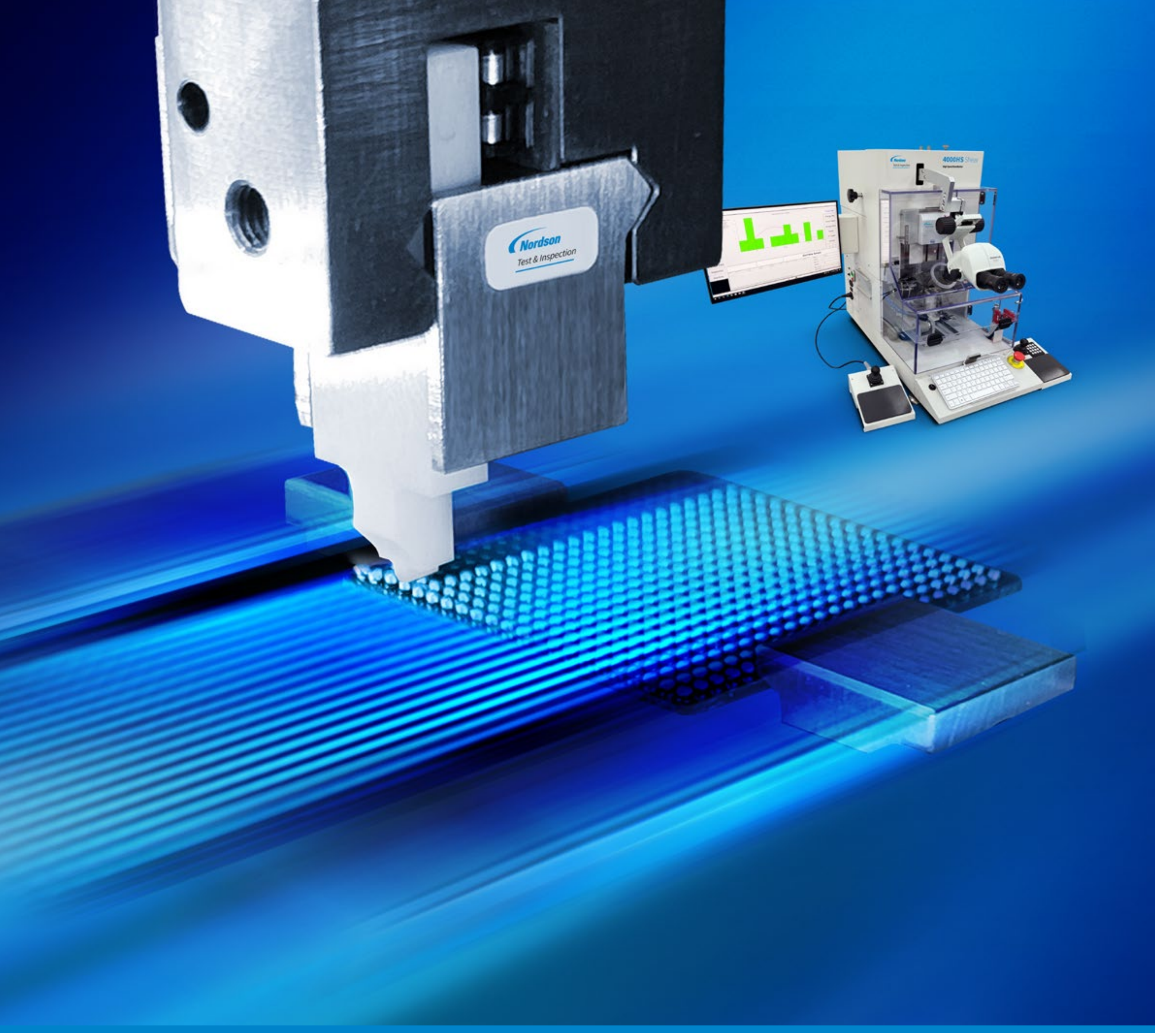


4000HS Shear

High Speed Bondtesting

www.nordson.com/TestInspect

Nordson
Test & Inspection

Nordson Test & Inspection

Founded in 1954, Nordson Corporation is a market leading industrial technology company with annual revenues of over $2.1 billion and more than 7,500 employees worldwide.

