

# ***EEE Component*** *Electronic, Electrical & Electro-Mech*

# ***CPPA Capability*** *Central Parts Procurement Agency*



# Introduction to Force Technologies Ltd



- Experience & Heritage
- Structure
- Pedigree
- Capabilities
- Skills

## Introduction to Force Technologies Ltd

Since 1986 Force has provided specialist EEE (Electronic, Electrical & Electro-mechanical) products to a variety of high reliability and safety critical industries, including the Space industry.

A spacecraft and all its components must withstand the extremes of vibration, pyrotechnic shock, cosmic radiation and large temperature fluctuations. There are no service calls, no repairs, and no replacement parts once a spacecraft is launched – and therefore, there is no tolerance for anything less than perfection. The failure of a single component on a satellite can jeopardize an investment of several years and hundreds of millions of dollars.

With stakes this high, satellite manufacturers must be certain that every company in their supply chain has the proven capability to design and manufacture reliable technology for space and deliver it precisely on time.

# Why Use Force Technologies Ltd

- Force has an established world class reputation for supplying high reliability components to the Aerospace & Defence and other harsh environment industries
- The skills and experience built up in component sourcing, procurement, project management, inspection, test, storage, and failure analysis directly map across to Space
- The Space industry requires high reliability components but these are in an increasingly short supply due to commercial cost pressures in the EEE Component Equipment manufacturers (CEM) market place
- The Force skill set can be directly applied to Pro-active Management and resolution of EEE Component Sourcing, which is a major problem for the Space industry.

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## Experience & Heritage

As a Specialist EEE Component supplier based in the UK, FORCE have progressively expanded in response to customers needs, and thirteen (13) years ago took the decision to manufacture their own range of components, specifically tailored to address customers requirements which could not be addressed in the general market place due to the Diminishing of Manufacturing Sources (DMS) and the increase in End Of Life (EOL) notifications from CEM's. This is achieved by providing aftermarket Manufacture, Testing & Screening of semiconductor devices as FFF replacements to devices made obsolete by the original CEM.

All technology we engineer is exhaustively analyzed and tested, and manufactured with extraordinary precision and control so that its performance in a high reliability and harsh environment is absolutely predictable and consistent.

## Experience & Heritage - 2

Force Technologies Ltd. is a financially stable, zero liability, independent Company providing High Reliability electronic components and related services to the High reliability and hazardous / harsh environment industries. When you choose us to help you solve a component problem, you gain access to a team of engineers and technicians bringing you nearly 25 years of experience in component technology.

From a Failure Analysis of a single component, to a multi-million pound parts procurement project covering thousands of line items, Our expertise in High Reliability components supports customers around the globe.

We have a vast amount of experience in managing both centralised and coordinated programmes.

Our Component engineers have major experience with MIL, ESCC, NASA, DESC and DEF-STAN's Specs for High-Reliability EEE components.

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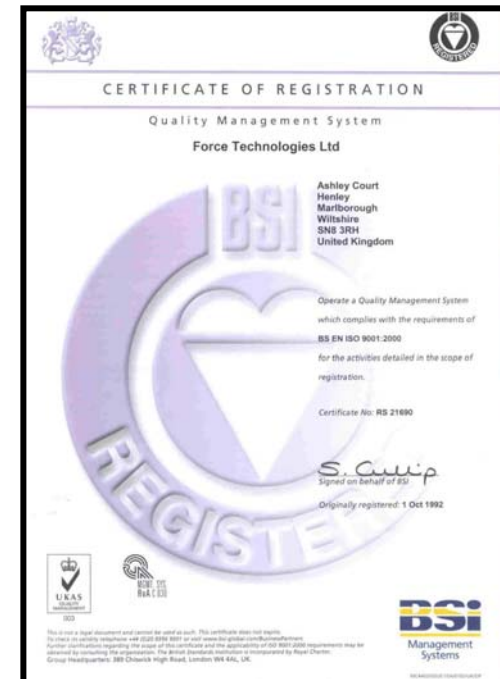




# Quality

By embracing the principles and concepts of a "Total Quality Management" culture, Force Technologies recognises the need to extend the quest for quality beyond manufacturing. Quality awareness is inherent in all aspects of our business through new test development, manufacturing, administration, sales and customer service.

Force is an ISO-9001:2000 and AS9100 RevB accredited company. We are also a signatory of SC21. Our manufacturing and testing services are in accordance with all industry standards, including JEDEC, MIL-STD-883, Mil Prf 38535 etc.



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# Some of our suppliers



Plus many others for Passives, Connectors, Microwave and other such products

Some of our customers



GE Aviation

GOODRICH



Ministry of DEFENCE

THALES

NORTHROP GRUMMAN

BAE SYSTEMS



Raytheon

SELEX Sensors and Airborne Systems Ltd.

FINMECCANICA



# Applications of our Expertise

- Some of our customers Platforms



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# Capabilities

FORCE has continually, and continues to expand and enhance its facilities, enabling the Company to become the leading provider of EEE Components and the associated Evaluation Services, servicing a global customer base.

FORCE has nearly 25 years experience in EEE component procurement, test, evaluation and device technology.

Services we offer include: -

- Evaluation of New Products
- Parts Procurement Management
- Engineering and Consultancy
- AUTHENTICARE™ - Counterfeit Component avoidance
- Laboratory & Test Services
- COTS and PEMS Qualification
- Upscreening & Upgrading
- Testing & Certification
- Radiation
- EMC
- Optoelectronics
- Electronics & Mechanical Equipment safety
- Obsolescence Management solutions -
- BOM Monitoring
- Long Term storage
- Kitting/Consolidated Inventory
- Counterfeit Identification/screening

# Parts Procurement Management

Whether you want to purchase a single line item or components for a complete system, by outsourcing your parts procurement to FORCE, we can help you manage the parts related risks to your project.

We can support procurement of all types of Electronic, Electrical and Electromechanical parts.

Schedules, Cost, Quality & Performance are the key measures of success for any Space, Aviation or Defence system. We ensure that our customers obtain best value for money in parts procurement.



Space Systems



# Parts Procurement Management - 2

- Engineering support and management of parts related risks:
  - Delivery Times
  - Obsolescence
  - Export Licences
  - Performance
- Product Standardisation & rationalisation
- Assurance of appropriate Quality levels
- Back-up and alternative components
- Supplier and product selection and recommendation.



# Engineering and Management

Services we offer include: -

- Supplier Selection
- Parts Reduction Programme
- Manufacturer Audits
- Component Studies and Evaluations
- EEE Component compliance to requirements (RoHS..)
- Obsolescence advice and Mitigation



Test Scheduling

## Supplier Selection

- Our deep knowledge of the component engineering market place and experience with manufacturers from around the world allows us to recommend suppliers and components from within our QMS, to meet your specific needs

# Engineering and Management - 2

## Parts Reduction Programme

Using our extensive component-engineering databases we can advise on parts standardisation and rationalisation. This process will minimise the costs and potential risks to your programmes.

Our experienced parts engineers can identify:

- Critical components
- Obsolete devices
- Excessive lead-time parts
- Duplicated parts
- Non-compliance to required performance levels

Where necessary we can propose alternatives.



