TECHNICAL DATASHEET
CARAPACE®
EMP110 W- LED

Aqueous Developable
PHOTOIMAGEABLE SOLDERMASK
for LED applications

PRODUCT DESCRIPTION

Carapace® EMP110 has been used in the high volume production of PCBs since 1987. **EMP110 W-LED** has been formulated specifically to have a strong white colour and very low colour change during high temperature processing.

- **Fast processing times allowing High throughput and Productivity**
- **Brilliant White Coating with High Blocking Power**
- **Tailored Reflectivity for White LEDs**
- **Non Yellowing - High Resistance to Thermal and UV Ageing**
- **Rapid Tack Dry for Use on High Heat-sink Substrates**
- **Screen Print and Spray Versions**
- **Lead-free Compatible**
- **Contains no halogenated flame retardants**
- **EMP110 W-LED is RohS compliant**

Carapace® EMP110 W-LED is a contact exposure, aqueous developing, liquid photoimageable soldermask, using two-component epoxy technology.

CARAPACE® EMP110 W-LED

All **Carapace®** pastes are coded as EMP110 followed by a 4-figure number and letters. The 4-figure number and letters denote the colour, finish.

EMP110 W – LED pastes are specifically designed for use with pre-packaged dedicated hardeners.

Board surface preparation:
Copper surfaces should be mechanically or chemically cleaned to give a 60s waterbreak-free surface. Recommended mechanical methods are pumice, aluminium oxide or 320 grit brush.

All boards **must** be completely dry before coating.

Mixing:
Carapace® is supplied as standard in pre-weighed 1kg or 3kg packs for screen print and 2kg or 10kg packs for air-spray.

The resist is supplied in pre-weighed packages of paste + hardener. The original supplied mix ratio must be used if mixing smaller amounts than the standard pack-size.

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

Mixed pot life is 24 hours (maximum)

Viscosity reduction:

EMP110 W-LED screen print 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 on track edges and/or prolonged drying times.

EMP110 W-LED air-spray should be reduced with **Electrareducer ER6 or ER10.**
Where ER6 or ER10 are not available, an equivalent from an approved source may be used. The use of non-approved solvents is not recommended as they can cause contamination and other processing problems.

Addition level required will depend on spray system used.

Please contact Electra Technical Support Department for recommendation addition levels

Due to the fast viscosity readings using a $Zahn_3$ cup, air inclusion can give erratic readings. It is therefore recommended to use the Ford Nº4 or a cup giving similar values (e.g. Frikmar Nº4).

Process settings:

SP:

Mesh count: 43-55T (110-140 mesh) polyester.
Squeegee: 60-70 Shore.

20µm (0.75 mils) dry thickness should be aimed for; this is typically achieved using a 43T (110 mesh)

The board outline image may be made on the screen using conventional stencil material or masking tape and screen filler. To prevent a build up of ink on the reverse of the screen that may block holes, it is advisable to shift alternate boards along the x- or y-axis before printing. Alternatively, a rudimentary stencil, such as an expanded drill mask, can be used on the screen to prevent ink going into the holes.

Do not utilise the vacuum bed, as this will suck an exaggerated amount of ink into the holes.

AS: Exact spray parameters will depend on track height and circuit layout.
These parameters will also depend on equipment manufacturer, please contact Electra Technical Support Department for specific recommendations.

Below are general recommendations and guidelines:

Wet-weight: 40 to 65μm (1.5 to 2.5 mils)

Tank pressure and coating speed are set to give desired wet thickness.
Atomising pressure should be set to give minimal mottling.
Shaping air is to be adjusted to give an even spray pattern.

Lower atomising pressures and higher coating speeds will lead to increased mottling.

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 temperature	Recommended time (mins)	Max hold-time after optimum tack-dry
Specific LED-W Hardeners	70 °C (158°F)	30 – 40	12 – 24 hours*

*depending on ambient conditions

Exposure

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

Step wedge: 9 - 12 clear (Stouffer 21 step).*

*To prevent wrinkling of the soldermask between tracks when processing high film weights and / or increased copper track heights (i.e 2 oz and above), it is recommended to use higher exposure energies (e.g. higher step wedge).

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 on brushed copper 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.
Separate exposure tests should be carried out for each different colour, as variations in lamp emissions can cause differences in exposure speed. After determining the correct setting, energy level can be monitored as a means to check for any changes in lamp output.

Developing

Developer:	1% soln sodium or potassium carbonate.
Spray pressure:	2.5 – 3.0 kgcm^{-2}, 35 - 45 psi.
Spray time:	45 - 60s in carbonate chamber(s) (dependent on quantity of ink in holes).
Temperature:	31 - 33°C (88 - 91°F)

Boards should be well rinsed with fresh water and fully dried after developing.
Do not final cure boards when wet.

The optimum developing speed is set when an unexposed board develops off completely, 25- 50% of the way through the machine. This speed should be ascertained by preliminary tests prior to making exposure tests.

Developing speed and break-point settings will be determined by the amount of ink deposited in the holes during coating.

Final Cure Convection oven: 60 mins at 150°C (300°F) **Time at board temperature**

UV bumping

It is not recommended to UV bump Carapace® EMP110 W-LED as this may cause excessive yellowing on subsequent soldering operations.

Safelight

It is not normally necessary to print Carapace® EMP110 W-LED under safelight conditions, although it may be advisable if there are long delays before drying. Between drying/exposing and exposing/developing, boards should be kept in yellow light. Boards should, in any case, be kept out of direct sunlight until completely processed.

Notation/marking inks

Thermal curing notation inks are suitable for use with Carapace® EMP110 W-LED. Thermal curing inks may be applied before or after final cure.

Stripping

After curing, soldermask can generally be removed from copper surfaces using a high temperature proprietary stripper. Some additional scrubbing may be required. Soldermask cannot be fully removed from laminate surfaces.

Sn/SnPB rework

Care should be taken if a re-working process incorporates Sn or Sn/Pb stripping and a subsequent re-HASL cycle. This has been found to increase the yellowing potential of the coating.

Cleaning

Equipment should be cleaned of residual soldermask using **SW100 or Dowanol PMA.**

Shelf-life

Minimum 6 months from date of manufacture when stored in cool, dry, recommended conditions.
Storage should be between 10 and 25°C (50 - 77°F) and must be away from sources of heat and direct sunlight.

Final Properties

TEST	METHOD	RESULT	CLASSIFICATION
Hardness (pencil)	SM-840C	>6H	Pass, class H
Adhesion	SM-840C	Copper: 0% removal Base laminate: 0% removal SnPb: <10% removal	Pass, class H
Chemical resistance Isopropanol (min.120s) Isopropanol/H_20 (75/25) D-Limonene 10% Alkaline detergent Monoethanolamine Methylene chloride Deionised water	SM-840C Room temp. 120s 46 (± 2)°C 15 min Room temp. 120s 57 (± 2)°C 120s 57 (± 2)°C 120s Room temp. 60s 60 (± 2)°C 5 min	No surface roughness No blisters No delamination No swelling No colour change No cracking	Pass, class H
Hydrolytic stability	SM-840C	No evidence of reversion	Pass, class H
Insulation resistance	SM-840C	Before solder 2×10^{13} Ω After solder 2×10^{12} Ω	Pass, class H
Moisture & insulation	SM-840C	No blistering, separation, degradation. Initial 2×10^{13} Ω After 2×10^{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
Dielectric strength	SM840 C	1900 V/mil	Pass , class H
Dielectric Constant		4.5 (1MHz)	

Other **UL File E95722** 94 V-0

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