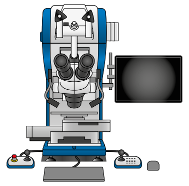
Nordson Test & Inspection offers its SMT & Semiconductor customers a robust product portfolio, including Acoustic, Optical and both Manual and Automated X-ray Inspection systems, X-ray Component Counting systems and Semiconductor measurement sensors. Nordson Test & Inspection is uniquely positioned to serve its customers with best-in-class precision technologies, passionate sales and support teams, global reach, and unmatched consultative applications expertise.

Exceptional support
from Nordson's worldwide network

BT Products

Test Your Design

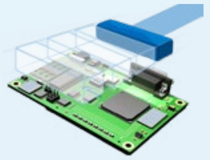
Bondtesters

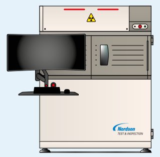


MXI Products

Making the Invisible, Visible

Manual
X-ray Inspection

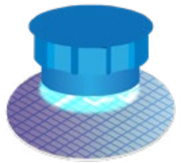


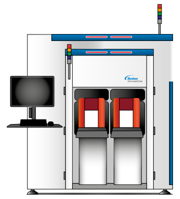


AXM Products

Measuring the Invisible

Automated
X-ray Metrology

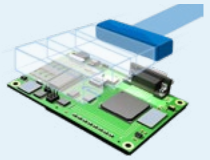


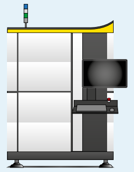


AXI Products

High Speed High Flexibility

Automated
X-ray Inspection

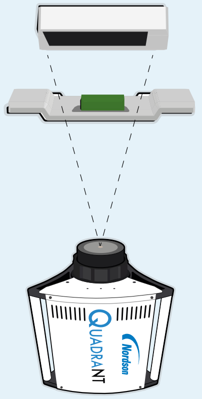




XT Products

High Speed High Resolution

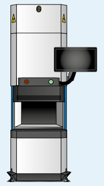
X-ray
Technologies



CC Products

Count On Us™

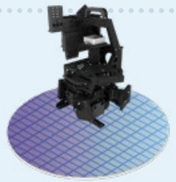
X-ray Component
Counting



AOI Products

Proprietary Advanced Technology

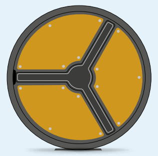
Optical Inspection
& Metrology



WS Products

Improve Your Yields

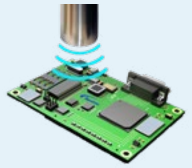
Semiconductor
Metrology Sensors

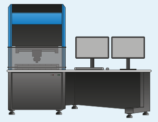


AMI Products

Qualify Your Design

Acoustic
Inspection





Repeatability, Reliability, Accuracy

The 4000HS Shear proudly maintains Nordson excellence in repeatable, reliability and most importantly the accuracy of measurement data, which are powered by carefully engineered motion system and patented high speed transducer technology.

Since its First Introduction

4000HS Shear has provided every customer with quality assurance, dependable performance and savings from ever more expensive drop testing.

High Speed

Up to 4M/Sec (4000mm/sec) Shear with automatic software controlled “retraction distance”.

Patented Technology

Ultra-high band width force measurement transducers (patent).

Safety as Standard

Built in automatic safety guards using interlocks (CE and UL compliant).

Configurable

Test results selectable in Force/Grams or Energy/Joules.

Paragon™ Software
Easy-to-use in production

Ergonomic Design
Microscope, keypads & joysticks

Traditional Bondtesting

Traditional bond testing is carried out at relatively low speeds (less than a 1mm/sec for shear and 5mm/sec for pull) and the principal failure mode is ductile failure of the solder itself. Research has noted that lead-free joint can be particularly susceptible to brittle fracture at the ball-to-pad interface.