Optical Inspection

# Engineering and Management - 3

## Component Evaluation

Backed by Internal Resources and a Parts & Materials Laboratory, we will support you in developing new equipment or systems by investigating the potential sources and suitability of new components. Similar components for different manufacturers can be compared.

In addition we often conduct reliability assessments of components.

## Advice on Obsolescence

Force can provide a key service in obsolescent management planning.

We have worked with clients in studies to cover Last Time Buy (LTB) requirements to mitigate component obsolescence for systems. We offer a Bill of Material (BOM) monitoring service.



Die probe

# Skills

How does FORCE Technologies Ltd. Achieve This  
By having access to a comprehensive collection of Test Equipment, backed up  
some of the best Engineers available.

Some of the services available include: -

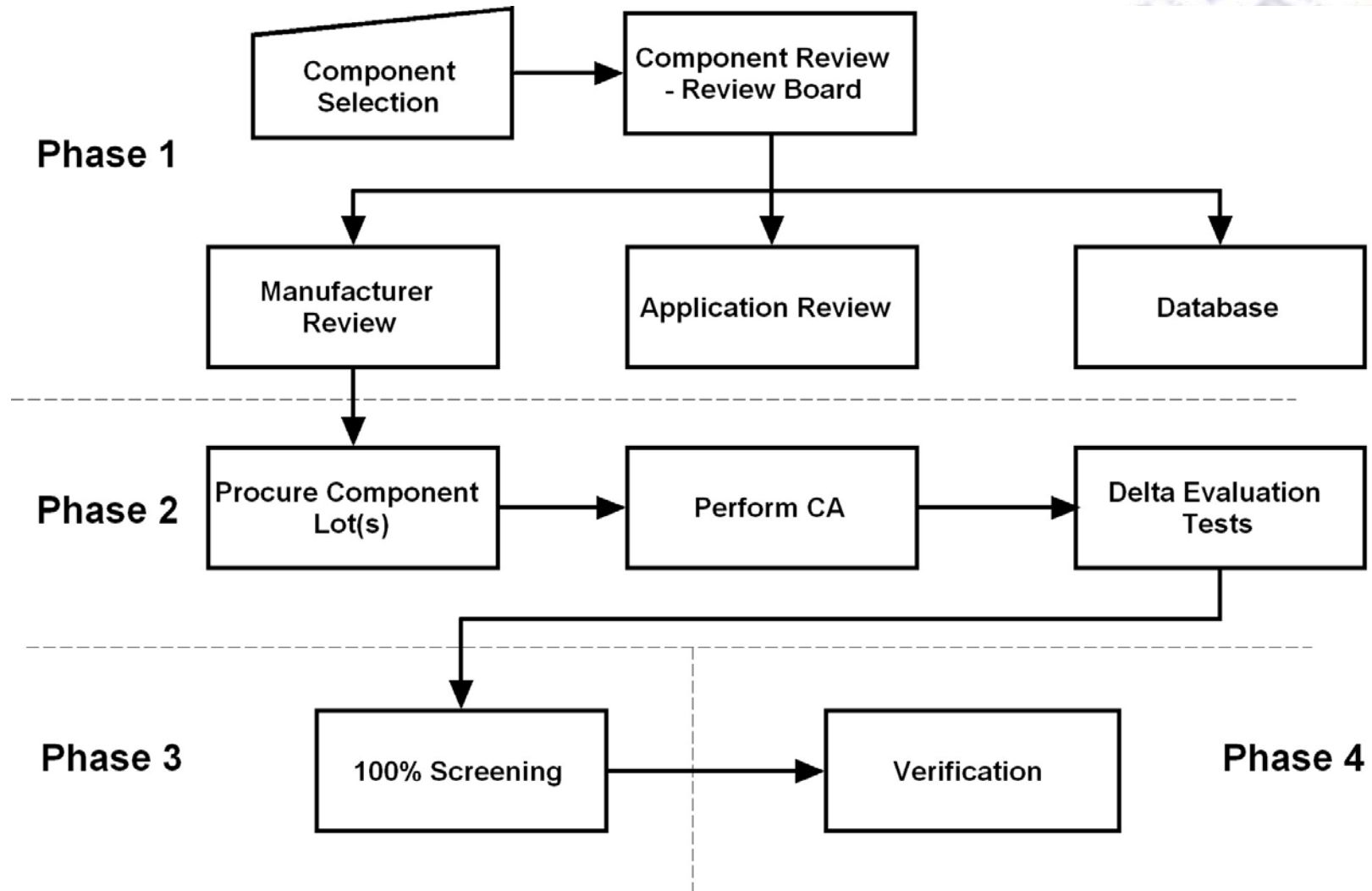
- Manufacturer reviews
- Component Evaluation & Qualification
- Failure Analysis (FA)
- Screening
- Targeted Screening
- Destructive Physical Analysis (DPA)
- Radiation Testing
- Scanning Electronic Microscopy (SEM)
- Scanning Acoustic Microscopy (C-SAM)
- Dynamic Radiographic Test
- Reliability Testing

The following slides will explain some of the equipment and techniques available,  
along with the benefit of their utilisation.



Burn in

## An example of COTS Qualification methodology



# AUTHENTICARE™ Product Verification Program



Why do you need	Combating the	What can you do?
<p><b>Counterfeit product threatens</b>            Manufacturer is no longer supporting the device.            Production of the device is not high            Manufacturer lead-time is long            Device required is a high cost product.</p>	<p><b>Combating Tools:</b>  <b>DDI</b> Device Die Identification            Counterfeiter not able to change the  <b>CPI</b> - Critical Parametric  <b>DMV</b> -Die Metallurgical Verification.</p>	<p><b>Supply Chain</b>            Only source from direct supplier or franchised source.            Confirmed Manufacturer C of C.            Verified Date and Batch Code.            Verified supply chain Flow-Down            Trusted Audit trail</p>

# AUTHENTICARE™

Product Verification Program (We test you rest)

Why do you need	Combating the	What can you do?
<p><b>Counterfeit devices are becoming harder to detect:</b></p> <p>Counterfeiters adapting to detection techniques Using scrap die to pass x-ray.</p> <p>Similar device packaged and marked to appear correct and may pass minimal Electrically lower grade parts used to Commercial grade used to emulate Gate arrays used to emulate IC's. Critical speeds-too fast Use of multiple manufactures which are</p>	<p><b>Testing, Verification &amp; Policy:</b></p> <p>Multiple levels of parametric and mechanical device authentication. Minimal DC testing to full SMD or Military screening. Confirm suitability and capability of test facilities. Request R&amp;R of test results. Bond tested, final product, in correct Comprehensive library of test Over 3000 test fixtures.</p>	<p><b>When there's no provenance:</b></p> <p>Treat ALL grey market products as suspect. Test before you pay or test before you use. What is the real cost of buying suspect product.</p> <ul style="list-style-type: none"> <li>Company reputation</li> <li>Reworking</li> <li>Reliability</li> <li>Extra resources</li> <li>Quality</li> </ul> <p>Use OEM die and get the part manufactured and tested.-100% guaranteed. Use Authentication program on finished parts-50%-99% assurance. Confidence at low cost</p>



