

Epoxy Preforms

Drawing guidelines for assembly
success

The epoxy preform has become an integral part of a microelectronics package or module assembly. Understanding the subsequent assembly process, and storage, handling, and quality requirements of this fragile part is crucial for manufacturing efficiency and scrap reduction. Including pertinent information on the epoxy preform drawing provides guidelines to the vendor to ensure the finished preform is presented in the manner that meets your organization's requirements.

This presentation reviews the parameters to be reviewed once the epoxy film selection and layout have been completed.

Epoxy preform evolution

- Epoxy film sheet stock considered an “As Required” material on a bill of material. The preform was not a specific part number.
- Preforms were cut by hand, outsourced for laser or die cutting, ordered as a preform from the epoxy film manufacturer.
- Drawings had information on the epoxy type, thickness, tolerances and DXF CAD data file.
- Many drawings contained notes found circuit board and/or machining drawing templates.

What
can be added to
ensure quality,
improve
manufacturing
efficiency, and
reduce scrap?

- Design tolerance guidelines.
- Details on dimensions and realistic tolerances.
- Pull back on critical areas.
- Cut quality requirements.
- C of C requirements for the material.
- AS9102 and/or first article requirements
- Packaging preferences
- Release sheet preferences.
- Marking and labeling
- Suggested sources of supply

Overall tolerance guidelines

- **Geometry spacing within a pre-form**
- Spacing between features within a pre-form should be no less than .020" to minimize breakage.
- **Hole Size**
- The smallest hole diameter we have done with epoxy is .010" +/- .002". There is no limit on how large.
- **Radius**
- Minimum Radius of .008" +/- .003"
- **Tolerances**
- +/- .003" up to 4.0"
- +/- .005" between 4.0" and 8.0"
- +/- .010" for 8.0" or larger
- Another acceptable and common practice is to have dimensions with two decimal points have +/- .010" tolerance, and dimensions with three decimal points have a +/- .005" tolerance

Dimensions and Tolerances

Examples:

3. DIMENSIONS AND TOLERANCES:

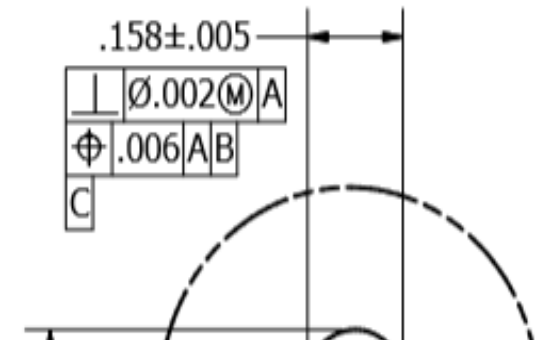
- 3.1 TOLERANCE ON ALL UNDIMENSIONED FEATURES SHALL BE $\pm .005$.
- 3.2 TOLERANCES ON DIMENSIONED FEATURES SHALL DEFAULT TO TOLERANCE BLOCK UNLESS OTHERWISE SPECIFIED.
- 3.3 DEFINITION OF ALL UNDIMENSIONED FEATURES SHALL BE PER ELECTRONIC DATA FILE 134-000036-XXXXREVA, WHERE XXXX STANDS FOR APPROPRIATE DASH NO.
- 3.4 DIMENSIONED FEATURES TAKE PRECEDENCE OVER ELECTRONIC FILE.
- 3.5 THE REVISION OF THE DRAWING AND ELECTRONIC FILE SHALL BE THE SAME.

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ARE :

<u>DECIMALS</u>	<u>HOLES</u>
.XX $\pm .01$.0135 THRU .125 $\begin{matrix} +.004 \\ -.001 \end{matrix}$
.XXX $\pm .005$.125 THRU .250 $\begin{matrix} +.005 \\ -.001 \end{matrix}$

Tables can be used for critical hole or cut out locations.

HOLE TABLE				HOLE TABLE			
HOLE	XDIM	YDIM	DESCRIPTION	HOLE	XDIM	YDIM	DESCRIPTION
A1	-1.720	.000	∅.201 THRU	D1	-1.658	1.300	∅.312 THRU ∅.010 A B C
A2	1.720	.000		D2	1.658	1.300	
A3	-1.720	4.250		D3	-1.658	12.700	
A4	1.720	4.250		D4	1.658	12.700	
A5	-1.720	9.500		E1	.000	3.750	∅.433 THRU ∅.010 A B C
A6	1.720	9.500		E2	.000	5.000	
A7	-1.720	14.000		E3	-1.485	7.000	
A8	1.720	14.000		E4	1.485	7.000	
B1	.000	.000	∅.158 THRU	E5	.000	9.000	
C1	-.905	.300	∅.240 THRU	E6	.000	10.250	
C2	-.445	.300		F1	.500	14.000	∅.065 THRU
C3	.905	.300					
C4	-.905	.800					
C5	-.445	.800					
C6	.445	.800					
C7	.905	.800					
C8	-.905	1.300					
C9	-.445	1.300					
C10	.445	1.300					
C11	.905	1.300					
C12	-.905	1.800					
C13	-.445	1.800					
C14	.445	1.800					
C15	.005	1.800					



