Electronic Polymers Newco Inc.

Polymer Based Interposer Offering Si Matched CTE + ESD protection

Karen Shrier
321 Limestone Terrace
Jarrell, TX 76537
512-636-1523
www.electronicpolymers.com

Introduction

- A concept of polymer based interposer is introduced which combines thermal stress relief and high intrinsic ESD protection capability at low cost.
- Thermal expansion of a polymer-metal interposer system can be adjusted over a wide range to comply with thermal expansion of silicon dies or any other stacked component.
- The presented polymer also provides intrinsic system ESD protection beyond 8 kV IEC by a matrix of embedded metal nanoparticles
- The interposer can be deployed in package-on-interposer or die-on-interposer stacks.

Our mission: 'Shrinking your world, & keeping you Connected '

- WE spent 10 years in development thin film nano-composite polymer passive devices for electrostatic discharge protection (ESD) of IC's and now WE are scaling production to target billions of units/month with Polymer Wafers/Panels containing >500K 0201 SMT PolyDiodes

- We chose ESD as our first target market for a Polymer device because ESD damage is ubiquitous… every IC needs ESD protection…. Example: ESD on smart phones ESD causes shortened battery life and dropped calls

- *In RF apps, OUR thin film PolyDiodes out performs competitive silicon and ceramic surge suppressors, and, our patented double sided electrode design, enables 3-D stacking, reduces part count, and improves Reliability.*

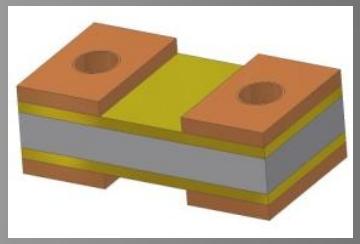
- *Our entire ESD surface mount component design enabled our INTERPOSER Solution.*

- Our need to solve customer ESD problems led us to providing PRODUCTION ESD Tester enabling a total ESD Spice Model Solution

EPI Products Naturally evolved to the INTERPOSER

- ESD PolyDiodes: 0201 SMT, custom press fit Connector ESD arrays
- Service – Lasering Nanofoil Solder Pre-forms for Indium Corporation of America –Eliminates solder reflow and is IDEAL for Interposers
- INTERPOSER FOR package to PCB attachment with built in ESD Protection
- Engineering and Production Model 7071TLP ESD tester
  - Shrinks design times for ESD from 3-4 months to days
  - Enables Spice Modeling

