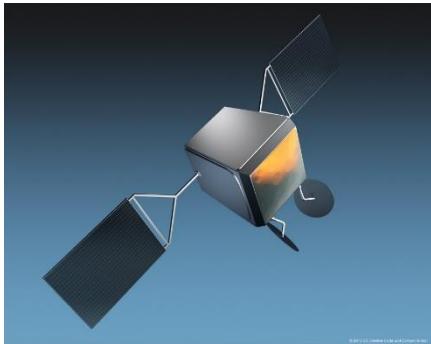




EEE SOLUTIONS IN FUTURE SPACE MISSIONS

NEW RULES



Facts & Figures

- size less than 150 kg
- weight up to 4 built every day
- 900 satellites to be built

Parts selection based on:

- New technologies
- Mass production
- Low cost
- Higher performance
- Low (no) heritage

Risk assessment

- Functionality
- Support
- Production

Part selection

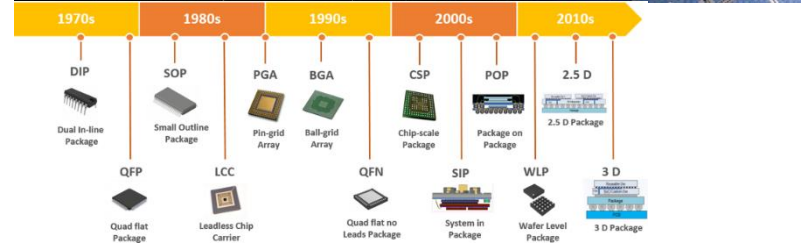
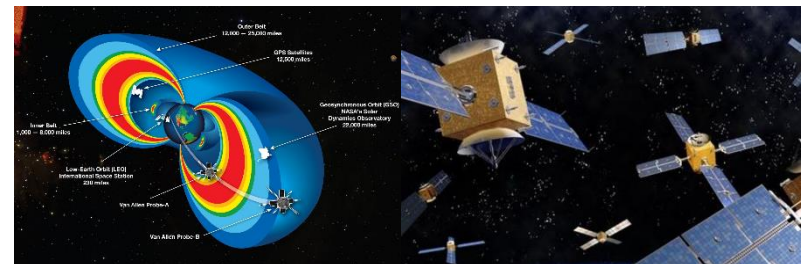
- Obsolescence control
- Know how
- Experience

Reliability assurance

- Characterization
- Screening
- Validation

Parts approach requiring technical analysis

- Radiation levels, dominant effects,
- Working temperature conditions: ranges and cycles
- Demanded technologies to achieve mission challenges,
- Identification of equipment – component criticality within the satellite
- Mission acceptance risk at different levels
- Component volumes, constellation size, recurrence, ...
- Time frame
- Cost
- Traceability

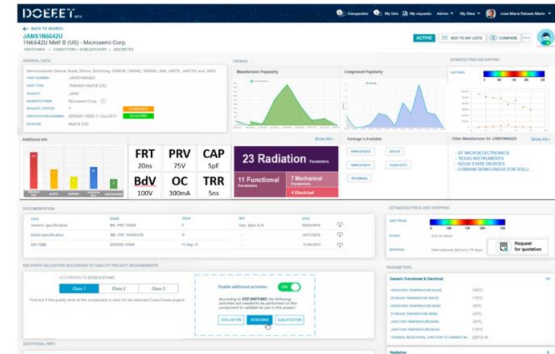


SELECTION AND VALIDATION



Selection is no longer an individual analysis

All required information in a single platform



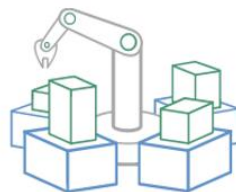
Unit price | Validation – Non recurrent cost | Granted reliability level | Manufacturer confidence status | Radiation level against mission requirement | Risk impact associated to device malfunction, at board, ...

Testing and validation based on a collaborative approach between suppliers and customers