bonding source

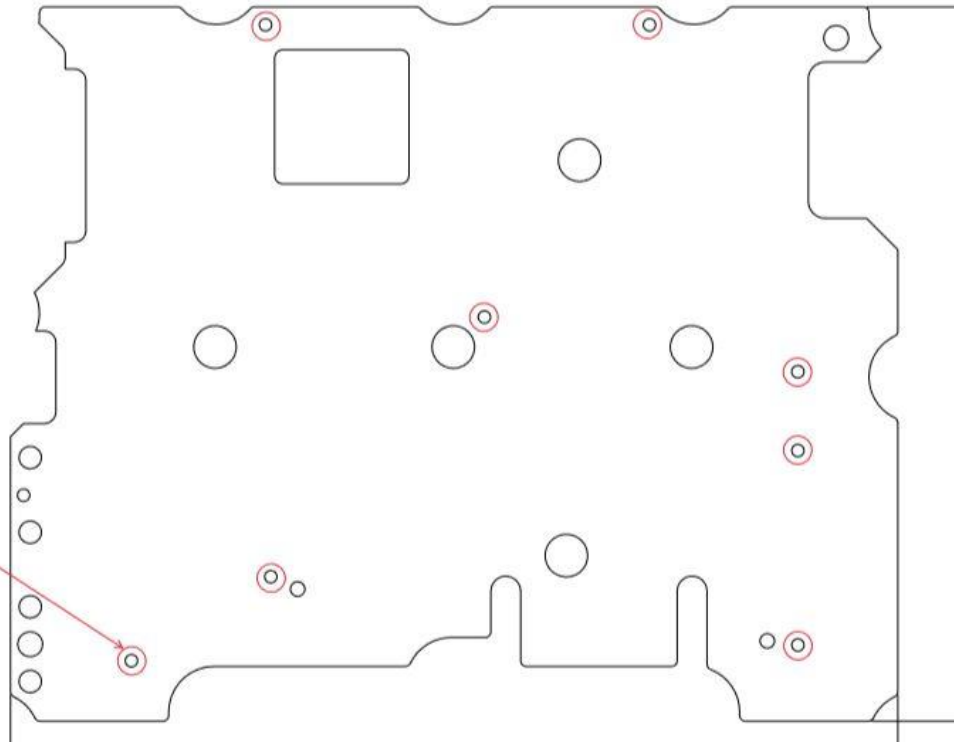
MODE, PART NUMBER,
IN THE MINIMUM

NATION AND
R SHIPPING.

NOTES: PACKAGE
CONTAINERS AT
RECOMMENDATIONS.

APPEAR ON THE
ORIGINAL MATERIAL

Added holes circled in red
for M2 screw clearance



Epoxy Pull Back

- In most instances, the epoxy preform drawing is done “one to one” with the dimensions of the circuit board. This approach allows for a post cure visual inspection of good flow coverage along the perimeter. However, there are times when the epoxy will flow into areas that can create a mechanical hindrance, electrical short, or antenna affect if excess epoxy gets into the wrong area. It is important to check with mechanical and electrical engineering before making any changes. Example to the left shows pull back areas so the epoxy does not flow into M2 threaded holes. Pull back is typically .005 - .010”

Certificate of Conformance/Analysis

- In the notes section of the drawing, require the preform supplier to provide a copy of the C of C/A for the film epoxy with the shipment.
- The copy of the C of C will provide back-up information if there are any issues with the batch of epoxy or problems on following assembly steps.
- The C of C is also a requirement for first article/AS9102 reporting.

Certificate of Analysis Example



Certificate of Analysis

DATE 02 April 2019
PAGE 1 from 2

Attention Of:

Customer No 1244111

Bonding Source
Rear loading dock
One Perimeter Rd STE 200
Manchester NH 03103-3340

Material: LOCTITE ABLESTIK 5025E-002
Known As: ABLEFILM 5025E-002(5011).10X12

Material Number: 1199912
Sub-Descriptor: 10" X 12" SH 5011
Batch No: 049CAC1832
Inspection Lot : 5828069
Manufacture Date: 11 March 2019
Expiration Date: 10 September 2019
Manufacturer: A US Rancho Dominguez
Storage Condition: 0C to +5C
Report Number: CE/2017/73417
Report Date: 20 July 2017