These failures can occur over the full life-cycle of a solder joint from manufacturer to the end product. With the volume increase in the packaging techniques in heterogeneous integration, the risk of brittle failure is rising. The impact of brittle failure can be even more expensive compared to a single FC-BGA.

High Speed Bondtester

Nordson 4000HS Shear test regime requires an area in which the tool (in reality, the test ball) can accelerate before contacting the ball. This is achieved by retracting the sample holder to an automatically calculated distance according to the speed chosen. Shear transducers covers industry standard solder bump and C4 bump sizes.

Superior Performance

High speed bond testing offers a viable alternative to cumbersome and expensive board level drop testing. Essentially, high speed bond testing reproduces the configuration of drop testing by applying high strain rates to the solder bump, thereby hardening the solder and largely transferring the load to the bond interface.

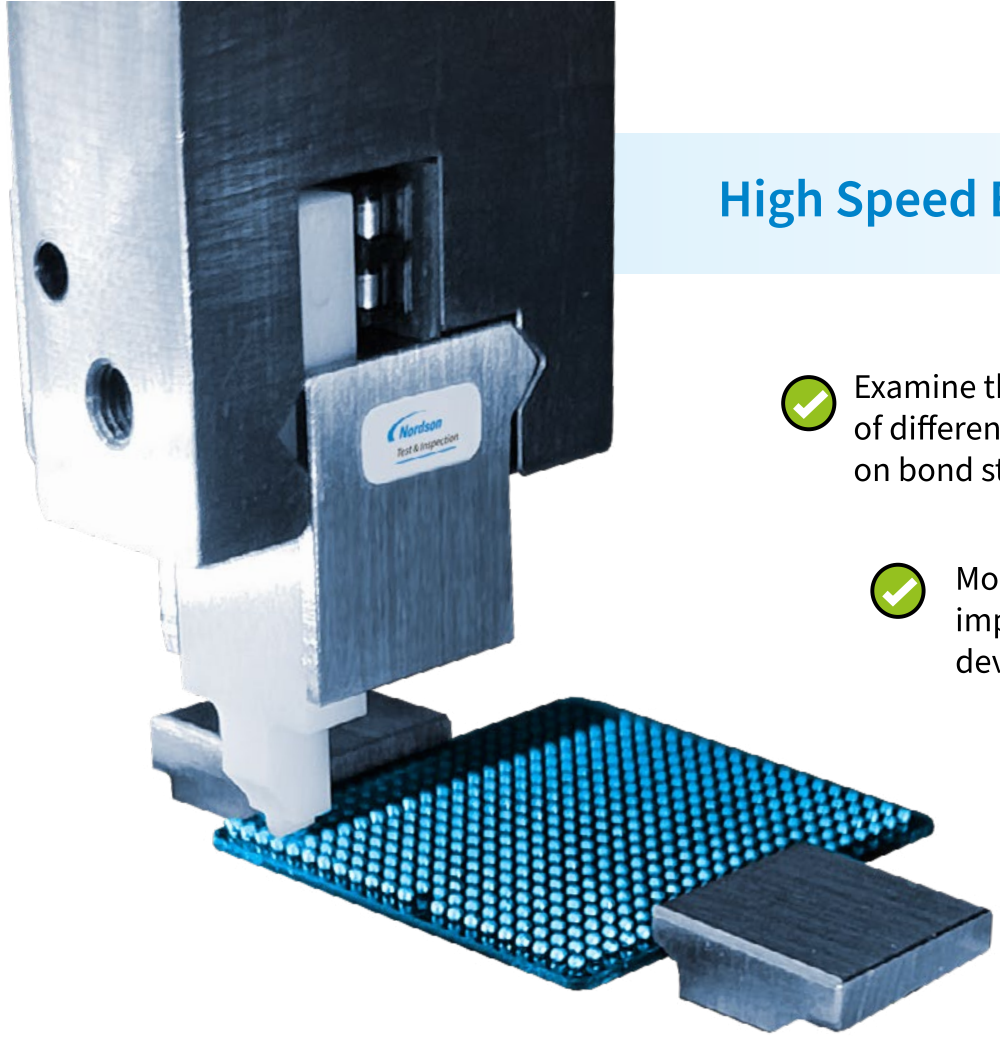
Why High Speed Testing is Important?