# AUTHENTICARE™ Product Verification Program

Testing Levels 1 to 6. You pick the confidence level you need					
Level	Test Conditions	Quantity	Test Definition	Typical Use	Data
<b>Level 0</b>	Anomaly Inspection	Sample or 100%	Ext. Visual. DDI on 3 date codes.	Typically used for Basic authentication of product from questionable suppliers.	R & R not available
<b>Level 1</b>	Anomaly Inspection. 25oC Datasheet DC's and	Sample or 100%	Ext. Visual/Limited DC/Function at 25°C. DDI on 3 date codes	More Detailed Verification than basic visual.	R & R available although not included
<b>Level 2</b>	Anomaly Inspection. 25oC Datasheet DC's and	Sample or 100%	Visual/Complete Datasheet Verification at 25oC. DDI on 3	Typically used when device is questionable on passing certain	R & R available although not included
<b>Level 3</b>	Anomaly Inspection. 25oC Datasheet AC & DC	Sample or 100%	Visual/Datasheet AC & DC Verification at 25oC. DDI on 3	Typically used for determine devices will functionally perform to datasheet.	R & R available although not included
<b>Level 4</b>	Anomaly Inspection. Datasheet DC Testing over temperature. C=Comm. I= Ind. M=Mil	Sample or 100%	Visual/DC Verification at Full Temp Range. DDI on 3 date codes.	Designed to test temperature variable DC parameters.	R & R available although not included
<b>Level 5</b>	Anomaly Inspection. Datasheet AC & DC Testing over temperature. C=Comm. I= Ind. M=Mil	Sample or 100%	Visual/ AC & DC Verification at Full Temp Range. DDI on 3 date codes.	High probability of detection. Designed to test temperature variable DC parameters & AC Functions.	R & R available although not included
<b>Level 6</b>	Anomaly Inspection. Datasheet AC & DC Testing over temperature. C=Comm. I= Ind. M=Mil	Sample or 100%	Visual. 25oC pre BI test. 168Hr BI. AC & DC Verification at Full Temp Range. DDI on 3 date codes.	Highest probability of counterfeit detection.. Designed to test temperature variable DC parameters & AC Functions. 168Hr Burn-In for reliability and high confidence.	R & R available although not included
<b>Level X</b>	Customer supplied.	As reqd	Customer supplied.	When more complex parameters require testing or wider tolerances than	As Reqd

# Inspection, Acceptance & Storage

We provide a comprehensive range of Receiving Inspections and Acceptance Tests that normally include:

- Verification of part type, quantity and traceability
- Mechanical dimensions on a representative sample
- Stereoscopic inspection at magnifications up to x30
- Electrical testing and measurement
- Detailed review of all supplied documentation



All results obtained are recorded and compared to the procurement requirements before being accepted into stores. Items that fail the requirements are moved to a separate 'quarantine' area.

Optical Inspection

# Inspection, Acceptance & Storage - 2

Proven processes



## RECOMMENDED INSPECTION PROCESS

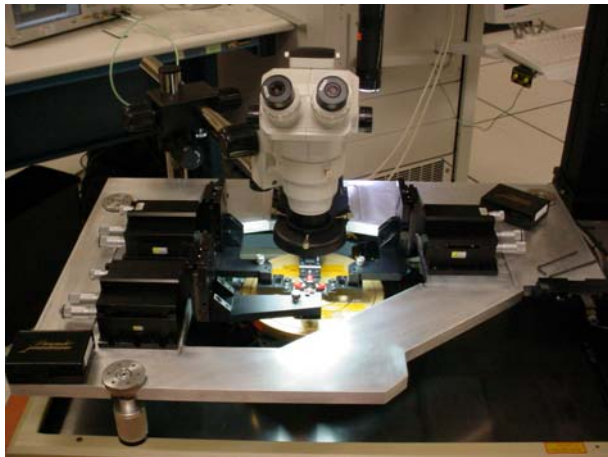
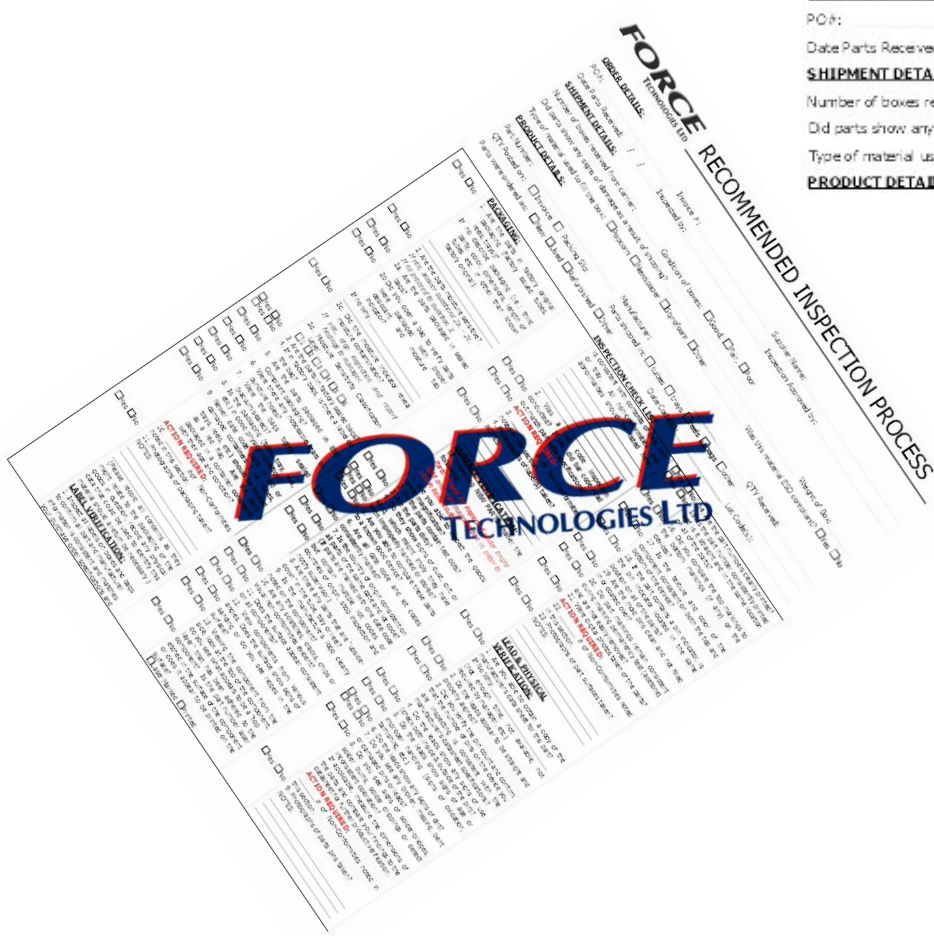
**ORDER DETAILS:**

PO#: \_\_\_\_\_ Invoice #: \_\_\_\_\_ Supplier Name: \_\_\_\_\_  
 Date Parts Received: / / Inspected by: \_\_\_\_\_ Inspection Approved by: \_\_\_\_\_

**SHIPMENT DETAILS:**

Number of boxes received from carrier: \_\_\_\_\_ Condition of boxes:  Good,  Fair,  Poor  
 Did parts show any signs of damage as a result of shipping? \_\_\_\_\_ Weight of Box: \_\_\_\_\_  
 Type of material used to fill the box:  Popcorn  Newspaper  Styrofoam  Other \_\_\_\_\_ Was this material ESD compliant?  Yes  No

