



2017 May Hot Topic Related to Supply Chain Concerns

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DFR Production Failure Modes



Dry Film Resists, aka DFRs or Laminate Resists, are a ~15-120 μ m layer of partially cured permanent film photoresists (between 2 opposing layers of PET films) which are mechanically laminated to a wafer surface and then lithographically processed similarly to traditional spin-on resists.

While DFRs have been used in the Display and MEMS industry for several years, they are newer materials to the semiconductor industry. The limited number of DFR suppliers and the low demand for Semi coupled with the challenges of a new material in a new application, provide an engineering and manufacturing environment ripe with opportunities for improvement.

Dry Film Resists are typically used in 2 SEMI Applications

- a. MEMS-like permanent epoxy structures which may be part of a chip design or part of a WLP design
- b. Very Thick Plating Resists for WLP Bumps or Pillars

Hot Topic Occurrence

The learning curve for DFRs is still young at both producers and consumers. The unique failure modes associated with the materials in supplier production, transport, storage, fab application, and final die package are still being discovered, understood, and eliminated.

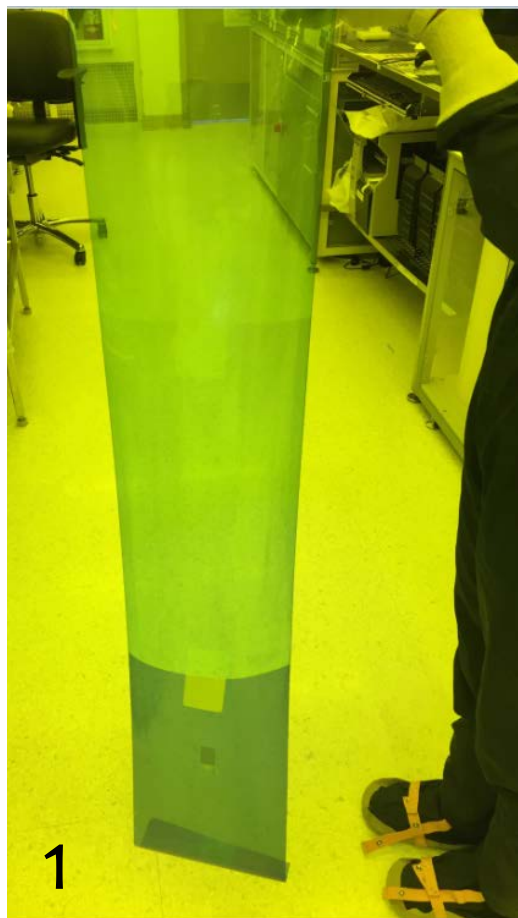
Various DFR types ensures some non-common Failure Modes, but there are some Failure Modes that and solutions available as fan-out learning.

Impact of Your Hot Topic



Unique DFR manufacturing requirements revealed and successfully addressed with more comprehensive specifications and controls.

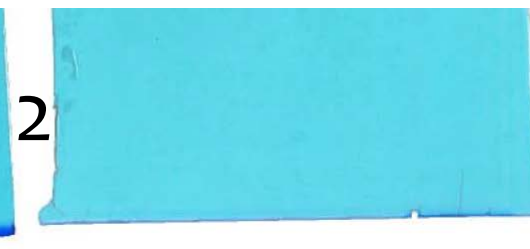
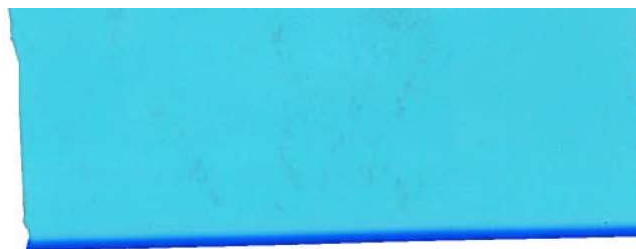
Qorvo material quality learnings that can be applied by any fab and or supplier, ie all customers should see the benefit



