

PSR-4000BN Colors *(UL Name: PSR-4000BN / CA-40 BN)*

LIQUID PHOTOIMAGEABLE SOLDER MASK



- ③ **Screen or Spray Application**
- ③ **Available in Black, Blue, White, Clear, Red, Yellow, Purple or Orange Semi-Gloss Finish**
- ③ **Best in Class for Small Hole Clearing**
- ③ **RoHS Compliant & Halogen-free**
- ③ **Compatible with Lead-Free Processing**
- ③ **Wide Processing Window**
- ③ **Withstands ENIG & Immersion Tin**
- ③ **Low Odor**

TECHNICAL DATA SHEET



PSR-4000BN Colors includes **Black, Blue, Clear, Red, White, Yellow, Orange or Purple**. They are two- component, alkaline developable LPI solder mask products for flood screen and spray application methods. 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 fine dams. **PSR-4000BN Colors** meet or exceed 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-4000BN SERIES COMPONENTS	PSR-4000BN Colors/ CA-40BN	
Mixing Ratio	100 parts	43 parts
Color	Black, Blue, Clear, Red, White, Yellow, Orange or Purple	White
<u>Mixed Properties PSR-4000BN Colors</u>		
Solids	77%	
Viscosity	175-225ps	
Specific Gravity	1.39	

MIXING **PSR-4000BN Colors** is supplied in pre-measured containers with a mix ratio by weight of 100 parts **PSR-4000BN Colors** and 43 parts **CA-40BN**. **PSR-4000BN Colors** 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 $\leq 20^{\circ}\text{C}$ (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-4000BN Colors**. Hold time after cleaning the printed circuit board should be held to a minimum to reduce the oxidation of the copper surfaces.

PROCESSING PARAMETERS FOR PSR-4000BN COLORS

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-4000BN Colors** 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-4000BN Colors require UV exposure to define solder mask dams and features. The spectral sensitivity of **PSR-4000BN Colors** 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-4000BN Colors**.

- Exposure Unit: 5 kW or higher
- See table for Energy and Stouffer Step per Color

TECHNICAL DATA SHEET



EXPOSURE (continued)

PSR-4000 BN Color	Exposure Energy	Stouffer Step Range
Black	Minimum 500 mJ/cm ²	9 – 11
Blue	Minimum 400 mJ/cm ²	10 – 12
Clear	Minimum 200 mJ/cm ²	9 – 11
Red, Orange, Purple	Minimum 400 mJ/cm ²	10 – 12
White	Minimum 500 mJ/cm ²	10 – 12
Yellow	Minimum 500 mJ/cm ²	10 – 12

DEVELOPMENT

PSR-4000BN Colors are 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-4000BN Colors require 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

FINAL PROPERTIES FOR PSR-4000BN COLORS

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 – 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
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	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 (2.02 x 10 ¹² ohms)
After Soldering		5 x 10 ⁸ ohms minimum	Pass (3.18 x 10 ¹² ohms)
Moisture & Insulation Resistance Before Soldering–In Chamber	3.9.1	5 x 10 ⁸ ohms minimum	Pass (4.97 x 10 ⁹ ohms)
Before Soldering–Out of Chamber		5 x 10 ⁸ ohms minimum	Pass (1.13 x 10 ¹² ohms)
After Soldering–In Chamber		5 x 10 ⁸ ohms minimum	Pass (4.08 x 10 ⁹ ohms)
After Soldering–Out of Chamber		5 x 10 ⁸ ohms minimum	Pass (2.61 x 10 ¹² ohms)
Electrochemical Migration	3.9.2	>2.0 x 10 ⁶ ohms, no growth	Pass (1.34 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 (1.12 x 10 ¹² ohms)
After Soldering		5 x 10 ⁸ ohms minimum	Pass (7.15 x 10 ¹¹ ohms)

FINAL PROPERTIES FOR PSR-4000BN COLORS

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 (1.94 x 10 ⁹ ohms)
Before Soldering–Out of Chamber		5 x 10 ⁸ ohms minimum	Pass (9.65 x 10 ¹¹ ohms)
After Soldering-In Chamber		5 x 10 ⁸ ohms minimum	Pass (2.18 x 10 ⁹ ohms)
After Soldering-Out of Chamber		5 x 10 ⁸ ohms minimum	Pass (1.48 x 10 ¹² ohms)
Electrochemical Migration	3.9.2	< 1 decade drop, no dendritic growth	Pass

