

XV501T Curtain Coat DI

From the Imagecure family of
Photoimageable Solder masks

1. Description

Imagecure XV501T Curtain Coat DI solder mask is a liquid product that dries by evaporation to give a film that can be sensitised by exposure to UV wavelengths between 360nm and 405nm. The unexposed material is developed in a dilute alkali solution and then cured to give a durable, chemical and heat-resistant film.

This Technical Information Leaflet (TIL) and the relevant Material Safety Data Sheet (MSDS) should be read carefully prior to using this product.

2. Product features

- Excellent adhesion to and encapsulation of copper tracks/surfaces
- Resolution capability down to 50µm (2mil) and less
- Exposure sensitivity 40 – 250mJ/cm² (depending on DI Machine)
- Proven resistance to HASL processing, compatible with a range of Ni/Au and Immersion Sn chemistries
- Halogen Free (<300ppm total halogen content)
- RoHS & WEEE Directive Compliant



U.L. FILE NUMBER E83564

® is a registered trade mark



3. Product Range

XV501T	Matt Green Halogen Free DI Curtain Coat Resist	6.00 kg.	CAWN2619(DI)
XV501T	Clear DI Curtain Coat Hardener	2.00 kg.	CAWN1286(DI)
XV501T	Clear Curtain Coat Hardener	2.00 kg.	CAWN 1286
XZ95	Curtain Coat Thinner	5.00 L.	CDSN4017
XZ95	Curtain Coat Thinner	25.00 L.	CDSN4018
XZ90	Curtain Coat Thinner	5.00 L.	CDSN4042
XZ108	Curtain Coat Thinner	5.00 L.	CDSN4065
XZ108	Curtain Coat Thinner	25.00 L.	CDSN4066

4. General Handling

4.1 Storage and Shipping

When stored in sealed containers, in a cool place (below 20°C / 68°F), away from sources of direct heat and sunlight, Imagecure XV501T DI resist components have a maximum shelf life of 12 months, hardener components have a maximum shelf life of 18 months.

Imagecure XV501T can withstand higher temperatures (40°C / 104°F), whilst in transit for up to periods of 1 month without any detrimental effect on its performance.

4.2 Waste disposal

Care should be exercised in the disposal of printing ink waste. This should be carried out in accordance with good industrial practice, observing all the appropriate regulations and guidelines.

For more specific handling advice refer to the detailed Safety Data Sheet (SDS), supplied by your local Sun Chemical Circuits representative.

5. Application / Processing Conditions

5.1 Processing Environment

The choice of printing and exposure environment has been found to have a direct effect on fine solder dam yield values. Every effort should be made to minimise the incidence of dust or fibres in the print room and exposure area. It is therefore recommended that a Class 10,000 clean room be considered the minimum requirement for resolving features less than 100µm (4mil) at high yield.

Commercial, automated printing equipment may already contain some level of air filtration and the manufacturers or local Sun Chemical Circuits representatives can advise on its suitability.

It is also recommended that the Mixing, Coating, Exposure & Development areas be fitted with UV screened illumination (yellow light) due to the high photosensitivity of this particular product.

5.2 Mixing

The resist and hardener components must be mixed together in the correct mixing ratio of 1 pack of resist to one pack of hardener before use. The hardener component must be added to the resist component. Once the resist and hardener components have been mixed together then the required Imagecure curtain coat solvent can be added to thin the mix to the correct application viscosity.

Mechanical mixing is recommended to ensure thorough mixing of the resist and hardener components. Recommended mixers include those with variable speed motors and paddle type mixing blades as well as the shaker or rotating type mixers. Mixing times will depend on the type of mixer or stirrer used but typical mix times of 10 - 15 minutes with stirrer speeds between 40 - 100 rpm can be expected. Avoid excessively fast speeds as this will entrap large volumes of air into the mixed resist.

It is recommended that attention be paid to ensuring that any resist at the sides of the container and on the bottom is completely mixed into the main body of the resist.

After the mixing operation is completed it is recommended to allow the mixed and thinned pack to debubble for ~ 30 min. before use.

Mixed pot life at 23⁰± 2°C (70 - 77°F) will be approximately 48 hours. Always ensure the lid is replaced on the container to avoid any contamination and excessive solvent evaporation

5.3 Thinning

The mixed ink should be reduced in a ratio of 5.6 : 1.00 w/w (Mixed Ink : Thinner), to an application viscosity of typically 85 +/- 5 seconds Ford No. 4 cup.

Automatic viscosity control reservoirs should also be filled with the appropriate solvent.

