

Technical Data Sheet

TAIYO PSR-4000HG

LIQUID PHOTOIMAGEABLE SOLDER MASK

- ③ **Screen or Spray Application**
- ③ **Halogen-Free Version**
- ③ **Green Semi-Gloss Finish**
- ③ **Excellent ENIG Resistance**
- ③ **Best In Class for Small Hole Clearing**
- ③ **Very Fast Photospeed**
- ③ **Wide Processing Window**
- ③ **Fine Dam Resolution**



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PROCESSING PARAMETERS FOR PSR-4000HG

PSR-4000HG is a two-component, liquid epoxy photoimageable solder mask applied by screen-printing or spray applications methods and developed in aqueous alkaline solution. **PSR-4000HG** has very low odor, fast photo and developing speeds, and a wide processing window. **PSR-4000HG** cures to an 8H pencil hardness and has good resistance to alternative metal finishes such as ENIG while maintaining solder mask dams of 3 mils or less. **PSR-4000HG** meets or exceeds the requirements of IPC SM-840C Class H and Class T, Bellcore GR-78-CORE Issue 1, and has a UL flammability rating of 94V-0.

PSR-4000HG COMPONENTS	PSR-4000HG/ CA-40HG	
Mixing Ratio	100 parts	43 parts
Color	Green	White
<u>Mixed Properties</u>		
Solids	77%	
Viscosity	135-165ps	
Specific Gravity	1.39	

MIXING **PSR-4000HG** is supplied in pre-measured containers with a mix ratio by weight of 100 parts **PSR-4000HG** and 43 parts **CA-40HG**. **PSR-4000HG** can be mixed by hand with a mixing spatula for 10 – 15 minutes. Mixing can be done with a mechanical mixer at low speeds to minimize shear thinning for 10 – 15 minutes. Also, mixing can be done with a paint shaker for 10 – 15 minutes.

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-4000HG**. Hold time after cleaning the printed circuit board should be held to a minimum to reduce the oxidation of the copper surfaces.



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SCREEN PRINTING Method: Single Sided and Double Sided Screening

- Screen Mesh: 74 – 110
- 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

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-4000HG** are as followed:

- Oven Temperature: 150 - 185°F (65 - 85°C)
- For Single-Sided (Batch Oven)
 - 1st Side: Dwell Time: 10 - 20 minutes
 - 2nd Side: Dwell Time: 25 - 45 minutes
- For Double-Sided (Conveyorized or Batch Oven)
- Dwell Time: 25 - 60 minutes

EXPOSURE **PSR-4000HG** requires UV exposure to define solder mask dams and features. The spectral sensitivity of **PSR-4000HG** is in the area of 365 nm. Exposure times will vary by bulb type and age of the bulb. Below are guidelines for exposing **PSR-4000HG**.

- Exposure Unit: 5 kW or higher
- Stouffer Step 21: Clear 9 minimum (on metal / under phototool)
- Energy: 200 mJ / cm² minimum (under phototool)



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DEVELOPMENT **PSR-4000HG** 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 - 105°F (29 - 41°C)
 - Spray Pressure: 25 - 45 psi
 - Dwell Time in developing chamber: 45 - 90 seconds
 - Water rinse is needed to remove developer solution followed by a drying step
-

FINAL CURE **PSR-4000HG** needs to be thermally cured 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
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For Process Optimization please contact your local Taiyo America Representative



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FINAL PROPERTIES FOR PSR-4000HG

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

TEST	SM-840 PARAGRAPH	REQUIREMENT	RESULT
Visual	3.4.8	Uniform in Appearance	Pass
Curing	3.4.5	Ref: 3.6.1.1, 3.7.1 and 3.7.2	Pass
Non-Nutrient	3.4.6	Does not contribute to biological growth	Pass
Dimensional	3.4.10	No Solder Pickup and Withstand 500 VDC	Pass
Pencil Hardness	3.5.1	Minimum "F"	Pass – 8H
Adhesion	3.5.2	Rigid – Cu, Ni, FR-4	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	Pass
Solderability	3.7.1	No Adverse Effect J-STD-003	Pass
Resistance to Solder	3.7.2	No Solder Sticking	Pass
Dielectric Strength	3.8.1	500 VDC / mil Minimum	2800 VDC/mil
Thermal Shock	3.9.3	No Blistering, Cracking or De-lamination	Pass