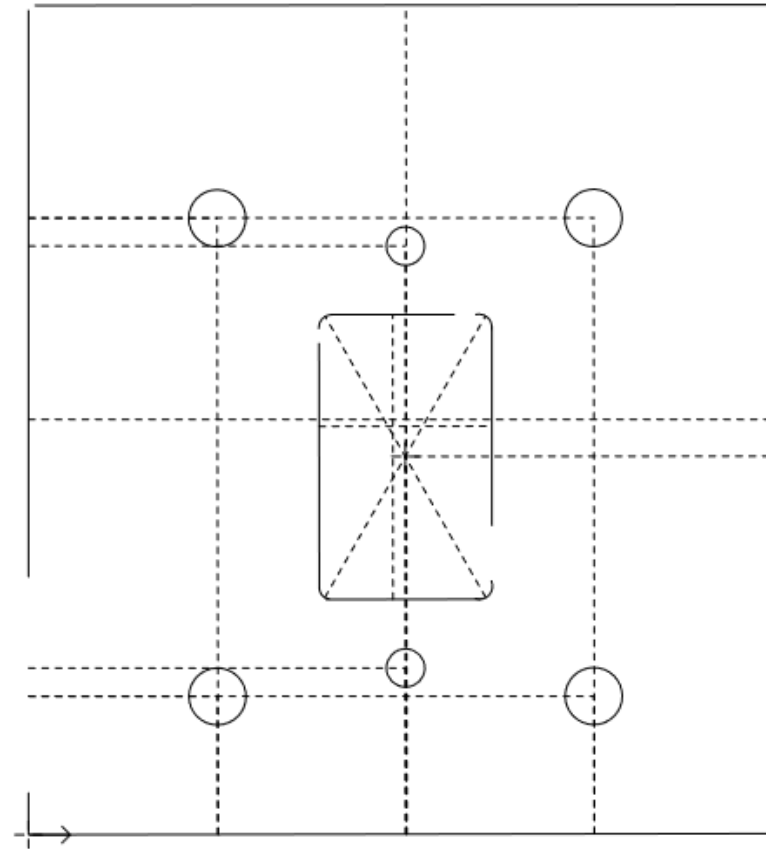
AS9102 or First Article Requirement

- If your quality group or customer requires an AS9102 report or first article report, include a note on the drawing. The preform supplier will provide the AS9102 report and bubble diagrams

Example of AS9102 report

AS9102 First Article Inspection			Page 1
Form 1: Part Number Accountability			
1. Part Number	2. Part Name	3. Serial Number	4. FAI Report Number
61279-0002_A	PREFORM, BASE D/C PWR S-BAND	#001	BS10-12-2016FAI -02
5. Part Revision Level	6. Drawing Number	7. Drawing revision level	8. Additional Changes
A	61279-0002_A	A	N/A
9. Manufacturing Process Reference	10. Organization Name	11. Supplier Code	12. P.O. Number
QW07-PCP-110, QW08-TST-210, QW-08-TST-310	Bonding Source	Cage code: 5WTE5 / Acct# 1404	P038730
13. Detail FAI <input checked="" type="checkbox"/>	14. Full FAI <input checked="" type="checkbox"/>	61279-0002_A Rev A	
	Partial FAI <input type="checkbox"/>	<i>Baseline Part Number including revision level</i>	
Assembly FAI <input type="checkbox"/>	<i>Reason for Partial FAI:</i>		
a) if above part number is a detail part only, go to Field 19			Weight (kg):
b) if above part number is an assembly, go to the "INDEX" section below			
INDEX of part numbers or sub-assembly number required to make the assembly noted above.			

Example of dimensional report



Feature	Actual	Nominal	Upper	Lower	Dev/Nom	Out/Tol
Circle D.150 Diameter	[System 4] 0.15167	0.15000	0.00500	-0.00500	0.00167	
Circle D.100 Diameter	[System 4] 0.10168	0.10000	0.00500	-0.00500	0.00168	
Circle D.150 Diameter	[System 4] 0.15192	0.15000	0.00500	-0.00500	0.00192	

Cut
quality
requirement

- A cut quality note will help ensure that the preform supplier and incoming inspection/clean room personnel will all know what is acceptable.

Common Note:

- Finished preform must be free of edge debris, tears and discoloration.

