

# STVision

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## Wire Bond Inspection System For Thick Wire AI Bonds Nov 2005 STVision

Aluminum wire bonds are inspected directly in the line, or on the bonder. The system replaces the requirement of third optical inspection in the production line of semiconductors.

Today the process of die and wire bonding has reached a level of high stability and reliability. Nevertheless every production process has the implication to get out of tune, with the result to produce undesired defected units and create yield loss.

In addition, some random failures remain undiscovered in today's statistical inspection methods. These can be surface scratches, die damages, cracks, or defects on wires. Any of these defects might not show up on electric tests, but might result in defective operation long after being delivered to the customer.

The system uses an unconventional optical method for obtaining the 3D wire loop height from just one top view camera. Because of this, the camera module is very compact, and can be integrated on the indexer track of the wire bonder. The operation is real time to the throughput of the bonder.

As a result, the production throughput is not affected. The system remains virtually invisible unless there is a serious problem on the process, when can either punch leads of the defective units, or stop the bonder and call for technical assistance (in case of repeated defects).

The system executes

- Position of the leadframe,
- Position of the die,
- Inspection of the die surface,
- Detection of solder / epoxy splash,
- Die chips, cracks, scratches,
- Measures the bond location,
- Measures the wedge width and tail,
- Broken wires,
- Wire sweep,
- Bad bond scheme,
- Measures the loop height in direct side view,
- Lifted bonds,
- Partially lifted bonds,
- Double bonds,
- Epoxy wetout.
- Up to 6 cameras for inline operation



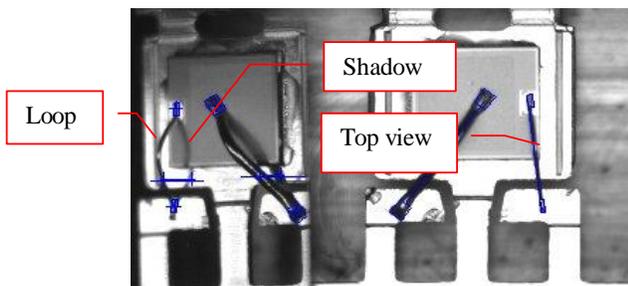
## Operation Mode

Aluminum thick wire bonding for power devices has long been recognized as a safe process. No inspection needed. However, this has changed recently. So STV offers an automatic inspection module, either be mounted to a bonder, or integrated with punch and index unit on an AutoLine.

The system consists of up to four camera modules. All modules are identical, and serve inspection on one track each in matrix frames. The modules include optics for 3D wire and wedge height measurement.

Three views to the device (top and two side views) are combined into a single camera image. The wire loop and wedge profile are directly visible in the side view. The spacing between shadow cast and wire directly correlates to the loop height. The system evaluates the XY loop profile first, and then utilizes the side views for height calculation.

In subsequent image you have an example of the shadow evaluation (red marks). Shadow and loop are measured at specific user defined points. Tolerances can be set for minimum and max loop heights.



This special combination of shadow / wire allows to execute loop height inspection. Result is detection of

- depressed wire loop,
- bond shortage of wire at edge of pad/die,

## Technical Data

Camera	Parameter	Dimension
Resolution	1280 x 1024	Pixel
Image	16 x 13	Mm
Pixel size (configurable)	13	Micron
# of cameras	1...6	cameras
Die Position	+/- 5	Micron

- partially lifted bonds.

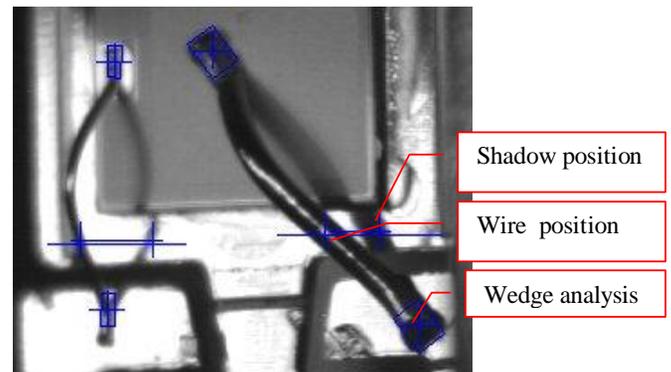
All of these items have always been critical to thick wire Al bonds, and are considered very difficult for automatic testing.

Specifically the partially lifted bond may not even be discovered during pull testing.

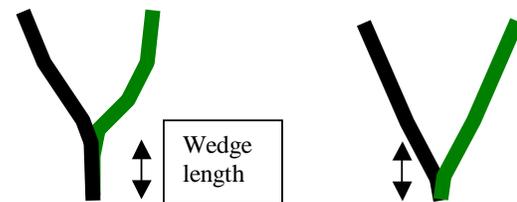
The die surface is also inspected for particles, epoxy splash, cracks and chipping, scratches, and other defects. The die position is measured and tested against tolerances. Wrong or rotated die (product mix) is automatically rejected.

The epoxy wetout around the die is inspected for insufficient epoxy.

Outside of the wetout area, the system checks for epoxy splash on forbidden area. The external die and specifically the leads (bond area) should be clean of epoxy splash.



See the difference between good bond (left) and partially lifted one (right):



Wedge position	+/- 8	Micron
Die surface defects	>= 18	micron
Wire tracer	6	Micron
Wire loop height	15	micron
Wedge height	15	micron
Performance (1 camera)	8000	UPH