Surface Mount Devices



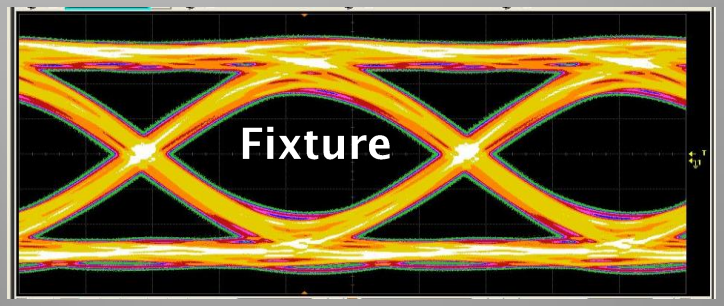
ESD Arrays

ESD Interposer protecting cell phone Power Amp

Model 7071

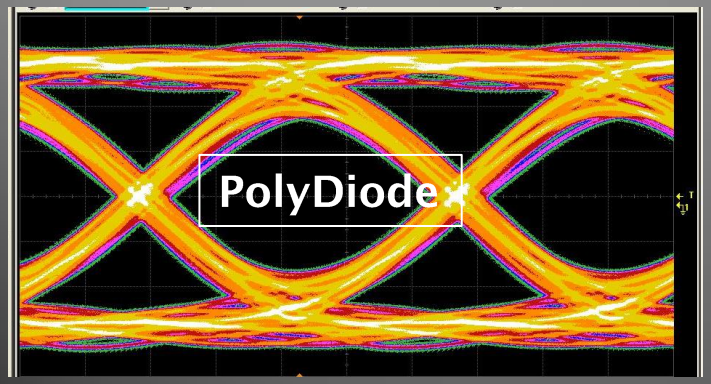
000677

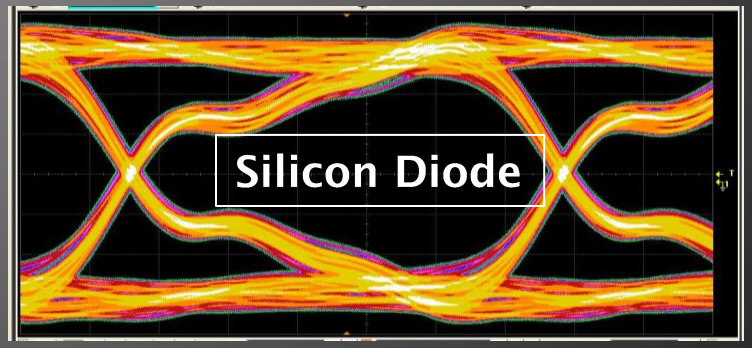
Our Competitive Advantage on Cell Phones : EPIN PolyDiode has No signal interference at 10Gb/s



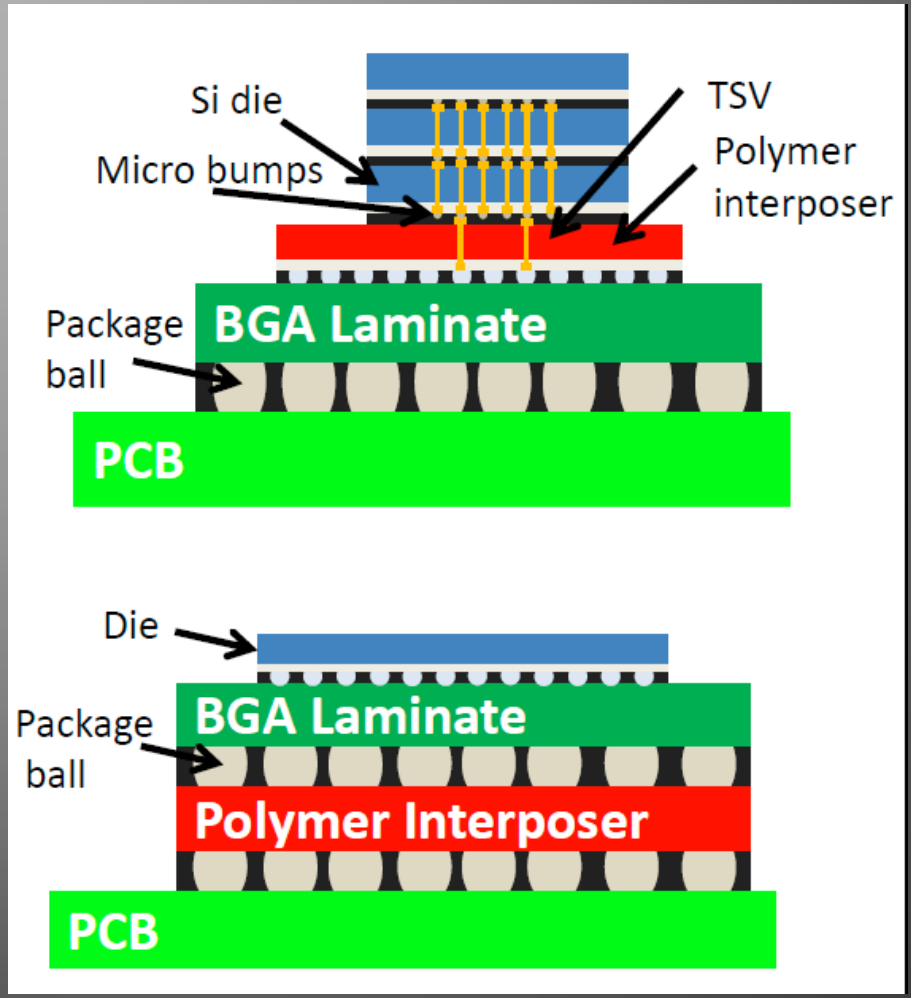
Eye Diagram of Fixture at 10.3Gb/s – 5.15GHz versus EPIN PolyDiode & Silicon Diode

