PSR-4000 HH01XR

(UL Name: PSR-4000KX / CA-40KX)

LIQUID PHOTOIMAGEABLE SOLDER MASK

- **Screen Print or Spray Application**
- **High Temperature Storage (200°C for 2000 hrs) and Thermal Cycling Capabilities**
- **Available in Green, Black, Blue, Red and White**
- **Matte Finish**
- **SVHC – Free, Melamine – Free version**
- **RoHS Compliant**
- **Halogen – Free**
- **Compatible with DI exposing**
- **Fine Dam Resolution**
- **Compatible with Lead-Free Processing**
- **Excellent Small Hole Clearing**
- **Wide Processing Window**
- **Withstands ENIG & Immersion Tin**
- **Low Odor**

PROCESSING PARAMETERS FOR PSR-4000 HH01XR

PSR-4000 HH01XR COMPONENTS:

PSR-4000 HH01XR / CA-40 HH01XR		
Mixing Ratio	70 parts	30 parts
Color	Green, Black Blue, Red or White	White

Mixed Properties	
Solids	80%
Viscosity:	220-270ps
Specific Gravity	1.5

MIXING

PSR-4000 HH01XR is supplied in pre-measured containers with a mix ratio by weight of 70 parts (2.8 kgs) **PSR-4000 HH01XRI** and 30 parts (1.2 kgs) **CA-40 HH01XR. PSR-4000 HH01XR** can be mixed in a mechanical mixer at low speeds to minimize shear thinning for 10 – 15 minutes.

For Spray, PM or PM/PMA solvent is added at 25-30%, of the mixed ink and hardener. **PSR-4000 HH01XR** can be mixed a mechanical mixer at low speeds to minimize shear thinning for 10 – 15 minutes. The resulting viscosity with the PM/PMA addition should be between 60 – 80 seconds in a Ford #4 or Erichsen #4 cup at 24°C.

PRE-CLEANING

Prior to solder mask application, the printed circuit board surface needs to be cleaned. Various cleaning methods include Pumice, Aluminum Oxide, Mechanical Brush, and Chemical Clean. All of these methods will provide a clean surface for the application of **PSR-4000 HH01XR**. Hold time after cleaning the printed circuit board should be held to a minimum to reduce the oxidation of the copper surfaces.

SCREEN PRINTING

Method: Single Sided and Double Sided Screening

- Screen Mesh: 29 – 43 threads/cm (74 – 110 tpi)
- Screen Mesh Angle: 22.5° Bias
- Screen Tension: 20 - 28 Newtons
- Squeegee: 60 – 80 durometer
- Squeegee Angle: 27 – 35°
- Printing Mode: Flood / Print / Print
- Flood Pressure: 20 – 30 psi
- Printing Speed: 2.0 – 9.9 inches/sec
- Printing Pressure: 60 – 100 psi

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SPRAY APPLICATION Typical spray parameters for **PSR-4000 HH01XR**: begin by setting the atomization pressure at 30 psi and spray a panel. Increase the spray atomization pressure until you have a smooth non-mottled surface. If you exceed 35 psi add additional solvent and reset the atomization pressure back to 30 psi and repeat process until you get a smooth sprayed surface. Adjust the Pot Pressure to get the desired solder mask thickness that meets your coverage requirements.

Method: HVLP sprayer

- Needle Set: 5 – 6 turns out
- Gun temperature: 90 - 100°C
- Atomization air temperature: 90 - 100°C
- Pot Pressure: 10-15 psi, adjust to get desired solder mask coverage
- Atomization Pressure: 30-35 psi, start at the low setting and increase until there is no mottling
- Conveyor speed: 2.5 – 3.0 ft./min; as slow as production allows

The spray parameters depend on the desired film thickness, which in turn depends on copper height, copper structures, final surface, etc., and should be adjusted to your final requirements.

