RJR POLYMERS, INC.
The Total Electronic Package Solution

Introductory Presentation
On
LCP Packaging
Why Liquid Crystal Polymer?

LCP Barrier Properties

- Water Vapor Permeability (g/m²·cm/24 hrs-atm) at 23°C
- Oxygen Permeability (cc·25 μm/m²·24 hrs-atm) at 23°C

Similar to Frit Glass
RJR Package Elements

Offered in two piece or three piece configurations

- Two piece for applications using epoxy die attach
- Three piece for applications using eutectic die attach
RJR Polymers, LCP Packaging Technology:
- The market is ready for a drop in replacement to existing Air Cavity Packaging Technology
- Provide Customers with cost reduction in comparison to legacy ceramic without diminished performance
- Offer high degree of design flexibility
- Lower cost of specialization
- Optimize process on both sides of Manufacturer/Customer relationship.
- Bridge the Power and Frequency spectrums
  - Lo to Hi-Power
  - Low to MM Wave frequencies
- Build a diverse product portfolio
R-Pak LCP Air Cavity Packages

Thermally enhanced metal based for microwave and power applications

- RF/ Wireless
  - Power
  - Signal
  - Microwave
- Imaging
- Sensors
- Fiber Optical
- MEMS
Power Packaging

- Flexible Platforms for product customization
- Full layout of open tools
- Wide array of available thermal bases
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<th>Avg CTE</th>
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Microwave Packaging

- The best performance is achieved in air cavity packages
- RF and microwave devices aren’t fond of being smothered in epoxy
  - detunes, shifts, degrades
- LCP is a very stable, low loss dielectric
  - loss tangent of .003 @ 10 GHz
  - good environmental protection
- Full metal base is an ideal ground plane and heat sink
- Many of RJR’s packages currently function well into millimeter wave frequencies

- Partially matched package
  - Integrated matching structures in the package provide impedance transform without additional cost
Why RPAK™?

- Can handle a wide range of power levels
- Can handle frequencies through millimeter wave frequencies
- Can utilize very high thermal conductivity materials
- Can tolerate CTE mismatch between package base and package sidewall.
- Maintains equivalent levels of mechanical stability as legacy ceramic packaging
- Maintains equivalent levels of moisture resistance as legacy ceramic packaging
- Is lower in cost than ceramic packaging
- Automation in both package manufacturing and assembly will provide for higher levels of future cost reduction
- Allows for higher degrees of materials selection (base materials, plating types, etc.) which can relate to reduced product cost.
- High degree of dimensional repeatability
- **Provides for very high degree of product flexibility and integrated features.**
Next generation packaging

- **Integration**
  - More Functionality in same or smaller space
  - Injection molding offers the opportunity for additional features and added functionality
  - LCP can be electrically conductive

- **Added Features/ Added Value**
  - Integrated Package housing and cable
  - Round packages
  - Impedence Transform
  - Integrated features such as integrated ferrules
  - Integrated package lids
    - Antenna/ radiating element in lid connected to elements of the package. Radio in a package
  - RF Shielding
  - LCP Films/ Board level integration