**PRODUCT DETAILS:**




# Inspection, Acceptance & Storage - 3

Established systems

Start date:	
Due to customer date:	

LOT TRAVELLER-INTERNAL	
PO number	
SO number	



Part Number: \_\_\_\_\_

ty: \_\_\_\_\_

Date Code: \_\_\_\_\_

Lot Code: \_\_\_\_\_

Job Number \_\_\_\_\_

Process	ty In	Date/Time In	Temp	ty Out	Time out	Date	Operator	Signature
<b>A Inspection</b> Doc: QA1001 JE_D22-B101A Pin Alignment								
<b>Lead Finish</b>								
<b>Marking (see *)</b> Doc: WP1024								
<b>Solvent Test</b> JE_D22-B107C								
<b>Bake</b> WP1033 48 hours J- TD-033A + J- TD-020								
<b>Tape/Reeling (outsourced)</b> Doc: WP1045								
<b>Final A Inspection</b> Doc: QA1002								
<b>Dry pack</b> Doc: WP1033 + J- TD-033A								

The undersigned, an authorised representative of Force Technologies certifies that all the above processes performed on the quantity of devices noted above, in strict adherence to the procedures called out in the above purchase order.

<b>Engineering</b>	Signature: _____	Position: _____
<b>A</b>	Signature: _____	Position: _____

**MARKING AS PER:**

AND DATE OF ASEMBLY

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# Inspection

Within Goods Receiving Inspection all component types can be electrically characterised either on a sample basis or as 100% testing, and most of the equipment can be "bussed" so that all data is computer recorded.

The goods receiving electrical test is supported and enhanced by the Specialist Test Facility

The Specialist Test Facility has the capability to fully characterise parts both electrically and at temperature extremes with component types ranging from chip resistors to complex integrated circuits.



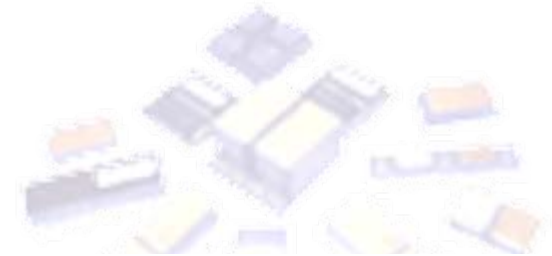
Wafer Inspection

# Acceptance

Force are able to analyse increasingly complex technologies and with the processing of ever decreasing die geometries, new inspection techniques are continuously under review.

Procurement of die has become more predominant and inspection facilities have been expanded to meet this demand.

Hybrid product has also increased in popularity and further expertise has been developed in this area.



# Storage

Dealing with issues like component obsolescence, control of multiple sources, storage, inspection and testing, Force Technologies Ltd can provide the services needed to meet your logistical requirements.

Many companies have a significant investment in stored components and this has placed more importance on the correct implementation of long-term storage.

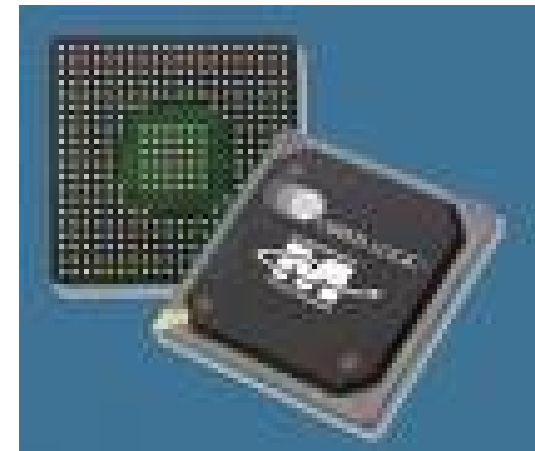
For Long Term Storage to be effective it must provide suitable protection for the parts and traceability of the Customer's investment.

The requirement is that when the part is withdrawn from Long Term Storage the part will perform the required function.

The prime objective is therefore to ensure that all parts taken from storage are in good condition.

To do so parts must enter the store in good condition and the storage must not promote any degradation.

It is imperative to "Ring Fence" the components in storage against store cleanses, misappropriation etc. Use of two storage locations.





## Storage & Kitting

Die banking allows customers to maintain stock profile of defined devices for up to 10 years (or longer in some cases). By banking the parts at the lowest cost, i.e.. die or wafer form, we enable parts to be guaranteed available for final assembly and test against the customers requirements.

Base product can be held over mirror sites for security and can be processed to standard military processes or to customers own SCD.

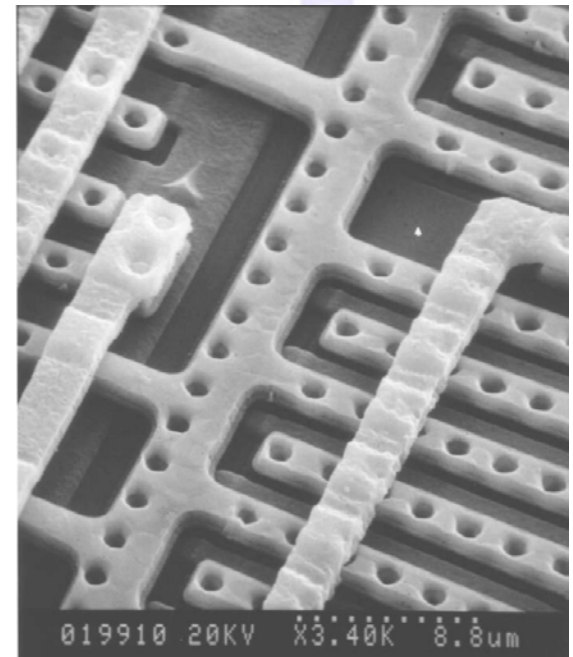
- Parts Inspection
- Visual / EM / Seal / Radiographic / DPA
- Batch Acceptance / Certification
- Pilot Screening
- Failure Analysis
- Targeted Screening
- Specialised Repackaging
- WatchDog (monitoring)
- Kitting, Distribution and Shipping

# Evaluation, Testing & Certification

We provide all varieties of evaluation and testing needed for certifying high reliability electronic components up to space or military specification. Our expertise covers;

## Initial Evaluation

- Constructional analysis
- Destructive physical analysis
- Electrical testing and measurement
- Radiation testing (total dose and heavy ions)
- Extreme temperature and pressure testing
- Environmental and mechanical testing
- Vibration testing
- Upscreening
- Failure analysis



SEM Image

# Electronic Component Testing

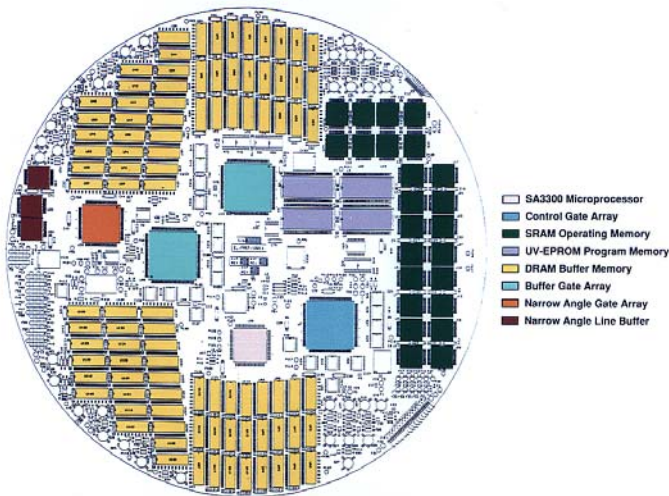
- Incoming inspection.
- Destructive Physical analysis (DPA) .
- Component evaluation:
  - Constructional analysis
  - Manufacturer audit
  - Mechanical, environmental, and reliability testing
  - Radiation testing
- Screening, upgrading, uprating, ..
- Lot acceptance testing (LAT) / quality conformance inspection (QCI).
- Failure analysis.
- Source inspection (pre-cap, buy-off).
- Relifing.
- Products comparative analysis.



