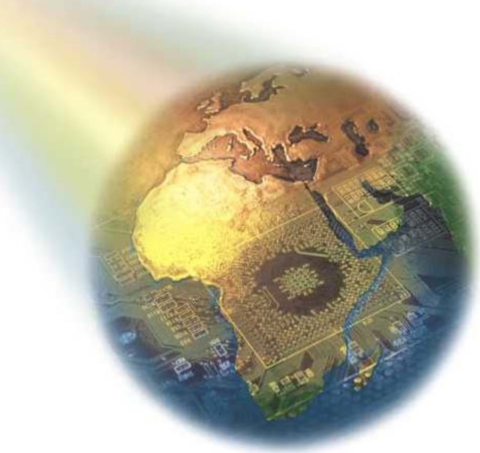

Coates Circuit Products

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IMAGECURE® XV501T-4 SCREEN

XV501T- 4 LV SCREEN (SCR)	XV501T- 4 HV SCREEN (SCR)
Gloss Green Gloss Dark Green Semi Matt Green Semi Matt Dark Green Extra Matt Green Blue, Opaque blue, Red, Yellow and Black are available in Gloss	Gloss Green Gloss Dark Green Semi Matt Green Semi Matt Dark Green Matt Green Matt Dark Green Yellow green and Blue are available in Semi Matt finish. White and Black are available in Matt

INTRODUCTION / INDEX

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U.L. FILE NUMBER E83564

® is a registered trade mark

ISO9001 **SM840C CLASS H PASS** **ISO14001**

BELLCORE PASS

1) DESCRIPTION

Imagecure® AQ XV501T- 4 Screen is a two component thermal hardening liquid photoimageable solder resist that dries by solvent evaporation to give a film that can be processed in either aqueous potassium carbonate, sodium carbonate or Butyl diglycol (BDG).

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

XV501T- 4 screen products have excellent adhesion to all clean copper surfaces, but are not recommended for use with reflow tin/lead and electrolytic gold plated conductors.

For reflow tin/ lead and electrolytic gold plated conductors the Imagecure® XV501T screen products are recommended.

2) MIXING

The resist and hardener components must be thoroughly mixed together in the correct mixing ratio before use. The hardener component must be added to the resist component.

For users of large pack sizes 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.

Returning of resist to the original container after use is not recommended as this can lead to dust particles or dried resist being introduced into the product which could affect future performance.

Mixed pot life at 23º± 2ºC (70 - 77ºF) will be approximately 72 hours. Always ensure the lid is replaced on the container to avoid excessive solvent evaporation.

3) 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 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 - 9º

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 >4º is recommended (optimum R delta q values 7 - 9º).
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 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.

4) APPLICATION

The XV501T- 4 series can be used with all types of vertical screen print units and horizontal screen print machines.

The low viscosity of the XV501T- 4LV series makes them compatible for users who require fast print speeds with complete encapsulation of all conductors. The higher viscosity specification of the XV501T-4HV series will give improved track encapsulation of boards with high copper conductors.

Typical polyester meshes will be 36/90 – 43/80cm (90/90 – 125/80inch) with a 65 - 70º shore squeegee with a square edge profile. The optimum mesh for printing is 43/80cm (110/80inch) and this will bee suitable for most 18µm and 35µm base copper board designs.

For boards with 70µm base copper, or for boards requiring a specific withstand voltage the use of meshes with lower mesh counts 32/100 – 36/90cm (80/100 - 90/90inch) may be necessary.

Print tests with subsequent micro-sections are recommended to ensure adequate track encapsulation.

All screens must be cleaned and thoroughly dried before use and free from residues of screen cleaner and solder mask residues.

5) PRE-DRY

Good drying of the printed film 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 debubble for approximately 5-10minutes in still air at ambient temperature prior to being placed in the oven.

Air flow speeds of 1 - 2ms^{-1} are recommended to achieve sufficient removal of the volatile solvent. Drying is less efficient as the air velocity drops below 0.5ms^{-1}.

For vertical screen print systems with a vertical drying oven a set air temperature of 80 -90ºC (176 - 194ºF) for 30 - 50 min. is recommended. Optimum 85ºC (185ºF) for 45 minutes. Drying will depend on board thickness and Imagecure thickness as printed, as well as air flow in the oven.

