TECHNICAL DATA SHEET

TAIYO AMERICA
Your Ultimate Solution

PSR-4000 GP01EU Series

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

LIQUID PHOTOIMAGEABLE SOLDER MASK

- **Screen Print or Spray Application**
- **Dark Green Satin or Glossy Finish**
- **RoHS Compliant**
- **Meets Aerospace Outgassing Requirements**
- **Compatible with Lead-Free Processing**
- **Automotive Approval**
- **Excellent Small Hole Clearing**
- **Wide Processing Window**
- **Fine Dam Resolution**
- **Withstands ENIG & Immersion Tin**
- **Low Odor**
- **Halogen-Free**

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PROCESSING PARAMETERS FOR PSR-4000 GP01EU SERIES

PSR-4000 GP01EU and PSR-4000 GP01EU (DG) are two-component alkaline developable LPI solder mask products for spray and screen print application. The products are designed to be user friendly with wide processing latitudes, low odor, fast developing and good resistance to alternate metal finishes such as ENIG and immersion Tin while maintaining dams of 3 mils or less. Both products have a UL 94V-0 rating. All Taiyo America products comply with the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the Restriction of the use of certain Hazardous Substances (RoHS) in electrical and electronic equipment.

PSR-4000 GP01EU SERIES COMPONENTS:

Mixing Ratio	70 parts	30 parts
Color	Green	White

Mixed Properties

Solids	80%	
Viscosity:	GP01EU	220-270ps
	GP01EU (DG)	200ps
Specific Gravity	1.5	

MIXING

PSR-4000 GP01EU Series are supplied in pre-measured containers with a mix ratio by weight of 70 parts (2.8 kgs) **PSR-4000 GP01EU** or **GP01EU (DG)** and 30 parts (1.2 kgs) **CA-40 GP01. PSR-4000 GP01EU** and **GP01EU (DG)** can be mixed in a mechanical mixer at low speeds to minimize shear thinning 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-4000 GP01EU Series**. 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: 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

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 condition for **PSR-4000 GP01EU Series** is as follows:

- Oven Temperature: 71 - 82°C (160 - 180°C)
- 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

EXPOSURE

PSR-4000 GP01EU Series requires UV exposure to define solder mask dams and features. The spectral sensitivity is in the area of 365 nm. Exposure times will vary by bulb type and age of the bulb. Below are guidelines for exposing.

- Exposure Unit: 7 kW or higher
- Stouffer Step 21: Clear 10 minimum (on metal / under phototool)
- Energy: 300mJ / cm^2 minimum (under phototool)

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DEVELOPMENT

PSR-4000 GP01EU Series 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.

FINAL CURE

PSR-4000 GP01EU (DG) 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

For Process Optimization please contact your local Taiyo America Representative

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FINAL PROPERTIES FOR PSR-4000 GP01EU SERIES

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	Pass
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	Pass
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	3100 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 – File #E166421
Insulation Resistance Before Soldering After Soldering	3.8.2	 5×10^8 ohms minimum 5×10^8 ohms minimum	 Pass (9.48×10^{11} ohms) Pass (2.34×10^{12} 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 (3.12×10^{11} ohms) Pass (1.03×10^{13}ohms) Pass (2.87×10^{11}ohms) Pass (1.15×10^{13}ohms)
Electrochemical Migration	3.9.2	>2.0×10^6 ohms, no dendritic growth	Pass (2.25×10^{12} ohms)

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FINAL PROPERTIES FOR PSR-4000 GP01EU SERIES

Specific Class "T" Requirements

TEST	SM-840 PARAGRAPH	REQUIREMENT	RESULT
Flammability	3.6.3.2	Bellcore 0_2 Index – 28 minimum	Pass
Insulation Resistance Before Soldering After Soldering	3.8.2	 5×10^8 ohms minimum 5×10^8 ohms minimum	 Pass (4.12×10^{12} ohms) Pass (3.82×10^{13} ohms)

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	 5×10^8 ohms minimum 5×10^8 ohms minimum 5×10^8 ohms minimum 5×10^8 ohms minimum	 Pass (2.61×10^{13} ohms) Pass (3.21×10^{13}ohms) Pass (2.10×10^{12}ohms) Pass (1.38×10^{13}ohms)
Electrochemical Migration	3.9.2	< 1 decade drop, no dendritic growth	Pass

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FINAL PROPERTIES FOR PSR-4000 GP01EU SERIES

Additional Tests / Results

TEST	REQUIREMENT	RESULT
CTI (Comparative Tracking Index)	ASTM-D-3638-07	600 Volts
Adhesion	GIP-008AA (TAIYO Internal Test Method) Cross-cut tape stripping test	100/100
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
Dielectric Constant	At 1 GHz	3.5
Dissipation Factor	At 1 GHz	0.022
Halogen Content:	<900 ppm Cl	432 ppm
Tg	Internal Test (TMA)	130 C
CTE	Internal Test (TMA) alpha 1 / alpha 2	75 / 140
Electroless Ni/Au	TAIYO Internal Test Method Ni: 3 microns, Au: 0.03 microns	Pass
Outgassing Test; A 2 J/cm^2 UV Cure was done after thermal cure	ASTM E-595-90; TML ≤ 1 % and CVCM ≤ 0.10%	TML-0.54%;CVCM-EU - .01%, EU (DG) 0.02%

Taiyo America, Inc. (TAIYO) warrants its products to be free from defects in materials and workmanship for the specified warranty period **(PSR-4000 GP01EU Series 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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