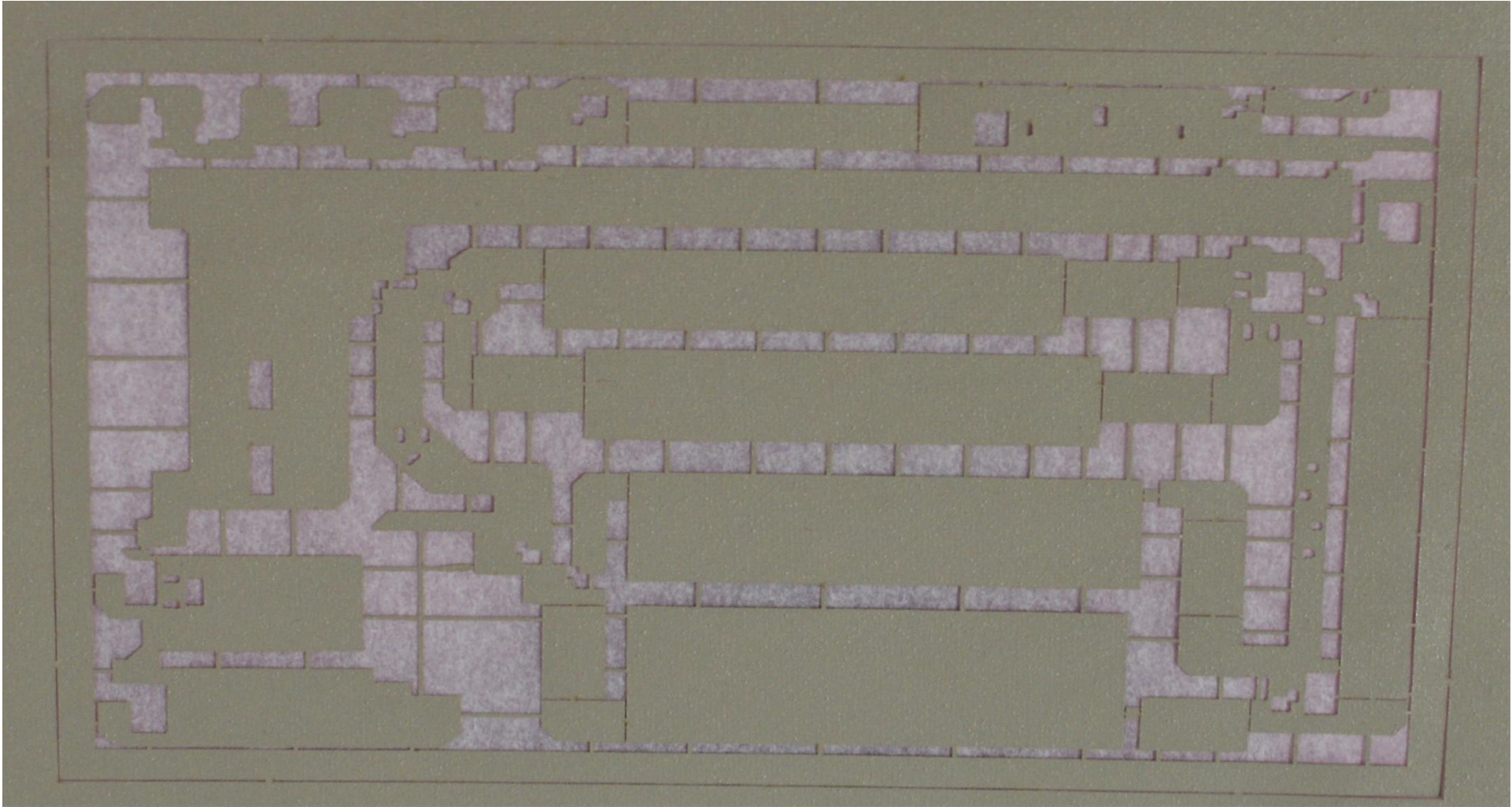
Packaging Requirement- Critical

- What is the working life of the epoxy film? How many preforms can manufacturing process in a shift/day/week?
 - Better to package preforms in a container that can be processed in one shift. Opening the package should be minimized to prevent damage to the preforms.
- What is the overall size of the part?
 - Larger preforms (greater than ~5") usually are packed between rigid boards. Smaller preforms can be packed in jewelers boxes. This can be left to the supplier to decide.
- Are there multiple preforms being used in one assembly?
 - These can be packaged together.

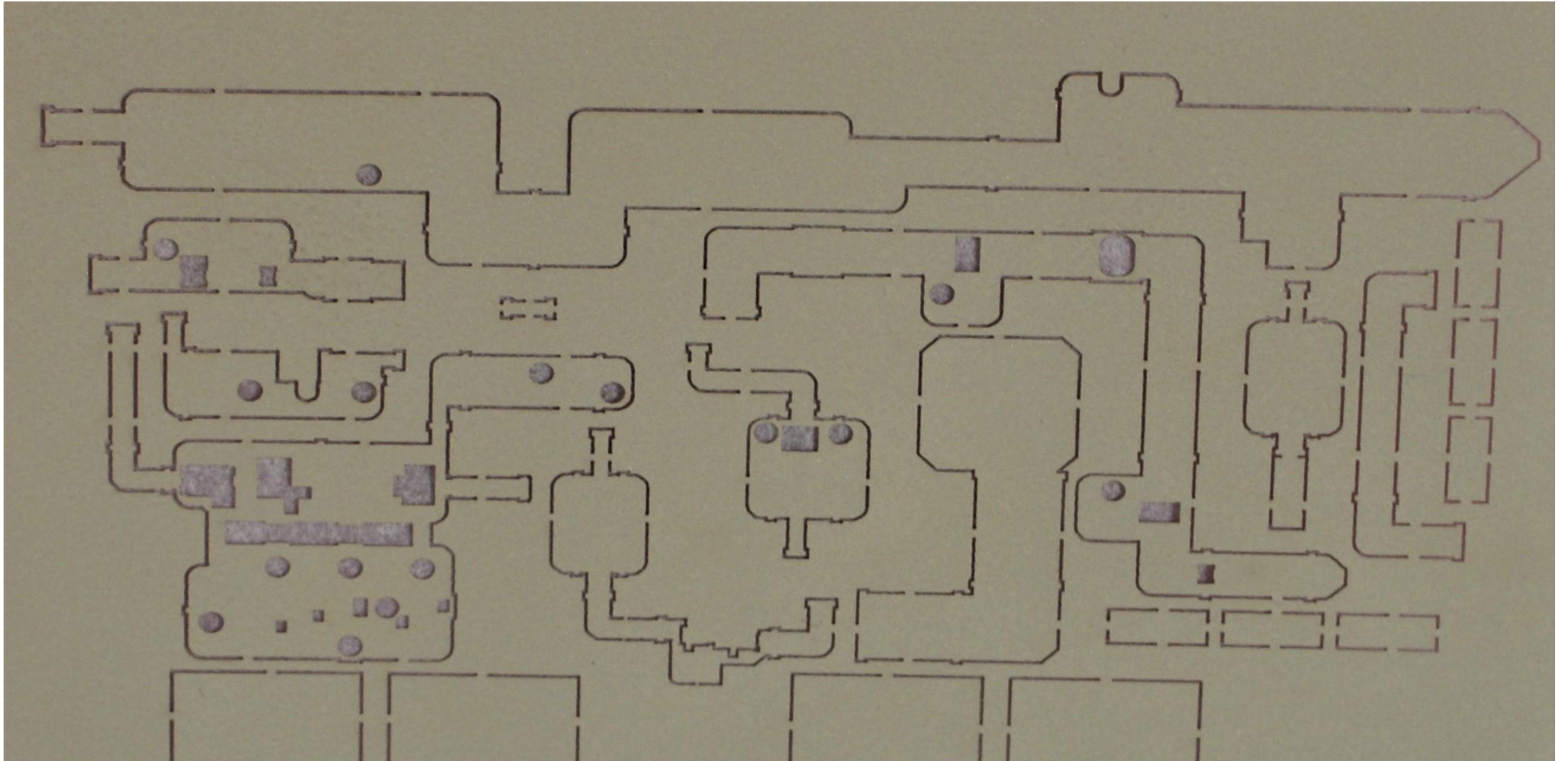
Packaging
Requirement
Note
Examples:

