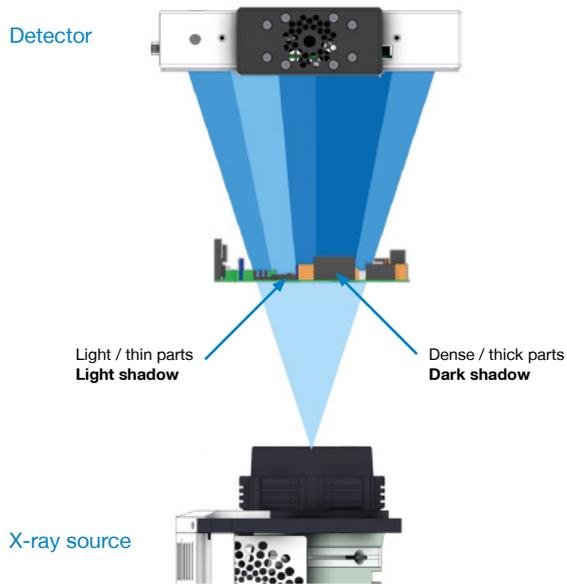


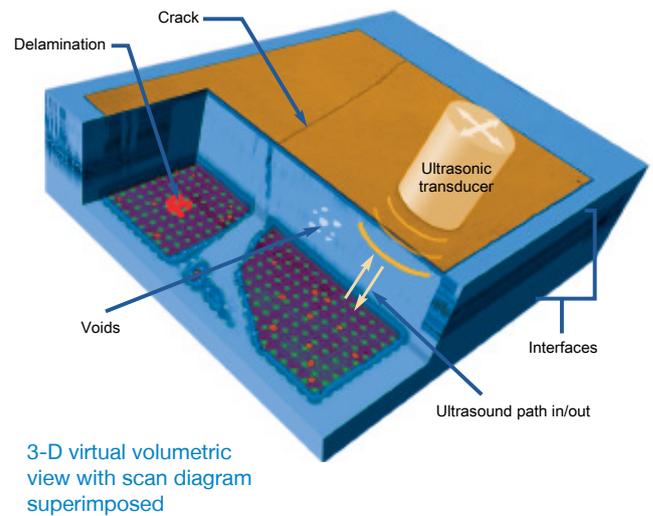
X-ray and Acoustic Inspection

Application Note

X-ray and acoustic imaging are two very complimentary tools for non destructively inspecting the quality of electronics components. Both techniques give information on different aspects of component integrity.



X-ray images are created by transmitting X-rays through the sample and detecting the shadow image it casts. Higher density materials such as solder cast a darker shadow while lower density regions such as voids cast a lighter shadow, making it easy to see features such as voiding.

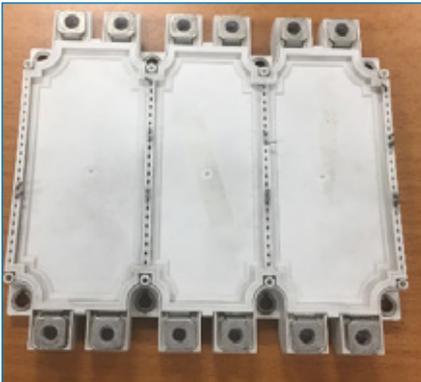


Acoustic imaging transmits high frequency sound waves into the sample. Reflected sound waves reveal delaminations, voids, cracks and other features. The echo time gives depth information making it easy to inspect sample quality at different layers. Transmitted sound waves may also be measured to image features throughout the sample.

X-ray and Acoustic Inspection

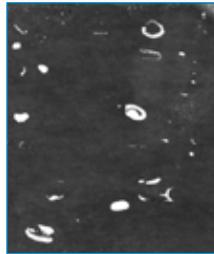
Application Note

IGBT Power Device

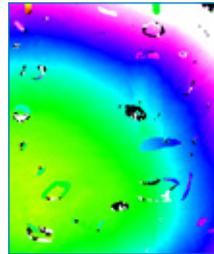


Efficient heat dissipation is particularly important for IGBT power devices and it is important to minimize the amount of voiding at interface layers.

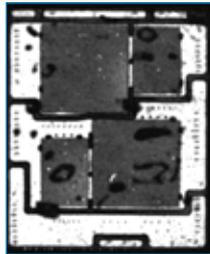
Acoustic



Solder interface layer (voids in white)



Color variation of solder thickness

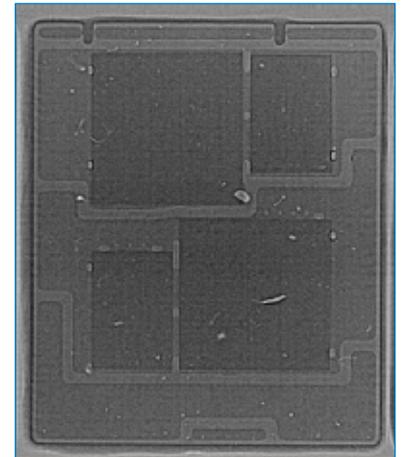


Individual dies visible



Dark spots wire bonds

X-ray



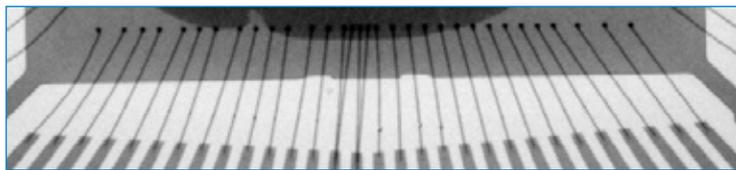
Clear resolution showing everything in sample

PEM Device



High quality wire bonding and good encapsulation quality ensures good device performance.