For printing processes that only print one side at a time the following is recommended for box ovens :-

Side 1	10 - 25 min. at 80 - 90ºC (176 - 194ºF)
Side 2	25 - 35 min .at 80 - 90ºC (176 - 194ºF)

The XV501T- 4 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.

Allow an adequate gap between panels. Spacing of 25 - 40 mm (1 - 1.6 in.) is recommended to ensure sufficient air flow between panels.

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.

6) EXPOSURE

All Imagecure® systems are negative working and can be used with all exposure units using ferric doped mercury vapour lamps with UV wavelengths between 300 - 400nm.

Ferric doped lamps with power ratings of 5 - 10kW are recommended. It is recommended that to remove the infra red radiation the unit is either cooled or has an infra red filter to keep the temperature of the artwork <30ºC. Optimum working temperature 22 - 25ºC

Exposure readings of *250 - 500 mJ/cm² are typical.
* Exposure readings taken with an IL390B radiometer from the International Light Co. Inc.

Stouffer values of 8 - 10 (solid resist) using a 21 step wedge are typical. For selective Ni/ Au and or immersion Sn exposure levels of 11/12 (solid resist) are recommended.

The artwork should have a Dmax > 4.0 and a Dmin < 0.15

7) DEVELOPMENT

The Imagecure® XV501T-4 screen products will readily develop in either potassium or sodium carbonate solutions. The recommended carbonate concentration is 10 ± 2g./lit.

The working pH range is 11.3 to 10.8 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.

Temperature range is 30 - 40ºC (optimum 35-38ºC).

Spray pressures between 2 - 4 bar (optimum 2.5 bar).

Dwell times in the developing chambers of 45 – 80s (optimum 60s). 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, with operating temperatures 15 -30ºC.

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.

Anti-foams will need to be added to the aqueous developing chambers to avoid foaming. The amount of anti-foam to be added may vary depending upon the type of anti-foam used, the size and number of developing chambers and spray bars, spray pressures and the loading of developed resist. In all cases it is recommended that the minimum amount of anti-foam be added.

Imagecure® will also develop in BDG (butyl diglycol). The developer temperature should be 30 ±2ºC, with a dwell time between 120 - 160s. Spray pressures of 4 - 5 bar are normal. Optimum conditions will include a dwell of 150s @ 30ºC with spray pressures of 4 - 5 bar.

It should be noted that Imagecure® films needing to be removed can be stripped by dipping in either a propriety solder mask stripper or 5% sodium hydroxide solution at 50-70ºC.

8) UV BUMP

Generally Imagecure® does not require a UV bump. However there may be certain customer processes or requirements that render the use of a UV bump desirable or necessary.

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 1000 - 1500 mJ/cm².

A UV bump can also be carried out after post bake, recommended energy of 2500 – 3000mJ/cm².
A UV bump will improve surface hardness, reduce volatile emissions, reduce ionic contamination and give increased resistance to OEM assembly cleaning processes.

9) 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 140 - 150ºC for 60 - 90 min (optimum 150ºC 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.

10) ELECTROLESS NICKEL GOLD or IMMERSION TIN PROCESSING

There are a number of competing chemistries available, each with a differing aggressiveness towards the solder resist. The following guidelines are given to help Imagecure® users avoid some of the problems associated with solder resists and these alternative solderable finishes :-

Pre-clean	Either silicon carbide brushing, pumice scrubbing or the use of a deep etch copper micro-etchants. The copper must be clean, tarnish free and with a good micro topography.
Application	Ensure that the tracks have sufficient solder mask. A minimum of 8 - 10µm is recommended.
Pre-dry	Insufficient pre-dry can lead to a lowering of the cured film's resistance to either Ni/Au or immersion tin as well as increasing the degree of undercut on development. The pre-dry should be carried out at 85 - 90ºC. It is recommended that oven thermal profiling be carried out to achieve optimum results.
Exposure	To achieve straight side walls with minimal undercut on development a Stouffer reading of 11 - 12 (solid resist) is recommended.
Development	Extended dwell times, high developing temperatures and high spray pressures should be avoided otherwise excessive undercut will take place. To achieve optimum results the developed edges should be straight with minimal undercut.

10) ELECTROLESS NICKEL GOLD or IMMERSION TIN PROCESSING (cont.)