Alternative reducers are available to suit customers' individual requirements. Your local Sun Chemical Circuits representative will be please to advise on product selection.

N.B. The mixed resist should be stirred thoroughly before reduction.

5.4 Pre-Clean

Ensure that all copper surfaces are completely clean, tarnish free and dry prior to applying Imagecure®. Mechanical pre-cleaning is recommended as follows: -

Brushing 280 - 400 grit silicon carbide brushes are recommended having a footprint on the copper of 8 - 15mm. (0.3 - 0.6 in). The water rinse and heater sections should be capable of thoroughly rinsing and drying the panels such that no water is left in the holes or between closely spaced conductors and that moisture or tarnish is not present on the freshly brushed panels. It is important that each brush is regularly checked and dressed as necessary to ensure optimum efficiency during use. Please note that Nylon brushes of 600 - 800 grit can also be used.

Pumice Pumice or Aluminium oxide slurry of between 12 - 18% is recommended with an optimum of 15%.
The water rinse and heater sections must be capable of rinsing and drying the panels such that residual pumice particles are completely removed and that no water is left in the holes or between closely spaced conductors and that moisture or tarnish is not present on the freshly cleaned panels.

For panels that are badly oxidised and tarnished then a micro-etch prior to mechanical pre-cleaning is recommended. The micro-etch should be capable of removing any oxide or tarnish staining and of thoroughly rinsing and drying the panel before being mechanically cleaned.

Panels which have close track/gap configurations (<100µm/.4mil.), may not be suitable for mechanical pre-cleaning and will need to be micro-etched. The use of either a standard micro-etch or the "deep etching" micro-etch chemistries can be effective in this process. It is recommended that each user ensures that the Imagecure product is compatible with the particular micro-etch used and all subsequent metal finishing processes.

Surface roughness figures of:- Ra 0.2 - 0.4µm R delta q 4 - 9°

would be considered to be optimum values for copper surfaces pre-cleaned as above. A minimum Ra of 0.2µm with an R delta q value of >4° is recommended (optimum R delta q values 7 - 9°).

Please refer to separate technical document on surface roughness for a fuller explanation of the above roughness values.

NOTE. It is recommended that all freshly cleaned panels are coated with Imagecure XV501T within a maximum time of 2 - 4 hours. The actual maximum time will vary depending upon ambient temperature and humidity. Panels left longer than 4 hours before coating should be pre-cleaned again.

5.5 Curtain Coating

The Imagecure XV501T DI curtain coat system can be used with all types of curtain coaters.

Once the thinned Imagecure XV501T has been added to the sump and the correct viscosity obtained, film weight can be set by the use of "weight gain" panels and by adjustment of the conveyor speed. The relationship between wet weight and conveyor speed is inverse. Typical coating speeds will be between 80–100m / min.

The nip gap on the curtain coater will vary depending on type and will be typically between 0.4 - 1.3mm. (16 – 52 mil), and once set does not normally need to be changed.

In-line filters of 50 - 75µm are recommended.

Wet weight values of 80 - 120gsm are typical. This will give a dry coating thickness of 30 - 50µm. Coating thickness may need to be changed depending on board configuration and conductor heights as well as end use requirements (withstand voltage etc.).

In some instances it may not be possible to achieve a suitable coating in a single coat and the use of double coating may be necessary. Discussion with your Imagecure partner is recommended in order to obtain optimum results.

5.6 Pre-Dry

Good drying of the coating is important, so ovens with good temperature profiles and extraction are necessary.

Specific drying parameters (time and temperature) will be dependent upon the specific oven used as well as the thermal mass and quantity of the panels being dried.

It is recommended that printed panels be allowed to de-bubble for approximately 3 - 5 minutes in still air at ambient temperature prior to entering the heated zones of the oven.

Board temperatures generally should be between 90 - 100°C (depending on individual oven settings) with a maximum temperature gradient across the panels of <10°C.

Air flow speeds of 1 - 2m./s. are recommended to achieve sufficient removal of the volatile solvent. Drying is less efficient as the air velocity drops below 0.5m/s.

BATCH OVEN Typical settings

Side 1: 10 mins @ 90°C (194°F) or 15 mins @ 85°C (185°F).
Side 2: 20 - 30 mins @ 90°C (194°F), or 35 - 40 mins @ 85°C (185°F)
Boards must be dried horizontally.

The Imagecure XV501T series can also be dried in IR ovens. Specific times and temperatures will depend on the specific Infra red oven used. Please discuss with your Imagecure partner the specific settings before use.

