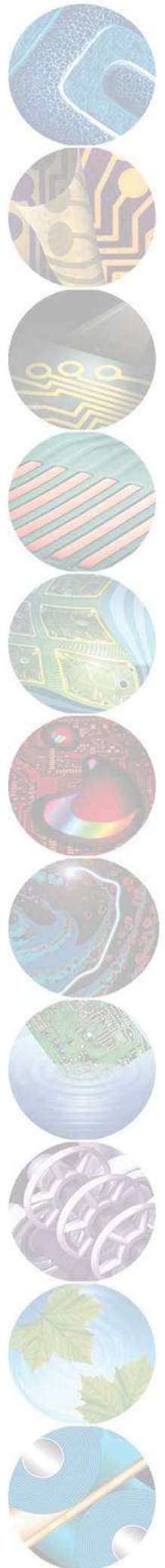




Coates Circuit Products

# Technical Information

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## IMAGECURE® XV501T

### MATT CURTAIN COAT

#### PRODUCT REFERENCE

Imagecure®	XV501T	Dark Green Curtain Coat Resist	CAWN1278
Imagecure®	XV501T	Dark Green Curtain Coat Resist	CAWN1356
Imagecure®	XV501T	Yellow Green Curtain Coat Resist	CAWN1362
Imagecure®	XV501T	Green HF Curtain Coat Resist	CAWN2245
Imagecure®	XV501T	Matt Clear Curtain Coat Hardener	CAWN1286
Imagecure®	XV501T	Matt Clear Curtain Coat Hardener	CAWN1321

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U.L. FILE NUMBER E83564

® is a registered trade mark

ISO9001

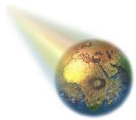
SM840C CLASS H PASS

ISO14001

BELLCORE PASS

IEC 60664

imaging@ion



## 1) DESCRIPTION

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

A range of products is available to suit a wide variety of process conditions.

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

Imagecure® XV501T products have excellent adhesion to all clean copper surfaces, and are suitable for use with reflow tin/lead and electrolytic gold plated conductors.

## 2) MIXING

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

<b>Resist</b>	<b>Hardener</b>	<b>Mixing ratio (w/w)</b>
CAWN1278	CAWN1286	5 : 3.50
CAWN1278	CAWN1321	5 : 3.75
CAWN2245	CAWN1286	5 : 3.50
CAWN2245	CAWN1321	5 : 3.75
CAWN1356	CAWN1286	5 : 3.50
CAWN1362	CAWN1286	5 : 3.50

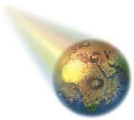
Once the resist and hardener components have been mixed together then the required Imagecure® Curtain Coat solvent can be added to thin the mix to the correct application viscosity (see Thinning section below).

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 23°± 2°C (70 - 77°F) will be approximately 14 days. Always ensure the lid is replaced on the container to avoid any contamination and excessive solvent evaporation.



### 3) THINNING

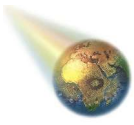
The mixed ink should be reduced in the ratio shown below: -

<b>Mixed Ink (Resist / Hardener)</b>	<b>Imagecure® Thinner</b>	<b>Mixing Ratio</b>
CAWN1278 / CAWN1286	XZ95	5.6 : 1.00 w/w.
CAWN1278 / CAWN1321	XZ95	7.6 : 1.15 w/w.
CAWN2245 / CAWN1286	XZ95	5.6 : 1.00 w/w.
CAWN2245 / CAWN1321	XZ95	7.6 : 1.15 w/w.
CAWN1356 / CAWN1286	XZ95	5.6 : 1.00 w/w.
CAWN1362 / CAWN1286	XZ106	4.0 : 1.00 w/w.

Viscosity on application should be typically 90 +/- 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.



#### 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 may 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 a "deep etching" micro-etch chemistry 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.

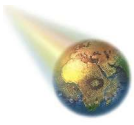
Surface roughness figures of :-

<b>Ra</b>	0.2 - 0.4µm.
<b>R delta q</b>	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 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) CURTAIN COATING

The Imagecure® XV501T Curtain Coat series 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, the 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 - 1.3 mm. (16 - 52 mil), and once set does not normally need to be changed.

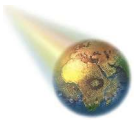
In-line filters of 50 - 75µm are recommended.

The recommended ink temperature is 20 - 25°C (68 - 77°F).

Wet weight values of 80 - 120 gsm 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.