- *“10 Preforms to be packed in a jewelers box, one per layer, with a release sheet between each layer”.*
- *“Preforms to be tabbed together and packaged between rigid boards with release sheet between each layer”.*
- *“Quantity 25 preform arrays to be packed between rigid boards.”*
- *Kit packing: In one jewelers box:*
 - *P/N 38521 Qty 2 in bottom layer*
 - *P/N 38522 Qty 5 in middle layer*
 - *P/N 38523 Qty 1 on top layer*

Module Preform Layout

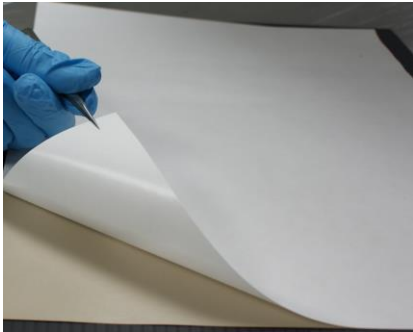


Module Preform Layout



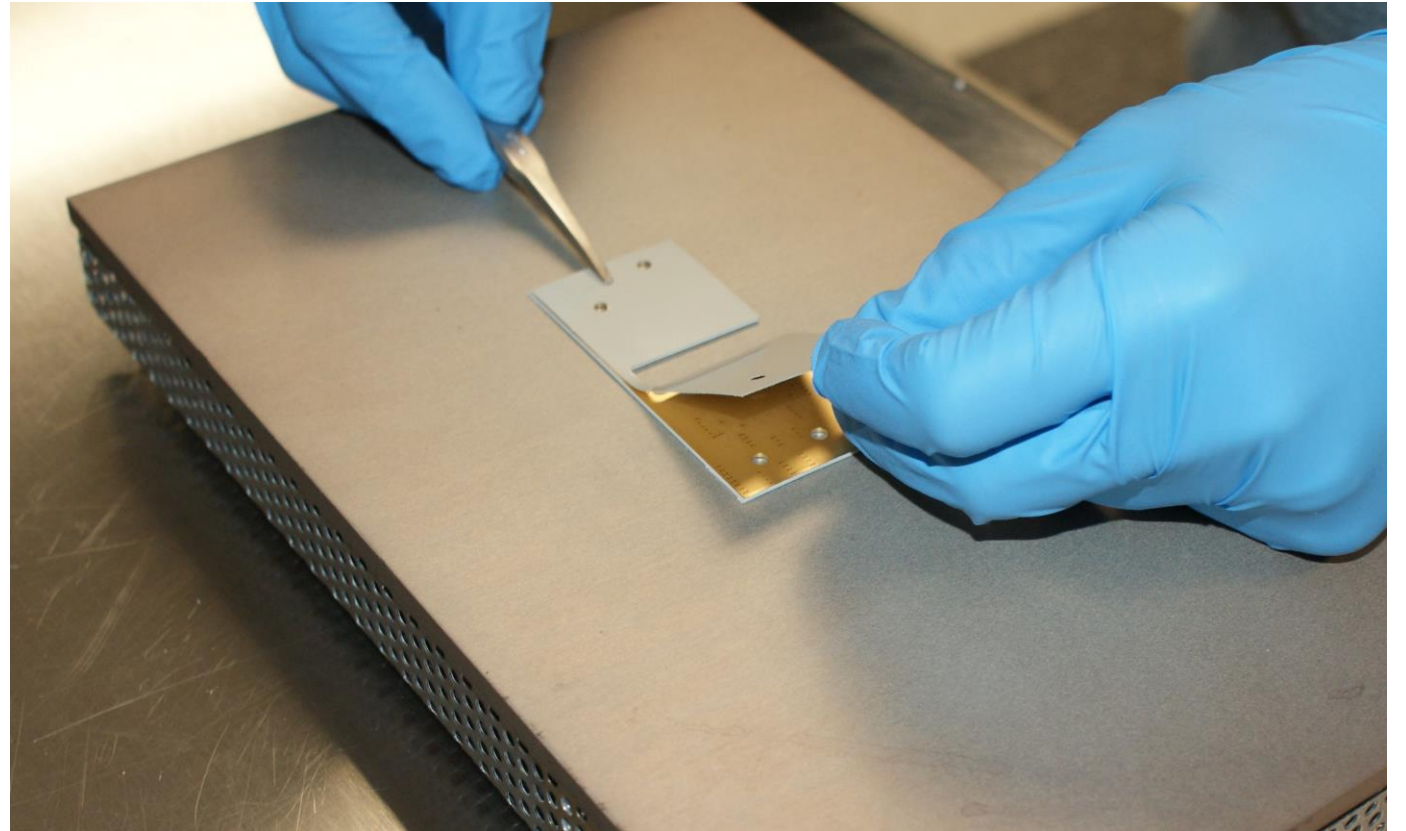
Release Sheet Preferences- **Critical**.

