Examination of Advanced Technologies in Characterization, Diagnostics, and Verification at Different Stages in the Manufacturing Lifecycle of Packaged IC Devices

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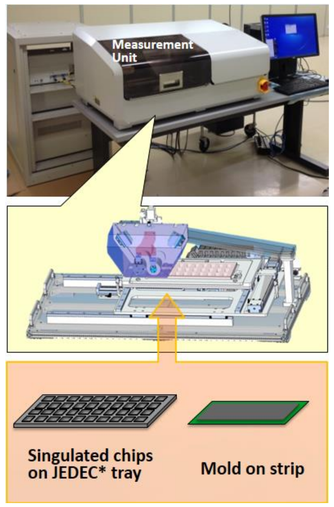
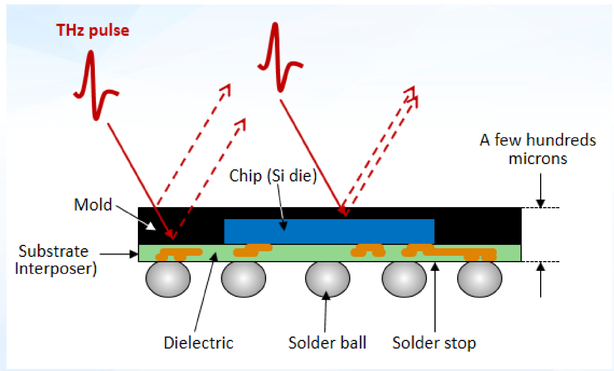
Mold Characterization
THz Time of Flight

Non-destructive IC mold metrology is needed in factory environment. Terahertz wave penetrates dielectric, reflecting from material interfaces and providing time-of-flight distance allowing thickness calculation. Manufacturing process is improved.

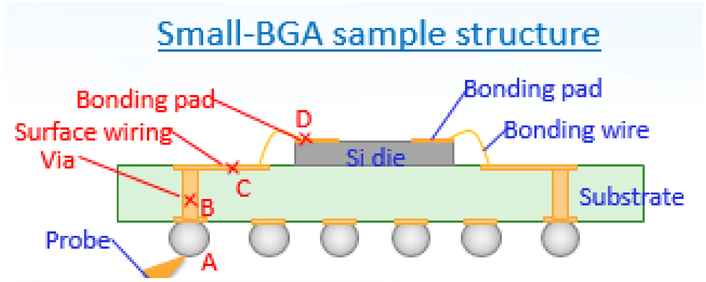


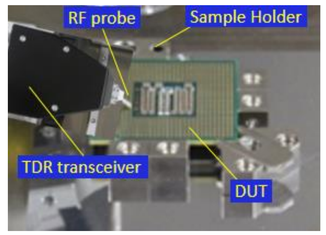


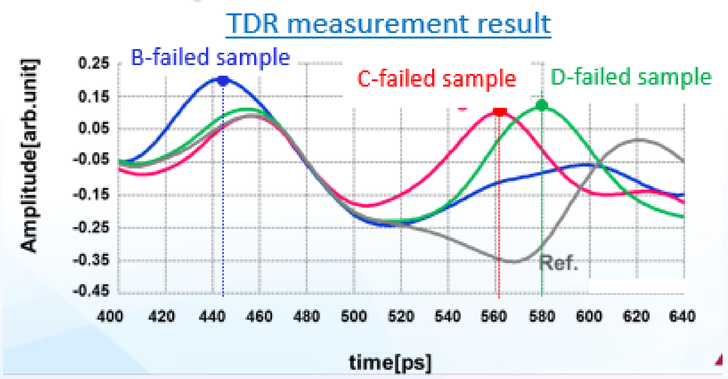
Mold Thickness Accuracy 3um

Electrical Diagnostics
THz TDR

High speed optical signal is converted to electrical and used for fault isolation by time domain reflectrometry. Resolution exceeds conventional methods, useful for advanced packaging failure analysis.







Fault Isolation Accuracy 5um

System Level Test
Endurance & Production

Endurance Test ensures device design and manufacturing process meet reliability claims. Production test ensures that a particular unit was manufactured to specification. Endurance test requires both thermal accuracy and consistency. Production test most critical to meet the minimum high temperature

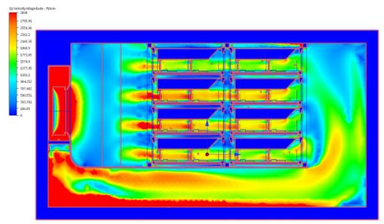
$$\textbf{Stress Test Time} \propto \frac{1}{\textbf{Stress Temperature}}$$

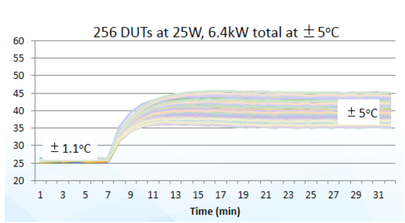
Endurance test requires thermal accuracy and stability

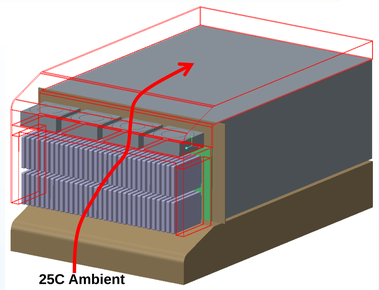
$$t_f = Ae^{E_A/kT}$$

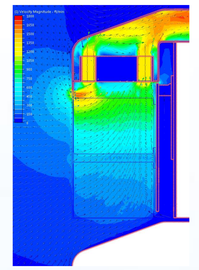
Arrhenius Equation
(Temperature Dependent Time to Fail)

t_f: time to fail **A**: acceleration factor E_A: activation energy;
T: temperature k: Boltzmann's constant









Active Cooling for Endurance, Closed-loop Ambient for Production

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