After drying it is recommended that all panels be exposed and developed within 24 hours. The maximum storage time of boards before exposure/development is 72 hours. However it is recommended that boards be stored in yellow light conditions with controlled temperature and humidity. If the humidity increases above 60% RH then the storage time of the dried panels will be reduced.

5.7 Exposure

DI Exposure

Ensure panels are at room temperature before exposure step. Please note that due to the extreme photosensitivity of this material, it is recommended that the panels be allowed to cool either in a yellow light area or a darkened room. To reduce the possibility of contamination, panels can be passed through a dust removal system (such as those supplied by Teknek), prior to placing in the DI Unit

Optimum resist spectral sensitivity: 360 – 405nm
Energy Requirement: 40 – 250mJ/cm² (dependant on Exposure Machine)

Conventional Exposure

If there is a requirement for use with Conventional Exposure, please contact your local Sun Chemical representative

After exposure, allow a hold time of 5 – 10 minutes before development. The maximum hold time for exposed panels is 24 hours in yellow light.

5.8 Development

Imagecure XV501T will readily develop in either potassium or sodium carbonate solutions. The recommended carbonate concentration is 10 ± 2g./lit.

The working pH range is 10.8 to 11.3 for aqueous carbonate solutions. To ensure the quality of development it is recommended that the pH of the developer solution does not drop below 10.8. At a pH <10.6 the efficiency of the developer solution may drop due to the increased loading of photopolymer.

Recommended temperature range is 30 - 35°C (86 - 95°F), optimum 33°C (95 - 91°F).
Spray pressures between 1.5 – 3 Bar (22 - 44 PSI), optimum 2 Bar (29 PSI).

Dwell times in the developing chambers of 45 - 80 seconds, optimum 60 seconds. For boards with small via holes (0.2 - 0.4mm) or with laminate thickness >3mm, longer dwell times may be necessary to ensure complete development of the holes.

Water rinse pressures to be 2 -3 bar (30 - 45 PSI), with operating temperatures 15 - 30°C (59 - 86°F). It is recommended that hard water (~200 ppm dissolved ions) be used where possible to give good rinsing, followed by a final rinse in deionised water.

It should be noted that Imagecure films needing to be removed can be stripped by dipping in either a proprietary solder mask stripper or 5% sodium hydroxide solution at 50 - 70°C (122 - 158°F).

5.9 UV Bump

A UV-Bump is generally recommended with Imagecure XV501T DI products.

If a UV bump is required then it is recommended that it be carried prior to post bake, and that a multi lamp double sided UV cure unit be used. Recommended UV energy is 2500 - 3000 mJ/cm².

A UV bump can also be carried out after post bake, recommended energy of 3000 - 4000mJ/cm².

A UV bump will improve surface hardness, reduce volatile emissions, reduce ionic contamination and give increased resistance to OEM assembly cleaning processes.

5.10 Post Bake

It is important to ensure that all ovens have an independent thermal profile taken, as the set air temperature is not always reliable and the air flow in the oven or the door seals may give rise to either hot or cold spots.

The recommended bake cycle is 150 - 155°C (302 - 311°F) for 60 - 90 min. Optimum is 155°C for 60 min. Bake times should be taken when oven temperature reaches the pre-set point.

Sufficient air flow is necessary to ensure a consistent temperature gradient in the oven as well as a uniform degree of cure for the solder resist.

With respect to batch ovens boards should be racked 25 - 40mm. (1.0 - 1.6 in.) apart.

All exhaust ducting and extraction fans should be adequately insulated to avoid any volatile emissions condensing around the oven area.

5.11 Legend / Notation Printing

All Imagecure XV501T curtain coat products are compatible with a wide range of UV curing, thermal curing and photoimageable notation inks.

Thermal curing inks can be applied prior to post bake to increase productivity.

6. Health and safety

Detailed material safety data sheets will be supplied by your local Sun Chemical Circuits representative.

The products detailed hereon have been tested in accordance with, and meet the requirements of, the RoHS 3 (EU Directive 2015/863), regarding the presence of the metals - Pb (Lead / Lead compounds), Hexavalent Chromium, Cd (Cadmium), Hg (Mercury), Phthalates – DEHP (0.1%), BBP (0.1%), DBP (0.1%), DIBP (0.1%) and Poly Brominated Flame Retardants.

Conforms to Regulation (EC) No. 1907/2006 (REACH), Annex II – Europe.