- There are many options for laser cutting two of the most common conductive films, 5025E and CF3350. 5025E comes with a white slip sheet (less sticky) and a white release sheet (more sticky). CF3350 comes with a clear slip sheet and a clear (with black line) release sheet.



- Presenting the cut preform in the correct format to the manufacturing floor helps with efficiency and improves yields. The first step in the board mount process is tacking the preform to the back of the circuit board or the carrier. Which process the assembly group does first determines release/slip sheet preferences.

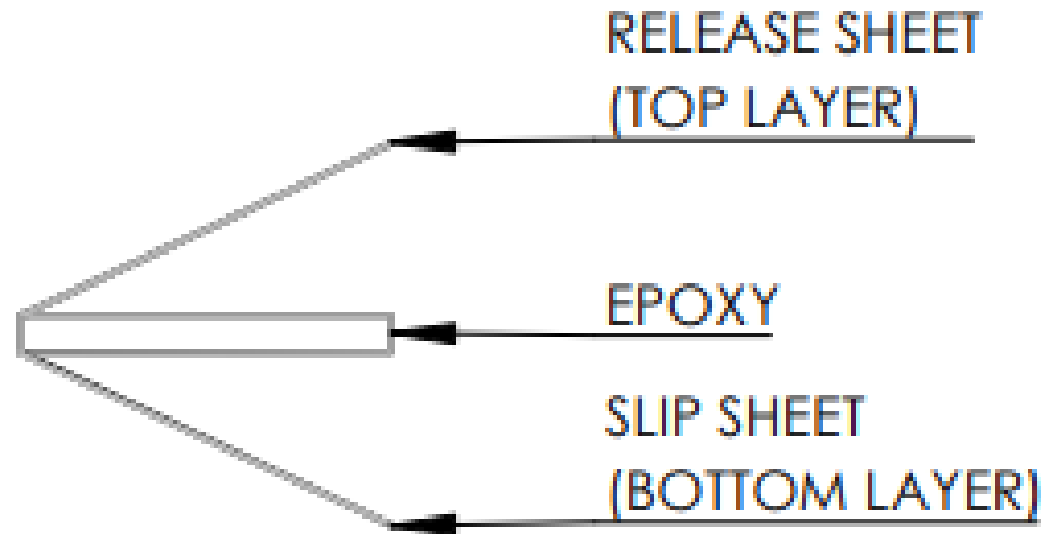
The picture show the first step in the assembly process. The top release sheet must be removed and the preform is tacked to the bottom of the circuit board on a hot plate.



Sample

Instructions for
release sheet
preference:

- Cut with no
top release
- Mirror image
- Use illustration
as an option:



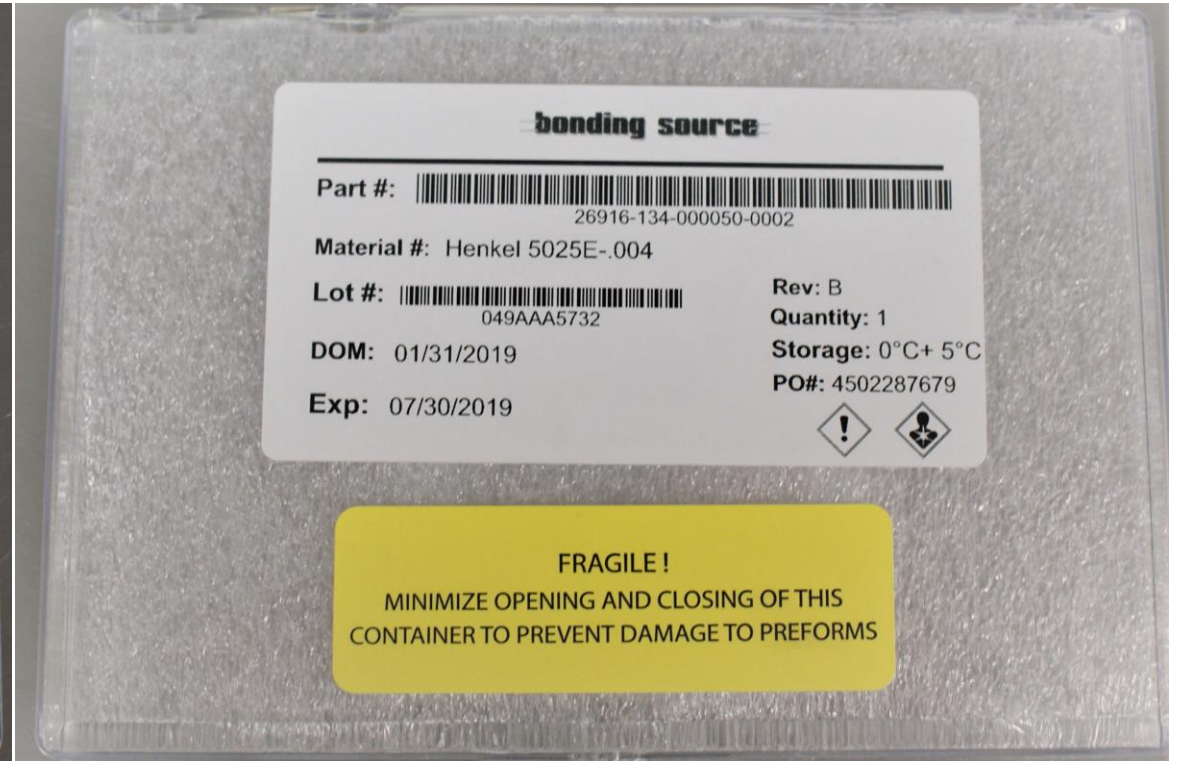
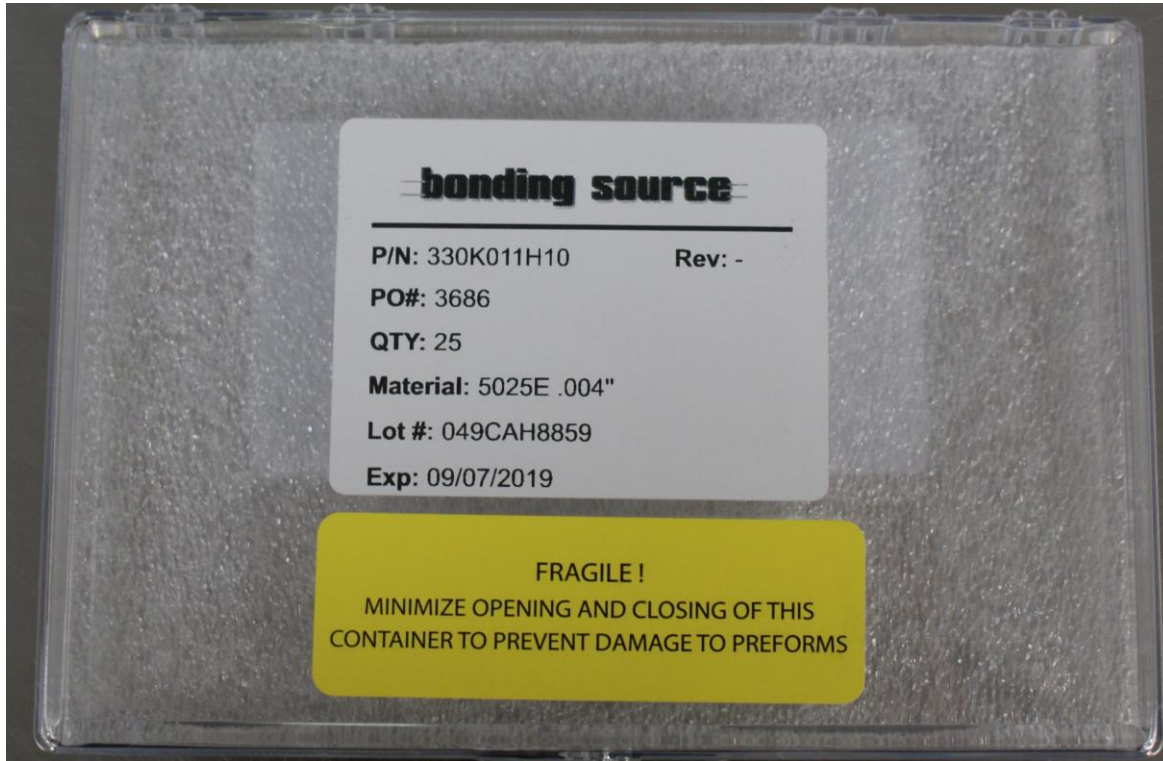
Preform Examples



Labeling of package

- Cut preforms are typically stored in a freezer or refrigeration and it is important to capture all required information on the outside of the container to minimize handling.
- P/N and revision
- Quantity in package
- Epoxy type and thickness
- Epoxy lot #
- Your Purchase Order #
- Manufacture Date
- Expiration Date
- Other options include bar coding, handling instructions, next assembly use (include P/N of module assembly)

Label Examples



Suggested/Approved Source of Supply: Helps the purchasing department identify a qualified supplier to manufacture the preform.