Additional Tests / Results

TEST	REQUIREMENT	RESULT
<i>Halogen Level</i>		
<i>Black, Clear and White</i>	<i>Halogen Free if <900 ppm</i>	<i>300 ppm</i>
<i>Blue</i>	<i>Halogen Free if <900 ppm</i>	<i>625 ppm</i>
<i>Red</i>	<i>Halogen Free if <900 ppm</i>	<i>634 ppm</i>
<i>Yellow</i>	<i>Halogen Free if <900 ppm</i>	<i>649 ppm</i>
<i>Purple</i>	<i>Halogen Free if <900 ppm</i>	<i>464 ppm</i>
<i>Orange</i>	<i>Halogen Free if <900 ppm</i>	<i>657 ppm</i>
<i>Electroless Nickel / Immersion Gold Resistance</i>	<i>Nickel (85C/30 min) Tape Test Adhesion</i>	<i>Pass</i>
<i>Solvent Resistance</i>		
<i>Acetone:</i>	<i>No attack – 24 hours</i>	<i>Pass</i>
<i>MEK:</i>	<i>No attack – 24 hours</i>	<i>Pass</i>
<i>IPA:</i>	<i>No attack – 24 hours</i>	<i>Pass</i>
<i>PMA:</i>	<i>No attack – 24 hours</i>	<i>Pass</i>
<i>Acid Resistance</i>		
<i>HCl – 10%:</i>	<i>No attack – 30 Minutes</i>	<i>Pass</i>
<i>H₂SO₄ – 10%:</i>	<i>No attack – 30 Minutes</i>	<i>Pass</i>
<i>Base Resistance</i>		
<i>NaOH – 10%:</i>	<i>No attack – 30 Minutes</i>	<i>Pass</i>
<i>Boiling Water Resistance:</i>	<i>No attack – 15 Minutes</i>	<i>Pass</i>
<i>Solder / Flux Resistance</i>		
<i>Alpha 857 water soluble:</i>	<i>No attack – 1 x 10 sec float (260C)</i>	<i>Pass</i>
<i>NR060 no-clean:</i>	<i>No attack – 1 x 10 sec float (260C)</i>	<i>Pass</i>
<i>3355-NB rosin-based:</i>	<i>No attack – 1 x 10 sec float (260C)</i>	<i>Pass</i>
<i>NR-3000A4 no-clean:</i>	<i>No attack – 1 x 10 sec float (260C)</i>	<i>Pass</i>
<i>Solder / Flux Resistance (Multicore) X32-10M no-clean:</i>	<i>No attack – 1 x 10 sec float (260C)</i>	<i>Pass</i>
<i>X32-06I no-clean:</i>	<i>No attack – 1 x 10 sec float (260C)</i>	<i>Pass</i>
<i>Solder/Flux Resistance-(Sanwa) SR-270 rosin-based:</i>	<i>No attack – 1 x 10 sec float (260C)</i>	<i>Pass</i>
<i>Conformal Coating Adhesion:</i>		
<i>Humiseal 1 B31 acrylic:</i>	<i>Crosscut (10/10) after tape</i>	<i>100/100</i>
<i>Humiseal 1A20 urethane:</i>	<i>Crosscut (10/10) after tape</i>	<i>100/100</i>
<i>Dow Corning 3-1753 silicone:</i>	<i>Crosscut (10/10) after tape</i>	<i>100/100</i>
<i>Glue Dot Adhesion – Loctite 3609</i>	<i>Adhesion of Glue Dot to PSR-4000BN</i>	<i>Excellent</i>

Taiyo America, Inc. (TAIYO) warrants its products to be free from defects in materials and workmanship for the specified warranty period (**PSR-4000BN Colors/ CA-40BN Warranty period is 12 Months**) provided the customer has, at all times, stored the ink at a temperature of 68°F(20°C) 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.