

Technical Data Sheet

TAIYO PSR-4000MP Black

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

LIQUID PHOTOIMAGEABLE SOLDER MASK

- ③ **Screen or Spray Application**
- ③ **Black, Matte Finish**
- ③ **Excellent Solder Ball Resistance**
- ③ **Resistance to No-Clean Flux Residue**
- ③ **Wide Processing Window**
- ③ **Withstands ENIG & Immersion Tin**
- ③ **Hard Surface Finish**
- ③ **Low Odor**



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2675 Antler Drive, Carson City, NV 89701 • (775) 885-9959 • Fax: (775) 885-9972 • www.taiyo-america.com

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PROCESSING PARAMETERS FOR PSR-4000MP BLACK

PSR-4000MP Black is a two-component, black 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 BLACK COMPONENTS	PSR-4000MP Black / CA-40MP	
Mixing Ratio	100 parts	25 parts
Color	Black	White
<u>Mixed Properties</u>		
Solids	80%	
Viscosity	140 – 180 ps	
Specific Gravity	1.58	

MIXING

PSR-4000MP Black is supplied in pre-measured containers with a mix ratio by weight of 100 parts **PSR-4000MP Black** and 25 parts **CA-40MP**. **PSR-4000MP Black** 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-4000MP Black**. 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 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-4000MP Black** requires UV exposure to define solder mask dams and features. The spectral sensitivity of **PSR-4000MP Black** 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 / cm² minimum (under phototool)



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DEVELOPMENT **PSR-4000MP Black** 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-4000MP BLACK** 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-4000MP BLACK** 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 / cm²
- Lamps: High Pressure Mercury Lamps

For Process Optimization please contact your local Taiyo America Representative



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FINAL PROPERTIES FOR PSR-4000MP BLACK

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, 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 After Soldering	3.8.2	5 x 10 ⁸ ohms minimum 5 x 10 ⁸ ohms minimum	Pass (3.7 x 10 ¹² ohms) Pass (3.1 x 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 x 10 ⁸ ohms minimum 5 x 10 ⁸ ohms minimum 5 x 10 ⁸ ohms minimum 5 x 10 ⁸ ohms minimum	Pass (6.4 x 10 ⁹ ohms) Pass (1.2 x 10 ¹³ ohms) Pass (1.0 x 10 ¹⁰ ohms) Pass (1.0 x 10 ¹³ ohms)
Electrochemical Migration	3.9.2	>2.0 x 10 ⁶ ohms, no dendritic growth	Pass (1.25 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 – 75
Insulation Resistance Before Soldering After Soldering	3.8.2	5 x 10 ⁸ ohms minimum 5 x 10 ⁸ ohms minimum	Pass (4.3 x 10 ¹³ ohms) Pass (1.7 x 10 ¹² ohms)



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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 (9.9 x 10 ⁹ ohms) Pass (4.2 x 10 ¹¹ ohms) Pass (1.9 x 10 ⁹ ohms) 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
Electroless Nickel / Immersion Gold Resistance	Nickel (85C/30min) Tape Test Adhesion	Pass
Solvent Resistance	Acetone: MEK: IPA: PMA:	No attack – 24 hours No attack – 24 hours No attack – 24 hours No attack – 24 hours
Acid Resistance	HCl – 10%: H ₂ SO ₄ – 10%:	No attack – 30 Minutes No attack – 30 Minutes
Base Resistance	NaOH – 10%:	No attack – 30 Minutes
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 to PSR-4000MP Black	Excellent

Taiyo America, Inc. (TAIYO) warrants its products to be free from defects in materials and workmanship for the specified warranty period (**PSR-4000MP Black / CA-40MP 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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