TECHNICAL DATA SHEET

EP3912 / EP2793

Combination coating for silicon-wafers

APPLICATION and END-USE DESIGN:

When properly processed the EP3912 **S.E.** (**S**ilicon **E**poxy) forms a high humidity and high temperature resistant coating.

It can be successfully applied by screen-printing. Formulations for other application methods (air-spray and spin-coat) may be available upon request.

It is normally used as a barrier layer underneath a photo-definable die-passivator, **EP2793** as detailed below.

PRODUCT RANGE:

Application method	Colour	Formulation code
Screen Print	Clear	EP3912
Screen Print	Clear	EP3912/4428

PROCESSING: **EP3912** is a single component product

Material rolling:

Prior to application, **EP3912** must be rolled in it's original container for a minimum of 10 minutes at a speed of 10-30rpm. See also storage (page 5).

Coating application:

Dry coating thicknesses of 5-10µm are normal for screen print applications. Typically, this requires a wet coating thickness of 10-20µm. Screen meshes of 70-140T will be suitable.

Drying:

After coating the **EP3912** needs to be dried in a forced air convection oven.

Typically 20 minutes @ 50°C, or 10 minutes @ 80°C **(time at substrate temperature)** will be suitable.

Conveyorised drying units can be used however the parameters will be dependant on the oven type itself. Care must be taken not to overdry the coating as this will impair the developing characteristics.

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Intermediate property testing:

The intermediate properties of **EP3912** coatings can be simply off-line tested by screening onto a substrate and following the curing recommendations detailed below.

Substrate choice, surface preparation, coating thickness and curing profiles can affect the results of this testing and the results may not bear any relevance to the final properties of the combination coating. Typical results expected for **EP-3912** would be: -

TEST	METHOD	RESULT	CLASSIFICATION
Hardness (pencil)	SM-840C	6H	Pass, class H
Adhesion	SM-840C	Copper: <5% removal	

Die-passivator application:

After drying, the **EP3912** is over-coated with a photo-definable die-passivator **EP2793**.

PRODUCT DESCRIPTION

EP2793 is a contact exposure, solvent developing, liquid photoimageable permanent plate-resist, using two-component epoxy technology to give high levels of chemical resistance.

Product codes

Paste: EP2793LV
Hardener: EP2793 Pt B

Mixing:

EP2793LV and EP2793 Pt B are supplied pre-weighed in cartridges.

The resist should be mixed in the ratio 85 parts paste (pt A) to 15 parts hardener by weight. Stir well to ensure complete mixing.

Incomplete mixing can cause poor developing, stickiness during exposure and impaired final properties.

Viscosity reduction:

EP2793 is supplied screen ready. If viscosity adjustment is required prior to, or during printing, then this may be achieved using **Electrareducer ER1.** No more than 5% reducer should be added or deterioration of the printing and drying properties may occur, resulting in thin deposits and/or prolonged drying times.

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Process settings:

Screen Print: Mesh count: 37-55T polyester.
Squeegee: 60-70 Shore.

20µm dry thickness should be aimed for; this is typically achieved using a 43T.

Tack-dry:

The aim of the tack-drying stage is to solely remove the solvents. It is important for the drying chamber (static or conveyorised) to have good air circulation with air supply and extraction facilities.

Convection dry
Recommended drying settings and hold times will vary with hardener selection, see below.

Hardener	Recommended/Max temperature (°C)	Recommended/Max time (min)	Max hold-time after optimum tack-dry
EP2793 Pt B	75/80	40/60	24 hours

IR Drying
IR drying is dependent on coating application method, IR wave-length and IR intensity.
Please contact Electra Technical Support Department for recommendations regarding specific equipment types and manufacturers.

Optimum **substrate temperature**: 125 to 135ºC. Peak temperature
Optimum drying time: 4 to 5 minutes

Exposure

Spectral output: 310-420 nm. Optimum wavelength is approx. 365-385nm.

Step wedge: 7-10 clear (Stouffer 21 step). Approx. 200-500 $mJcm^{-2}$ (IL390B)

Post Exposure Bake: A short 10-20 minute bake at 75-80ºC will improve resolution and resistance to the developer of UV exposed areas.
It is recommended to carry out the post-exposure bake immediately after the exposure process. Delays in carrying out the post exposure bake will reduce the efficiency.

Determination of the correct exposure should be carried out after setting the developing speed since this will affect the step wedge reading obtained.
Step wedge checks should be carried out with the step wedge under the phototool.