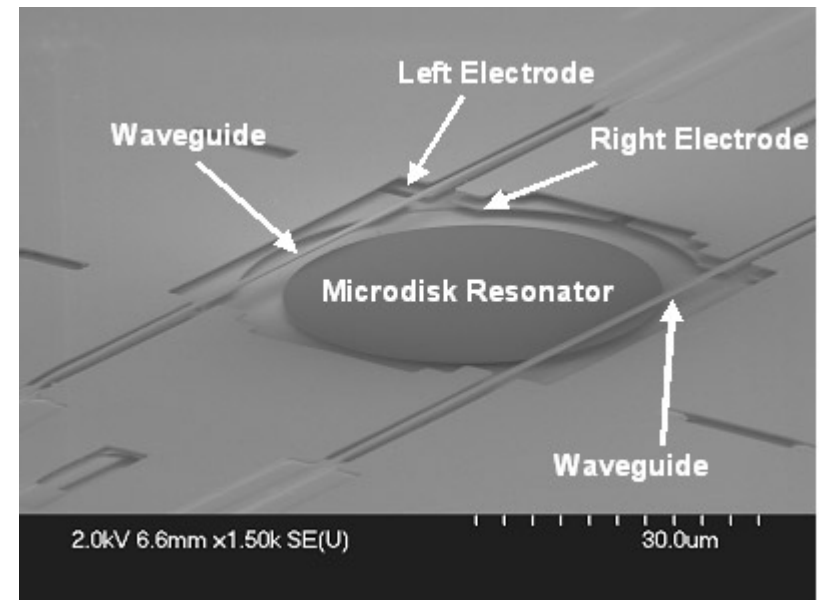
# Physical Analysis

A complete Physical Analysis test service is available, from initial Constructional Analysis (CA), to Failure Analysis (FA) and Destructive Physical Analysis (DPA).

All the above activities are performed by experienced engineers using state of the art equipment and the latest techniques.



MARS Observation Camera (MOC)



SEM Image

# Physical Analysis In Detail

## Functionality

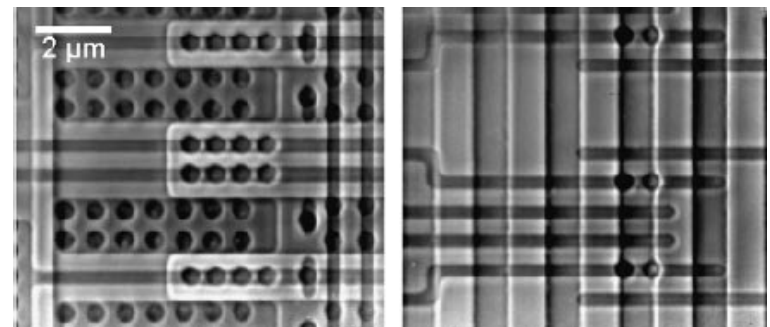
- External Optical Inspection, Mechanical Inspection, Electrical Test

## Usability

- Marking Permanence, Solderability, Lead Integrity, Lid Torque (non destructive)

## Reliability

- Fine Leak Test, Gross Leak Test, CSAM (Scanning Acoustic Microscopy), PIND (Particle Impact Noise Test), Radiographic Test, Internal Optical Inspection, Wire Bond Strength Test, SEM (Scanning Electron Microscope), FIB (Focused Ion Beam Inspection), Die Shear Test, Micro sectional Analysis



X-ray Image

# Destructive Physical Analysis (DPA)

Destructive Physical Analysis takes a small sample, normally 3, from each component batch delivered and performs a series of tests designed to prove functionality, usability and reliability.

Typical routines for destructive physical analysis are:

Functionality: external optical inspection, mechanical inspection, electrical test

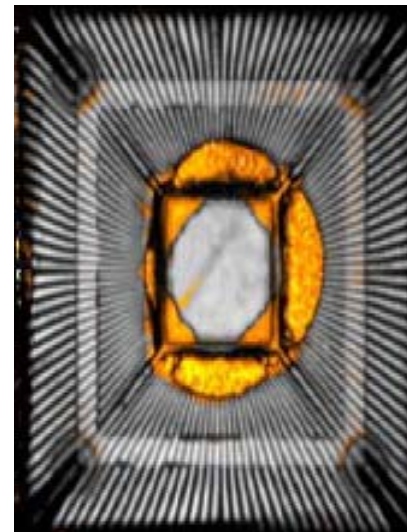
Usability: marking permanency, solderability, lead integrity, lid torque (non-destructive)

Reliability: fine leak test, scanning acoustic microscopy, gross leak test, particle impact noise detection, radiographic inspection, internal optical inspection, wire bond strength test, scanning electron microscope

# Constructional Analysis

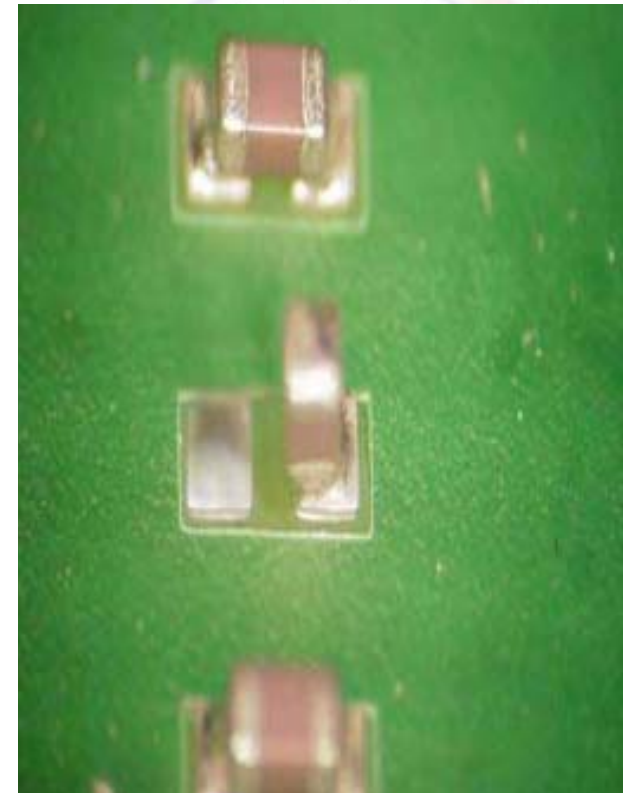
Constructional analysis routinely follows the flow of Destructive Physical Analysis, but includes certain extra elements, for example: -

- Electrical characterisation, Die mapping, Materials analysis, Microsectional analysis



# Failure Analysis

All Failure Analysis investigations begins with establishing the nature and location of the reported failure occurrence and may involve investigating the application of the component. Failure analysis is much more than simply the customer supplying a defective component to our Laboratory and awaiting an answer, it is a two way process. Our approach to failure analysis is to have an agreed series of actions:-





# Electrical Characterisation

## Passives Devices

- For Passive Devices testing, we have access to a comprehensive set of equipment, which permits the characterisation of the electrical behaviour of resistors, capacitors, coils, etc., in a wide range of test conditions and according with their applicable specifications.