With today's exploding traffic needs ESD must not interfere with at GHz speeds

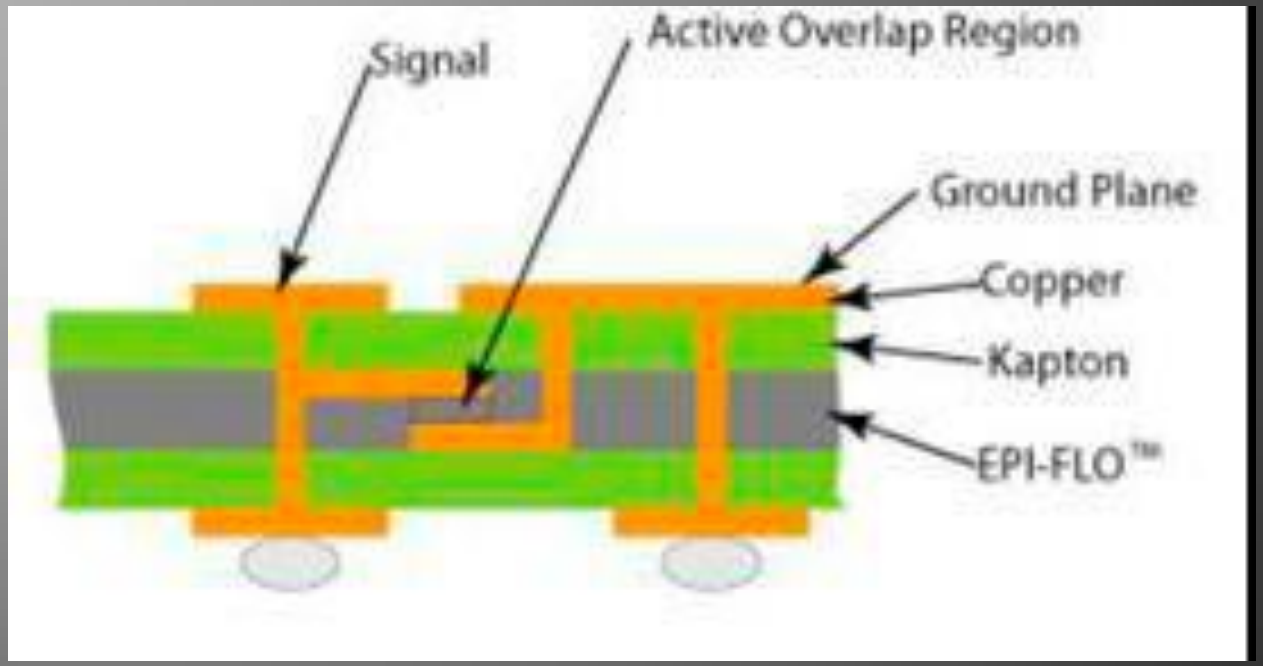




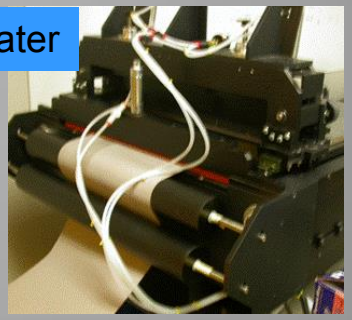
Interposer Concept



Stack of Polymer Interposer



12 Processes vs ~ 40 to make a competitive diode, a major cost advantage

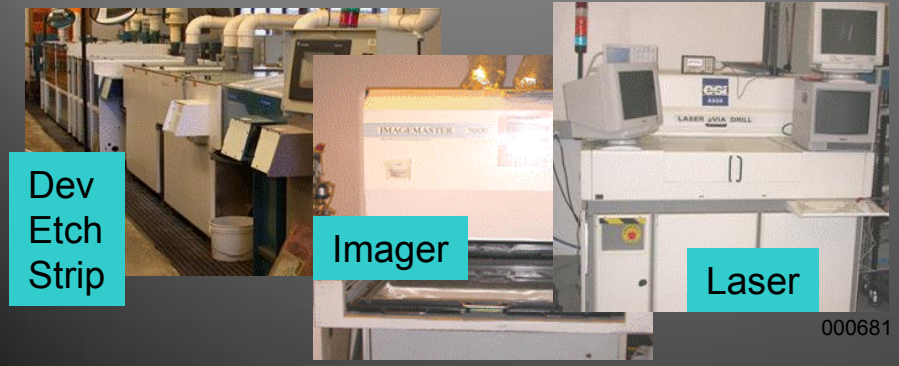


Weigh up **EPI-FLO™**

Mill → Coat → Lamination

Finished Laminate or **EPI-CORE** (12x18" & 18x24")

