

*Secondary Imaging***ConforMask 2500**

ConforMask 2500 Series is the latest advance in High Conformance Solder Mask (HCSM) technology. It has been specifically formulated to be compatible with the high temperature aqueous defluxing of water soluble solder pastes and wave solder fluxes. In addition, ConforMask 2500 HCSM has incorporated several other key performance properties, including:

ADVANTAGES

- Excellent Resolution
- High Gloss
- Low Odour
- Fast Exposure
- Low Light Bleed
- Scratch Resistance
- Improved Solvent Resistance
- Meets or exceeds all the requirements of IPC-SM-840B Class 3 and IPC-SM-840C Class T&H, MIL-P-55110D and Bellcore

ConforMask 2500 HCSM utilizes patented technology to provide a thin photoimageable solder mask and excellent via hole tenting. In addition, this photoimageable, epoxy-based material is 100% solid and aqueous processable.

ConforMask 2500 HCSM is supplied in roll form. The photopolymer layer is coated as a defect-free film and sandwiched between a 1.0 mil (25 µm) polyester cover sheet and a 1.0 mil (25 µm) polyethylene release sheet. Films are available in both 1.5 mil (37 µm) and 2.3 mil (58 µm) thicknesses. Rolls are available in a variety of widths and lengths.

Uses

ConforMask 2500 Series HCSM is designed for use as a permanent solder mask on rigid printed wiring boards using epoxy or polyimide laminates and copper, tin/lead or gold circuitry. The excellent physical, chemical and electrical properties of this epoxy based solder mask provide environmental protection for printed wiring boards, both during and after assembly soldering. The reduced solder mask thickness, ability to tent via holes and epoxy based chemistry provide excellent solderability and reliability for high density through-hole and surface mount printed wiring assemblies.

Application

Solvent-free, ConforMask 2500 HCSM is applied using a conventional yellow room process. It utilizes a patented application technique which allows the polyester cover sheet to be removed immediately after vacuum application. Processing techniques include:

- PC board surface preparation
- Lamination
- Exposure
- Development
- Curing

ConforMask 2500 HCSM has been successfully processed in a variety of assembly operations using Water Soluble, RMA and No Clean solder paste and wave soldering flux chemistries. If required, defluxing should be carried out utilizing either a high temperature water wash, a low concentration neutralizing aqueous rinse or 1, 1, 1-trichloro-ethane based solvent. Shipley Company does not recommend the use of high concentrations of alkaline saponifying cleaners or methylene chloride for defluxing this material.

Processing Parameters

ConforMask is applied using conventional vacuum lamination and yellow room processing techniques including:

1. PC board surface preparation
2. Lamination
3. Polyester cover sheet removal
4. Finishing
5. Exposure
6. Development
7. Curing

Processing Environment

ConforMask film is a negative working photopolymer and sensitive to ultraviolet light, excessive temperature and relative humidity. Lamination, polyester removal, finishing, and exposure steps should be conducted in a controlled yellow room environment.

- | | |
|----------------------|-----------------------|
| 1. Lighting | Yellow light |
| 2. Temperature | 65 - 75°F (18 - 24°C) |
| 3. Relative Humidity | Up to 50% |

Panel Specifications

	<u>Minimum</u>	<u>Maximum</u>
Design	Requires Solid Border Metal or Laminate	
Metalisation	Cu, Ni, Sn/Pb or Au	
Base Material	FR-4 and polyimide (rigid only)	
Circuit Height	None	4.0 mils (100 microns)
encapsulated	(circuit heights greater than 4.0 mils (100 microns) may be reliably depending upon board design and lamination conditions. Minimum resist coverage over conductors greater than 4.0 mils is less than the IPC-SM-class 3 requirement of 0.7 mils (17 microns) minimum).	
840B		
Tented Via Holes	None	25 mils (0.6 mm)
	In order yo achieve reliable tenting performance the stated application and environmental conditions must be followed.	

Surface Preparation

Precleaning of the printed wiring board is essential to the adhesion of the solder resist and the electrical performance of the solder resist and the electrical performance of the printed wiring board. Any moisture and/or organic contaminants trapped by the solder resist during lamination may cause solder mask delamination, blistering and/or adhesion loss during subsequent soldering operations or during extended use.