Joints are exposed to high strain rates during both manufacturing and during their working life.

One potential problem has recently been identified as a major area of concern and that is "Brittle Fracture" joint failures.

There are a few reasons why a joint may degrade such that it fails later in life and a few of the potential failures are related to process problems during manufacturing.

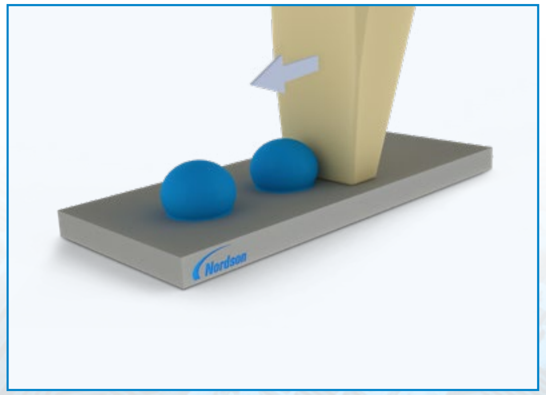
High speed testing more accurately simulates these conditions than traditional test speeds. Better position to identify potential future failures



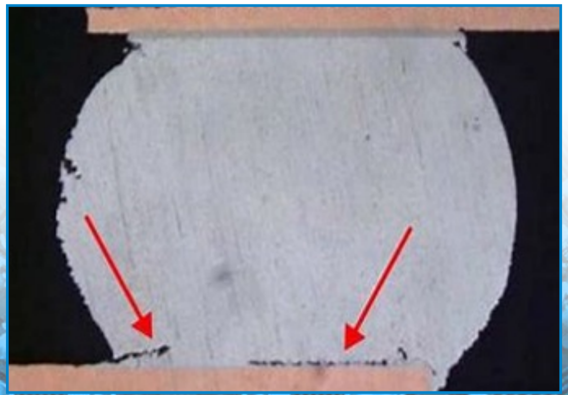
High Speed Shear Testing

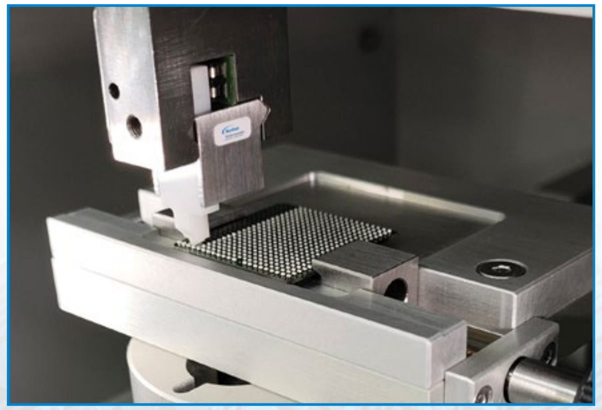
High Speed Bond Testing Can:

- ✓ Examine the influence of different materials on bond strength.
- ✓ Effects of thermal aging.
- ✓ Monitor process improvements in device bumping.
- ✓ Proven method to substitute board level drop test and impact testing.



