

Addressing Package Chip Out Corrective Action Through Point to Point Sensor to Detect Dislodge Units

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I. OVERVIEW

- Package Singulation process is a form of process aimed to individually separate the units from strip package at full cut singulation.
- After Package Singulation (either Jig saw or Tape saw) the separated units will undergo transferring process from package singulation dicer to Pick and Place tray for 100% Visual Mechanical Inspection (VMI). Figure 1.0 below is a simple process flow diagram of a Dicer with auto pick and place transferring module after sawing of a strip type package.



Fig. 1.0 Process flow of a Standalone package sawing machine with auto-pick and place

- Singulated units auto transferring process (pick and place) aims to set the units on the sitting plane of the provided tray in order to secure on any mechanical contacts, vibrations and handling contamination.
- Mechanical contacts such as Z-axis down force contact on singulated units is considered a highly risk that contribute units' package chip out defect.

II. PROBLEM IDENTIFICATION

- After package sawing process, strips will then proceed to the next steps which is the Auto pick and place to establish a singulated units to a JEDEC tray prior 100% visual and mechanical inspection (VMI). All rejects encountered will then be screened out including Package chips out for analysis. Figure 2.0 below shows the process steps which may contribute to the defect.
- During tray transfer of singulated units from jig saw or cured UV tape, Operators frequently called Line technician support due to dislodged units on tray sitting plane as illustrated on Figure 3.0 below.
- Dislodged units or scattered units happened due to irregular mechanical tray grippers functionality, linear motor movement variation and non-optimized pick and place parameters.
- Dislodged units on tray pocket sitting plane lean a tilting positions which results to chip-out when applied Z-down force which is happened after tray filed up.



Fig. 2.0 Process flow where the package chips out happened.

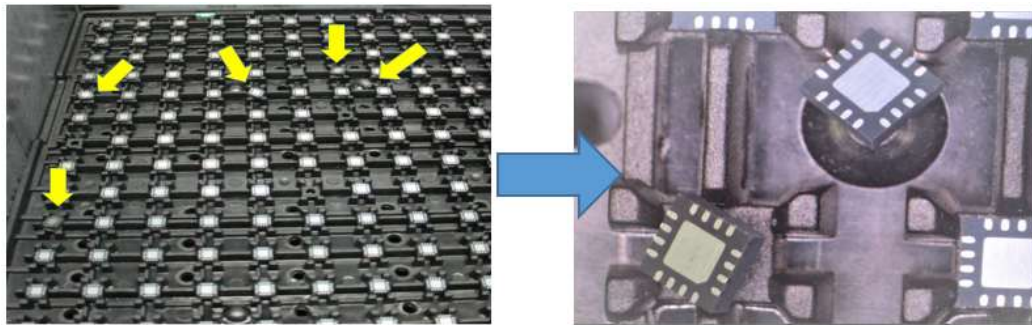


Fig. 3.0 Actual dislodged units at tray after auto-pick and place process.

- On figure 4.0 below shows the effect of a dislodged units. After full tray has been completed, the tray will go to the tray output module and will be filed up on the other tray with full singulated units. At this point, trays with dislodged units or scattered units are pressed by the other full loaded tray until the maximum trays has been reached. Maximum of 10 trays can be filed up until the machine persists a warning to operator that lot is finished to remove the completed trays.



Fig. 4.0 Actual filed up trays with dislodged units inside.

- Filed up trays with dislodged units experienced Z-axis down force pressure due to weight of loaded trays and force from operator when doing the removal of trays from tray output module. Figure 5.0 below shows sample of unit with package chip-out defect encountered by assembly related on dislodged units on tray.