Laser Through Hole VIA → Develop, Etch , Strip → Plate → TLP Test

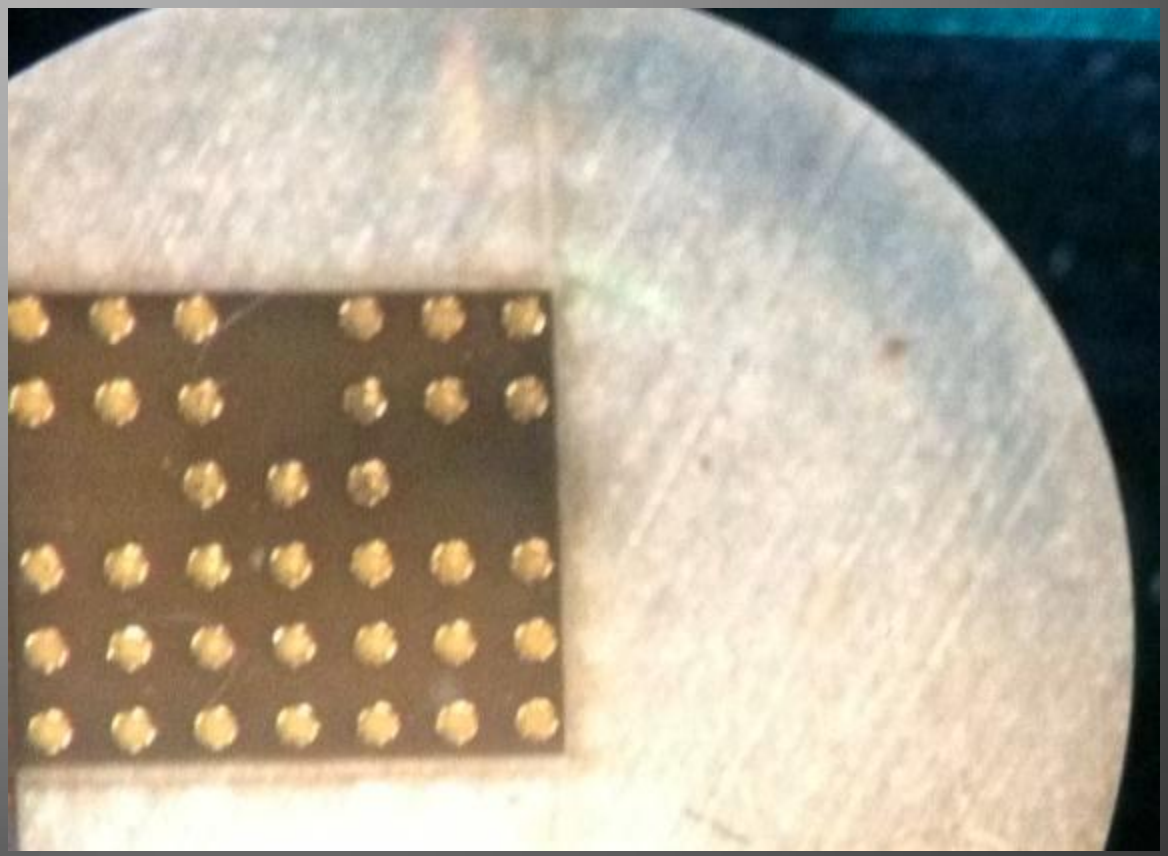


Laser Singulate → Package