Ball Shear





4000HS workholder and transducer

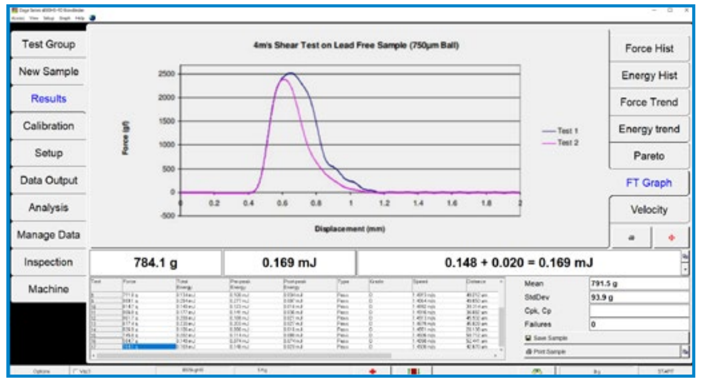
Data Analysis

Digital data capture offers the possibility of detailed information on the bond failure.

Failure Force Analysis

Force-displacement curves provide signature shapes for different types of bond failures.

In addition, fracture energy values (which can be subdivided into pre and post-peak load energies) give the means to further characterize the bond and differentiate between different failure types. For example, the total fracture energy for a brittle failure is generally much less than that for a ductile failure.



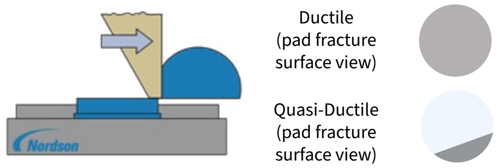
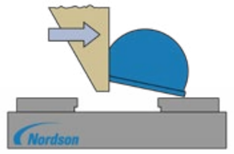
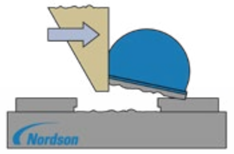
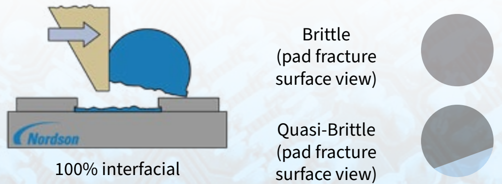
784.1 g