Coated panels should be held for 5 - 10 minutes prior to pre-dry.

Discussion with your Imagecure® partner is recommended in order to obtain optimum results.



## 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 debubble 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.

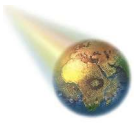
Air flow speeds of 1 - 2m./s. are recommended to achieve sufficient removal of the volatile solvent. Drying is less efficient as the air velocity drops below 0.5m/s.

<b>BATCH OVEN</b> <b>Typical settings</b>	Side 1:	10 mins. at 90°C (194°F) or 15 mins. at 85°C (185°F).
	Side 2:	20 - 30 mins. at 90°C(194°F), or 35 - 40 mins. at 85°C (185°F)
	Boards must be dried horizontally.	

<b>LD2 LOUVRE DRIER</b> <b>Typical settings</b>	Index time	20 - 30s.
	Zone 2 temperature	90 - 105°C
	Zone 3 temperature	100 - 110°C
	Board temperature maximum of 99 C (210 F) on temperature strips.	

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.



### 7) EXPOSURE

All Imagecure® XV501T 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 <30°C.

Optimum working temperature 22 - 25°C.

Exposure readings of 250 - 500 mJ/cm<sup>2</sup> 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

### 8) DEVELOPMENT

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

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 - 40°C (optimum 35-38°C).

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

Dwell times in the developing chambers of 45 - 80s. (optimum 60s). 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.

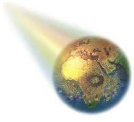
Water rinse pressures to be 2 -3 bar, with operating temperatures 15 -30°C.

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® XV501T will also develop in BDG (butyl diglycol). The developer temperature should be 30 ±2°C, with a dwell time between 120 - 160s. Spray pressures of 4 - 5 bar are normal. Optimum conditions will include a dwell of 150s @ 30°C with spray pressures of 4 - 5 bar.

It should be noted that Imagecure® XV501T films needing to be removed can be stripped by dipping in either a propriety solder mask stripper or 5% sodium hydroxide solution at 50 - 70°C.



### 9) UV BUMP

Generally Imagecure® XV501T 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 1500 - 1800 mJ/cm<sup>2</sup>.

A UV bump can also be carried out after post bake, recommended energy of 2500 - 3000mJ/cm<sup>2</sup>.

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

### 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.

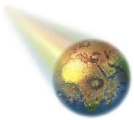
The recommended bake cycle is 140 - 150°C for 45 - 60 min. (Optimum 150°C for 60 min.).

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.



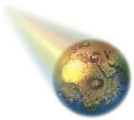
## **11) ELECTROLESS NICKEL GOLD or IMMERSION TIN PROCESSING**

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® XV501T users avoid some of the problems associated with solder resists and these alternative solderable finishes :-

<b>Pre-clean</b>	Either silicon carbide brushing, pumice scrubbing or the use of a deep etch copper microetchants. The copper must be clean, tarnish free and with a good micro topography.
<b>Application</b>	Ensure that the tracks have sufficient solder mask. A minimum of 8 - 10µm is recommended.
<b>Pre-dry</b>	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 - 90°C. It is recommended that oven thermal profiling be carried out to achieve optimum results.
<b>Exposure</b>	To achieve straight side walls with minimal undercut on development a Stouffer reading of 11 - 12 (solid resist) is recommended.
<b>Development</b>	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.
<b>UV Bump</b>	Can be used before post bake to eliminate film discoloration after metallisation. 1500 - 1800 mJ/cm <sup>2</sup> is recommended.
<b>Post Bake</b>	Avoid excessive temperatures during post bake as these can lead to oxidation of the copper surfaces. Recommended process temperature 140 - 150°C with a maximum dwell of 60 minutes.
<b>Micro-etch</b>	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.
<b>Tape test</b>	Panels should be tape tested a minimum of one hour after metallization.

## **12) LEGEND / NOTATION PRINTING**

Imagecure® XV501T is 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.



### 13) STORAGE AND SHIPPING

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

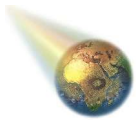
Imagecure® XV501T can withstand higher temperatures (40 - 60°C / 104 - 140°F), whilst in transit for up to periods of 1 month without any detrimental effect on its performance.

### 14) HEALTH AND SAFETY

Detailed material safety data sheets will be supplied by your local Coates representative.