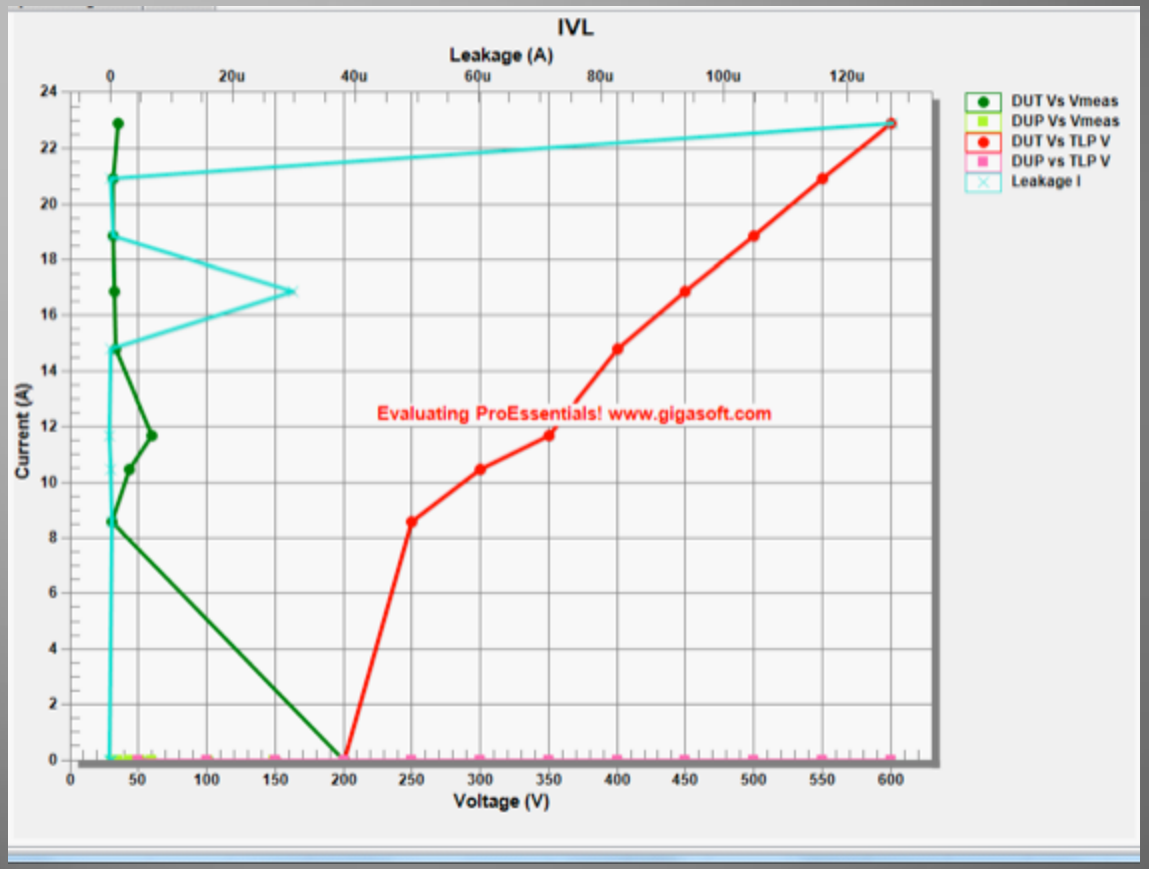
Our Roadmap uses one process for all products: SMT, Connector arrays, Interposers