Copper

When cleaning copper circuitry which has been produced utilizing a metallic etch resist process, it is important to remove all inter-metallic compounds, oxides, organic and ionic contaminants. An abrasive scrub is necessary to provide a rough surface for the ConforMask film to adhere. Presence of contaminants or eliminatin of the abrasive scrub may cause adhesion loss. Good drying is essential to the prevention of ConforMask solder mask blistering during hot air solder leveling.

One method which has proven successful for precleaning copper circuitry includes:

1. Conveyorized Acid Spray Rinse (5% H₂SO₄)
2. Water Spray Rinse
3. Pumice (3F-4F) or impregnated Brush (320 grit) Scrub
4. High Pressure Water plus DI Water Spray Rinse
5. Turbines Dry
6. Bake Dry 30 min at 160 - 180°F (71 - 82°C)
7. Maximum Hold Time - 4 hours

Process Monitoring

Ionic Cleanliness - PWB ionic cleanliness should be monitored utilizing solvent extract resistivity in a frequency in accordance with customer requirements.

Water Break Tests - A clean copper surface should hold an unbroken film of water for at least 30 seconds.

Surface Area - A "surface profile" of the copper surface should show 18-24 peaks/100 microns, with a score depth of 2-4 microns.

Fused Tin/Lead

When cleaning fused tin/lead circuitry and other melting metals for which abrasive scrubbing is not permitted, it is important to remove all oxides, organic contaminants and moisture prior to solder resist application.

These boards must also be completely dried.

1. Conveyorised saponifying spray cleaner
2. Water Spray Rinse plus DI Water Spray Rinse
3. Turbine Dry
4. Bake Dry 20 - 30 min at 230 - 265°F (110 - 130°C)
5. Maximum Hold Time - 4 hours

Process monitoring

Ionic Cleanliness - PWB ionic cleanliness should be monitored utilizing solvent extract resistivity in a frequency in accordance with customer requirements.

Surface Organic Contaminant Detection Test - IPC - TM - 650 2.3.38)

Surface Organic Contaminant Detection Test (Infrared analytical method) - IPC - TM - 650 2.3.39

Vacuum Lamination

ConforMask is best applied to the printed wiring board utilizing the appropriate vacuum lamination equipment, such as the Shipley vacuum applicator model 724 or 730. Hot roll lamination is not recommended because of potential conformation and/or entrapment problems.

After the ConforMask HCSM film is pre-tacked to the printed wiring board , it is placed in a vacuum applicator. During vacuum lamination, a hard vacuum is drawn within the laminating chamber, assuring complete air removal between the circuit traces. Concurrently, both the ConforMask HCSM film and the printed wiring board are heated to laminating temperature. Once the vacuum cycle is complete , the upper platen blanket "slaps down" forming the initial physical bond between the ConforMask HCSM resist and the printed wiring board. The rigid polyester cover sheet does not allow for the complete conformation of the thin solder mask resist to the printed wiring board.

1. ConforMask should be applied to both sides of the printed wiring board utilizing a suitable pre-laminator such as the Shipley ConforMASK Film Applicator or Shipley 360 DFSM (please see Operating Manual for further details), or by hand.

2. Vacuum Laminator	Shipley Vacuum Applicator Model 742 or 730
Cycle Time	45 - 60 sec
Slap Time	2 - 4 sec. (if utilizing bleed-in adapter kit adjust air bleed -in valve time to 3 seconds and slap down timer to 5-7 sec).
Platen Temperature	
Top	150 -170°F (65 - 76°C)
Bottom	150 -170°F (65 - 76°C)
Panel Temperature	
Top	140 - 150°F (60 - 65°C) Thermolables Set #2
Bottom	140 - 150°F (60 - 65°C) Thermolables Set #2
Vacuum	0.2 - 1.0 mbars
Free Space	0.02 - 0.06 inches

Acceptable exposure levels for ConforMask HCSM can be achieved by using time/energy parameters that result in clear metal 9 - 11 (top and bottom) when using a stouffer 21 step sensitivity Guide on top of the art work. The energy required to achieve a clear metal 9 - 11 is normally in the range of 250 - 500 millijoules when using Shipley model #500 Radiometer.

Development

Unexposed (unpolymerised) ConforMask HCSM photopolymer can be easily developed using a mild alkaline solution in a totally aqueous, conveyorised spray developing unit. Development is followed by a thorough water rinsing, DI water rinsing and turbine drying in order to meet stringent ionic cleanliness requirements (1.0 - 1.56 mg/cm²).

