

## ***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**
- ③ **Compatible with Lead-Free Processing**
- ③ **Wide Processing Window**
- ③ **Withstands ENIG & Immersion Tin**
- ③ **Low Odor**

## **PROCESSING PARAMETERS FOR PSR-4000BN COLORS**

**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.

<b>PSR-4000BN SERIES COMPONENTS</b>	<b>PSR-4000BN Colors / CA-40BN</b>	
Mixing Ratio	100 parts	43 parts
Color	Black, Blue, Clear, Red, White, Yellow, Orange or Purple	White
<b><u>Mixed Properties PSR-4000BN Colors</u></b>		
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 ≤ 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 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**

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**SCREEN PRINTING** Method: Single Sided and Double Sided Screening

- Screen Mesh: 83 – 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: 65 – 100 psi
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**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)
    - 1<sup>st</sup> Side: Dwell Time: 15 - 20 minutes
    - 2<sup>nd</sup> Side: Dwell Time: 25 - 45 minutes
  - For Double-Sided (Conveyorized or Batch Oven)
  - Dwell Time: 40 - 65 minutes
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**EXPOSURE** **PSR-4000BN Colors** uses UV-LED curing technology to define solder mask dams and features. The spectral sensitivity is around 365 nm – 405nm. Exposure times will vary by power, light source, wavelength and age of the light source. Below are guidelines for exposure.

- Exposure Unit: Direct Imaging Exposure Unit
- Stouffer Step 21: Clear 8 minimum (on metal)
- Energy: 250mJ / cm<sup>2</sup> minimum

# TECHNICAL DATA SHEET



## EXPOSURE (continued)

PSR-4000 BN DI Color	Exposure Energy	Stouffer Step Range
Black	Minimum 800 mJ/cm <sup>2</sup>	9 – 11
Blue	Minimum 300 mJ/cm <sup>2</sup>	10 – 12
Clear	Minimum 200 mJ/cm <sup>2</sup>	9 – 11
Red, Orange, Purple	Minimum 300 mJ/cm <sup>2</sup>	10 – 12
White	Minimum 800 mJ/cm <sup>2</sup>	10 – 12
Yellow	Minimum 800 mJ/cm <sup>2</sup>	10 – 12

## DEVELOPMENT

**PSR-4000BN Colors** 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 minimum, to
- 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

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## 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.

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**FINAL CURE** **PSR-4000BN COLORS** 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

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*For Process Optimization please contact your local Taiyo America Representative*

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## FINAL PROPERTIES FOR PSR-400BN 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 <sup>8</sup> ohms minimum	Pass (2.02 x 10 <sup>12</sup> ohms)
After Soldering		5 x 10 <sup>8</sup> ohms minimum	Pass (3.18 x 10 <sup>12</sup> ohms)
Moisture & Insulation Resistance Before Soldering–In Chamber	3.9.1	5 x 10 <sup>8</sup> ohms minimum	Pass (4.97 x 10 <sup>9</sup> ohms)
Before Soldering–Out of Chamber		5 x 10 <sup>8</sup> ohms minimum	Pass (1.13 x 10 <sup>12</sup> ohms)
After Soldering–In Chamber		5 x 10 <sup>8</sup> ohms minimum	Pass (4.08 x 10 <sup>9</sup> ohms)
After Soldering–Out of Chamber		5 x 10 <sup>8</sup> ohms minimum	Pass (2.61 x 10 <sup>12</sup> ohms)
Electrochemical Migration	3.9.2	>2.0 x 10 <sup>6</sup> ohms, no growth	Pass (1.34 x 10 <sup>12</sup> ohms)

### Specific Class "T" Requirements

TEST	SM-840 PARAGRAPH	REQUIREMENT	RESULT
Flammability	3.6.3	Bellcore O <sub>2</sub> Index – 28 minimum	Pass – 74
Insulation Resistance Before Soldering	3.8.2	5 x 10 <sup>8</sup> ohms minimum	Pass (1.12 x 10 <sup>12</sup> ohms)
After Soldering		5 x 10 <sup>8</sup> ohms minimum	Pass (7.15 x 10 <sup>11</sup> ohms)

# TECHNICAL DATA SHEET



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

### Additional Tests / Results

TEST	REQUIREMENT	RESULT
Halogen Level	Black, Clear and White	Halogen Free if <900 ppm
	Blue	Halogen Free if <900 ppm
	Red	Halogen Free if <900 ppm
	Yellow	Halogen Free if <900 ppm
	Orange and Purple	Halogen Free if <900 ppm
Electroless Nickel / Immersion Gold Resistance	Nickel (85C/30 min) Tape Test	Pass
Solvent Resistance	Acetone:	No attack –
	MEK:	24 hours No
	IPA:	attack – 24
	PMA:	hours No
Acid Resistance	HCl – 10%:	No attack – 30 Minutes
	H <sub>2</sub> SO <sub>4</sub> – 10%:	No attack – 30 Minutes
Base Resistance	NaOH – 10%:	No attack – 30 Minutes
	Boiling Water Resistance:	No attack – 15 Minutes
Solder / Flux Resistance	Alpha 857 water soluble:	No attack – 1 x 10 sec float
	NR060 no-clean:	(260C) No attack – 1 x 10
	3355-NB rosin-based:	sec float (260C) No attack –
	NR-3000A4 no-clean:	1 x 10 sec float (260C) No
Solder / Flux Resistance(Multicore) X32-10M no-clean:		attack – 1 x 10 sec float
	X32-06l no-clean:	(260C) No attack – 1 x 10
Solder/Flux Resistance-(Sanwa) SR-270 rosin-based:		sec float (260C) No attack –
Conformal Coating Adhesion: Humiseal 1 B31 acrylic:	Crosscut (10/10)	100/100
	after tape Crosscut	100/100
	(10/10) after tape	100/100
Glue Dot Adhesion – Loctite 3609	Adhesion of Glue Dot to PSR-	Excellent

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.