



FARNELL ELECTRONIC COMPONENTS LIMITED,  
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## PHOTO-RESIST COPPER CLAD BOARD

699 421.

CAT REF: 699-421.  
QUANTITY: 1 sheet  
SIZE: 440 X 305mm

SINGLE SIDED

THE PROTECTIVE BLACK PEELABLE  
CREPE TAPE ENABLES THE MATERIAL  
TO BE HANDLED IN NORMAL LIGHT  
CONDITIONS.  
REMOVE BEFORE EXPOSURE

See overleaf for detailed  
processing instructions. For  
best results use within 3  
months of purchase.

### SPECIFICATIONS

Base material	:	FR4 epoxy all woven glass laminate to BS4584 Part 3
Thickness	:	1/16" (1.6mm)
Copper Foil cladding per square ft	:	1oz (35 microns)
Water absorption	:	0.10%
Specific gravity	:	1.85 - 1.9
Dielectric constant $\epsilon$ at 1 MHz	:	5.0
Dissipation factor $\tan\delta$ at 1 MHz	:	0.020
Flex strength length wise	:	550N/mm <sup>2</sup>
Surface resistance	:	10 <sup>11</sup> $\Omega$
Volume resistivity	:	10 <sup>14</sup> $\Omega$
Foil pull off strength	:	140N
Photoresist	:	Positive working
Sensitivity	:	Ultra violet
Coating thickness	:	7 microns + 0.7 micron
Exposure time	:	2-8 mins (clear carrier film)
Developed image	:	Blue/green tint
Photoresist developer	:	FEC Order Code 141-310
Etchant	:	FEC Order Code 149-080 or 141-311

Shelf life is approximately 6 months stored at 15 - 20 °C.  
Do not store near excessive heat i.e. radiators, window sill etc.

699-421

## PRODUCT SAFETY DATA

### PRODUCT DESCRIPTION

Laminated material consisting of woven glass fabric bonded with heat cured, flame retardent epoxy resin. Base material is clad on either one or both sides with copper which is itself clad with positive photoresist.

### HAZARDS

1. During handling there is a slight risk of loose glass fibre dust from the edge of the boards causing reactions to those persons sensitive to skin allergies. In these instances it is advised that rubber or plastic gloves be worn. Do not use woven fabric gloves or barrier creams.
2. The base material and epoxy coatings are inert at normal room temperatures. At elevated temperatures (above 100°C) adequate ventilation and extraction must be provided.
3. Do not allow foodstuff into the working area and ensure hands are washed with soap and warm water before handling foodstuffs.

### FLAMMABILITY

The material will burn in the presence of an external flame source giving copious black asphyxiating fumes.

The material is self extinguishing if the external flame source is removed.

In the event of fire, then evacuate personnel.

### DISPOSAL

To normal solid city waste. Local regulations must be observed.

## RECOMMENDED PROCESSING INSTRUCTIONS

Positive laminate is produced under strict quality controlled conditions to ensure uniformity in process parameters from batch to batch and high accuracy definition.

In order to maintain consistent quality during process the following instructions should be carefully followed:-

### 1. ARTWORK

- a) Cleanliness and neatness are essential - ensure satisfactory track thickness and spacing - high quality draughting aids should always be used - NEVER INK.
- b) Where 1:1 artwork is to be used ensure that clear or polyester draughting film is used - tracing paper is not suitable. All tapes must be on the side which is not in contact with the laminate during exposure. (printed pads only may appear on the contact side).

NOTE: The track widths will reduce when exposing from the non contact side.

### 2. EXPOSURE

- a) Remove the black protective tape from the laminate, after cutting to the required blank size.
- b) Using a high resolution exposing lamp system (FEC Order Code 149-855) place the artwork in good contact with the laminate and expose for 2-8 minutes. If draughting films are used the exposure times may be considerably longer than for clear films.

c) For accurate exposure calculation see No. 6 "STEP TEST".

NOTE: The UV content of light emitted by the lamps reduces with age.  
Lamps and tubes should be renewed on a regular basis.

CAUTION - EXPOSURE TO U.V. LIGHT CAN CAUSE PERMANENT EYE DAMAGE - ENSURE LID IS CLOSED BEFORE SWITCHING ON.

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### 3. DEVELOPMENT

- a) Developer solution should always be kept covered as exposure to air degrades the chemical make-up, and leads to erratic process control.
- b) Immerse exposed laminate in developer and gently cause the solution to 'wash' the surface either by agitating the work or the developer container. Continue for 2 minutes. Wash in clean water.
- c) Developer solution (FEC Order Code 141-310) is chemically balanced to give consistent removal of resist and should be used whenever possible. Throughput approximately eight square feet per litre of working solution.

CAUTION - DEVELOPER SOLUTIONS ARE CAUSTIC BASED - PROTECTION TO HANDS AND EYES IS ESSENTIAL - WASH SPILLS AND SPLASHES WITH LIBERAL AMOUNTS OF WATER THEN SEEK MEDICAL ADVICE.