Developer	Horizontal or Vertical with a minimum chamber length of 36 inches.
Solution	0.5 - 1.0% Na ₂ or K ₂ CO ₃ REsolve 211 recommended
Temperature	80 - 85°F (26 - 29°C)
Breakpoint	35 - 50%
Developing Time	105 - 130 secs
Spray Pressure	25 - 30 psi
Spray Rinse	25 - 30 psi
Rinse Chamber length	50% developing chamber length minimum
Spray Pressure	25 - 30 psi
Turbine Dry	

Cure

Optimal Physical, chemical, electrical, environmental and soldering performance properties of ConforMaskHCSM are obtained only after final curing. Final curing (polymerisation) is a two step process involving both UV and thermal cross-linking, utilisation conventional UV curing units and convention air ovens.

UV CURING

Unit	Shiplely UVCS 933
Speed	8 - 12ft/min
Energy	3 - 5 J/cm ²
Panel Temperature	250°F (121°C) maximum

1. UV cure side A at the above conditions.
2. Allow panels to cool completely to room temperature.
3. UV Cure side B at the above conditions.

THERMAL CURE

Unit	Forced air oven
Time	60 minutes
Temperature	300 - 310°F (150 - 155°C)
Total Time	90 miutes

Thermal cure boards for one hour at 150-155°C (300 - 310°F). Allow oven to reach temperature before the one hour timing starts.

Hot Air Solder Levelling

Recommended hot air solder levelling parameters may include:

PRECLEAN	
Microetch	5% HCl or H ₂ SO ₄ or Persulphate Type
Rinse	Spray
SOLDERING	
Flux	See Hotline Bulletin
Flux Dwell Time	4 - 10 seconds
Solder Temperature	465 - 500°F (240 - 260°C)
Solder Dwell Time	4 - 10 seconds
Air Temperature	330 - 380°F (165 - 193°C)
Air Pressure	35 - 45 psi
DEFLUXING	
Unit	Conveyorised Spray
Deflux Time	45 - 120 seconds
Solution	3 - 5% solution of alkaline cleaner (see flux manufacturer recommendations)
Temperature	120 - 130°F (49 - 55°C)
Rinse	Conveyorised spray

Developer Disposal

Waste material disposal will vary with local requirements. It is suggested that inquiries be made to the local governing authority. Recommended treatment method:

1. Utilize Shipley Advantage 2000™ Waste Treatment Chemistry RS-1240 and equipment systems.
2. Add one 50lb bag of RS-1240 to the mixing sump of the appropriately sized ADVANTAGE 2000 unit. Fill the sump with water and stir until the powder is completely dissolved.
3. The ADVANTAGE 2000 system will automatically compensate for the alkalinity of the waste material and add chemistry for the stripper/developer waste in the correct proportion.
4. After the treatment is completed, the mixture of the solution and hard resist particles is pumped to a filter press.

An alternative method is:

1. Slowly lower the solution pH using either hydrochloric acid or sulphuric acid to a pH of 5-7
2. Stir to agitate to ensure proper dispersion.
3. Let solution settle for approximately 2 to 4 hours, allowing all of the resist to precipitate out of the solution.
4. Filter off liquid; Precipitate may be discarded in chemical landfill.
5. Neutralise the liquid using sodium or potassium hydroxide, and discharge per local guidelines.

Product Data

Physical Properties-Unexposed Film.

PROPERTY	TEST METHOD	REQUIREMENT	VALUE
Appearance	Visual	None	Transparent, high gloss green photopolymer
Solids Content	ASTM D-1259	None	100%

Material Properties-Cured Film

PROPERTY	TEST METHOD	REQUIREMENT	VALUE
Appearance	Visual	None	Dark green, high gloss finish
Visual I	IPC-SM-840B 4.8.1	A max of 1 imperfection/ in ² which does not bridge more than one conductor. No encroachment of foreign material (Class 3).	Pass. Less than one imperfection/ in ² both before and after soldering
Dimensional	IPC-SM-840B 4.8.2 TM 2.1.1	0.7 mil minimum	Pass. Dependent upon ConforMask thickness and circuit height.
Non-Nutrient	IPC-SM-840B 4.8.1.1 TM 2.6.16	No support of, contribution to, or degradation by biological growth.	Pass
Curing	IPC-SM-840B 4.8.5	Meet requirements of IPC-SM-840B 3.6.1, 3.7.1, 3.7.2, and 3.7.3.	Pass (See Chemical and Soldering Properties).

