TAIYO AMERICA

PSR-4000BN DI Series

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

LIQUID PHOTOIMAGEABLE SOLDER MASK

- **Designed specifically for the latest DI Technology**
- **Screen or Spray Application**
- **Available in Green or Dark Green Semi- Gloss Finish**
- **RoHS Compliant**
- **High Viscosity version for improved edge coverage on High Traces**
- **Compatible with Lead-Free Processing**
- **Best in Class for Small Hole Clearing**
- **Wide Processing Window**
- **Fine Dam Resolution**
- **Withstands ENIG & Immersion Tin**

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PROCESSING PARAMETERS FOR PSR-4000BN DI SERIES

PSR-4000BN DI Series includes **PSR-4000BN DI, PSR-4000BN (HV) DI**, and **PSR-4000BN (DG) DI.** 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 dams of 3 mils or less. The **PSR-4000 BN (HV) DI** provides improved edge coverage over high circuits while the **PSR-4000BN (DG) DI** provides the same benefit in a Dark Green color. **PSR-4000BN DI Series** 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-4000BN DI SERIES COMPONENTS

	PSR-4000BN DI Series	CA-40BN DI
Mixing Ratio	100 parts	43 parts
Color	Green	White

Mixed Properties	**HV**	**DG**
Solids	77%	77%
Viscosity	175-225ps	175-225ps
Specific Gravity	1.39	1.39

MIXING

PSR-4000BN DI Series is supplied in pre-measured containers with a mix ratio by weight of 100 parts **PSR-4000BN DI Series** and 43 parts **CA-40BN DI. PSR-4000BN DI 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-4000BN DI 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: 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

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 DI Series** are as follows:

- Oven Temperature: 150 - 185°F (65 - 85°C)
- For Single-Sided (Batch Oven)
  - 1st Side: Dwell Time: 15 - 20 minutes
  - 2nd Side: Dwell Time: 25 - 45 minutes
- For Double-Sided (Conveyorized or Batch Oven)
- Dwell Time: 40 - 65 minutes

EXPOSURE

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: 250mJ / cm^2 minimum

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DEVELOPMENT

PSR-4000BN DI 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 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

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.

FINAL CURE

PSR-4000BN DI 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

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-4000BN DI / CA-40BN DI Warranty period is 12 Months)** provided the customer has, at all times, stored the ink at a temperature of 68ºF(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.

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FINAL PROPERTIES FOR PSR-4000BN DI SERIES

IPC-SM-840E, Class H & T, Solder Mask Vendor Testing Requirements

TEST	SM-840 PARAGRAPH	REQUIREMENT	RESULT
Visual	3.3.1	Uniform in Appearance	Pass
Curing	3.2.5.1	Ref: 3.6.1.1, 3.7.1 and 3.7.2	Pass
Non-Nutrient	3.2.6	Does not contribute to biological growth	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, 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	3.8.2		
Before Soldering		5 x 10^8 ohms minimum	Pass (1.29 x 10^{13} ohms)
After Soldering		5 x 10^8 ohms minimum	Pass (3.31 x 10^{13} ohms)
Moisture & Insulation Resistance	3.9.1		
Before Soldering–In Chamber		5 x 10^8 ohms minimum	Pass (6.61 x 10^{10} ohms)
Before Soldering–Out of Chamber		5 x 10^8 ohms minimum	Pass (2.50 x 10^{12} ohms)
After Soldering-In Chamber		5 x 10^8 ohms minimum	Pass (1.89 x 10^{10} ohms)
After Soldering-Out of Chamber		5 x 10^8 ohms minimum	Pass (1.07 x 10^{13} ohms)
Electrochemical Migration	3.9.2	>2.0 x 10^6 ohms, no dendritic growth	Pass (1.35 x 10^{12} ohms)

Specific Class “T” Requirements

TEST	SM-840 PARAGRAPH	REQUIREMENT	RESULT
Flammability	3.6.3	Bellcore 0_2 Index – 28 minimum	Pass – 74
Insulation Resistance	3.8.2		
Before Soldering		5 x 10^8 ohms minimum	Pass (2.23 x 10^9 ohms)
After Soldering		5 x 10^8 ohms minimum	Pass (1.14 x 10^{13} ohms)

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TECHNICAL DATA SHEET

FINAL PROPERTIES FOR PSR-4000BN DI 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 minimum	Pass (1.77 x 10^9 ohms)
Before Soldering–Out of Chamber		5 x 10^8 ohms minimum	Pass (1.80 x 10^{13}ohms)
After Soldering-In Chamber		5 x 10^8 ohms minimum	Pass (2.78 x 10^{10}ohms)
After Soldering-Out of Chamber		5 x 10^8 ohms minimum	Pass (2.31 x 10^{13}ohms)
Electrochemical Migration	3.9.2	< 1 decade drop, no dendritic growth	Pass

Additional Tests / Results

TEST		REQUIREMENT	RESULT
CTI (Comparative Tracking Index)		ASTM-D-3638-07	450 Volts
Dielectric Constant		Internal Test at 1 GHz	3.9
Dissipation Factor		Internal Test at 1 GHz	0.0270
Tg		Internal Test	125˚C
CTE		Internal Test (α1 / α2)	70/140 ppm
Outgassing Test ASTM E-595-90 A 2 J/cm^2 UV Cure was done after thermal cure		TML ≤ 1 % CVCM ≤ 0.10%	TML-0.51% CVCM-0.02%
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-4000BN	Excellent

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