## Active Devices

- For Active Devices testing, we also have access to a comprehensive set of equipment, which permits the characterisation of the electrical behaviour of discrete (diodes and TRT) through standard linear and digital components to VLSI.

## RF Devices

- RF Component testing requires specific equipment, coupled with a broad experience and accumulated historical knowledge. Typical tests include S parameters, power, noise and frequency measurements.

# Mechanical Testing

Mechanical Testing includes : -

- Dimensions and weight check
- Solderability testing
- Destructive and non-destructive semiconductor wire bond strength test
- Gold wire ball shearing
- BGA solder ball attachment
- Semiconductor die shear strength testing
- Terminal strength test of semiconductors and passive components.
- Cross Section Inspection



# Dimensions and weight check

Dimensions and weight check on EEE components are necessary operations to compare and confirm the actual dimensions and weights with those stated in the manufacturers specifications.

The aim of this test is to detect manufacture deviations or handling damages that could affect to the device assembly and the final application.



# Optical Inspection

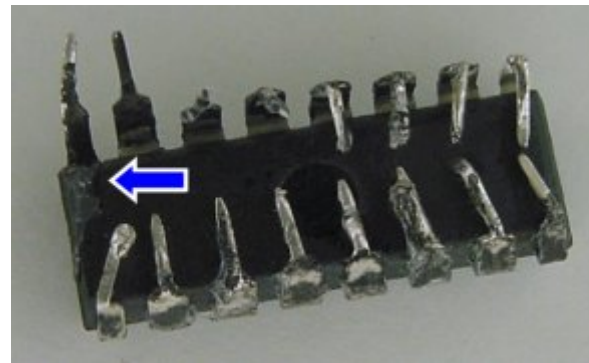
## External Optical Inspection

This is a process to verify the conformity of the external component appearance: -marking, sealing, leads, vias, and other features, with the manufacturers specification, thus detecting any manufacture or handling defects.

## Internal inspection

This is performed to assess the internal appearance, materials, design, construction and workmanship of all EEE component device types.

All of these images are captured electronically for ease of reporting to customers.

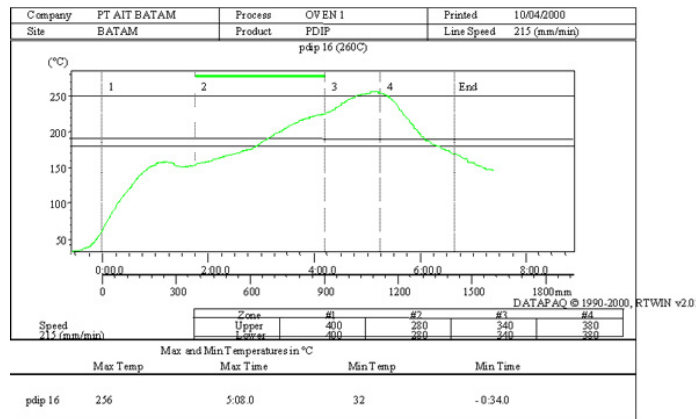


# Solderability Test

The Solderability Test is used to examine the suitability of differing solder terminations using a standard soft soldering process, verifying whether or not the terminations have a new and uniform solder coating after being wetted by a solder melt.

Different techniques are available: -

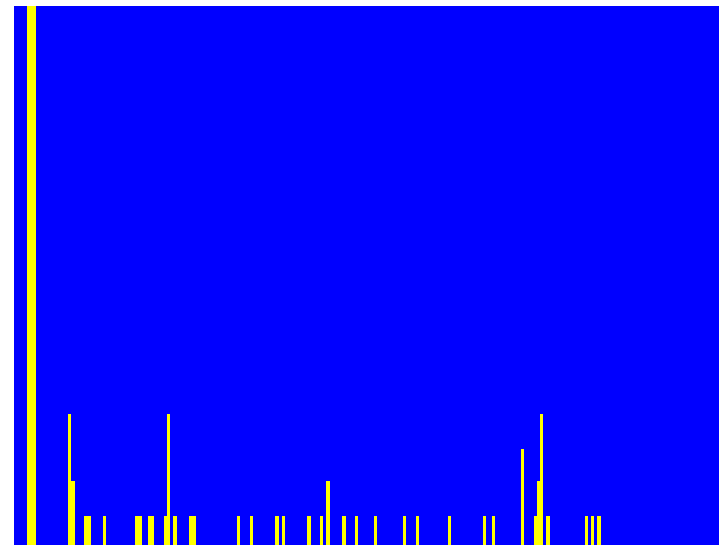
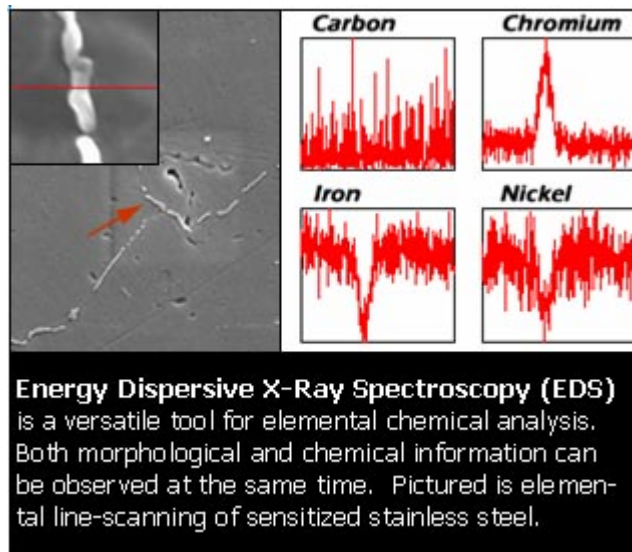
- wetting balance
- globule test
- solder dip



## EDS (Energy Dispersive X-Ray Spectroscopy)

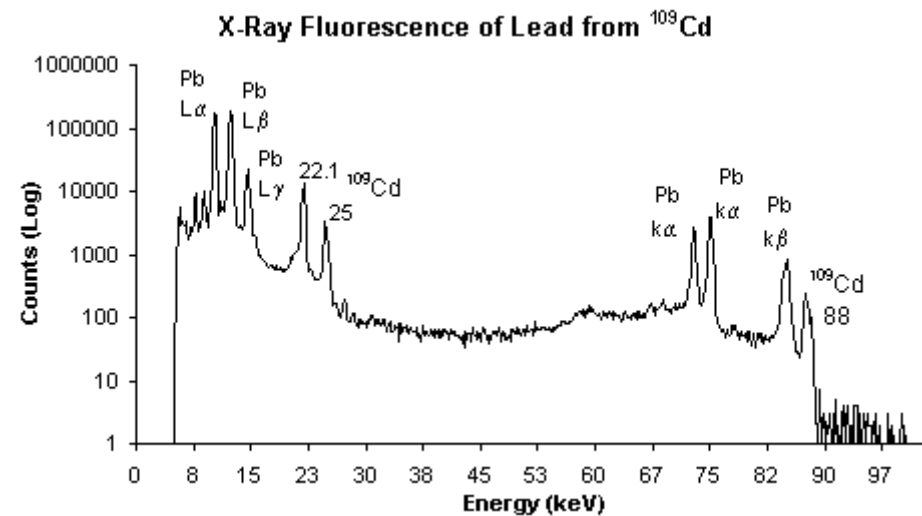
EDS (Energy Dispersive X-ray Spectroscopy) is a valuable add-on to the SEM. The EDS is a semiconductor device used to detect and measure the energy of X-rays emitted from a sample.