1 DESIGN

Design your tests over the web



2 CONDUCT

Virtual Lab conducts your tests



3 EXPLORE

Virtual Lab organizes your data into a smart data base

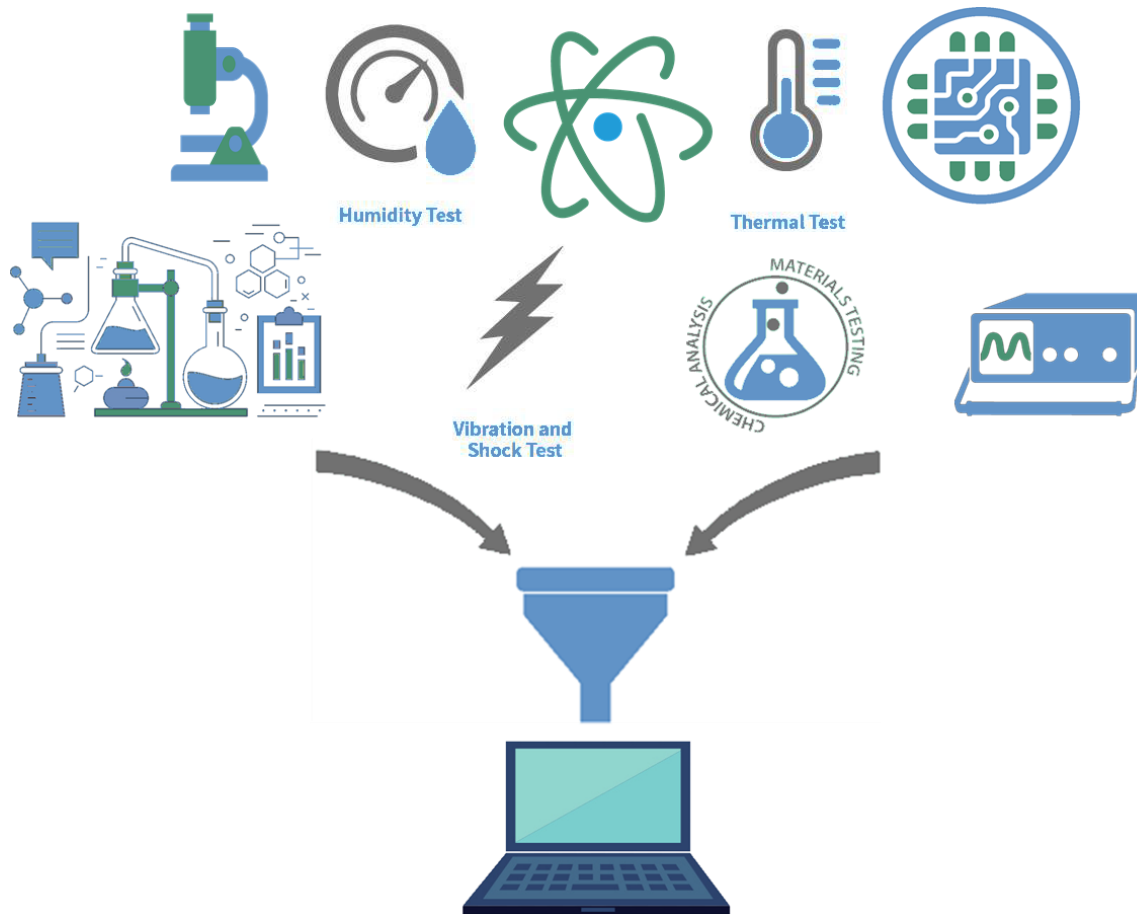


4 ANALYZE

DOBEET crunches and analyzes data

VIRTUAL LAB

Test design using all available knowledge from EEE parts to specific application needs

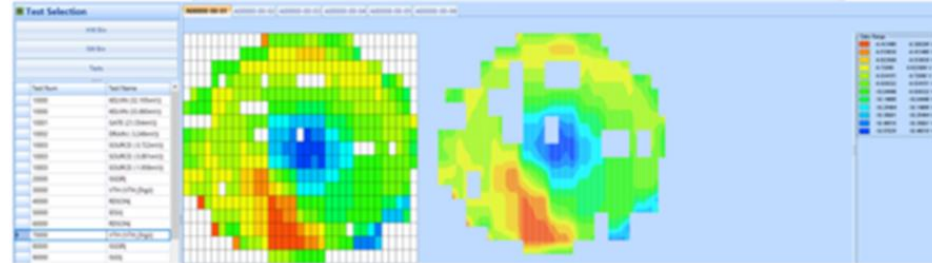


PLASTIC PACKAGING

Use of RT dice or commercial wafers (full traceability)

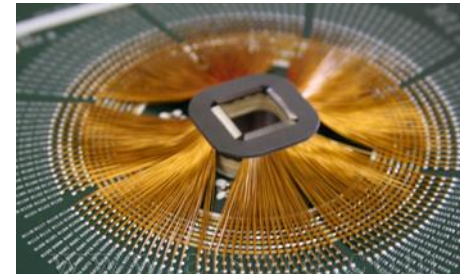
Why use plastic package over ceramic or metal?

- Smaller package footprint.
- Chip performance.
- Cost reduction.



Why QFN / BGA

- Very flexible, range of package sizes with same tool.
- Low cost to switch between packages / customise.
- Matches market requirements.
- Why lead free packages? - dedicated tools per type.



