TECHNICAL DATA SHEET

PSR-4000 MP

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

LIQUID PHOTOIMAGEABLE SOLDER MASK

- **Screen or Spray Application**
- **Dark Green, Matte Finish**
- **RoHS Compliant**
- **Excellent Solder Ball Resistance**
- **Compatible with Lead-Free Processing**
- **Hard Surface Finish and Low Odor**
- **Wide Processing Window**
- **Fine Dam Resolution**
- **Withstands ENIG & Immersion Tin**

Revised March 31, 2016
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PROCESSING PARAMETERS FOR PSR-4000 MP

PSR-4000 MP is a two-component, matte dark Green, alkaline developable LPI solder mask products for flood screen and spray application methods. This product has a low odor, a wide process window and is capable of withstanding alternate metal finishes such as ENIG and immersion Tin. It has a matte Dark Green finish and provides excellent solder ball resistance in no clean flux assembly applications. **PSR-4000 MP** meets or exceeds the requirements of IPC SM-840E Class H and Class T, Bellcore GR-78-CORE Issue 1, and has a UL flammability rating of 94V-0. 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 MP COMPONENTS

	PSR-4000MP / CA-40MP
Mixing Ratio	100 parts / 25 parts
Color	Green / White
Mixed Properties	
Solids	80%
Viscosity	140-180ps
Specific Gravity	1.58

MIXING

PSR-4000 MP is supplied in pre-measured containers with a mix ratio by weight of 100 parts **PSR-4000 MP** and 25 parts **CA-40MP. PSR-4000 MP** 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.

Pot life after mixing is 72 hours when stored in a dark place at ≤ 25°C (77°F).

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 MP**. 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: 86 – 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-4000 MP** are as follows:

- 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-4000 MP requires UV exposure to define solder mask dams and features. The spectral sensitivity of **PSR-4000 MP** 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-4000 MP**.

- Exposure Unit: 5 kW or higher
- Stouffer Step 21: Clear 10 minimum (on metal / under phototool)
- Energy: 250 mJ / cm^2 minimum (under phototool)

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DEVELOPMENT

PSR-4000 MP 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-4000 MP 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

PSR-4000 MP has good solder ball resistance. For even better solder ball **(OPTIONAL)** resistance a UV Bump can be done after Final Cure.

- UV Energy 2000 – 3000 mJ/cm2
- Lamps: High Pressure Mercury Lamps.

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 MP / CA-40 MP 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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FINAL PROPERTIES FOR PSR-4000 MP

IPC-SM-840E, 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 – 7H
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
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	2900 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	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 (3.7×10^{12} ohms) Pass (3.1×10^{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 (6.4×10^9 ohms) Pass (1.2×10^{13} ohms) Pass (1.0×10^{10} ohms) Pass (1.0×10^{13} ohms)
Electrochemical Migration	3.9.2	>2.0×10^6 ohms, no dendritic growth	Pass (1.25×10^{12} ohms)

Specific Class "T" Requirements

TEST	SM-840 PARAGRAPH	REQUIREMENT	RESULT
Flammability	3.6.3	Bellcore 0_2 Index – 28 minimum	Pass – 75
Insulation Resistance Before Soldering After Soldering	3.8.2	 5×10^8 ohms minimum 5×10^8 ohms minimum	 Pass (4.3×10^{13} ohms) Pass (1.7×10^{12} ohms)

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FINAL PROPERTIES FOR PSR-4000 MP

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 (9.9 x 10^9 ohms)
Before Soldering–Out of Chamber		5 x 10^8 ohms minimum	Pass (4.2 x 10^{11}ohms)
After Soldering-In Chamber		5 x 10^8 ohms minimum	Pass (1.9 x 10^9ohms)
After Soldering-Out of Chamber		5 x 10^8 ohms minimum	Pass (2.2 x 10^{11}ohms)
Electrochemical Migration	3.9.2	< 1 decade drop, no dendritic growth	Pass

Additional Tests / Results

TEST	REQUIREMENT	RESULT
Dielectric Constant	Internal Test at 1 MHz	4.7
Dissipation Factor	Internal Test at 1 MHz	0.0220
Outgassing Test ASTM E-595-90 A 2 J/cm^2 UV Cure was done after thermal cure	TML ≤ 1 % CVCM ≤ 0.10%	TML-0.62% CVCM-0.01%
Electroless Nickel / Immersion Gold Resistance	Nickel (85C/30 min) Tape Test Adhesion	Pass
Solvent Resistance Acetone:	No attack – 24 hours	Pass
MEK:	No attack – 24 hours	Pass
IPA:	No attack – 24 hours	Pass
PMA:	No attack – 24 hours	Pass
Acid Resistance HCl – 10%:	No attack – 30 Minutes	Pass
H_2SO_4 – 10%:	No attack – 30 Minutes	Pass
Base Resistance NaOH – 10%:	No attack – 30 Minutes	Pass
Boiling Water Resistance:	No attack – 15 Minutes	Pass
Solder / Flux Resistance (Alphametals)		
Alpha 857 water soluble:	No attack – 1 x 10 sec float (260C)	Pass
NR060 no-clean:	No attack – 1 x 10 sec float (260C)	Pass
3355-NB rosin-based:	No attack – 1 x 10 sec float (260C)	Pass
NR-3000A4 no-clean:	No attack – 1 x 10 sec float (260C)	Pass
Solder / Flux Resistance (Multicore)		
X32-10M no-clean:	No attack – 1 x 10 sec float (260C)	Pass
X32-06I no-clean:	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:	Crosscut (10/10) after tape	100/100
Humiseal 1A20 urethane:	Crosscut (10/10) after tape	100/100
Dow Corning 3-1753 silicone:	Crosscut (10/10) after tape	100/100
Glue Dot Adhesion – Loctite 3609	Adhesion of Glue Dot to PSR-4000MP	Excellent

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