TECHNICAL DATA SHEET

TAIYO AMERICA

PSR-4000 CC01SE SM-SP

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

LIQUID PHOTOIMAGEABLE SOLDER MASK

- **Spray and Screen Print Application**
- **Aqueous Developing Solder Mask**
- **RoHS Compliant**
- **Halogen-Free**
- **Compatible with Lead-Free Processing**
- **Wide Processing Window**
- **Excellent Resistance to ENIG & Immersion Tin**
- **Resistant to Hot Storage**
- **Conforms to IPC SM-840E Requirements**
- **Compatible to LASER Marking**
- **Semi-Matte finishes**

Revised March 06, 2019

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PROCESSING PARAMETERS FOR PSR-4000 CC01SE SM-SP

PSR-4000 CC01SE SM-SP COMPONENTS:

	PSR-4000 CC01SE SM-SP	/ CA-40 CC01
Mixing Ratio	80 parts	20 parts
Color	Green	White

Mixed Properties	
Solids	81%
Viscosity	185 – 225 ps
Specific Gravity	1.99

MIXING

PSR-4000 CC01SE SM-SP is supplied in pre-measured containers with a mix ratio by weight of 80 parts, **PSR-4000 CC01SE SM-SP** and 20 parts, **CA-40 CC01.** For Screen Printing, mix both components together for 10 – 15 minutes.

For Spray, PMA solvent is added at 20-25%, of the mixed ink and hardener. **PSR-4000 CC01SE** can be mixed a mechanical mixer at low speeds to minimize shear thinning for 10 – 15 minutes. The resulting viscosity with the PMA addition should be between 60 – 100 seconds in a Ford #4 or Erichsen #4 cup at 24°C. The pot life is 72 hours if stored in dark place < 25° C.

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. For full body gold an alkaline cleaner is recommended. All of these methods will provide a clean surface for the application of **PSR-4000 CC01SE SM-SP.** Hold time after cleaning the PCB should be held to a minimum to reduce the oxidation of the copper surfaces.

SCREEN PRINTING

Method: Single Sided and Double Sided Screening

- Screen Mesh: 29 – 43 threads/cm (74 – 110 tpi)
- 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: 70 – 100 psi

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SPRAY APPLICATION

Start by setting the atomization pressure at 30 psi and spray a panel. Increase the spray atomization pressure until you have a smooth non-mottled surface. If you exceed 35 psi add additional solvent and reset the atomization pressure back to 30 psi and repeat process until you get a smooth sprayed surface. Adjust the Pot Pressure to get the desired solder mask thickness that meets your coverage requirements.

Method: HVLP sprayer

- Needle Set: 5 – 6 turns out
- Gun temperature: 90 - 100°C
- Atomization air temperature: 90 - 100°C
- Pot Pressure: 10-15 psi, adjust to get desired solder mask coverage
- Atomization Pressure: 30-35 psi, start at the low setting and increase until there is no mottling
- Conveyor speed: 2.5 – 3.0 ft./min; as slow as production allows

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-4000 CC01SE** are as follows:

- Oven Type: Conventional Batch or Conveyor
- Oven Temperature: 66 - 80°C (150 - 176°F)
- For Single-Sided (Batch Oven)
  - 1st Side: Dwell Time: 15 - 20 minutes
  - 2nd Side: Dwell Time: 15 - 40 minutes
- For Double-Sided (Batch or Conveyor)
- Dwell Time: 30 - 60 minutes

- Oven Type: IR or IR assisted
  - Conveyor Speed: 2.7 – 3.2 ft./min
  - Time above 80°C: 2 – 2.1 minutes
  - Maximum Peak Temperature: 115°C
  - Total Dwell Time: 3 – 6 minutes

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EXPOSURE

PSR-4000 CC01SE SM-SP requires UV exposure to define solder mask dams and features. The spectral sensitivity of **PSR-4000 CC01SE SM-SP** is in the area of 365 nm. Exposure times will vary by bulb type, age of the bulb and light source type. Below are guidelines for exposing **PSR-4000 CC01SE SM-SP** using standard flood exposure equipment. Retention of smallest feature will determine the exposing energy.