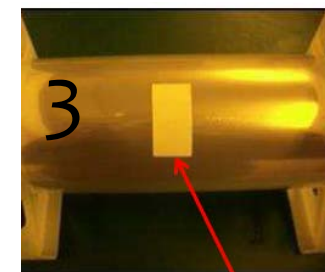
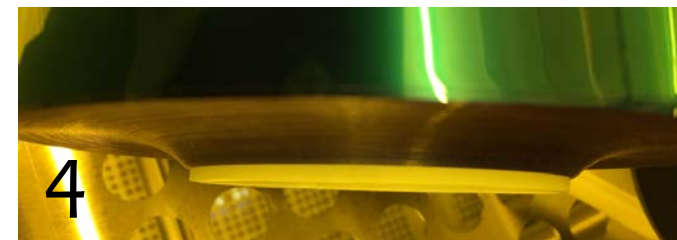
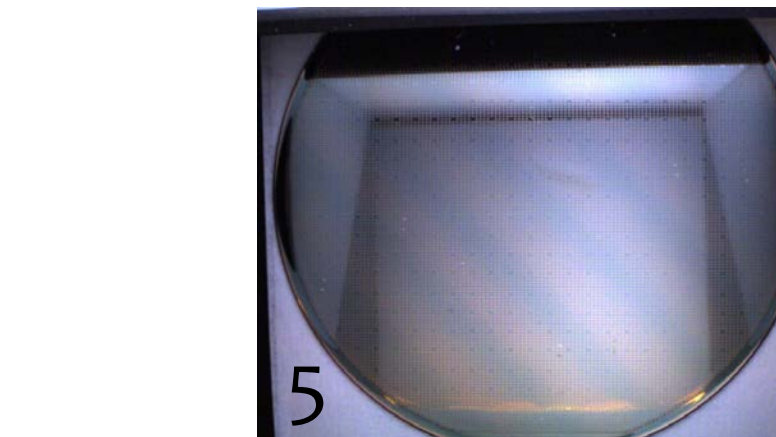
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DFR errors resulting in damage to the film

1. Outer layers of roll exposed to light, unusable
2. Edge Fusion (resist seepage from edges of roll result in “gluing the edges”) due to missed process step before package
3. Indentation caused by tape marking
4. Telescoping
5. Coating Striations due to loss of base film tension control



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■ Other types of Failure Modes

- Packing materials outgassing contaminates results in “spoiled” resist and shifted Photospeed
- Overpack boxes and cold pack uniformity to control temp in shipment
- Materials where the top and bottom PET films are not identical must be wound in specific configuration. If wound upside down, then Base film becomes Cover film and vice versa. Some imaging may be done thru the cover film.
- PET Film quality is important to ensure no debris on the film becomes embedded in the resist layer.
- PET films have release agents to help cleanly release the resist; monitor controls.
- PET films thickness, ease of cutting, and laminator blade maintenance is important to reducing laminator chamber contamination—cutting debris “floats” in the chamber and contaminates all surfaces.
- Resist Roll Core must be specified ID and length to ensure smooth operation in the laminator.
- Outer layers of a roll have damage and indentations that result in image failures. Important to feed proper length thru tool before running production.
- Surface roughness at end of roll due to jagged edges caused by film cutting condition.
- Unique batch # required for slit rolls that were slit different time from same master roll to allow different expiration dates.



Expectations for Your Hot Topic

As more companies begin using DFRs, please be aware of the new types of failure modes. There is very little information that is published on these materials so sharing between CMC users can help ensure we are all protected from common issues, regardless of individual material or supplier.

Resolution of Your Hot Topic

Vigilant attention to detail

Ensure all learnings from any material and supplier are fanned out to all suppliers and materials (while protecting IP)

No substitute for seeing how the films are made in order to understand failure modes

Drive detailed FMEAs at supplier



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