X-ray



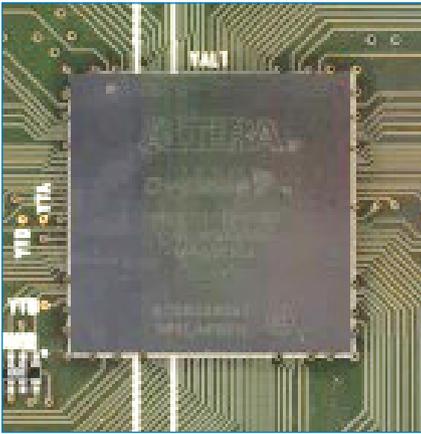
Wire bond breaks visible

Acoustic



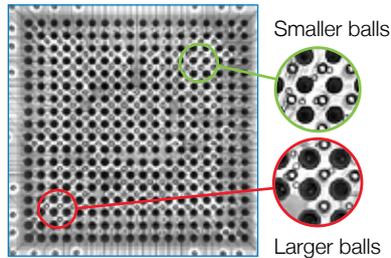
Package crack which caused the break clearly visible

BGA Device



High quality reflow of the solder balls connecting the device to the PCB ensures long term reliability. Good device encapsulation is also important for durability.

X-ray

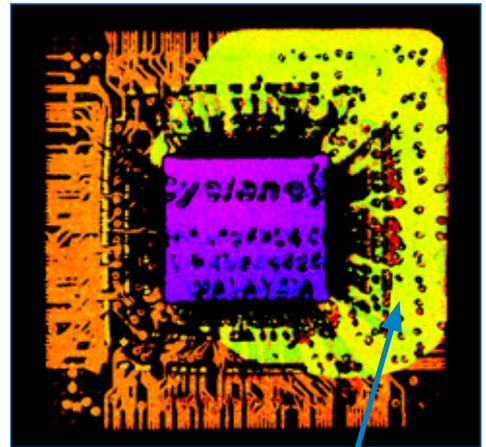


Large difference in ball size visible (warped reflow)



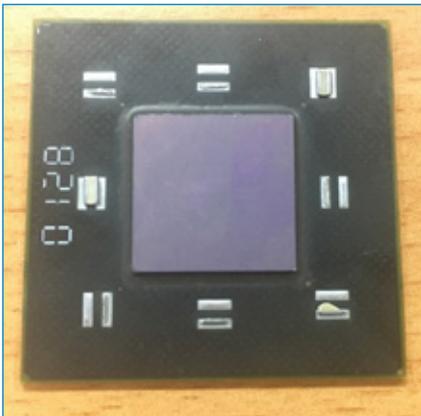
3D visualization using X-ray CT shows head in pillow defect and solder ball cracking

Acoustic



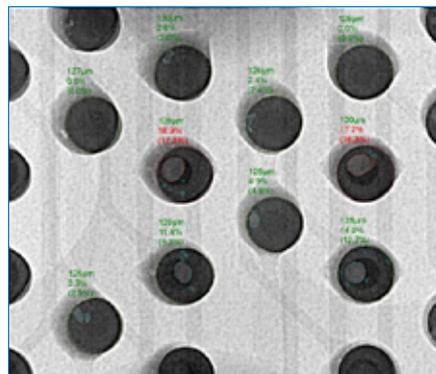
Package delamination at substrate

Flip Chip



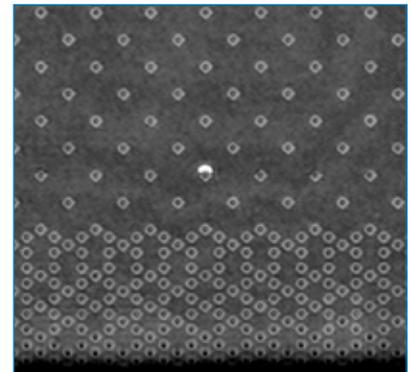
Internal solder bump size and voiding can affect device performance, as can underfill and encapsulation quality.

X-ray



Solder ball size and voiding

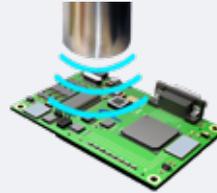
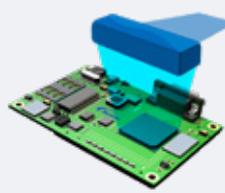
Acoustic



Underfill delamination at bumps

Summary

Together, Nordson X-ray and acoustic inspection tools provide the full picture.



Applications	X-ray	Acoustic
Solder, heavy metals and dense plastics	✓✓✓ Good X-ray contrast	✓✓ Limited Acoustic contrast
Organic and light metals	✓✓ Limited X-ray contrast	✓✓✓ Good Acoustic contrast
Defects		
Voiding	✓✓✓	✓✓✓
Delamination	Limited	✓✓✓
Solder open, bridging, head in pillow	✓✓✓	✓
Cracks	✓✓	✓✓✓
Wire bonds	✓✓✓	Limited
Modes of operation		
Imaging modes	Transmission	Reflection, transmission, surface flatness/warpage
Solutions		
Laboratory based inspection	 Nordson DAGE Quadra®	 Nordson SONOSCAN Gen7™
High throughput inspection	 Nordson MATRIX XS Series	 Nordson SONOSCAN Facts2™ DF2400

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

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