0.169 mJ

0.148 + 0.020 = 0.169 mJ

Mean: 791.5 g
StdDev: 93.9 g
Cpk, Cp:
Failures: 0

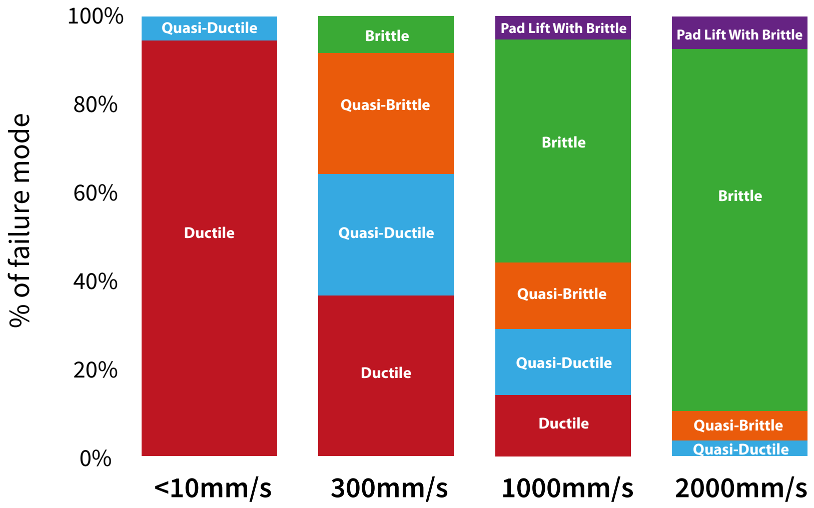
Possible Failure Modes

Failure Mode	Description	Illustration
Type A: Ductile	A – Ductile: Solder ball fracture at or above the surface of the solder mask within the bulk solder material.	 Ductile (pad fracture surface view) Quasi-Ductile (pad fracture surface view)
Type B: Quasi-Ductile	B – Quasi-Ductile: Mixed ductile/brittle fracture with the dominant failure mode (>50% area) being ductile.	
Type A: Pad Lift Or Type B: Pad Crater	A – Pad Lift: Solder pad lifts with solder ball. B – Pad Crater: Lifted pad includes ruptured base material.	 Pad separation at base material or  Lifted pad includes ruptured base material
Type A: Brittle	A – Brittle: The break is at the solder/intermetallic interface or intermetallic/base metal interface.	 100% interfacial fracture Brittle (pad fracture surface view) Quasi-Brittle (pad fracture surface view)
Type B: Quasi-Brittle	B – Quasi-Brittle: Mixed brittle/ductile fracture with the dominant failure mode (>50% area) being brittle.	

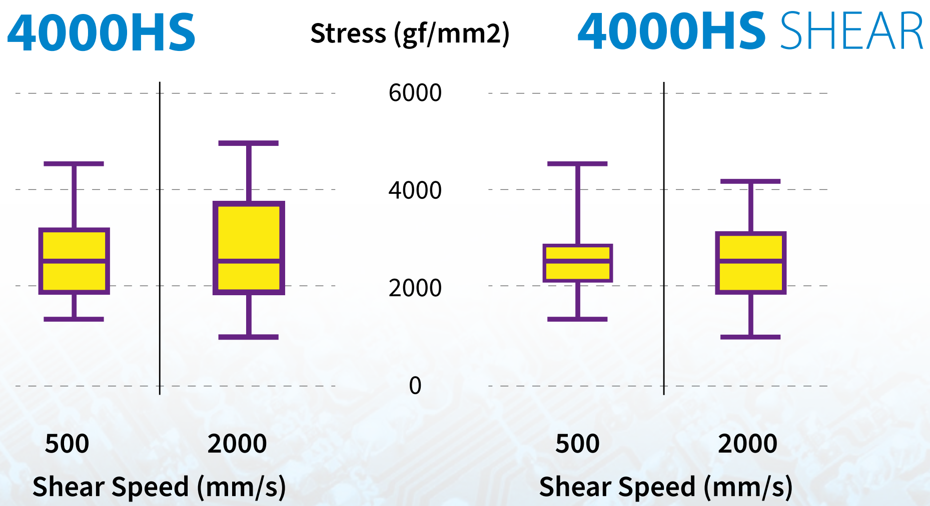
Why we do High Speed Testing

4000HS Test Data

4000HS Shear's exceptional high speed motion control and data acquisition capability deliver the characterization requirement of the Pb-free joint quality under high strain rate. Its controllable test speed helps draw a comprehensive picture of the joint material quality.



Whilst ensuring the data correlation with the mature products, Nordson leveraged its manufacturing excellence and process improvement to deliver a system with increased performance minimising quality tool's influence on your manufacturing Process Capability Index.



Nordson Paragon Software

Nordson Paragon™ software takes bond testing to the next level. Its highly intuitive and configurable interface provides quick and easy access to advanced functionality, increasing efficiency and providing 100% confidence in your bond testing results.

PARAGON

Intelligent Bond Testing

Quick and Easy Test Set-Up

Intuitive design ensures test set-up parameters are easily accessible with the start-up check list enabling a quick start.

Advanced Data Presentation

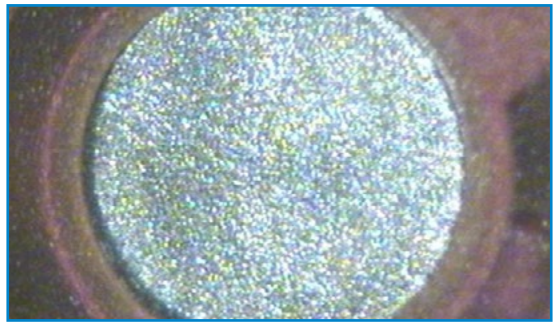
Extensive charting functionality allows several graphs to be displayed at once and to resize and zoom in easily.