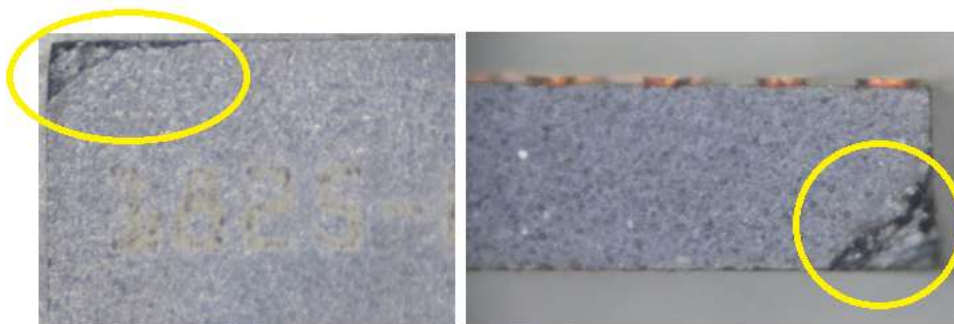


Fig. 5.0 Actual units with package chip out defects after 100% Visual inspection.

III. DESIGN SOLUTION

- Dislodged units during auto-pick and place are given to be encountered due to Mechanical X-Y and Z movement variation resulting to frequent mis-align placement.
- In order to prevent units for chip-out defect, mistake proofing to detect dislodged units on tray must be considered.
- Since dislodged units contribute height variation of tray after filed up as figure 4.0 illustrated, this can be detect using a proximity sensor (Laser point to point detection) as per figure 6.0 below illustrated.

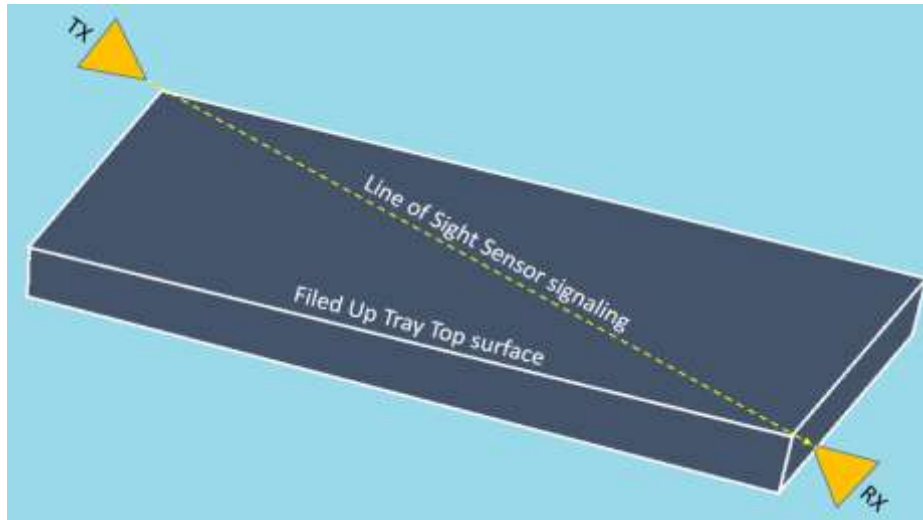


Fig. 6.0 Sensor TX/RX point to point detection set-up.

- Figure 6.0 above illustrate the sensor set-up to detect tray filed up height variation. When units are dislodged it contribute additional height on the next tray resulting to cut the signal of sensor from Transmitter (TX) towards the Receiver (RX). At this point the mistake proofing design is to stop the Tray transferring robot arm to execute the next command. The machine will stop and the operator will remove the affected tray to proceed the machine process.
- Figure 7.0 below illustrate a simple diagram for the installed sensors. On this diagram, two (2) sensors are installed to tightened the dislodged units on tray detection. A combination of sensors signal will give the tray picker robot arm a command to execute or not. Only the 1,1 combination will trigger to continues the robot arm executions but the 0,1/1,0 and 0,0 combinations will have disabled the robot arm execution resulting to persist machine error to call the operator attention. Feedback system has been including to have self-correcting factors on sensors threshold sensitivity.
- Operator must be oriented on the mistake proofing installed on output module specially on the tray picker robot arm. Operator must also be oriented on the package chip-out scenario to have a better understanding on how the defect happened and what is the purpose of mistake proofing installed. On this knowledge sharing, Operator will be empowered and have a quick response when the machine error encountered.

