TECHNICAL DATA SHEET

PSR-4000 MP Series

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

LIQUID PHOTOIMAGEABLE SOLDER MASK

- **Screen or Spray Application**
- **Green or Black Matte Finish**
- **DI version available for both Green and Black**
- **Designed specifically for the latest DI equipment**
- **Excellent Solder Ball Resistance**
- **Resistance to No-Clean Flux Residue**
- **Wide Processing Window**
- **Withstands ENIG & Immersion Tin**
- **Hard Surface Finish**
- **Low Odor**

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PROCESSING PARAMETERS FOR PSR-4000 MP Series

PSR-4000 MP Series includes **PSR-4000 MP** and **PSR-4000 MP Black** as well as **PSR-4000 MP DI** and **PSR-4000 MP Black DI**. They are two-component, matte, alkaline developable LPI solder mask product for flood screen and spray application methods. This product has a very low odor, a wide process window and is capable of withstanding alternate metal finishes such as ENIG and immersion Tin. It has a matte finish and provides excellent solder ball resistance in no clean flux assembly applications. **PSR-4000MP Black** 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.

PSR-4000MP Series COMPONENTS

	PSR-4000 MP Series / CA-40MP	
Mixing Ratio	80 parts	20 parts
Color	Green or Black	White
Mixed Properties		
Solids	80%	
Viscosity	140 – 180 ps	
Specific Gravity	1.58	

MIXING

PSR-4000 MP Series is supplied in pre-measured containers with a mix ratio by weight of 80 grams **PSR-4000 MP Series** and 20 grams **CA-40 MP. PSR-4000 MP Series** 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.

Pot life after mixing is 72 hours when stored in a dark place at ≤ 20°C (68°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 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: 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-4000MP Black** 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 (Standard)

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

- Exposure Unit: 5 kW or higher
- Stouffer Step 21: Clear 10 minimum (on metal / under phototool)
- Energy: 400 mJ / cm^2 minimum (under phototool)

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PROCESSING PARAMETERS FOR PSR-4000 MP Series

EXPOSURE (DI)

PSR-4000BN DI Series uses UV-LED curing technology to define solder mask dams and features. The spectral sensitivity is in the area 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

- Stouffer Step 21: Clear 8 minimum (on metal)
- Energy: 200 mJ / cm^2 minimum

DEVELOPMENT

PSR-4000 MP 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 - 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 drying of the board

FINAL CURE

PSR-4000 MP Series 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: 45 – 60 minutes

UV CURE (OPTIONAL)

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

- UV Energy: 2000 – 3000 mJ / cm^2
- Lamps: High Pressure Mercury Lamps

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FINAL PROPERTIES FOR PSR-4000 MP Series

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
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 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 Series

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

Additional Tests / Results

TEST		REQUIREMENT	RESULT
Electroless Nickel / Immersion Gold Resistance		Nickel (85C/30min) Tape Test	Pass
Solvent Resistance		No attack – 24 hours	Pass
Acetone:		No attack – 24 hours	Pass
	MEK: IPA: PMA:	No attack – 24 hours	Pass
		No attack – 24 hours	Pass
Acid Resistance	HCI – 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	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 to PSR-4000 MP Series	Excellent

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