

PSR-4000 CR01MW

(PSR-4000KL / CA-40KL)

LIQUID PHOTOIMAGEABLE SOLDER MASK

- ✔ **Superior crack resistance for White solder mask**
- ✔ **Bright White for LED Applications**
- ✔ **Matte Surface Finish**
- ✔ **Excellent light reflectance for LED back panels**
- ✔ **Higher photosensitivity than standard white solder mask**
- ✔ **Screen Print or Spray Application**
- ✔ **RoHS Compliant**
- ✔ **Compatible with Lead-Free Processing**
- ✔ **Wide Processing Window**
- ✔ **Withstands ENIG & Immersion Tin**
- ✔ **Meets IPC-SM-840E Requirements**

PROCESSING PARAMETERS FOR PSR-4000 CR01MW

PSR-4000 CR01MW COMPONENTS:

| <u>PSR-4000 CR01MW / CA-40 CR01MW</u> | | |
|---------------------------------------|----------|----------|
| Mixing Ratio | 87 parts | 13 parts |
| Color | White | White |

Mixed Properties

| | |
|------------------|-------------|
| Solids | 73% |
| Viscosity | 90 – 110 ps |
| Specific Gravity | 1.51 |

MIXING

For Screen Printing: **PSR-4000 CR01MW** is supplied in pre-measured containers with a mix ratio by weight of 87 parts, 3.48 kgs **PSR-4000 CR01MW** and 13 parts, 0.52 kgs, **CA-40 CR01MW**. **PSR-4000 CR01MW** can be mixed by a mechanical mixer at low speeds to minimize shear thinning for 10 – 15 minutes.

For Spray Application: after mixing the two parts, add 20% PM or PMA solvent to dilute the **PSR-4000 CR01MW** solder mask to a viscosity that can be sprayed. After adding the diluting solvent, thoroughly mix it to a consistent viscosity. A Din 4 cup reading of 75 – 85 seconds is recommended.

The mixed pot life is 48 hours at room temperature.

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 CR01MW**. Hold time after cleaning the printed circuit board 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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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 condition for **PSR-4000 CR01MW** is as follows:

- Oven Type: Conventional Batch or Conveyor
- Oven Temperature: 68 - 82°C (155 - 180°F)
- For Single-Sided (Batch Oven)
 - 1st Side: Dwell Time: 15 - 20 minutes
 - 2nd Side: Dwell Time: 35 - 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

EXPOSURE **PSR-4000 CR01MW** requires UV exposure to define solder mask dams and features. The spectral sensitivity of **PSR-4000 CR01MW** 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 CR01MW**. Retention of smallest feature will determine the exposing energy.

- Exposure Unit: 7 kW or higher
- Stouffer Step 21: **Clear 10 minimum** (on metal / under phototool)
- Energy: 600-800mJ / cm² minimum (under phototool)

DEVELOPMENT **PSR-4000 CR01MW** 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: 60 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.

FINAL CURE

PSR-4000 CR01MW 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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UV CURE

To improve moisture and chemical resistance a UV cure of 2 J/cm² is recommended. This will provide better surface cure and not yellow the white solder mask.

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 CR01MW / CA-40 CR01MW Warranty period is 4 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 CR01MW

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 | Pass 4600 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 | 3.6.3.1 | UL 94V-0 | Pass – File #E166421 | |
| Insulation Resistance Before Soldering | 3.8.2 | 5 x 10 ⁸ Ω minimum | 1.00 x 10 ¹⁰ Ω | |
| After Soldering | | 5 x 10 ⁸ Ω minimum | 4.21 x 10 ¹⁰ Ω | |
| Moisture & Insulation Resistance | 3.9.1 | Before Soldering–In Chamber | 5 x 10 ⁸ ohms minimum | 6.13 x 10 ¹² Ω |
| Before Soldering–Out of Chamber | | 5 x 10 ⁸ ohms minimum | 7.34 x 10 ¹³ Ω | |
| After Soldering–In Chamber | | 5 x 10 ⁸ ohms minimum | 5,24 x 10 ¹³ Ω | |
| After Soldering–Out of Chamber | | 5 x 10 ⁸ ohms minimum | 6,36 x 10 ¹³ Ω | |
| Electrochemical Migration | 3.9.2 | >2.0 x 10 ⁶ ohms, no dendritic growth | Pass | |

FINAL PROPERTIES FOR PSR-4000 CR01MW

Specific Class “T” Requirements

| TEST | SM-840 PARAGRAPH | REQUIREMENT | RESULT |
|--|------------------|---|---------------------------|
| Flammability | 3.6.3.2 | Belcore O ₂ Index – 28 minimum | Pass |
| Insulation Resistance Before Soldering | 3.8.2 | 5 x 10 ⁸ ohms minimum | 2.17 x 10 ¹⁰ Ω |
| After Soldering | | 5 x 10 ⁸ ohms minimum | 5.22 x 10 ¹⁰ Ω |

Specific Class “T” Requirements

| TEST | SM-840 PARAGRAPH | REQUIREMENT | RESULT |
|--|------------------|--------------------------------------|---------------------------|
| Moisture & Insulation Resistance Before Soldering–In Chamber | 3.9.1 | 5 x 10 ⁸ ohms minimum | 4.21 x 10 ¹² Ω |
| Before Soldering–Out of Chamber | | 5 x 10 ⁸ ohms minimum | 5.57 x 10 ¹³ Ω |
| After Soldering–In Chamber | | 5 x 10 ⁸ ohms minimum | 3.35 x 10 ¹³ Ω |
| After Soldering–Out of Chamber | | 5 x 10 ⁸ ohms minimum | 4.76 x 10 ¹³ Ω |
| Electrochemical Migration | 3.9.2 | < 1 decade drop, no dendritic growth | Pass |

Additional Tests / Results

| TEST | REQUIREMENT | RESULT |
|------------------------|---|---------|
| Adhesion | GIP-008AA (TAIYO Internal Test Method) Cross-cut tape stripping test | 100/100 |
| Solder Heat Resistance | Solder float test: Rosin Flux 300°C/10sec., 3 cycle | Pass |
| Solvent Resistance | PGM-AC dipping, temp 20°C. / 20 min, Tape peeling test | Pass |
| Acid Resistance | 10 vol% H ₂ SO 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 |
| Reflectance ratio | Internal Test, XYZ color system, Y value; solder mask thickness: 20 μm on copper | 79 |
| Halogen Content | Halogen-Free if < 900 ppm | Pass |