldermask – suitable for screen printing, curtain coating or spraying
- Epoxy chemistry giving excellent chemical, electrical and mechanical properties
- Excellent process latitude
- High resolution capability
- Excellent resistance to electroless nickel and gold processes (ENIG).
- 94V-0 UL flammability-approved

SPSR 5900 PRODUCT RANGE

5900 SP Gloss	Green, high gloss
5900 SP Matte	Green, semi-matte
HL-3 Hardener	Clear, colourless hardener for both Gloss and Matte 5900 resists.

Board surface preparation:

Copper surfaces should be mechanically or chemically cleaned to give a 60s waterbreak-free surface. Recommended mechanical methods are pumice, aluminium oxide or 320 grit brush.

Tin/lead boards should be thoroughly degreased using detergent/water rinse or solvent cleaning methods. Adhesion over tin/lead will be enhanced by lightly brushing the surface prior to coating.
All boards **must** be completely dry before coating.

Mixing:

Ronascreen SPSR 5900 is supplied pre-weighed.

The SPSR 5900 resist should be mixed in the ratio 83 paste (pt A) to 17 parts HL-3 Hardener, w/w. Stir well to ensure complete mixing.

Mixed ink pot-life is at least 48hours at 20^{o}C

Incomplete mixing can cause poor developing, stickiness during exposure and impaired final properties.

Viscosity reduction:

Screen Printing:
SPSR 5900 SP is supplied screen ready. If viscosity adjustment is required prior to, or during printing, then this may be achieved using Thinner BC**.** No more than 5% reducer should be added or deterioration of the printing and drying properties may occur, resulting in thin deposits on track edges and/or prolonged drying times.

Curtain-coating:
Approximately 20% Thinner OA is typically used to reduce the viscosity of the mixed ink to 110 – 120 seconds Din # 4cup

Airspray:
20 - 25% Thinner OA is typically used to reduce the viscosity of the mixed ink to 90 – 110 secs. Din #4 Viscosity Cup (Din Dip 4mm Cup)

Electrospray:
20 - 25% Thinner OA or Thinner BA may be used to reduce the viscosity of the mixed ink to a minimum of 18 secs, Zahn S90 viscosity cup #5. Recommendations will be made by the Electra Technical Service Department during pre-trial discussions.

Process settings:

Screen Printing:

Mesh count:	37-55T polyester
Screen tension:	min. 18 N/cm^2
Squeegee:	60-70 Shore

20µm dry thickness should be aimed for; this is typically achieved using a 43T.

The print may be bubbled but this will clear quickly. A rack of panels should be held for 3 - 5 minutes after the last is printed before transferring to the drying oven.

The board outline image may be made on the screen using conventional stencil material or masking tape and screen filler. To prevent a build up of ink on the reverse of the screen that may block holes, it is advisable to shift alternate boards along the x- or y-axis before printing. Alternatively, a rudimentary stencil, such as an expanded drill mask, can be used on the screen to prevent ink going into the holes.

Do not utilise the vacuum bed, as this will suck an exaggerated amount of ink into the holes.

Curtain-coating:
The exact coating parameters required to give optimum results should be determined by preliminary tests using typical board designs. Viscosity and coating speed can vary according to track height, density and sidewall configuration. Below are recommended settings for initial set-up:

- Solvent addition: approx. 20% Thinner OA
- Viscosity: 110 – 120 seconds Din # 4cup
- Ink temperature: 23 - 25°C
- Nip gap: 0.4 – 0.6 mm
- Filter: 90µm Betapure type.
- Wet weight: 90 – 120 g/m², dependant on track height

Altering the pump rate is a fast and precise method of adjusting the wet-weight. Changing the coating speed will also vary the wet-weight, but it should normally be maintained above 80m min^{-1} to avoid belt contamination and 'tear-drops', and below 120 m min^{-1} to avoid skips and shadowing.

Airspray:
Exact spray parameters will depend on track height and circuit layout. The parameters will also depend on the equipment manufacturer. Please contact Electra Technical Dept. for specific recommendations.
Below are general conditions and guidelines:

- Atomization Pressure: 40 – 50 psi
- Reservoir Pressure: 15 – 25 psi
- Spray Conveyor Speed: 0.9 – 1.1 m/min
- Spray Pitch: 2.5 – 3.0 cm
- Atomization Temperature: 80 – 90°C
- Gun Temperature: 80 – 90°C
- Viscosity: 90 – 110 secs. Din #4 Viscosity Cup (Din Dip 4mm Cup)

Tank pressure and coating speed are set to give the desired wet thickness.
Atomising pressure should be set to give minimal mottling
Shaping air is to be adjusted to be adjusted to give an even spray pattern.

Lower atomising pressures and higher coating speeds will lead to increased mottling.

Electrostatic spray:

Exact spray parameters will depend on track height and circuit layout. The parameters will also depend on the equipment manufacturer. Please contact Electra Technical Dept. for specific recommendations.
Below are general conditions and guidelines:

- Atomizer (Bell) Rotation Speed: 15,000-45,000 RPM
- Atomizer Tip Voltage: 25kV-35kV (-DC) for Vertical & 15kV-90kV (-DC) for Horizontal
- Voltage not to exceed 4kV / cm (atomizer to panel distance)
- Back Plane Voltage (Vertical Only): 10kV-18kV (+DC)
- Roller Ground Resistance (Horizontal Only): 0 ohms to earth ground
- Focus Device Voltage (Vertical Only): Max. 5 kV (-DC) higher than the Atomizer Tip Voltage set point
- Conveyor Speed (Horizontal Only): 1-3 m/min.
- Pump Speed: Variable; adjusted for adequate mask coverage
- Shaping Air: 5-25 psi
- Reciprocation Rate: 25-35 cycles/min at a conveyor speed of 1 – 2 m/min.
- Viscosity: Min.18 secs. Zahn S90 viscosity cup #5

The potential required will depend on the board design. Boards with a higher rtack density will need a higher potential; conversely, boards with large laminate areas will require lower potentials.