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### 4. POST DEVELOPMENT CHECK

Prior to etching it is essential (and is considered both economic and professional) to inspect for, and correct, any faults in the conductor patterns. By placing the developed boards into etching solution for a few seconds, rinsing well in water and drying, the non resist areas will show dark pink and offers a suitable contrast to determine whether full development has taken place or if further immersion in developer is required. The contrast also highlights major faults in conductors, which can be corrected using a PCB marker pen (FEC Order Code DAL033 Red or Blue).

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### 5. ETCHING

Following inspection to satisfaction the board may be etched in a suitable etchant such as ferric chloride solution (FEC Order Code 141-311 in pellet form sufficient to make 1 litre).

After etching the positive resist may be left on the copper to act as protection. Solder flow is readily achieved through the resist.

CAUTION - ETCHANT SOLUTIONS ARE ACID BASED - PROTECTION TO HANDS AND EYES IS ESSENTIAL - WASH SPILLS AND SPLASHES WITH LIBERAL AMOUNTS OF WATER THEN SEEK MEDICAL ADVICE

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### 6. STEP TEST

As the UV content of exposure lamps varies considerably this test should be carried out periodically and whenever problems are experienced to re-determine exposure time.

- a) Set a standard developing condition i.e. - 2 minutes immersion at 25 degrees C using fresh made up developer.
- b) Expose a piece of laminate using a thin sheet of cardboard to uncover 1/8 of the surface. Expose for 2 minutes, continue 7 further step exposures for 1/2 minute to give a range of 2 to 10 minutes.
- c) Develop for 2 minutes at 25 degrees C wash and dry.
- d) Inspect to see which exposure time the resist has just been removed (immersion in etchant assists here) and calculate the exposure time for the first fully clear area.

Possible problems and how to solve them.

FAULT	POSSIBLE CAUSES	REMEDY
1. Bad edge definition/ Tracks etching away	<ol style="list-style-type: none"> <li>1. Bad contact in exposure unit</li> <li>2. Over exposure</li> <li>3. Over development</li> <li>4. Over etching</li> <li>5. Draughting film too thick - causes light to diffuse during exposure</li> <li>6. Fault on artwork</li> </ol>	<ol style="list-style-type: none"> <li>1. Check exposure unit and rectify</li> <li>2. Reduce exposure time</li> <li>3. Reduce development time</li> <li>4. Reduce etching time</li> <li>5. Make copy of artwork onto Reprofine Film and use this to process board</li> <li>6. Check and repair</li> </ol>
2. Unreasonably long development time/ board will not develop at all	<ol style="list-style-type: none"> <li>1. Under exposure</li> <li>2. Developer exhausted or contaminated</li> <li>3. Developer too cold</li> <li>4. Shelf life of board expired</li> </ol>	<ol style="list-style-type: none"> <li>1. Increase exposure</li> <li>2. Use new developer</li> <li>3. Check temperature of developer and increase if necessary</li> <li>4. Use new board</li> </ol>
3. Unreasonably long exposure time	<ol style="list-style-type: none"> <li>1. UV lamps need replacing</li> <li>2. UV source unsuitable</li> <li>3. Draughting film unsuitable - not allowing light to pass through</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace lamps</li> <li>2. Replace with suitable source</li> <li>3. Use suitable film</li> </ol>
4. Patches of copper left behind after etching	<ol style="list-style-type: none"> <li>1. Photoresist left on board due to under development and/or under exposure</li> <li>2. Grease on artwork or photomaster</li> </ol>	<ol style="list-style-type: none"> <li>1. Increase development and/or exposure time. Check board carefully before etching</li> <li>2. Clean artwork</li> </ol>
5. Unreasonably long etching time	<ol style="list-style-type: none"> <li>1. Etching solution exhausted or contaminated</li> <li>2. Photoresist not fully developed</li> </ol>	<ol style="list-style-type: none"> <li>1. Use new etching solution</li> <li>2. Increase development and/or exposure time</li> </ol>
6. Copper specks between tracks after etching	<ol style="list-style-type: none"> <li>1. Dirt on exposure unit glass or photomaster</li> </ol>	<ol style="list-style-type: none"> <li>1. Clean glass or scrape spots from photomaster</li> </ol>
7. Resist in non exposed areas breaks down before exposed areas are clear	<ol style="list-style-type: none"> <li>1. Under exposed/over developed</li> <li>2. Developer too hot or concentrated coupled with under exposure</li> </ol>	<ol style="list-style-type: none"> <li>1. Check UV lamps/increase time for exposure</li> <li>2. Ensure developer is mixed correctly. When a non exposed board is immersed for 2 minutes the resist should show no sign of degradation i.e. It should remain glossy in appearance.</li> </ol>

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