TECHNICAL DATA SHEET

PSR-4000 HFX Satin Colors

(UL Name: PSR-4000DE / CA-40HF)

LIQUID PHOTOIMAGEABLE SOLDER MASK

- **Application by Screen Printing**
- **Available in Black, Blue, Clear, Red and White Satin Finish**
- **All Colors are Halogen-Free**
- **RoHS Compliant**
- **Compatible with Lead-Free Processing**
- **Excellent Small Hole Clearing**
- **Wide Processing Window**
- **Excellent Resistance to ENIG and Immersion Tin**

Revised March 31, 2016

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PROCESSING PARAMETERS FOR PSR-4000 HFX SATIN COLORS

PSR-4000 HFX Satin Colors includes **Black, Blue, Clear, Red and White.** They are two-component, alkaline developable LPI solder mask products for screen printing application. These products are designed to be user friendly with wide processing latitudes They have a very fast photospeed and good resistance to alternate metal finishes such as ENIG and immersion Tin. They also have very good small hole clearing capabilities. **PSR-4000 HFX Satin Colors** meet or exceed the requirements of IPC SM-840E Class H and Class T, Bellcore GR-78-CORE Issue 1, and have 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-4000 HFX SATIN COMPONENTS

	PSR-4000 HFX Satin Colors / CA-40HF	
Mixing Ratio	100 parts	43 parts
Colors	Black, Blue, Clear, Red or White	White

Mixed Properties

Solids	75%
Specific Gravity	1.39

MIXING

PSR-4000 HFX Satin Colors are supplied in pre-measured containers with a mix ratio by weight of 100 parts **PSR-4000 HFX Satin Colors** and 43 parts **CA-40HF. PSR-4000 HFX Satin 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 of these methods will provide a clean surface for the application of **PSR-4000 HFX Satin Colors.** 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: 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 photospeed. Insufficient tack dry will result in artwork marking and/or sticking. Typical tack dry conditions for **PSR-4000 HFX Satin 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 - 50 minutes
- For Double-Sided (Conveyorized or Batch Oven)
- Dwell Time: 25 - 50 minutes

EXPOSURE

PSR-4000 HFX Satin Colors requires UV exposure to define solder mask dams and features. The spectral sensitivity of **PSR-4000 HFX Satin 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-4000 HFX Satin Colors.**

- Exposure Unit: 7 kW or higher
- See table for Energy and Stouffer Step per Color

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PROCESSING PARAMETERS FOR PSR-4000 HFX Satin Colors

EXPOSURE (CONTINUED)

PSR-4000 HFX Satin Colors	Exposure Energy	Stouffer Step Range	Resolution Capabilities*
Black	Minimum 500 mJ/cm^2	9 – 11	4 mil dams
Blue	Minimum 400 mJ/cm^2	10 – 12	3 mil dams
Clear	Minimum 200 mJ/cm^2	9 – 11	3 mil dams
Red	Minimum 400 mJ/cm^2	10 – 12	3 mil dams
White	Minimum 500 mJ/cm^2	10 - 12	4 mil dams

***At coating thicknesses of 30 microns or less.**

DEVELOPMENT

PSR-4000 HFX Satin 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 - 95°F (29 - 35°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-4000 HFX Satin Colors 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 at Temperature: 45 – 60 minutes

For Process Optimization please contact your local Taiyo America Representative

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FINAL PROPERTIES FOR PSR-4000 HFX Satin 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 – 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
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	3200 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 UL Name: PSR-4000 DE / CA-40 HF
Insulation Resistance Before Soldering After Soldering	3.8.2	 5×10^8 ohms minimum 5×10^8 ohms minimum	 Pass (8.60×10^{11} ohms) Pass (1.98×10^{12} 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	 5×10^8 ohms minimum 5×10^8 ohms minimum 5×10^8 ohms minimum 5×10^8 ohms minimum	 Pass (7.6×10^{10} ohms) Pass (3.0×10^{12} ohms) Pass (4.4×10^{10} ohms) Pass (2.4×10^{13} ohms)
Electrochemical Migration	3.9.2	>2.0×10^6 ohms, no dendritic growth	Pass (1.6×10^{12} ohms)

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FINAL PROPERTIES FOR PSR-4000 HFX Satin Colors

Specific Class "T" Requirements

TEST	SM-840 PARAGRAPH	REQUIREMENT	RESULT
Flammability	3.6.3	Bellcore 02 Index – 28 minimum	Pass
Insulation Resistance			
Before Soldering	3.8.2	5 x 10^8 ohms minimum	Pass (3.3 x 10^{13} ohms)
After Soldering		5 x 10^8 ohms minimum	Pass (3.9 x 10^{12} 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 (3.1 x 10^9 ohms) Pass (1.5 x 10^{13}ohms) Pass (8.4 x 10^9ohms) Pass (1.5 x 10^{12}ohms)
Electrochemical Migration	3.9.2	< 1 decade drop, no dendritic growth	Pass

Additional Tests / Results

TEST	REQUIREMENT	RESULT
CTI (Comparative Tracking Index) – Green Satin	ASTM-D-3638-07	600 Volts
Halogen Content	Halogen-Free if < 900 ppm	Halogen Level: Black 270 ppm Blue 363 ppm Clear 305 ppm Red 832 ppm White 303 ppm Green 400 ppm
Dielectric Constant – Green Satin	Internal Test at: 1 GHz	3.5
Dissipation Factor – Green Satin	Internal Test at: 1 GHz	0.019
Electroless Nickel / Immersion Gold Resistance	Tape Test Adhesion	Pass

Taiyo America, Inc. (TAIYO) warrants its products to be free from defects in materials and workmanship for the specified warranty period **(PSR-4000 HFX Satin Colors / CA-40HF Warranty period is 9 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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