

ENPLATE® DSR-3241

Photoimageable solder mask



ENPLATE DSR-3241 is a liquid photoimageable solder mask system. It is applied by screen printing, dried, and exposed with a phototool in a hard-contact mode. Development of the image is a fully aqueous process. READ ENTIRE TECHNICAL DATA SHEET BEFORE USING THIS PRODUCT.

PROPERTIES OF ENPLATE DSR-3241

Color	Green - ENPLATE DSR-3241G Light Green - ENPLATE DSR-3241LG Pale Green - ENPLATE DSR-3241PG Clear - ENPLATE DSR-3241U Red - ENPLATE DSR-3241R Blue - ENPLATE DSR-3241B Black - ENPLATE DSR-3241BK
Viscosity	35,000 to 45,000 cps @ 77 °F (25 °C)
Non-volatiles	75%
Sensitivity	<u>Steps on 21 Step - Stouffer Step Tablet</u> @ 300 mj/cm ^{2*} 9 steps @ 500 mj/cm ^{2*} 12 steps @ 750 mj/cm ^{2*} (BK) 14 steps
Cured Film	Meets or exceeds requirements for IPC-SM-840B, Class 3 UL recognized, 94V-0
Resistance to Molten Solder	10 seconds @ 550 °F (287 °C), minimum

*As measured through the MYLAR on a Colight 1330 5 Kw UV exposure unit using an EIT UV monitor, Model UR365CHI.

ENPLATE DSR-3241 - PROCESSING GUIDE SUMMARY

Application	110T mesh monofilament polyester screen mesh
Tack Dry	Side One: 20 to 25 minutes @ 160 ± 5 °F (71 ± 3 °C) Side Two: 25 to 30 minutes @ 160 ± 5 °F (71 ± 3 °C)
Exposure	300 to 500 mj/cm ² 750 to 900 mj/cm ² (BK)
Development	0.8 to 1.2% sodium carbonate (1.0% optimum) 1 minute @ 90 to 120 °F [95 °F (35 °C) optimum]

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Final Cure	30 minutes @ 300 °F (150 °C) convection
Lighting	Yellow lamps are suitable for all color versions of ENPLATE DSR-3241, though commercially - available clear plastic shields for fluorescent lamps are suitable for the green version. These filter out UV radiation without changing the apparent color of the light. These filters can be purchased from UV Process Supply, Chicago, Illinois, 1-800-621-1296.

PROCESS DETAILS

Substrate Preparation

The substrate surface must be free of contaminants and/or oxidation. Bare copper printed wiring boards may be prepared by pumice scrubbing, wet mechanical scrubbing (320 to 500 grit brushes) or by wet chemical process. Solder-plated printed wiring boards may be mechanically scrubbed or treated with a proprietary Enthone-OMI cleaner to ensure removal of reflow residuals.

Solder Mask Mixing Procedures

ENPLATE DSR-3241 is supplied as a two component system, consisting of a pre-weighed principle component, ENPLATE DSR-3241A* and a pre-weighed hardener component, ENPLATE DSR-3241BR.

The ENPLATE DSR-3241BR component must be thoroughly stirred prior to adding to the ENPLATE DSR-3241A component to ensure against solvent separation.

The ENPLATE DSR-3241A is mixed with ENPLATE DSR-3241BR in a 3:1 weight ratio. Enthone-OMI provides pre-weighed 1 Kg containers of ENPLATE DSR-3241BR and 3 Kg containers of ENPLATE DSR-3241A (which have been pre-matched for correct viscosity) that may simply be mixed together.

It is imperative that the two components are THOROUGHLY MIXED, as incomplete mixing will change process latitudes and final ink characteristics. When mixing small amounts of ink (1 Kg or less total), blending may be done by hand.

For larger batches, the two methods listed below are widely used or in some cases an explosion-proof electric stirrer may be used and should be operated at 400 to 600 rpm for a minimum of 5 minutes. In any case, ink should be gently scraped from the sides and bottom of the container during the mixing process. This mixture has a usable pot life of one week at 55 to 77 °F (13 to 25 °C).

Method #1: REVOLVING BASE MIXER*

1. Mix the 'B' (hardener) component for 5-10 minutes in an industrial paint shaker.
2. Fold 'B' component into the 'A' component with a spatula.
3. Mix on a revolving base mixer where bucket rotates while the blade (spatula like) remains fixed. One design uses a blade with holes in it for solder mask to pass through. This method creates a low shear action.