### 15) PACKAGING

Imagecure®	XV501T	Dark Green Curtain Coat Resist	5.00 kg.	CAWN1278
Imagecure®	XV501T	Dark Green Curtain Coat Resist	5.00 kg.	CAWN1356
Imagecure®	XV501T	Yellow Green Curtain Coat Resist	5.00 kg.	CAWN1362
Imagecure®	XV501T	Green Halogen Free Curtain Coat Resist	5.00 kg.	CAWN2245
Imagecure®	XV501T	Matt Clear Curtain Coat Hardener	3.50 kg.	CAWN1286
Imagecure®	XV501T	Matt Clear Curtain Coat Hardener	3.75 kg.	CAWN1321
Imagecure®	XZ95	Curtain Coat Thinner	25.00 L.	CDSN4018
Imagecure®	XZ106	Curtain Coat Thinner	25.00 L.	CDSN4052



**16) FILM PERFORMANCE / TECHNICAL SPECIFICATION**

**PHYSICAL PROPERTIES OF IMAGECURE® XV501T CURTAIN COAT**

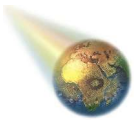
<b>Pack Code</b>	<b>Viscosity (PaS)*</b>	<b>S.G.</b>	<b>Flash point</b>	<b>Non volatile content</b>
CAWN1278	Record Only	1.17	49°C (120°F)	73.8%
CAWN1356	20 - 24 PaS.	1.17	49°C (120°F)	74.4%
CAWN1362	16 - 24 PaS.	1.17	49°C (120°F)	74.4%
CAWN2245	20 - 24 PaS.	1.30	49°C (120°F)	78.7%
CAWN1286	35 - 45 PaS.	1.17	49°C (120°F)	71.2%
CAWN1321	Record Only	1.31	49°C (120°F)	64.1%

\*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)** 370 - 400g./L. (mixed & unthinned)

**PHYSICAL & CHEMICAL PROPERTIES OF IMAGECURE® XV501T CURED FILM**

<b>Solder Resistance</b>	MILP55110 IPC SM840C	30 secs @ 288°C (550°F) 10 secs @ 260°C (500°F)
<b>Resistance to Solder Levelling</b>		> 5 passes
<b>Resistance to Fluxes</b>	IPC SM840C	Pass
<b>Ni/Au Plating</b>		Pass
<b>Hydrolytic Stability</b>	IPC SM840C Class H	Pass
<b>Solvent, Cleaning Agent, &amp; Flux Resistance</b>	IPC SM840C Class H	Pass
<b>Fungal Resistance</b>	IPC SM840C Class H	Pass
<b>Thermal Shock</b>	IPC SM840C Class H MIL 551100 MIL STD202E BS6096 Tests	Pass Pass Pass Pass
<b>Chemical Resistance</b>	IPA 1,1,1 Trichloroethane MEK Methylene Chloride Alkaline Detergent Fluxes	>1 hour >1 hour >1 hour >1 hour >1 hour >1 hour
<b>Abrasion Pencil Hardness</b>	IPC SM840C Class H	Pass (7H)
<b>Adhesion (Copper)</b>	IPC SM840C Class H	Pass
<b>IEC60664</b>		Pass



**16) FILM PERFORMANCE / TECHNICAL SPECIFICATION (cont.)**

**PHYSICAL PROPERTIES OF IMAGECURE® XV501T CURTAIN COAT (CONT.)**

<b>Flammability</b>	UL 94V0 Rating	File No. E83564
<b>Ionic Contamination</b>	MILP55110D	<0.3µg. NaCl/cm <sup>2</sup> Using Alpha Ionograph 500M
<b>ES-E5ZF-14A608-AA</b>		Pass

**ELECTRICAL PROPERTIES OF IMAGECURE® XV501T CURED FILM**

<b>Bellcore</b>	TR-NWT000078	Pass
<b>Insulation Resistance</b>	IPC SM840C Classes T & H	Pass
<b>Moisture &amp; Insulation Resistance</b>	IPC SM840C Classes T & H	Pass
<b>Electromigration</b>	IPC SM840C Classes T & H	Pass
<b>Comparitive Tracking Index</b>	IEC 112	>325
<b>Siemens E-Corrosion Test</b>	SN 57030	Pass
<b>Dielectric Strength (50 Hz.)</b>	IPC SM840C Classes T & H DIN53481	100kV/mm.

**17) DISCLAIMER**

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.

**18) SUPPORT**

Coates are an international company, and as such can offer technical, engineering and sales support to our customers worldwide. If you require more information regarding this product, or any of our extensive range of materials for PCB fabrication, please contact our local sales offices.