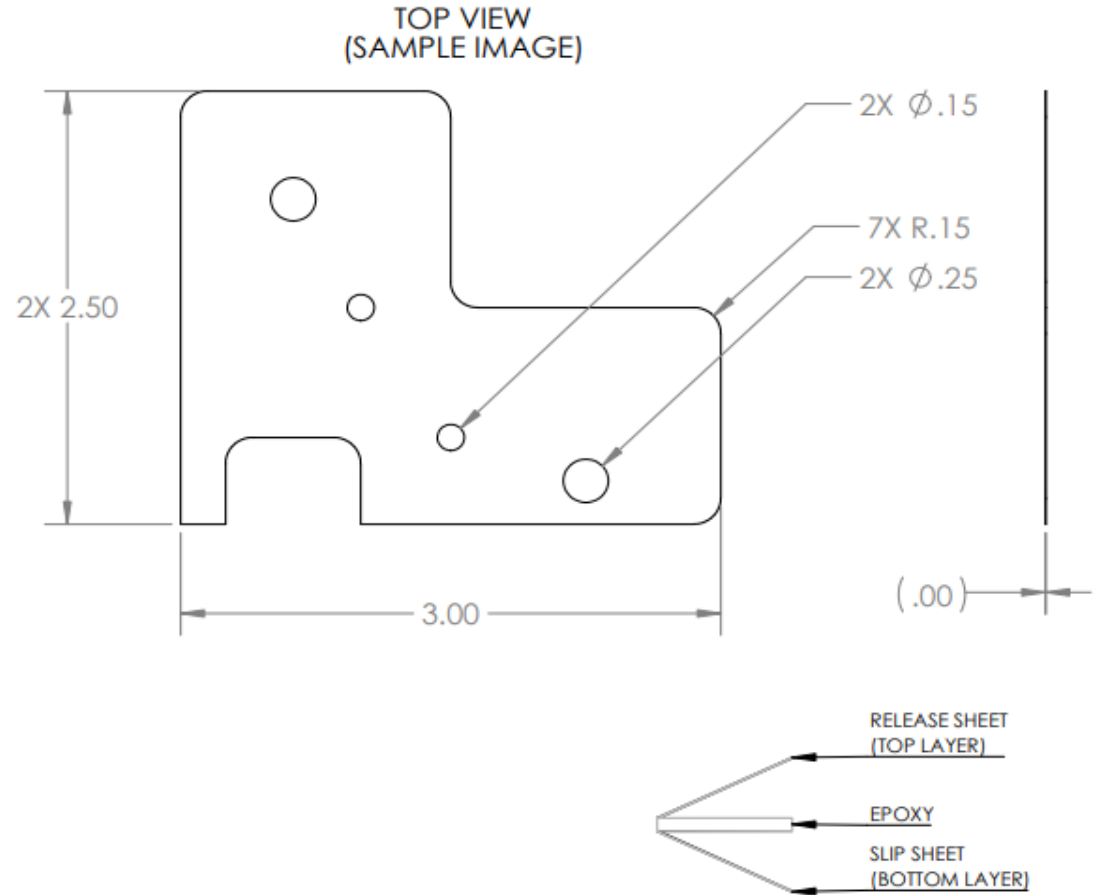
NOTES:

1. MATERIAL: ABLEFILM 5025E CONDUCTIVE SHEET, .002 THICK.
2. EPOXY PREFORM WILL BE LASER CUT TO SIZE USING CAD FILE.
3. EPOXY PREFORMS SHALL BE SHIPPED IN COLD PACKS WITH PART NUMBER MARKED ON THE CONTAINER AND INDIVIDULLY WRAPPED PREFORMS.
4. SUGGESTED SOURCE OF SUPPLY: BONDING SOURCE
4 TOWNSED WEST
NASHUA, NH, 06063

Sample Drawing Template

Notes:

1. Material: Ablefilm 5025E, .004" thick.
 2. Finished pre-form must be free of any burrs, edge debris and discoloration
 3. Each shipping lot must include C of C, and epoxy manufacture date and expiration date.
 4. Packaging: (Suggestions below. Appropriate packaging instructions protects the pre-forms in transit and storage and should also minimize the times that the pre-forms will be moved at your facility. If we package them in jewelers boxes, then it is best to package the amount that will be processed in one shift. Large pre-forms, or large panels of pre-forms tabbed together are best packaged between rigid boards.)
 - a. Package in jewelers boxes XXX per box.
 - b. Package between rigid boards
 5. Parts to be shipped on cold packs per the manufacturer's specification for shipping and storage requirements.
 6. Pre-form must have XXX months of shelf life remaining upon receipt. Any other remaining shelf-life must be approved in writing by purchasing prior to shipment. (The films from Henkel and Rogers only guarantee a 50% shelf life from the manufacture date. The manufacturers will not accept any orders requiring 75 or 80% shelf life. Please see the shelf life of the films we carry below)
 - a. 5025E- 6 months
 - b. CF3350- 9 months
 - c. ECF561E- 12 months
 - d. Coolspan TECA- 12 months
 - e. 5020K- 12 months
 - f. 550K- 12 months
 - g. 561K- 12 months
 7. Dimensions of the part to be within .005" of CAD data unless otherwise stated.
- Process with "Sticky Release" sheet top and "Slip" sheet bottom. (5025E and CF3350 material have release sheets with different adhesion levels. We can process these either way. Please consult with your assembly folks to see if they have a preference, if at all. This does not apply to other films Bonding Source stocks)



Suggested Source of Supply
 Bonding Source
 One Perimeter Road
 Manchester NH 03103
 603-565-9600

ITAR STATEMENT
 YOUR COMPANY'S ITAR STATEMENT
 HERE

PROPRIETARY AND CONFIDENTIAL
 YOUR COMPANY'S PROPRIETARY
 STATEMENT HERE

UNLESS OTHERWISE SPECIFIED:
 DIMENSIONS ARE IN INCHES
 TOLERANCES:
 FRACTIONAL ±
 ANGULAR: MACH ± BEND ±
 TWO PLACE DECIMAL ±.010
 THREE PLACE DECIMAL ±.005

MATERIAL:
 SEE NOTES

	NAME	DATE
DRAWN		
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		
COMMENTS:		

TITLE: SAMPLE		
SIZE A	DWG. NO.	REV