This is very useful for detecting the material elements in a sample, such as Lead (Pb) or Tin (Sn).



## XRF (X-Ray Fluorescence Spectroscopy)

XRF (X-ray Fluorescence Spectroscopy) is a valuable aid for quickly and cost effectively determining the tin/lead (Pb/Sn) or RoHS pure tin (Pb) lead finish of a component.



# Harsh Environment Testing

Environmental Testing including:-

Hermetic seal testing using helium gas as a tracer (fine leak)

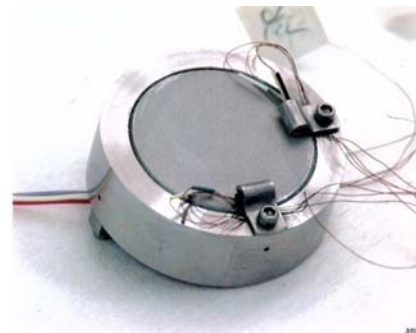
Hermetic seal testing using various liquids (gross leak testing)

Hermetic seal using a penetrating dye

Permanency of marking (resistance to solvents)

PIND (Particle Impact Noise Detection) for detecting loose particles in hermetically sealed packages

Complemented by a wide range of ovens, temperature cycling, thermal shock and humidity chambers are available.

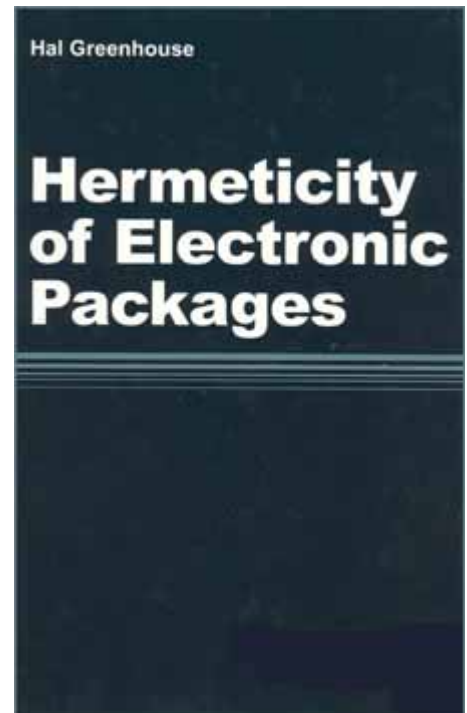




## Hermeticity Test

This test determines the effectiveness of the sealing of a component, used mainly for hermetic packages with internal cavities.

- Some of the techniques available are : -
- Fine leak testing (with helium)
- Gross leak (bubble test)
- Penetrating Dye (followed by De-cap)



# Temperature Testing

Hot and Cold testing, in dry and damp atmospheres, cycling between the limits of the specified temperature range. Temperature cycling can have a wide range of temperature change rates, using tests such as:

- thermal shock air to air
- thermal shock liquid to liquid



# Terminal Strength Test

Terminal Strength Test is used to determine whether or not the design of the terminals and their method of attachment is sufficiently robust to withstand one or more of the mechanical stresses encountered during installation and service.

Different techniques are available:

- lead fatigue
- pull test
- torsion test

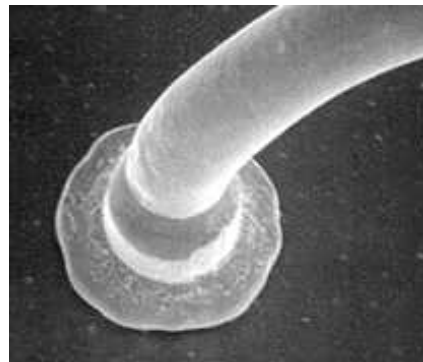
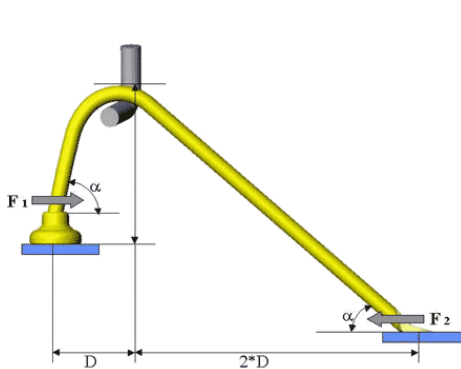


# Bond Pull and Die Shear Test

Bond Pull & Die Shear are a set of mechanical tests designed to verify the mechanical integrity of some constructional elements.

Bond pull test measures the wire-bond strength detecting manufacture or handling defects.

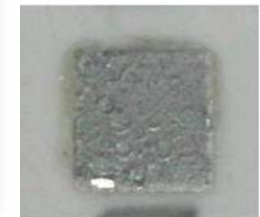
Die shear test determines the integrity of materials and procedures used to attach semiconductor die or passive elements to package headers or other substrates.



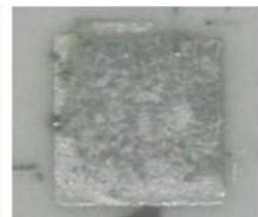
SnAgCu to die (AgPd pad)



SnAgCu to Ag pad



SnPb to die (AgPd pad)



SnPb to Ag pad

## Biased Burn-in, Humidity, Life-test, HAST.

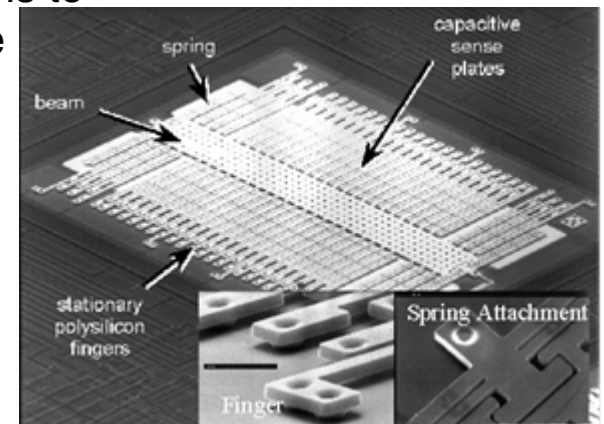
These are a set of tests that combine the environmental conditions (temperature, moisture and pressure), with a certain degree of electrical stress.

Burn-in (to remove the infant mortality),

Life test (to verify reliability mainly related to the active elements), and other tests like

Moisture and HAST, that are oriented to specific technologies.