UV Bump	Can be used before post bake to eliminate film discoloration after metallisation. 100 - 1500 mJ/cm² is recommended.
Post bake	Avoid excessive temperatures during post bake as these can lead to oxidation of the copper surfaces. Recommended process temperature 140 - 150ºC with a maximum dwell of 60 minutes.
Micro-etch	Only 1.0µm etching should be necessary to remove the oxide layer. Excessive micro-etching (> 2.0µm) can lead to under plating and edge lifting of the solder resist film. Ensure that the micro-etch process is controlled and consistent across the panel.

11) NOTATION / LEGEND PRINTING

All XV501T- 4 screen 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.

12) STORAGE & SHIPPING

When stored in sealed containers, in a cool place (20ºC / 68ºF), away from sources of direct heat and sunlight, the XV501T- 4 resist and hardener components have a shelf life of 12 months.

XV501T- 4 can withstand higher temperatures (40 - 60ºC / 104 - 140ºF), whilst in transit for up to periods of 1 month without any detrimental effect on its performance.

13) PACKING

Component Description	Pack Size
Resist	3.00 kg.
Green hardener	1.00 kg.

The Yellow green (YG) product is available in a 7.5 kg mixed pack size

All colours, including the Extra matt (XM) green are available in 1 kg mixed pack size

14) FILM PERFORMANCE / TECHNICAL SPECIFICATION

PHYSICAL PROPERTIES OF IMAGECURE XV501T-4 SCREEN

	Viscosity (Haake VT550)	S.G.	Flash point	Non volatile content
LV Clear resist	14.0 - 19.0 PaS	1.38 - 1.39	> 70ºC	74.0 ± 1.5%
LV Coloured resist	10.0 - 16.0 PaS	1.36 - 1.37	> 70ºC	73.6 ± 1.5%
LV Hardener	5.5 - 15.5 PaS	1.17	> 70ºC	79.5 ± 1.5%
HV Clear resist	17.0 - 27.0 PaS	1.32 - 1.37	> 70ºC	75.0 ± 1.5%
HV Coloured resist	13.0 - 21.0 PaS	1.32 - 1.39	> 70ºC	75.0 ± 1.5%

Solder Resistance	MILP55110	30 secs @ 288□C
	IPC SM840C	10 secs @ 260□C
Resistance to Solder Levelling		>5 passes
Resistance to Fluxes	IPCSM840C	Pass
Electroless Ni/Au Plating		Pass
Adhesion (Copper)	IPC SM840C Class H	Pass
Hydrolytic Stability	IPC SM840C Class H	Pass
Resistance to solvents	IPC SM840C Class H	Pass
and cleaning agents		
Fungal Resistance	IPC SM840C Class H	Pass
Thermal Shock	IPC SM840C Class H	Pass
	MIL 551100	Pass
	MIL STD202E	Pass
	BS6096 Tests	Pass
Abrasion Pencil Hardness	IPC SM840C Class H	Pass
Resistance to:	IPA	>1 hour
	1,1,1 Trichloroethane	>1 hour
	MEK	>1 hour
	Methylene Chloride	>1 hour
	Alkaline Detergent	>1 hour
	Fluxes	>1 hour
Ionic Contamination	MILP55110D	<0.3□g. NaCl/cm² (Using Alpha Ionograph 500M)

14) FILM PERFORMANCE / TECHNICAL SPECIFICATION (cont.)

ELECTRICAL PROPERTIES OF CURED FILM

Bellcore	TR-NWT000078	Pass
Insulation Resistance	IPC SM840C Classes T & H	Pass
Moisture & Insulation Resistance	IPC SM840C Classes T & H	Pass
Electromigration	IPC SM840C Classes T & H	Pass
Siemens E-Corrosion Test	SN57030	Pass
Dielectric Strength (50 Hz.) 20-S-Value	IPC SM840C Class H DIN53481	100kV/mm.
Comparative Tracking Index	IEC 112	Gloss 600 SM425 M400

CTI measurements carried out on laminate of 400 CTI.

DISCLAIMER

This information has been carefully compiled from experience gained in field conditions and detailed laboratory testing. However, the product's performance and its suitability for the customer's 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 print run. Since we cannot anticipate or control the conditions under which our products are used, it is not possible to guarantee their performance. All sales are subject to our standard terms and conditions of sale.