*Revolving base mixers: 'Tornado' made by AWT, World Trade Co., Chicago, IL
'Mix Aire' explosion proof mixer by Mix Aire Co., Osh Kosh, WI

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Method #2: PAINT SHAKER

1. Mix the 'B' (hardener) component for 5-10 minutes in an industrial paint shaker.
2. Fold 'B' component into the 'A' component with a spatula.
3. If 4 kilogram kit is being mixed, return the bucket to the paint shaker for an additional 15 to 20 minutes. If a 16 kilogram kit is being mixed and the paint shaker will not accommodate the container, mix for 15 to 20 minutes on a revolving base mixer as described above.

*NOTE: For Example: ENPLATE DSR-3241A is actually packaged as ENPLATE DSR-3241A-G for applications requiring a green formulation or ENPLATE DSR-3241A-U for applications requiring a clear, unpigmented formulation. (See page one "PHYSICAL PROPERTIES" FOR solder mask color codes.) The processing guidelines for all formulations are the same, except as noted for the exposure of the BK (black) solder mask.

Application

ENPLATE DSR-3241 is applied via conventional screen printing techniques. It can be applied through an open (non-imaged) mesh monofilament polyester screen (typical mesh size used is 110T). An imaged, "pad-master" screen may be used to keep material out of the through holes and minimize resist waste by preventing deposition of material onto areas of the panel which do not require solder mask. A 60 to 70 durometer squeegee should be used. Use ENPLATE Solvent 33 or butyl cellosolve for clean-up.

Tack Drying

The wet film is dried tack-free in a ventilated convection oven. Drying times and temperatures are as follows:

Side one: 20 to 25 minutes @ 160 ± 5 °F (71 ± 3 °C)

Side two: 25 to 30 minutes @ 160 ± 5 °F (71 ± 3 °C)

The oven should be calibrated to ensure proper drying conditions. Coated parts should never be subjected to a temperature higher than 170 °F (77 °C), as this will thermally polymerize the coating. Electronic thermal profiling equipment or temperature sensitive labels may be used to monitor oven temperatures during this step.

Coated and dried parts may be stored in a cool, dark area for up to 48 hours prior to exposure.

Exposure

Allow the coated and dried printed circuit board to cool to room temperature. The part is then exposed in a conventional vacuum photo exposure unit. Following proper registration of the phototool onto the printed circuit board, a low vacuum is drawn to bring the artwork into intimate contact with the substrate.

Exposure by 3 to 5 kW metal halide or mercury lamp is 300 to 500 mj/cm².

Exposure for ENPLATE DSR-3241(BK) 750 mj/cm².

The vacuum may be lowered to prevent marring of the solder mask surface. Phototool release agents may be used to prevent sticking of the phototools to the solder mask film surface, although their use is unnecessary if drying has been properly accomplished.

Development

The exposed printed circuit board is developed through a conveyORIZED unit equipped with direct fan nozzles, in 0.8 to 1.2% sodium carbonate @ 95 °F (35 °C). Elevated temperatures can be used [up to 120 °F (49 °C)] in situations where nozzle configuration or spray impingement is less than optimum. A dwell time of one minute is normally required. Under nominal conditions, a 20% maximum breakpoint (distance into the developing chamber to achieve clean copper) should be observed. Breakpoint and spray uniformity can be determined by processing a coated and dried (but unexposed) test piece.

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Development (Cont.)

The developer concentration should be monitored by frequent chemical analysis. The following procedure is recommended:

1. Start developer and allow solution to mix for 5 minutes.
2. Remove a 50 mL sample and place in a 125 mL Erlenmeyer flask.
3. Add 3 to 5 drops of phenolphthalein indicator solution.
4. Titrate with 0.5N sulfuric acid until red color disappears.
5. Record volume titrated and calculate percent concentration as follows:

$$\frac{(\text{mL of Sulfuric Acid}) (\text{Normality of Sulfuric Acid}) (10.6)}{\text{mL of sample}} = \text{Weight \% of Sodium Carbonate}$$

Final Cure

A final thermal curing step* is required to completely cure the ENPLATE DSR-3241 solder mask image and to ensure optimum mask characteristics. The following cure cycles are required:

Convection Oven: 30 minutes @ 300 °F (150 °C)

Ovens should be calibrated to ensure the proper curing temperature is reached. Electronic thermal profiling equipment or thermal labels may be used to monitor oven temperature during curing.

*NOTE - UV and thermal cure nomenclature ink application may occur prior to final cure.

Substrate Reclamation

The coated substrate may be reclaimed by removal of the ENPLATE DSR-3241 film at process points prior to final cure. Developer solution will remove the dried, unexposed coating. Commercially available proprietary solder mask strippers designed to remove exposed or fully cured solder mask maybe used, however, care should be taken to avoid damaging the PWB substrate. Empirical determination of the proper stripping parameters is recommended.