- Exposure Unit: 8 kW or higher
- Stouffer Step 21: **Clear 8 minimum** (on metal / under phototool)
- Energy: 250 mJ / cm^2 minimum (under phototool)

DEVELOPMENT

PSR-4000 CC01SE SM-SP 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 (1.7 – 3.1 bars)
- Dwell Time in developing chamber: 45 - 120 seconds
- Water rinse is needed to remove developer solution followed by a drying step

FINAL CURE

PSR-4000 CC01SE SM-SP 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

UV CURE

To improve moisture and chemical resistance a UV cure of 2 – 3 J/cm^2 is recommended.

For Process Optimization please contact your local Taiyo America Representative

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FINAL PROPERTIES FOR PSR-4000 CC01SE SM-SP

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 – 6H
Adhesion	3.5.2.1	Rigid – Cu, Ni, FR-4	Pass
Adhesion	3.5.2.6	Doubled Layered Solder Mask	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	3123 VDC/mil (123 VDC / µm)
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		5×10^8 ohms minimum	Pass (2.0×10^{13} ohms)
After Soldering		5×10^8 ohms minimum	Pass (3.2×10^{13} ohms)
Moisture & Insulation Resistance	3.9.1		
Before Soldering–In Chamber		5×10^8 ohms minimum	Pass (3.2×10^{11} ohms)
Before Soldering–Out of Chamber		5×10^8 ohms minimum	Pass (2.8×10^{12} ohms)
After Soldering-In Chamber		5×10^8 ohms minimum	Pass (7.7×10^{10} ohms)
After Soldering-Out of Chamber		5×10^8 ohms minimum	Pass (7.6×10^{12} ohms)
Electrochemical Migration	3.9.2	>2.0×10^6 ohms, no growth	Pass (1.3×10^{12} ohms)

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Specific Class "T" Requirements

TEST	SM-840 PARAGRAPH	REQUIREMENT	RESULT
Flammability	3.6.3	Bellcore 0_2 Index – 28 minimum	Pass – 89
Insulation Resistance	3.8.2		
Before Soldering		5 x 10^8 ohms minimum	Pass (1.5 x 10^{11} ohms)
After Soldering		5 x 10^8 ohms minimum	Pass (6.5 x 10^{10} ohms)

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 (1.6 x 10^9 ohms)
Before Soldering–Out of Chamber		5 x 10^8 ohms minimum	Pass (1.8 x 10^{13} ohms)
After Soldering-In Chamber		5 x 10^8 ohms minimum	Pass (2.5 x 10^9 ohms)
After Soldering-Out of Chamber		5 x 10^8 ohms minimum	Pass (9.2 x 10^{12} ohms)
Electrochemical Migration	3.9.2	< 1 decade drop, no dendritic growth	Pass

Additional Tests / Results

TEST	REQUIREMENT	RESULT
Surface Tension after Cure	Internal test; greater than 40 dynes/cm	42
CTI (Comparative Tracking Index)	ASTM-D-3638-07	≥600
Adhesion	GIP-008AA (TAIYO Internal Test Method) Cross-cut tape stripping test	100/100
Solder Heat Resistance	Solder float test: Rosin Flux 300°C/30sec., 1 cycle	Pass
Solvent Resistance	PGM-AC dipping, temp 20°C. / 20 min, Tape peeling test	Pass
Acid Resistance	10 vol% H_2SO_4, temp 20°C. / 20 min, Tape peeling test	Pass
Alkaline Resistance	10 wt% NaOH, temp 20°C. / 20 min, Tape peeling test	Pass
Electroless Ni/Au	TAIYO Internal Test Method Ni: 3 microns, Au: 0.03 microns	Pass
Immersion Tin Plating resistance	TAIYO internal test method Tin thickness: about 1 um	Pass
Hot Storage Resistance	160ºC for 1000 hours – cross hatch adhesion (Mec Etch pretreatment)	Pass
Hot Storage Resistance	150ºC for 2000 hours – cross hatch adhesion (Mechanical Brush pretreatment)	Pass