Consistency Guaranteed

Failure mode grading available to provide analytical information for each test. GR&R is tool kit is available to determine the bond testers repeatability and reproducibility.

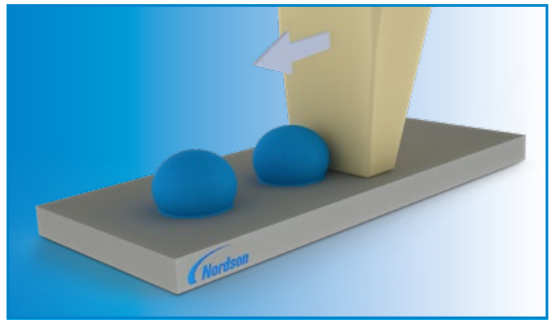
Applications

Nordson's 4000HS Shear Bondtester supports your Semiconductor (Package Assembly and Test), Substrate Manufacturers (New Materials/Plating Qualification), Materials Manufacturers (New Materials Qualification), Lead Free Product Qualification and R&D / Development.



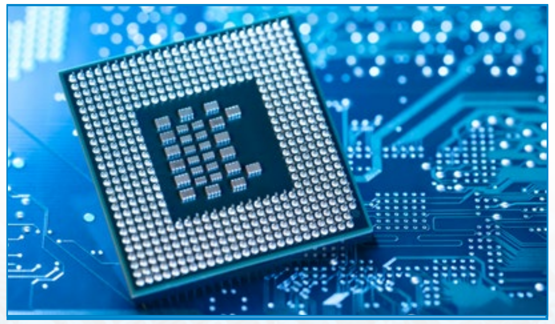
Lead free solder brittle fracture joint analysis

One potential problem has recently been identified as a major area of concern in the industry is "Brittle Fracture" joint failures. High speed testing more accurately simulates these conditions than traditional test speeds. Better position to identify potential future failures.



Alternative to electronic devices drop testing and impact testing

Essentially, high speed bond testing reproduces the configuration of drop testing by applying high strain rates to the solder bump, thereby hardening the solder and largely transferring the load to the bond interface.



Test every interconnect on a device

BGA, CSP, QFN, SiP, MCM, solder joints, bond pad and substrate evaluation.

Specifications

Key Features	
Software	Paragon V10
Adapter	Application specific (please consult factory)
Optical	Olympus SZ51 binocular
PC & Monitor	Factory configured PC & Dell 24@ monitor
Transducer	Ultra high bandwidth force measurement technology
Cartridge	High speed shear 5KG
Motor	high precision DC servo motor
Installation	
Footprint (W × D × H)	1100mm (excluding PC) x 850mm x 670mm
Weight	110kg
Power supply	100/110V, 220/230V AC, 50/60Hz switchable
Pneumatic supply	5-7 bar, 6mm OD/4mm ID plastic pipe
Interfaces	RS232 opt. network card
Vacuum supply (workholders)	Min 500mm Hg plastic pipe
Test Parameters	
Programmable	Shear speed, step back height, landing speed, fallback, overtravel, grade list and product group fields
Sample dimension	100 x 45 x25mm

Performance	
Step back accuracy	± 1 µm
Sample Size	100 mm × 45 mm × 25 mm
Shear in Y axis	Adjustable up to 4m/sec
Shear in Y axis	Ball Shear 5kg (+/- 1% FSD)
Analysis Features	
Statistics	Force or energy results, min, max, mean, range, standard deviation, m-3s, CpK, Cp
Measurement	Force vs Distance/time graphs, Energy results: total, pre-peak and post-peak load.
Certification	
CE	Machinery, EMC & RoHS
Factory accreditation	ISO 9001:2015
Environmental	ROHS (2011/65/EU)

For more information, speak with your Nordson representative or contact your Nordson regional office

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www.nordson.com/TestInspect

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THE QUEEN'S AWARDS FOR ENTERPRISE: INTERNATIONAL TRADE 2020

BR-4000HS 09/06/2025

Nordson
Test & Inspection