Tack-dry:

The aim of the tack-drying stage is to solely remove the solvents. It is important for the drying chamber (static or conveyorised) to have good air circulation with air supply and extraction facilities. Actual drying conditions will be dependent on soldermask application method, oven type and airflow. Drying times may need to be extended for larger batches. Ink applied by screen print will generally require a shorter drying period.

For **conventional hot air** circulation ovens, typical conditions are:

- Oven air temperature: 75 – 82^{o}C
- Drying time: 30 – 45mins, once air is within temperature range.

For **infra-red** drying equipment:

- Panel surface temperature: 100 – 120^{o}C
- Drying time: 3 – 5mins.

After drying, boards must be stored away from UV and white light. Dried boards may be stored for up to **72 hours** before exposure. Storage must be in yellow light or darkness and at a temperature below 25°C.

Exposure

Spectral output: 310-420 nm. Optimum wavelength is approx. 365-385nm.

Step wedge: 8-10 clear (Stouffer 21 step).

Determination of the correct exposure should be carried out after setting the developing speed since this will affect the step wedge reading obtained.

Step wedge checks should be carried out on brushed copper with the step wedge under the phototool.
Energy level should be measured through the artwork and mylar/glass. It is important to recognise that the energy level should only be used as a guide for setting the correct exposure; step wedges should be used for determining the actual exposure setting.

Hold-time: Not less than 10 minutes and not more than 24 hours. Extending the hold time from 24 to 72 hours is possible but may require adjustment of development conditions.

Developing

Typical development conditions:

Developer:	0.9 – 1.1% aqueous solution of sodium or potassium carbonate.
Spray pressure:	1.5 - 2.5 kgcm^{-2}, 20-40 psi.
Solution pH:	10.6 – 11.4
Temperature:	30° - 35°C
Breakpoint:	25 - 45%,
Dwell time:	40 – 60 seconds

Boards should be well rinsed with fresh water and fully dried after developing.
Do not final cure boards when wet.

The breakpoint should be ascertained by preliminary tests prior to making exposure tests.

Actual developing speed and break-point settings will depend on the amount of ink deposited in the holes during coating. Lower breakpoint settings (minimum 10%) and higher spray pressures will facilitate ink clearance from holes.

The use of carbonate developing solutions at **above 1.5%** carbonate is not recommended. This tends to give poor developing, leaving residues on the copper, a matted surface and step wedges having more than one degraded steps between 'solid' ink and 'clean' copper.

Final Cure

Convection oven: 60 mins at 145 - 155°C ***Time at board temperature***

UV bumping

It is not normally necessary to UV cure Ronascreen SPSR 5900 but under certain conditions it may be advantageous (see below). Under these conditions, conveyor speeds should be set to attain 1.5 to 2.5 J cm^{-2}.

High film weight plating:
When depositing high film weights and/or coating heavily plated tracks it is sometimes possible to see slight wrinkling of the soldermask between the tracks after final cure. UV curing before final cure may prevent this.

Flux residues/staining:
Occasionally flux residues or staining can be seen on boards after hot-air-solder-level of ENIG processes. Rinsing boards when still hot can cause this and may be exaggerated by using hot water.

Boards must be allowed to cool after soldering before rinsing and it is recommended all rinse solutions be below 40°C (104°F).

Cleaning

Equipment should be cleaned of residual soldermask using **SW100 or Dowanol PMA.**

Shelf-life

Minimum 12 months from date of manufacture when stored in cool, dry, recommended conditions.
Storage should be between 10 and 25°C and must be away from sources of heat and direct sunlight.

Final Properties

TEST PROCEDURE	TEST CONDITIONS	SOLDERMASK REQUIREMENT	TYPICAL RESULT
Hydrolytic Stability	90 – 98% RH / 28 days	No irreversible change of state	Pass
Solvent Resistance IPA 75%IPA + 25% water D-Limonene 10%Alk. Det. / 90% water Monoethanolamine Deionised water	 Ambient / 2mins 46° +/-2°C / 15 mins Ambient / 2mins 57° +/-2°C / 2 mins 57° +/-2°C / 2 mins 60° +/-2°C / 5 mins	All: No evidence of degradation or change of state	Pass
Class H Moisture and Insulation Resistance	18 cycles, 65°C / 90%RH Non-soldered Soldered	No blistering or separation. Resistance during the 18th cycle shall be >=5 x 10^8 ohms	Pass > 1 x 10^{10} ohms Pass > 1 x 10^9 ohms
Class H Electromigration	7 days, 85°C / 90%RH Non-soldered	No evidence of electrochemical migration. Final resistance >= 1 x 10^6 ohms	Pass Final resistance > 2 x 10^8 ohms
Thermal Shock	100 cycles, -65° to 125°C	No blistering, crazing or delamination	Pass
Ionic Cleanliness	Non-Soldered Soldered	Contamination <= 1.55ug/cm^2	Pass < 0.1 ug/cm^2 Pass < 0.5 ug/cm^2
Dielectric Strength		500 V DC / mil. Minimum 500 V DC for layers less than 1 mil	> 2.5 kV / mil

UL flammability approval: ***94V-0 (certificate E80180)***

Complies with specifications according to: ***IPC SM-840C***

For further information, contact:

Electra
Roughway Mill
Dunk's Green
Tonbridge
Kent TN11 9SG
ENGLAND

Tel: +44 (0)1732 811 118
info@electrapolymers.com

Or visit our Website for details of local offices and Distributors

www.electrapolymers.com