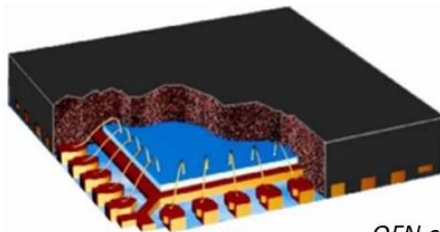
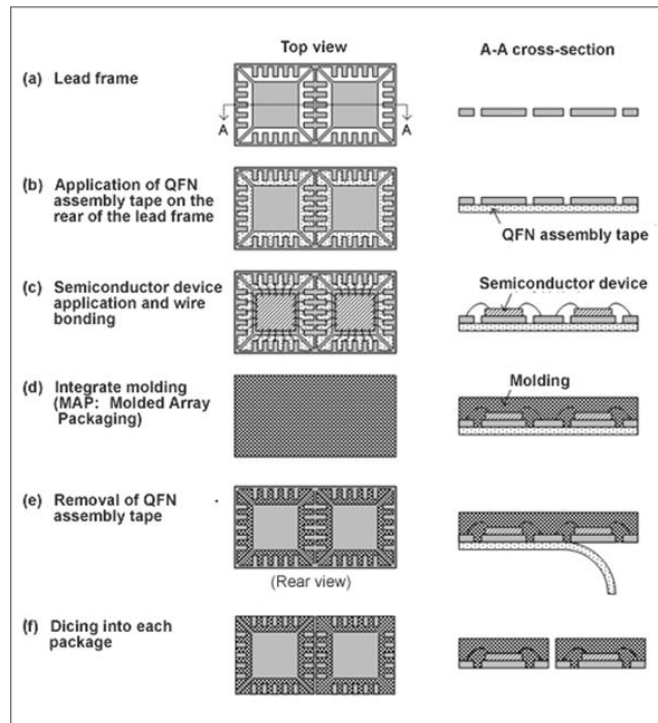
Current Market Offering and Trends

- Plastic packaging centred in Asia.
- Difficult to access for low volumes.
- Plastic widely adopted in most markets.
- Emerging use in Space.



PLASTIC PACKAGING

Process Illustration



QFN cut-away

Can be beneficial for:

- Fast Prototyping
- Low volume production 1000 – 10,000 per lot.
- Space, custom assemblies not catered by OCM.
- Specialist applications – i.e. Ribbon, wedge, flip-chip.

With tailored testing approach based on mission and requirements.

Assumptions

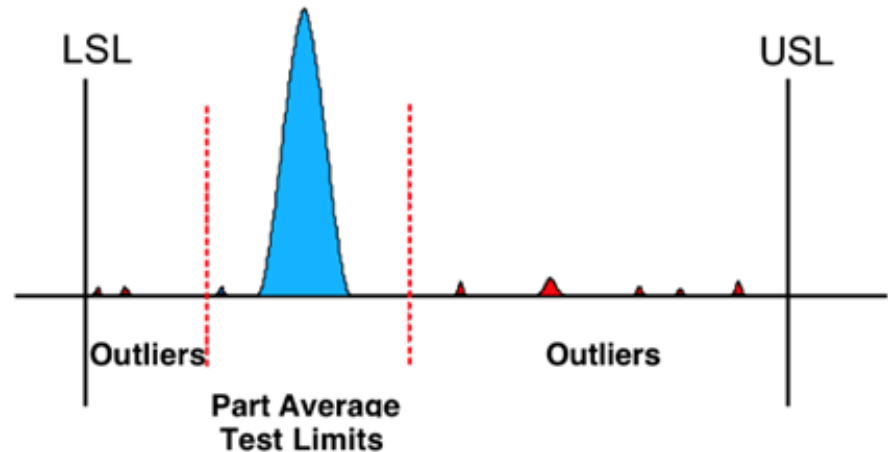
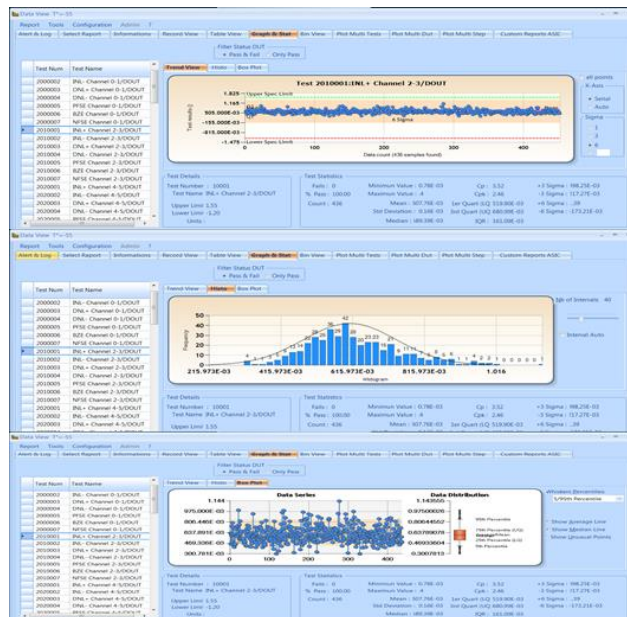
- Package body size variations achieved with a new lead frame / substrate.
- NiPdAu/Ag pre-plated lead-frame
- Laser mark
- Design the mold to allow just a change of top plate to increase the depth.

ELECTRICAL TESTING COTS



To perform complete lot procurement (even at wafer level), same date code and same wafer diffusion to avoid any variability and test complete lot to minimize test cost.

- Perform upsampling for extended temperature ranges -55°C up to $+125^{\circ}\text{C}$ as a minimum.
- Perform post processing analysis using PAT (Process average testing) technics to eliminate outliers parts.
- Perform limited radiation test on key devices (COBALT 60 / SEE as required) according to the mission profile and satellite lifetime.
- Take advantage of our ATG system group to perform functional safety analysis at system level (ISO 26262) FMEA/FMEACA (Failure Modes, Effects and Criticality Analysis) to determine critical devices.





THANK YOU!

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