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SAFETY AND HANDLING INSTRUCTIONS

WARNING! ENPLATE DSR-3241A, ENPLATE DSR-3241BR AND THEIR RESULTANT MIXTURE MAY CAUSE SEVERE SKIN AND EYE IRRITATION, EYE BURNS, SENSITIZATION, ALLERGIC REACTION.

HAZARDS: ENPLATE DSR-3241A, ENPLATE DSR-3241BR and their resultant mixture may cause severe skin and eye irritation, eye burns, sensitization, allergic reaction. Ingestion may also cause severe gastro-intestinal irritation. Inhalation may also cause headache, nausea. ENPLATE DSR-3241BR and the resultant mixture contain a possible mutagen and reproductive hazard based on tests with laboratory animals. Do not get in eyes, on skin, or on clothing. Do not take internally.

FIRST AID: In case of eye contact with ENPLATE DSR-3241A, ENPLATE DSR-3241BR or their resultant mixture, immediately flush eyes with plenty of water for at least 15 minutes; hold eyelids apart to insure flushing of entire surface, seek immediate medical attention. For skin contact, wash with soap and water, DO NOT USE SOLVENTS. If ingested, DO NOT INDUCE VOMITING. Remove and wash contaminated clothing. Discard any contaminated leather articles.

HANDLING INFORMATION: Always wear goggles, protective clothing and gloves* when handling ENPLATE DSR-3241A, ENPLATE DSR-3241BR or their resultant mixture.

* Gloves for:

- Heavy duty use (mixing, clean-up, etc.)
 - ⇒ Best** Nitrilsolve #730 (15 mil nitrile)
- Light duty use (handling coated panels, etc.)
 - ⇒ Best** N-Dex Plus #8005 (8 mil nitrile)
 - ⇒ Best** N-Dex Plus #9005PF (6 mil long cuff nitrile)

** Best Manufacturing Company, (404)862-2302

Avoid contact with strong oxidizers or any other foreign material. Use with adequate ventilation. Do not mix any solvents or other inks into ENPLATE DSR-3241A or ENPLATE DSR-3241BR or their resultant mixture. Keep out of sunlight. Wash thoroughly after handling.

CONTAINER INFORMATION: For optimum shelf life, store in a cool, dry, well-ventilated area. May be refrigerated (5 °C to 10 °C) [40 °F to 50 °F], but do not freeze. Keep out of direct sunlight and away from heat (do not exceed 35 °C [95 °F]). Loosen closure cautiously when opening. Do not reuse container. Improper disposal or reuse of container may be dangerous and illegal.

REFER TO MSDS FOR FURTHER SAFETY AND HANDLING INFORMATION

Manufactured by Enthone-OMI under license from Tamura Kaken Co., Ltd., Tokyo, Japan. (U.S. Patent 5,100,767)
Manufacture and sale of this product licensed by Taiyo Ink Manufacturing Company Ltd. of Japan under U.S. patents 4,943,516 and 5,009,982 and Canadian Patent 1,331,711.

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MATERIAL SAFETY DATA SHEETS

For more detailed information on the toxicological properties of the products described herein, reference can be made to the Material Safety Data Sheet (MSDS) for each product. If you do not have the proper MSDS, it can be requested from: Enthone Inc., attention: Regulatory Affairs Department, 350 Frontage Road, West Haven, CT 06516. For emergency assistance call CHEMTREC (800) 424-9300.

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Enthone Inc. (Canada) MATERIAL SAFETY DATA SHEETS

For detailed information on the toxicological properties of the products described herein, reference can be made to the Material Safety Data Sheet (MSDS) for each product. If you do not have a current MSDS, it can be requested from the W.H.M.I.S. coordinator, Enthone Inc. (Canada), 121 Watline Avenue, Mississauga, Ontario, L4Z-1P2. For emergency assistance regarding accidents with this product resulting in container rupture, spills, poisoning, bodily injury or threats to health call: CHEMTREC (800) 424-9300.

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UNITED STATES

West Haven, Connecticut
Performance Coatings (800) 496-8326
Precious Metal Products (800) 560-7214
Fax (203) 933-0249
ctchemorders@cooksonelectronics.com

PWB Chemistry (U.S. and Canada) (800) 877-9871
Londonderry, New Hampshire Fax (603) 645-4402

MEXICO

Mexico, D.F. (011-52-55) 5078-3904
Fax (011-52-5) 567-6326



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