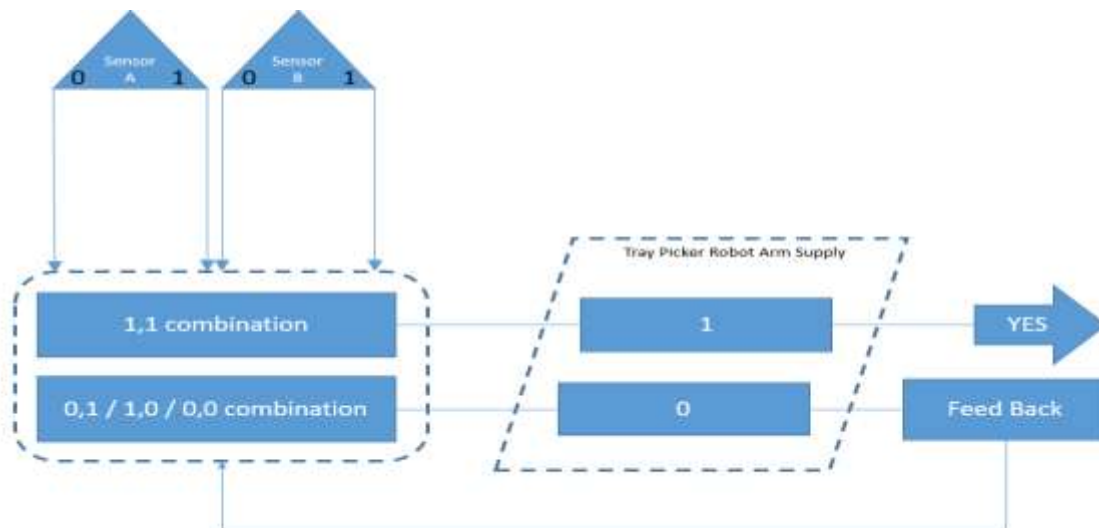


Fig. 7.0 Installed Sensors Simple system diagram.

- Figure 8.0 shows the scenario of dislodged units that contribute tray height variation. The TX signal towards RX was being blocked therefore no signal received by RX.

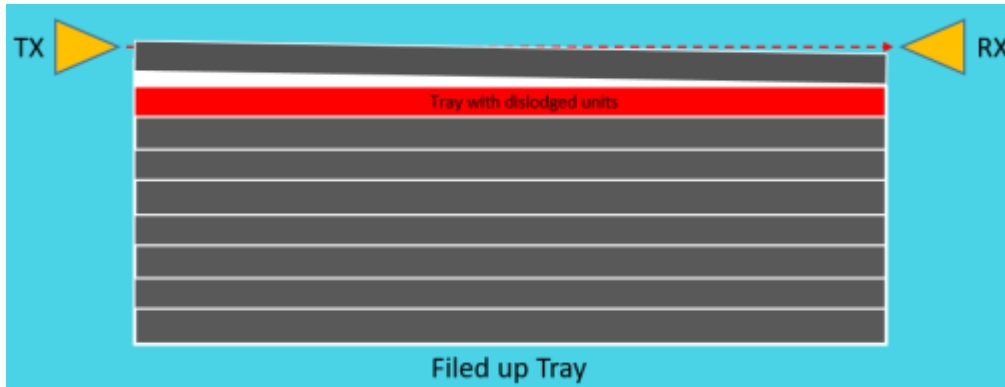


Fig. 8.0 TX to RX signal has been cut due to tray height variation.

- Machine will stop the output module process and will call the attention of the assigned operator to remove the tray with affected dislodged units and call the line sustaining technician to correct the problem.
- On this point the machine will have the capability to detect dislodged units on tray and will prevent/eliminate the units chip out defect.