TECHNICAL DATA SHEET

PSR-4000 LDI (US)

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

LASER DIRECT IMAGING SOLDER MASK

- **For LDI Exposing**
- **Available in Green, Blue, Black, Clear and Red Satin Finish**
- **Halogen-Free**
- **RoHS Compliant**
- **Compatible with Lead-Free Processing**
- **Fine Dam Resolution**
- **Excellent Small Hole Clearing**
- **Wide Processing Window**
- **Excellent Resistance to ENIG and Immersion Tin**

PROCESSING PARAMETERS FOR PSR-4000 LDI (US)

PSR-4000 LDI (US) is a dark green liquid Laser Direct Imaging solder mask with a satin finish. It is a two-component, alkaline developable LPI solder mask products for spray or screen printing application. This product is designed to be user friendly with wide processing latitude. It can be exposed using an LDI Exposure Unit. It has good resistance to alternate metal finishes such as ENIG and immersion Tin while maintaining solder dams of 2 mils or less. It also has very good small hole clearing capabilities. **PSR-4000 LDI (US)** 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-4000 LDI (US)

	PSR-4000 LDI (US)	/ CA-40LDI
Mixing Ratio	70 parts	30 parts
Colors	Color	White

Mixed Properties	
Solids	75%
Specific Gravity	1.39

MIXING

PSR-4000 LDI (US) is supplied in pre-measured containers with a mix ratio by weight of 70 parts **PSR-4000 LDI (US)** and 30 parts **CA-40LDI PSR-4000 LDI (US)** 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 48 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 LDI (US).** 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-4000 LDI (US)

SCREEN PRINTING

Method: Single Sided and Double Sided Screening

- Screen Mesh: 92 – 110 threads/inch (36 – 43 threads/cm)
- 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 LDI (US)** are as follows:

- Oven Temperature: 150 - 185°F (65 - 85°C)
- For Single-Sided (Batch Oven)
  1st Side: Dwell Time: 10 - 15 minutes
  2nd Side: Dwell Time: 20 - 30 minutes
- For Double-Sided (Conveyorized or Batch Oven)
- Dwell Time: 30 - 45 minutes

EXPOSURE

PSR-4000 LDI (US) requires UV exposure to define solder mask dams and features. The spectral sensitivity of **PSR-4000 LDI (US)** is in the area of 355 - 365 nm. Below are guidelines for exposing **PSR-4000 LDI (US).**

LDI Exposure Unit

- Exposure Unit: Orbotech 8k Series or above
- Stouffer Step 21: Clear 10 minimum (on metal)
- Energy: 25 - 100 mJ/cm^2 minimum

PROCESSING PARAMETERS FOR PSR-4000 LDI (US)

DEVELOPMENT

PSR-4000 LDI (US) 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 - 95°F (29 - 35°C)
- Spray Pressure: 25 - 45 psi
- Dwell Time in developing chamber: 60 - 90 seconds
- Water rinse is needed to remove developer solution followed by a drying step

FINAL CURE

PSR-4000 LDI (US) 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

Taiyo America, Inc. (TAIYO) warrants its products to be free from defects in materials and workmanship for the specified warranty period **(PSR-4000 LDI (US) / CA-40 LDI Warranty period is 6 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.

FINAL PROPERTIES FOR PSR-4000 LDI (US)

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 – 6H
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	3100 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 (3.48 x 10^{13} ohms)
After Soldering		5 x 10^{8} ohms minimum	Pass (1.14 x 10^{13} ohms)
Moisture & Insulation Resistance	3.9.1		
Before Soldering–In Chamber		5 x 10^{8} ohms minimum	Pass (5.12 x 10^{10} ohms)
Before Soldering–Out of Chamber		5 x 10^{8} ohms minimum	Pass (2.03 x 10^{13} ohms)
After Soldering-In Chamber		5 x 10^{8} ohms minimum	Pass (4.87 x 10^{10} ohms)
After Soldering-Out of Chamber		5 x 10^{8} ohms minimum	Pass (1.25 x 10^{13} ohms)
Electrochemical Migration	3.9.2	>2.0 x 10^{6} ohms, no dendritic growth	Pass (2.25 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
Insulation Resistance	3.8.2		
Before Soldering		5 x 10^{8} ohms minimum	Pass (4.21 x 10^{12} ohms)
After Soldering		5 x 10^{8} ohms minimum	Pass (7.82 x 10^{12} ohms)

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FINAL PROPERTIES FOR PSR-4000 LDI (US)

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 (3.16 x 10^{13} ohms)
Before Soldering–Out of Chamber		5 x 10^8 ohms minimum	Pass (4.12 x 10^{13}ohms)
After Soldering-In Chamber		5 x 10^8 ohms minimum	Pass (1.10 x 10^{12}ohms)
After Soldering-Out of Chamber		5 x 10^8 ohms minimum	Pass (3.38 x 10^{13}ohms)
Electrochemical Migration	3.9.2	< 1 decade drop, no dendritic growth	Pass

Additional Tests / Results

TEST		REQUIREMENT	RESULT
Outgassing Test ASTM E-595-90		TML ≤ 1 %	TML-0.66%
A 2 J/cm^2 UV Cure was done after thermal cure		CVCM ≤ 0.10%	CVCM-0.00%
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
Dielectric Constant Dk		Internal Test at 1 GHz	3.9
Dissipation Factor Df		Internal Test at 1 GHz	0.020
Tg		TMA Method	130°C
CTE		Internal Test (a1 / a2)	83 / 147 ppm

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