

General Micro Electronics Case Study

By: Abby Zurvalec, Monique Willis, Jared Wogoman, & Ryan Beck

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Is the process capable of meeting GME's internal wire bond strength requirement of at least 7 grams?

• The process is not capable of meeting the requirement of at least 7 grams. The process is not capable of meeting the requirement of at least 7 grams.

Sample Data for New Machine

- Time frame: 4 months
- Technician randomly selected one of the six dies once everyday on the first lead frame from the production lot.
- Next they randomly picked two wires on each side of the die that was selected.
- Two out of the six wires on both sides of the die were then chosen to complete the test.
- This gave an overall of 8 observations a day
 - 4 sides x 2 wires per side = 8 observations

DOE Experiment was conducted to investigate the process variation and determine the effect of the wire bond strength on the process.

• The experiment was conducted using a 2³ factorial design.

Factor	Level
Power	150, 225
Temperature	190, 225
Time	10, 20

Overview

- GME has recently purchased a new wire-bonder machine
- First two months it performed well
- After that the performance keeps becoming more and more erratic.
- It's getting to the point where it is not acceptable to use anymore.
- This issue needs to be fixed immediately.

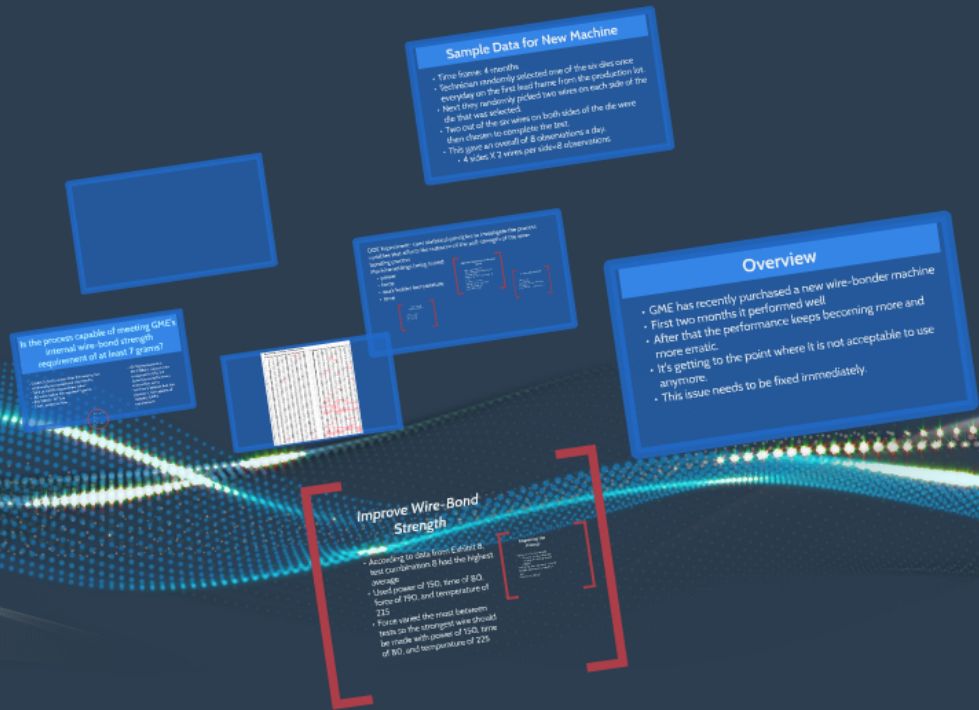
Improve Wire-Bond Strength

- According to data from Exhibit B, lead combinations B had the highest average.
- Used power of 150, time of 20, temp of 190, and temperature of 225
- From your test the most between tests to the strongest wire should be made with power of 150, time of 10, and temperature of 225

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 - $4 \text{ sides} \times 2 \text{ wires per side} = 8 \text{ observations}$

Is the process capable of meeting GME's internal wire-bond strength requirement of at least 7 grams?

- Exhibit 5 clearly shows how the process has continually worsened over the months
- Total of 1,008 observations taken
- 80 were below the required 7 grams
- $80/1,008 = .07936$
- 7.94% defective rate

- Six Sigma requires a 99.99966% success rate or approximately 3.4 defective parts for every one million parts
- We firmly believe that this process is not capable of meeting GME's requirement

Process Capability

$Cp = (U - L) / 6\sigma$

$U = 350$

$L = 3125$

$\sigma = 3125$

$Cp = 1.1$ thus not capable

Process Capability

$$Cpl = (\mu - LCL) / 3(SD)$$

$$SD = 3.34$$

$$Cpl = .52125$$

.52125 < 1 thus not capable

DOE Experiment- uses statistical principles to investigate the process variables that affects the outcome of the pull-strength of the wire-bonding process

Machine settings being tested:

- power
- force
- work holder temperature
- time

Additional Parameters that could impact

- Work holder cleanliness
- Work holder planarization (uneven or out of plane)
- Capillary size and finish (smooth or matte)
- Lead frame material
- Wire span shape and length
- Bond shape/imprint
- The wire material

Concerns and Recommendations

- Operator dependent
- Number of samples
- Random result of A.O
- More experts on DOE

16 Treatment Combinations

- 2 levels of force
- 2 levels of power
- 2 levels of work holder temperature
- 2 levels of time
- 12 observations for each combination