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Additional Tests / Results

Test	Method	Result
Legend Ink Adhesion	Tape test: • LPI Legend – PSR-4100 WL(HD) • Thermal Legend – S-200W • UV Legend – UVR-110W • Inkjet – IJR-4000 MW300	Pass Pass Pass Pass
Gloss after Final Cure	Internal test; recorded at 60° angle • PSR-4000 CC01SE Matte • PSR-4000 CC01SE Semi-Matte	<19 20 - 30
Conformal Coat Adhesion	Crosshatch adhesion/tape test: • Dow Corning 1-2577 (Silicone) • Humiseal 1B51 (Synthetic Rubber) • Humiseal 1B73 (Acrylic) • Humiseal 2A64 (Urethane) • Cytec CE 1155 (Urethane)	Pass Pass Pass Pass Pass
Halogen Level	Halogen Free if < 900 ppm	285 ppm
Outgassing Test ASTM E595 A 2 J/cm^2 UV Cure was done after thermal cure	TML $\leq$ 1% CVCM $\leq$ 0.10%	TML-0.87% CVCM-<0.01%
Dk / Df	Internal Test at: 1.1 GHz 5.1 GHz 10.0 GHz 19.8 GHz	Dk / Df 3.6 / 0.022 3.6 / 0.021 3.5 / 0.021 3.5 / 0.020

Taiyo America, Inc. (TAIYO) warrants its products to be free from defects in materials and workmanship for the specified warranty period **PSR-4000 CC01SE SM-SP / CA-40 CC01 Warranty period is 12 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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Hot Storage Photographs: 180ºC for 250, 500, 1000 and 2000 hours – cross hatch adhesion (Mechanical Brush pretreatment). No cracking at the corners.

Photo 1: after 250 hours over copper

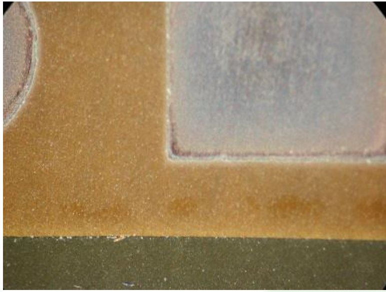


Photo 2: after 250 hours over FR4 laminate

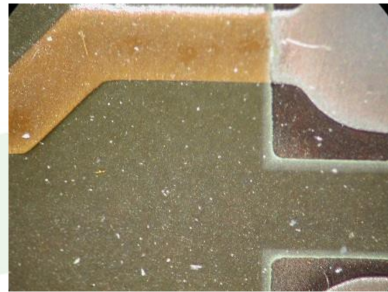


Photo 3: after 500 hours over copper

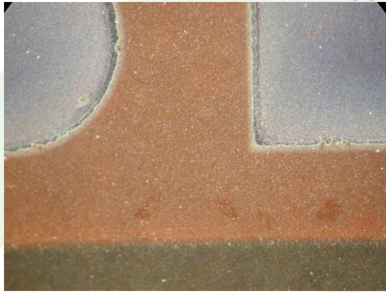


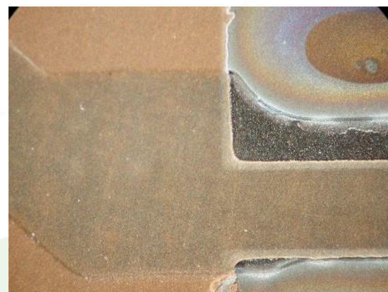
Photo 4: after 500 hours over FR4 laminate

Photo 5: after 1000 hours over copper

Photo 6: after 1000 hours over FR4 laminate

Photo 7: after 2000 hours over copper

Photo 8: after 2000 hours over FR4 laminate



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Legend Ink Adhesion: PSR-4000 CC01SE was coated with various types of Taiyo legend ink. Below are photos after tape testing of LPI, Thermal Cure, UV Cure and Inkjet.

Photo 9: LPI Legend, PSR-4100WL (HD)

Photo 10: Thermal Cure Legend, S-200W

Photo 11: UV Cure Legend, UVR-110W

Photo 12: Inkjet Legend, IJR-4000 MW300

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