Physical Properties-Cured Film

PROPERTY	TEST METHOD	REQUIREMENT	VALUE
Adhesion	IPC-SM-840B 4.8.4.1 TM 2.4.28	Class 3	Pass (Before and after soldering).
Bare Copper		0% Removed	0%
Bare Laminate		0% Removed	0%
Melting Metals		Max 10% Removed	<2%
Machinability	IPC-SM-840B 4.8.1.2	No cracks or tears due to normal machining.	Pass
Abrasive Resistance Taber	IPC-SM-840B TM 2.4.27.1	50 cycles min. (Class 3)	>50 cycles
Pencil Hardness	IPC-SM-840B TM 2.4.27.2	F (min.)	3H-4H

Chemical Resistance Properties-Cured Film

CHEMICAL	TEST METHOD	REQUIREMENT	VALUE
Resistance to Solvents	IPC-SM-840B 4.8.6	No surface roughness tackiness, blistering or color change.	
Isopropanol (boiling vapor)			Pass
1,1,1-trichloroethane (boiling vapor)		Pass	
96% 1,1,1-trichloroethane, 4% isopropanol (boiling vapor)			Pass
TSP solution (pH = 13.0)		Pass	
3% Alpha 2210 at 60°C		Pass	
10% alkaline detergent (40% alkanolamine, 20% butoxyethanol, 20% glycol ether and 20% water) at 60°C		Pass	
Fluxes	IPC-SM-840B 4.8.6	No surface roughness tackiness, blistering or color change.	
Air-Brite 1			Pass
Argus 855			Pass
Ardrox			Pass
Kester 185			Pass
Alpha 850-33			Pass
Lonco 7733-TA			Pass
Hydrolytic Stability	IPC-SM-840B 4.8.7 T.M. 2.6.11	No irreversible change of state.	Pass (>28 days)
Flammability Rating	Underwriters Laboratories 94 Flame Class Test	IPC-SM-840B 4.8.8 UL 94 V number shall not be raised.	
2.3 mil film thickness		94V-O	94V-O
0.025 in FR-4 laminate thickness			
2.3 mil film thickness		94V-O	94V-O
0.062 in FR-4 laminate thickness			

Environmental Properties-Cures Film

PROPERTY	TEST METHOD	REQUIREMENT	VALUE
Moisture/ Insulation Resistance	IPC-SM-840B 4.8.10.3 TM 2.6.3.1	5 x 10 ⁸ ohms (Class 3 min).	>1 x 10 ⁹ ohms
Electromigration Resistance	IPC-SM-840B 4.8.10.4 TM 2.6.14	None allowed (Class 3).	Pass (5 x 10 ¹¹ ohms)
Thermal Shock	IPC-SM-840B 4.8.11 TM 2.6.7.1	No blistering, crazing or delamination after 100 cycles.	Pass (>100 cycles)

Electrical Properties-Cured Film

PROPERTY	TEST METHOD	REQUIREMENT	VALUE
Dielectric Strength	IPC-SM-840B 4.8.10.1 TM 2.5.6.1	500 VDC peak/mil min.	2500V/mil
Insulation Resistance	IPC-SM-840B 4.8.10.2 TM 2.6.3.1	5 x 10 ⁸ ohms (Class 3 min)	>1 x 10 ¹² ohms
Dielectric Constant			3.56
Dissipation Factor			0.040

Soldering Properties-Cured Film IUL File No. E68935 Vol.1

PROPERTY	TEST METHOD	REQUIREMENT	VALUE
Solderability	IPC-SM-840B 4.8.9.1 inspected to IPC-S-804	The solderability of the board shall not be diminished.	Pass
Solder Resistance	IPC-SM-840B 4.8.9.3	Solder shall not adhere to the solder mask.	Pass (>10 sec.)
Soldering/	IPC-SM-840B 4.8.9.3	No separation from base laminate or conductors beyond area of fused coating.	Pass (No Desoldering separation under 7x magnification.)

Disposal Information

Please read and understand this product's Material Safety Data sheet before use.

It is the customer's responsibility to ensure that disposal of this product complies with national and local guidelines.

Due to the nature of ConforMask 2500 HCSM, disposal of it, or residues therefrom, should be made in compliance with federal, state and local environmental regulations.

Flush empty containers thoroughly with water before discarding.

Storage

Store ConforMask 2500 HCSM in accordance with the finished product container label.

Handling Precautions

Before using this product, consult the Current Material Safety Data Sheet for details on product hazards, recommended handling precautions, and product storage.

For Industrial Use Only

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