TACK DRY CYCLE The Tack Dry step is required to remove solvent from the solder mask film and produce a firm dry surface. The optimum dwell time and oven temperature will depend on oven type, oven loading, air circulation, exhaust rate, and ramp times. Excessive tack dry times and temperature will result in difficulty developing solder mask from through holes and a reduction in photo speed. Insufficient tack dry will result in artwork marking and/or sticking. Typical tack dry conditions for **PSR-4000 HH01XR** are as follows:

- Oven Temperature: 71 - 82°C (160 - 180°F)
- For Single-Sided (Batch Oven)
  - 1st Side: Dwell Time: 15 - 30 minutes
  - 2nd Side: Dwell Time: 20 - 40 minutes
- For Double-Sided (Conveyorized or Batch Oven)
  - Dwell Time: 20 - 70 minutes

- Oven Type: IR or IR assisted
  - Conveyor Speed: 2.7 – 3.2 ft./min
  - Time above 80°C: 2 – 2.1 minutes
  - Maximum Peak Temperature: 115°C
  - Total Dwell Time: 3 – 6 minutes

PROCESSING PARAMETERS FOR PSR-4000 HH01XR

EXPOSURE

PSR-4000 HH01XR uses UV-LED curing technology to define solder mask dams and features. The spectral sensitivity is in the range of 365 nm – 405nm. Exposure times will vary by power, light source, wavelength and age of the light source. Below are guidelines for exposing.

- Exposure Unit: Direct Imaging Exposure Unit

PSR-4000 HH01XR	Exposure Energy	Stouffer Step Range
Green	Minimum 150 mJ/cm^2	8 - 10
Black	Minimum 400 mJ/cm^2	8 – 10
White	Minimum 300 mJ/cm^2	8 – 10
Blue and Red	Minimum 150 mJ/cm^2	8 – 10

***At coating thicknesses of 30 microns or less**

DEVELOPMENT

PSR-4000 HH01XR is developed in an aqueous sodium or potassium carbonate solution. Developing can be done in either a horizontal or vertical machine.

- Solution: 1% by wt. Sodium Carbonate or 1.2% Potassium Carbonate
- pH: 10.6 or greater
- Temperature: 85 - 95°F (29 - 35°C)
- Spray Pressure: 25 - 45 psi (1.7 – 3.1 bars)
- Dwell Time in developing chamber: 45 - 90 seconds
- Water rinse is needed to remove developer solution followed by a drying step

PRE-CURE (OPTIONAL)

This step may be required if the vias remain tented on both sides after developing due to the board design. The added drying cycle will prevent out-gassing of the vias. This phenomenon can cause the solder mask over the vias to peel or pop and may also exhibit a degree of oozing due to the entrapped solvent. The required drying cycle is 100 - 110°C for 40 to 60 minutes. An extended time may be required on the higher aspect ratio.

PROCESSING PARAMETERS FOR PSR-4000 HH01XR

FINAL CURE **PSR-4000 HH01XR** requires a thermal cure to insure optimal final property performance. Thermal curing can be done in a batch oven or conveyorized oven.

- Temperature: 275 – 300°F (135 – 149°C)
- Time at Temperature: 45 – 60 minutes

UV CURE To improve moisture and chemical resistance a UV cure of 2 -3 J/cm^2 is recommended

For Process Optimization please contact your local Taiyo America Representative

Taiyo America, Inc. (TAIYO) warrants its products to be free from defects in materials and workmanship for the specified warranty period **(PSR-4000 HH01XR Warranty period is 12 Months)** provided the customer has, at all times, stored the ink at a temperature of 68ºF or less. TAIYO accepts no responsibility or liability for damages, whether direct, indirect, or consequential, resulting from failure in the performance of its products. If a TAIYO product is found to be defective in material or workmanship, its liability is limited to the purchase price of the product found to be defective. TAIYO MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED, AND MAKES NO WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR ANY PARTICULAR PURPOSE. TAIYO'S obligation under this warranty shall not include any transportation charges or costs of installation or any liability for direct, indirect, or consequential damages or delay. If requested by TAIYO, products for which a warranty claim is made are to be returned transportation prepaid to TAIYO'S factory. Any improper use or any alteration of TAIYO'S product by the customer, as in TAIYO'S judgment affects the product materially and adversely, shall void this limited warranty.