Energy level should be measured through the artwork and mylar/glass. It is important to recognise that the energy level should only be used as a guide for setting the correct exposure; step wedges should be used for determining the actual exposure setting.
After determining the correct setting, energy level can be monitored as a means to check for any changes in lamp output.

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Developing

Developer: ER-7

ER-7 is supplied ready to use.

Process conditions must be determined by experiment by the end-user to ensure suitable development of the photo-defined die-passivator.

The refresh rate or replacement rate must be determined by the end-user in accordance with material loading and development requirements. Over-loading of developed die-passivator will lead to poor developing performance and potential re-deposition onto substrate surfaces.

Substrate should be well rinsed with fresh water and fully dried after developing. Do not final cure when wet. The optimum developing speed is set when an unexposed resist develops off completely, 50% of the way through the machine. This speed should be ascertained by preliminary tests prior to making exposure tests.

For more detailed information refer to licensor supplied data.

Final Cure

The combination coating of **EP3912** and **EP2793** must be cured for 60 minutes @ 200°C.

Lower temperatures will result in poor humidity and temperature resistance of the **EP3912**

Safelight conditions

EP3912 does not require processing under safelight conditions.

It is also not normally necessary to print **EP2793** under safelight conditions, although it may be advisable if there are long delays before drying. Between drying/exposing and exposing/developing, coated materials should be kept in yellow light. All materials should, in any case, be kept out of direct sunlight until completely processed.

Cleaning

Equipment should be cleaned of residual material using **SW200.**

SW200 is supplied ready to use in standard screen cleaning equipment. Refer to equipment manufacturers information for operating instructions

Shelf-life

EP3912., **EP3912/4428, EP2793LV** and **EP2793 Pt B**	Minimum 9 months from date of manufacture
ER-7 and SW200	Minimum 12 months from date of manufacture

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Storage:

All products should be stored between 10-25 degs C in a dry store.
Avoid subjecting containers to temperatures below 5 deg C because of the risk of splitting.

SW200 is flammable and must be stored according to local regulations

EP 3912 is not suitable for sea-shipments.

To reduce potential of settling, product must be rotated (180°) in original containers every 8 weeks. Alternatively, product can be rolled on material rollers at a speed of 10 – 30 rpm.

The above procedure is not required for EP3912/4428

Disposal:

Waste products must be disposed of in accordance with local and national regulations.

Final Properties: EP2793 (as cured 60mins @ 150°C)

Outgassing	Total Mass Loss (TML)	Collected Volatile Condensable Material (CVCM)	Water Vapour Recovered (WVR)
ASTM-E-595 requirement	Max. 1.0%	Max. 0.10%	Report
EP2793 No UV bump	2.58%	0.06%	0.31%
EP2793 Plus 3200mJcm^{-2} UV bump	**0.95%**	**0.02%**	**0.31%**

TEST	METHOD	RESULT	CLASSIFICATION
Hardness (pencil)	SM-840C	9H	Pass, class H
Adhesion	SM-840C	Aluminium: <5% removal Silver: <5% removal	
Chemical resistance Isopropanol (min.120s) Isopropanol/H_20 (75/25) D-Limonene 10% Alkaline detergent Monoethanolamine	SM-840C Room temp. 120s 46 (± 2)°C 15 min Room temp. 120s 57 (± 2)°C 120s	No surface roughness No blisters No delamination No swelling	Pass, class H

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TEST	METHOD	RESULT	CLASSIFICATION
Methylene chloride Deionised water	57 (± 2)°C 120s Room temp. 60s 60 (± 2)°C 5 min	No colour change No cracking	
Hydrolytic stability	SM-840C	No evidence of reversion	Pass, class H
Insulation resistance	SM-840C	Before solder 10^{11}-10^{12} Ω After solder 10^{11}-10^{12} Ω	Pass, class H
Moisture & insulation	SM-840C	No blistering, separation, degradation. Initial 10^{11} – 10^{12} Ω During 10^{9} – 10^{10} Ω After 10^{11} – 10^{12} Ω	Pass, class H
Wave-solder resistance 10 (± 1)s at 260 (± 5)°C	SM-840C	No loss of adhesion or solder pick-up.	Pass, class H
Thermal shock	SM840 C	No cracks, delamination, crazing or blistering	Pass , class H
	-40°C to +150°C (30 min. each extreme) (10 sec. transfer time)	No cracks, delamination, crazing or blistering	1050 cycles
Dielectric strength	SM840 C		Pass , class H
	IEC60243-1 and IEC60464-2	134 KV/mm (3417 V / mil)	
Dielectric constant		4 (1 MHz)	

For further information, contact:

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