Specific Class "H" Requirements

TEST	SM-840 PARAGRAPH	REQUIREMENT	RESULT
Flammability	3.6.3	UL 94V-0	Pass – File #E166421
Insulation Resistance Before Soldering	3.8.2	5 x 10 ⁸ ohms minimum	Pass (1.02 x 10 ¹² ohms)
After Soldering		5 x 10 ⁸ ohms minimum	Pass (3.48x 10 ¹² ohms)
Moisture & Insulation Resistance Before Soldering–In Chamber	3.9.1	5 x 10 ⁸ ohms minimum	Pass (5.50 x 10 ¹⁰ ohms)
Before Soldering–Out of Chamber		5 x 10 ⁸ ohms minimum	Pass (6.81 x 10 ¹² ohms)
After Soldering–In Chamber		5 x 10 ⁸ ohms minimum	Pass (1.39 x 10 ¹⁰ ohms)
After Soldering–Out of Chamber		5 x 10 ⁸ ohms minimum	Pass (1.95 x 10 ¹³ ohms)
Electrochemical Migration	3.9.2	>2.0 x 10 ⁶ ohms, no dendritic growth	Pass (1.35 x 10 ¹² ohms)

Specific Class "T" Requirements

TEST	SM-840 PARAGRAPH	REQUIREMENT	RESULT
Flammability	3.6.3	Bellcore O ₂ Index – 28 minimum	Pass – 74
Insulation Resistance Before Soldering	3.8.2	5 x 10 ⁸ ohms minimum	Pass (1.33 x 10 ¹² ohms)
After Soldering		5 x 10 ⁸ ohms minimum	Pass (8.73 x 10 ¹² ohms)



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FINAL PROPERTIES FOR PSR-4000HG

Specific Class "T" Requirements

TEST	SM-840 PARAGRAPH	REQUIREMENT	RESULT
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 x 10 ⁸ ohms minimum 5 x 10 ⁸ ohms minimum 5 x 10 ⁸ ohms minimum 5 x 10 ⁸ ohms minimum	Pass (5.33 x 10 ⁹ ohms) Pass (8.47 x 10 ¹² ohms) Pass (4.21 x 10 ⁹ ohms) Pass (4.74 x 10 ¹² ohms)
Electrochemical Migration	3.9.2	< 1 decade drop, no dendritic growth	Pass

Additional Tests / Results

TEST	REQUIREMENT	RESULT
Halogen Content	Halogen-Free if <900ppm	Pass-650ppm
Electroless Nickel / Immersion Gold Resistance	Tape Test Adhesion	Pass
Solvent Resistance	Acetone: MEK: IPA: PMA:	No attack – 24 hours Pass No attack – 24 hours Pass No attack – 24 hours Pass No attack – 24 hours Pass
Acid Resistance	HCl – 10%: H ₂ SO ₄ – 10%:	No attack – 30 Minutes Pass No attack – 30 Minutes Pass
Base Resistance	NaOH – 10%: Boiling Water Resistance:	No attack – 30 Minutes Pass No attack – 15 Minutes Pass
Solder / Flux Resistance (Alphametals)	Alpha 857 water soluble: NR060 no-clean: 3355-NB rosin-based: NR-3000A4 no-clean:	No attack – 1 x 10 sec float (260C) Pass No attack – 1 x 10 sec float (260C) Pass No attack – 1 x 10 sec float (260C) Pass No attack – 1 x 10 sec float (260C) Pass
Solder / Flux Resistance (Multicore)	X32-10M no-clean: X32-06I no-clean:	No attack – 1 x 10 sec float (260C) Pass No attack – 1 x 10 sec float (260C) Pass
Solder/Flux Resistance-(Sanwa)	SR-270 rosin-based:	No attack – 1 x 10 sec float (260C) Pass
Conformal Coating Adhesion: Humiseal 1 B31 acrylic: Humiseal 1A20 urethane: Dow Corning 3-1753 silicone:	Crosscut (10/10) after tape Crosscut (10/10) after tape Crosscut (10/10) after tape	100/100 100/100 100/100
Glue Dot Adhesion – Loctite 3609	Adhesion of Glue Dot to PSR-4000BN	Excellent

Taiyo America, Inc. (TAIYO) warrants its products to be free from defects in materials and workmanship for the specified warranty period (**PSR-4000HG / CA-40HG Warranty period is 12 Months**) provided the customer has, at all times, stored the ink at a temperature of 68°F 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.



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