- yield >500,000 0201, 30X600um, units/panel

PA Polymer Interposer with ESD VIA Protectors



PA INTERPOSER Attached to PCB with solder balls ready for Test

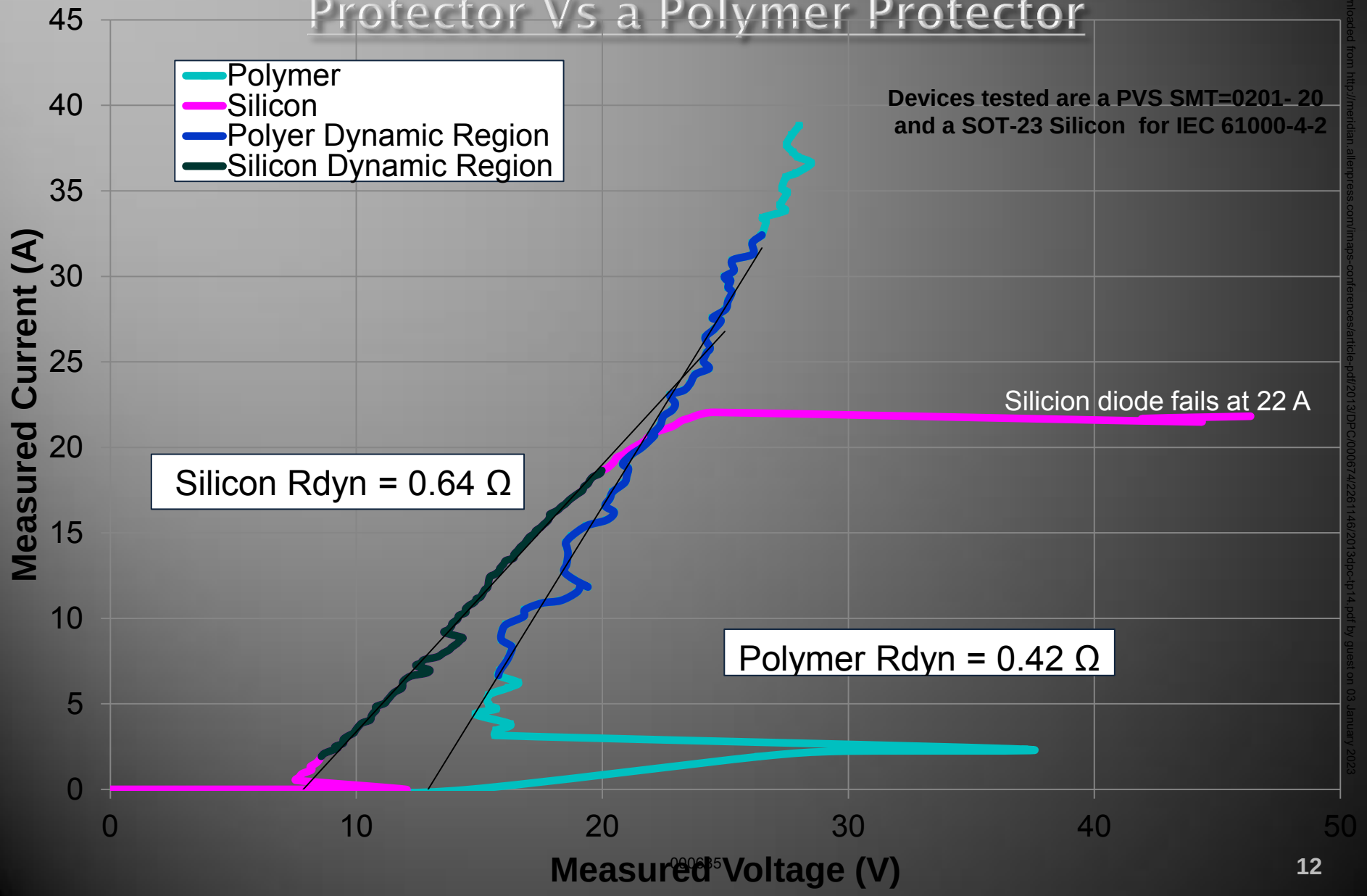


ESD Protection: 8KV equivalent ESD, without INTERPOSER PA damaged at < 2KV

High current TLP analysis of PA including ESD interposer. Peak voltage (red) and clamp voltage (green) during a 40 ns TLP pulse are shown. Leakage progression after each pulse is depicted as well (light blue). A large increase of leakage current indicates the failure of the device.

EPI-FLO

Dynamic Resistance Comparison of Silicon ESD Protector Vs a Polymer Protector



Thermal Expansion Measurements

Material	CTE[ppm/C
Silicon	2.6 (at 25C)
Copper[3]	16.8
Kapton w Copper[3]	14.2 Measured TMA
LCP	17 Measured TMA
EPIFLO	0-17 Dominated by substrate
Modified Polyimide * Comparable to DuPont Kapton E from Saint Gobain	2-4

EPI's value proposition

1. Biggest inherent advantage…EPIN's Polymer stands alone in providing ESD protection without damaging RF signals

2. By preventing the ESD damage to cell phone antenna Modules that makes them leaky, the result : less dropped calls, improved battery life, reliability

Cost for Antenna ESD Protection	***Conventional***	***EPI PSM70***
Resistor, Capacitor, Inductor VS EPI	1.0¢	0.15¢
Board Space & Pick & Place	.5¢	.05¢
Total LCR vs PolyDiode	1.5¢	0.2¢
ESD Cost/7 antennae/module Smart Phone	***10.5¢***	***1.4¢***

Phenomenal savings of 9.1¢/Phone, with EPI on only 7 of ~ 50 total Diodes

3. EPIN reduces cost, size, and time to market, and, provides ESD protection +3-Stacking thereby removing key barriers to allow industry to keep pace with Moore's law