FINAL PROPERTIES FOR PSR-4000 HH01XR

IPC-SM-840E, Class H & T, Solder Mask Vendor Testing Requirements

TEST	SM-840 PARAGRAPH	REQUIREMENT	RESULT
Visual	3.3.1	Uniform in Appearance	Pass
Curing	3.2.5.1	Ref: 3.6.1.1, 3.7.1 and 3.7.2	Pass
Non-Nutrient	3.2.6	Does not contribute to biological growth	Pending
Pencil Hardness	3.5.1	Minimum "F"	Pass – 7H
Adhesion	3.5.2.1	Rigid – Cu, Ni, FR-4	Pass
Adhesion	3.5.2.6	Doubled Layered Solder Mask	Pass
Machinability	3.5.3	No Cracking or Tearing	Pass
Resistance to Solvents and Cleaning Agents	3.6.1.1	Table 3 Solvents	Pass
Hydrolytic Stability and Aging	3.6.2	No Change after 28 days of 95-99°C and 90-98% RH	Pending
Solderability	3.7.1	No Adverse Effect J-STD-003	Pass
Resistance to Solder	3.7.2	No Solder Sticking	Pass
Resistance to Solder	3.7.3	No Solder Sticking	Pass
Simulation of Lead Free Reflow	3.7.3.1	No Solder Sticking	Pass
Dielectric Strength	3.8.1	500 VDC / mil Minimum	3000 VDC/mil
Thermal Shock	3.9.3	No Blistering, Crazing or De-lamination	Pass

Specific Class "H" Requirements

TEST	SM-840 PARAGRAPH	REQUIREMENT	RESULT
Flammability	3.6.3.1	UL 94V-0	Pass
Insulation Resistance Before Soldering After Soldering	3.8.2	 5×10^8 ohms minimum 5×10^8 ohms minimum	 Pass (7.5×10^{12} ohms) Pass (2.7×10^{13} ohms)
Moisture & Insulation Resistance Before Soldering–In Chamber Before Soldering–Out of Chamber After Soldering-In Chamber After Soldering-Out of Chamber	3.9.1	 5×10^8 ohms minimum 5×10^8 ohms minimum 5×10^8 ohms minimum 5×10^8 ohms minimum	 Pass (1.4×10^9 ohms) Pass (1.5×10^{10} ohms) Pass (7.5×10^8 ohms) Pass (1.3×10^{10}ohms)
Electrochemical Migration	3.9.2	$>2.0 \times 10^6$ ohms, no dendritic growth	Pass (1.4×10^{12} ohms)

Specific Class "T" Requirements

TEST	SM-840 PARAGRAPH	REQUIREMENT	RESULT
Flammability	3.6.3.2	Bellcore 0_2 Index – 28 minimum	Pass – File #E166421
Insulation Resistance Before Soldering After Soldering	3.8.2	 5×10^8 ohms minimum 5×10^8 ohms minimum	 Pass (7.5×10^{12} ohms) Pass (2.7×10^{13} ohms)

FINAL PROPERTIES FOR PSR-4000 HH01XR

Specific Class "T" Requirements

TEST	SM-840 PARAGRAPH	REQUIREMENT	RESULT
Moisture & Insulation Resistance	3.9.1		
Before Soldering–In Chamber		5 x 10^8 ohms minimum	Pass (5.2 x 10^9 ohms)
Before Soldering–Out of Chamber		5 x 10^8 ohms minimum	Pass (1.7 x 10^{10}ohms)
After Soldering-In Chamber		5 x 10^8 ohms minimum	Pass (4.0 x 10^9ohms)
After Soldering-Out of Chamber		5 x 10^8 ohms minimum	Pass (2.1 x 10^{10}ohms)
Electrochemical Migration	3.9.2	< 1 decade drop, no dendritic growth	Pass

Additional Tests / Results

TEST	REQUIREMENT	RESULT
Solder Heat Resistance	Solder float test: Rosin Flux 300°C/30sec., 1 cycle	Pass
Solvent Resistance	PGM-AC dipping, temp 20°C. / 20 min, Tape peeling test	Pass
Acid Resistance	10 vol% H_2SO_4, temp 20°C. / 20 min, Tape peeling test	Pass
Alkaline Resistance	10 wt% NaOH, temp 20°C. / 20 min, Tape peeling test	Pass
Electroless Ni/Au	TAIYO Internal Test Method Ni: 3 microns, Au: 0.03 microns	Pass
Hot Storage	Internal Test: 200°C for 2000 hours; examined for cracks	Pass
Thermal Cycling	Internal Test: -40°C ↔ 160°C for 1000 cycles, examined for cracks	Pass