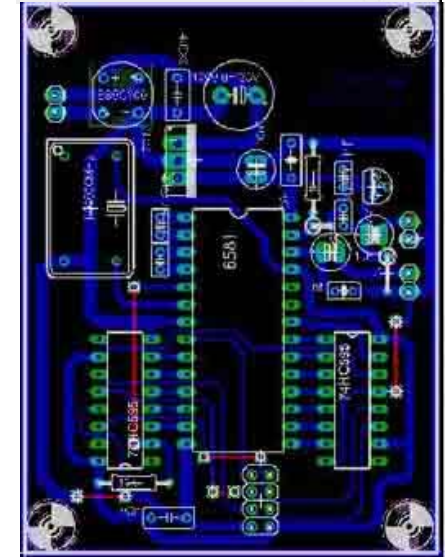
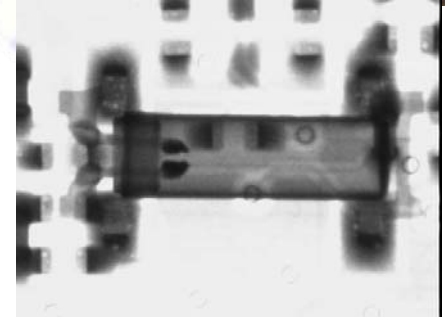
Force Technologies Ltd have access to a wide number of differing chambers and biasing systems to allow the application of these tests across a wide range of parameters and conditions.



# X-ray

This non-destructive technique is able to detect internal defects (design, construction or handling) on the devices: foreign objects, improper interconnecting wires, voids in the die attach material.

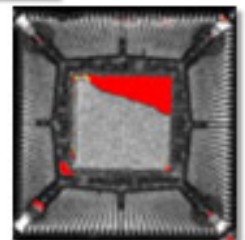
Dynamic X-Ray or Fine Focus X-Ray or Real Time X-Ray are terms for a form of radiographic inspection where the engineers sees the X-Ray image of the component on a TV monitor and can manipulate the component in the X-Ray chamber. No X-Ray film (plates) are involved. Not only can the position of the image be manipulated but the magnification of the image may be varied from X1 to X1,000. Images are captured electronically and are transferred directly to the final report.



# SAM (Scanning Acoustic Microscopy)

SAM (Scanning Acoustic Microscopy) uses ultrasound pulses to assess the attachment of layers of materials in a solid component. The most immediate application is in assessing the quality of the adhesion of the plastic encapsulant of microcircuits to the silicon die and the metal leadouts. Good adhesion is essential for good reliability.

SAM can be used to identify delaminations (separations between two layers), internal cracks or bubbles usually in plastic components, PCB's , and therefore not detectable using X-ray.



# SEM (Scanning Electron Microscopy)

SEM (Scanning Electron Microscopy) forms a three-dimensional image on a cathode-ray tube by moving a beam of focused electrons across an object and reading both the electrons scattered by the object and the secondary electrons produced by it with a high degree of magnification.

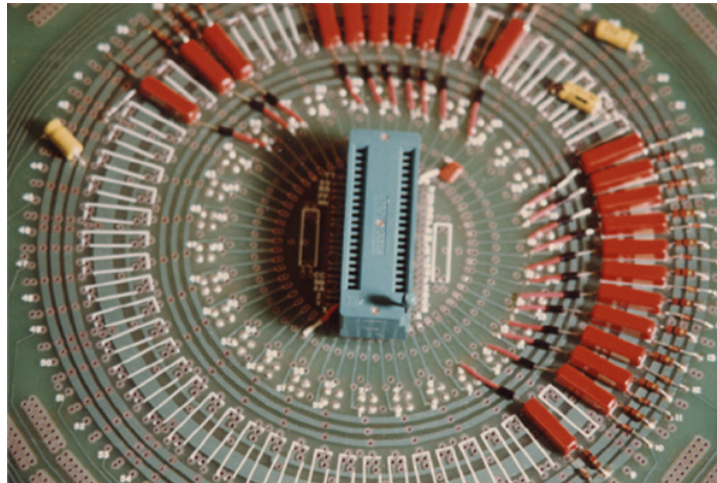
SEM can be used to check the interconnect metallization on integrated circuits, metal step coverage and bond attaches.





# PIND (Particle Impact Noise Detection)

- The PIND (Particle Impact Noise Detection) test provides a non-destructive means of identifying if components with internal cavities contain no loose articles or objects.
- These particles could be the origin of an electrical anomaly or another physical problem, which could produce a malfunction of the component, affecting its reliability.

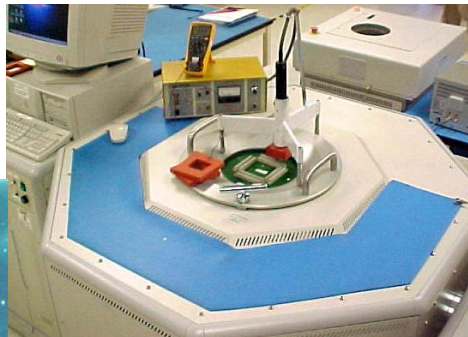
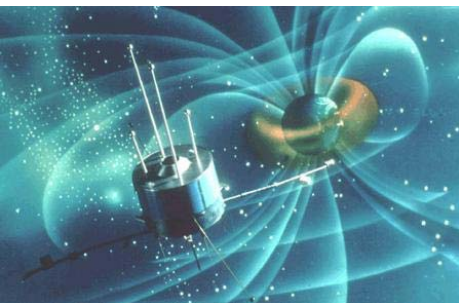


# Radiation Testing

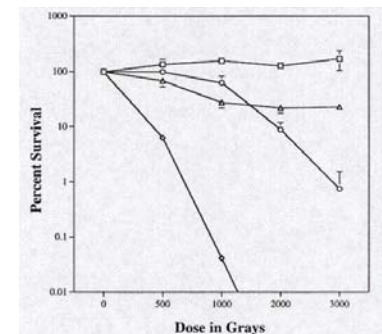
It is well known the negative effect radiation has on components, equipment and systems.

New smaller component feature sizes, and the continued advancement in technologies and applications trends are bringing this subject to the fore, necessitating the resolution of radiation issues early in the project phases.

Radiation is not only relevant in the classic radiation environment (space, high energy physics, etc) but also for electronics at avionics and ground altitude with more components being susceptible to Single Event Upset.



The low intensity irradiator



# Contents

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- Experience & Heritage
- Structure
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- Capabilities
- Skills



# FORCE Competitive Advantage



## People

- Entire Company is Customer Focused
- 99% Customer Satisfaction, 100% On Time Delivery
- Mature Management Team (>20 years average industry experience)

## Services

- Support All Device Technologies (RF, M/S, Linear, Mem & Dig)
- ISO 9001:2000 Registered, AS9100 accredited
- SC21 signatory
- Project facilitation

## Experience

- 23 Year History.
- Project Management & Engineering Expertise
- Equipment & Facilities and accredited sub-contractors and technology partners
- Broad Equipment Base (Testers, Chambers and Handlers)
- Cold & Hot Temp Automated Handlers
- Inhouse quality auditors

## Systems

- Web based report access, Lot Tracking Database
- Automated scheduling

# Contacts

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# Questions



Thank you for listening