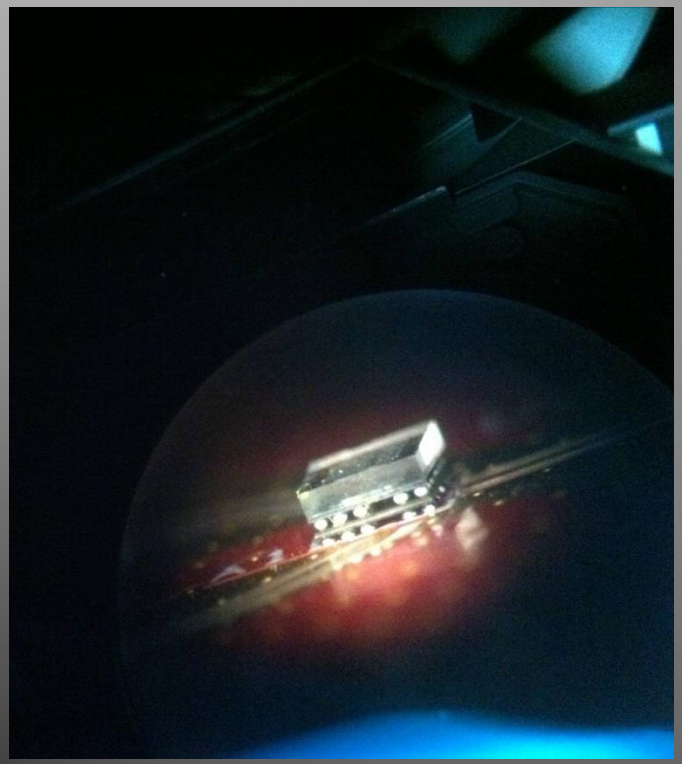
EPI-FLO

Conclusion

- A novel polymer based interposer with integrated ESD protection capability has been presented.
- The effectiveness of protection has been proven by a package on interposer solution of a power amplifier doubling the ESD robustness of the stack to > 8 kV IEC.
- *Using the nano particle polymer interposer for die-on-package stacks allows matching of the thermal expansion to silicon.*
- *This offers a low cost replacement for silicon Interposers & an Interposer from the Package to the PCB incorporating additional functions such as ESD Reliability from the factory.*

The Future: 1st ESD Interposer, then Thermoelectric → new integrated through-hole-via Interposers

http://www.idtechex.com/events/presentations/reel-to-reel-manufacturing-of-printed-electronics-and-systems-000225.asp



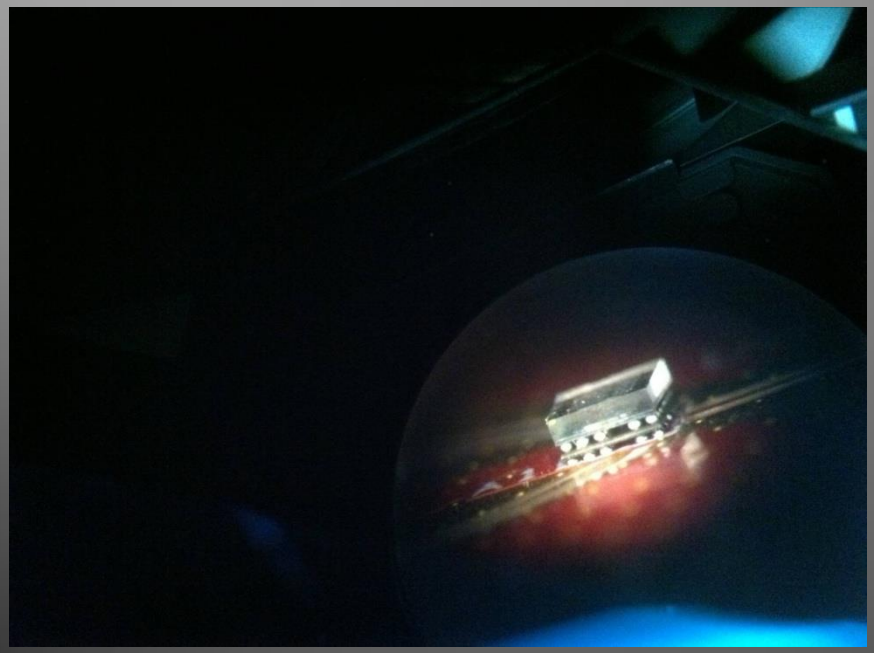
Protection Demo on TLP

Electronic Polymers Newco, Inc. Sales & MKT_Short Desc of Interposer wi Marthas Painting

4/12/2012

My friend Martha Inman Lorch Creation, the Interposer is Karen Shrier's career Creation: see slide 5 above, and photo below…karen

"I'm thrilled to tell you that my painting, *Mime with Rose, Paris*, has been accepted into the 145th Annual International Exhibition of the American Watercolor Society. The exhibit will be at the Salmagundi Club in New York City during April. The list of exhibitors reads like a who's who of the watercolor world, so I feel very excited to be in such good company. " Martha



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