As the world’s foremost producer of inks, pigments and colour technology, Sun Chemical is leading our industry in developing and producing products which minimise our impact – and our customers’ impact – on the environment and striving to maximise the use of renewable resources. We consider it our responsibility to be involved in the communities in which we live and work and to offer direction in meeting today’s needs without compromising the ability of future generations to meet theirs.

7. Film Performance / Technical Specification

7.1 Physical Properties of Imagecure XV501T DI Curtain Coat

Pack Code	Viscosity (Pa.s)	S.G.	Flash point	Non volatile content
CAWN2619(DI)	18.5 – 22.5 Pa.s	1.28	80°C (176°F)	66 – 70%
CAWN1286(DI)	8.5 – 10.5 Pa.s	1.20	100°C (212°F)	78 – 82%
CAWN 1286	8.5 – 10.5 Pa.s	1.20	100°C (212°F)	78 – 82%

*Viscosity measured at 25°C (77°F). Please note viscosity can vary greatly depending on ink temperature, volume of ink tested, type of viscometer used and the test method.

Volatile Organic Content (VOC) 360 - 400g./L. (mixed & unthinned)



7.2 Cured Film Properties of Imagecure XV501T DI Curtain Coat

Solder Resistance	IPC SM840E	10 seconds @ 260°C (500°F) 30 seconds @ 288°C (550°F)
Resistance to Fluxes	IPC SM840E	Pass
Electroless Ni/Au Plating		Pass
Hydrolytic Stability	IPC SM840E Class H	Pass
Solvent, Cleaning Agent, & Flux Resistance	IPC SM840E Class H	Pass
Fungal Resistance	IPC SM840E Class H	Pass
Thermal Shock	IPC SM840E Class H MIL-PRF-55110F MIL-STD-202G	Pass Pass Pass
Chemical Resistance		IPA >1 hour 1,1,1 Trichloroethane >1 hour MEK >1 hour Methylene Chloride >1 hour Alkaline Detergent >1 hour Fluxes >1 hour
Abrasion Pencil Hardness	IPC SM840E Class H	Pass (7H)
Adhesion (Copper) (Tin / lead)	IPC SM840E Class H IPC SM840E Class H	Pass Pass
IEC 60664		Pass
Flammability	UL 94V0 Rating	File No. E83564 UL Grade: XV501TM Curtain Matt
Ionic Contamination	MIL-PRF-55110F	<0.3µg. NaCl/cm ² Using Alpha Ionograph 500M
Bellcore	TR-NWT000078	Pass
Insulation Resistance	IPC SM840E Classes T and H	5 x 10 ¹⁰ Ohm
Moisture & Insulation Resistance	IPC SM840E Classes T and H	Pass
Electromigration	IPC SM840E Classes T and H	Pass
Comparitive Tracking Index (FR4 Laminate – CTI Rated 500 V)	IEC 112	≥600
Siemens E-Corrosion Test	SN 57030	Pass
Dielectric Strength (50 Hz.)	IPC SM840E DIN53481	160kV/mm.
Note: A minimum coating thickness of 10µm is required to achieve a 500V Breakdown Resistance		
Dielectric Constant Dk		1 GHz – 2.717 5 GHz – 2.553 10 GHz – 2.301
Dielectric Loss Factor tangent		1 GHz – 0.0255 5 GHz – 0.0238 10 GHz – 0.0214
Fire Protection on Railway Vehicles	CEN TS 45545	Pass



8. Disclaimers

This information has been carefully compiled from experience gained in field conditions and extensive laboratory testing. However, the products' performance and its' suitability for the customers' purpose depend on the particular conditions of use and the material being printed. We recommend that customers satisfy themselves that each product meets their requirements in all respects before commencing a production run.

Since we cannot anticipate or control the conditions under which our products are used, it is impossible to guarantee their performance. All sales are also subject to our standard terms and conditions.

9. Technical Assistance / Contacts

Sun Chemical Circuits are an international company, and as such can offer technical, engineering and sales support to our customers worldwide.

For further information regarding this product, or any of our extensive range of materials for PCB fabrication, please contact your local Sun Chemical team or visit the Technical Help Desk at website: <http://www.sunchemicalhelpdesk.com>

Our Products are intended for sale to professional users. The information herein is general information designed to assist customers in determining the suitability of our products for their applications. All recommendations are made without guarantee since the application and conditions of use are beyond our control. We recommend that customers satisfy themselves that each product meets their requirements in all respects before commencing a print run. There is no implied warranty of merchantability or fitness for purpose of the product or products described herein. In no event shall Sun Chemical be liable for damages of any nature arising out of the use or reliance upon this information. Modifications of the product for reasons of improvements might be made without further notice.

