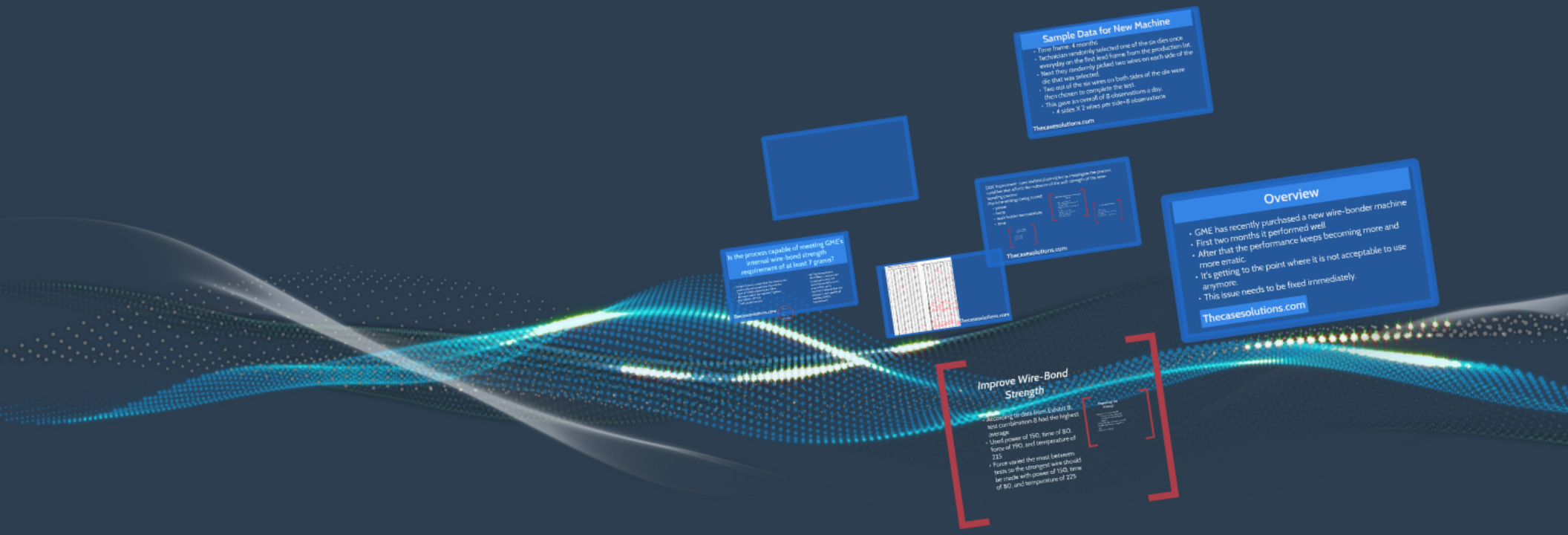
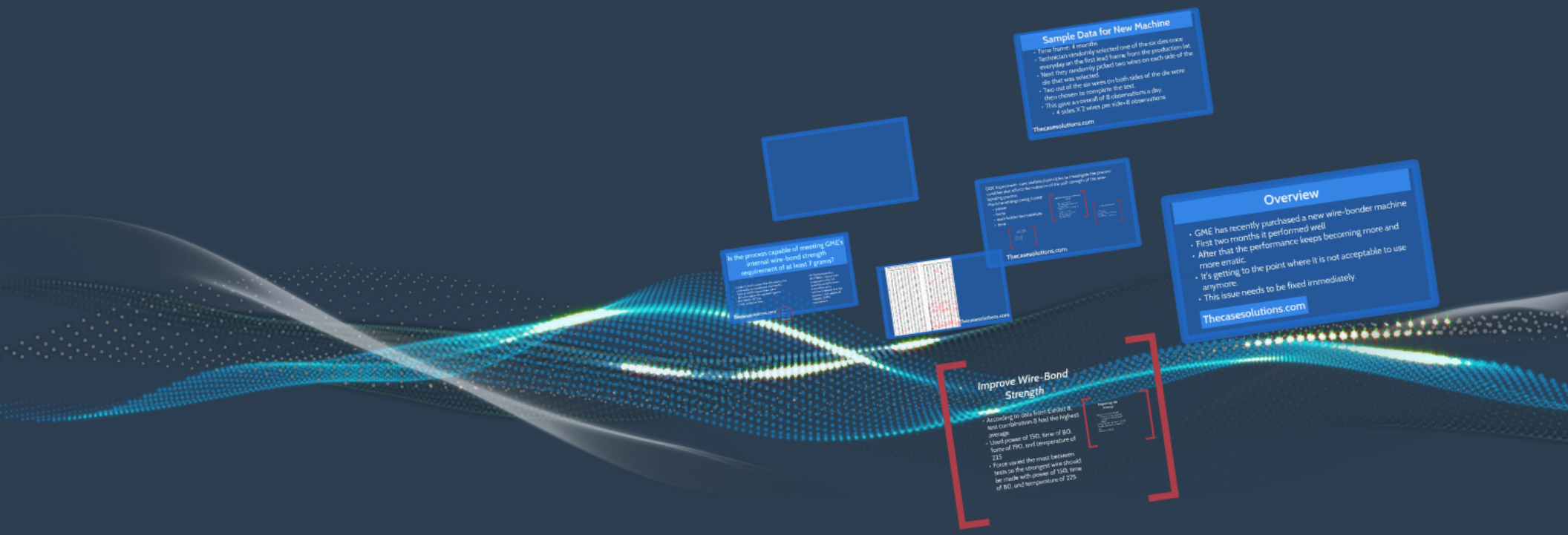
The TSMC Way: Meeting Customer Needs at Taiwan Semiconductor Manufacturing Co.



Thecasesolutions.com

The TSMC Way: Meeting Customer Needs at Taiwan Semiconductor Manufacturing Co.



Thecasesolutions.com

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.

Thecasesolutions.com

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

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

Thecasesolutions.com

Process Capability

Cpl=(Mu - LCL)/ 3(SD)

SD = 3.34

Cpl = .52125

.52125 > 1 thus not capable

Thecasesolutions.com

EXHIBIT 1: Sample Data For New Wire-Bonding Machine

Sample	Obs 1	Obs 2	Obs 3	Obs 4	Obs 5	Obs 6	Obs 7	Obs 8
1	17.0	15.0	13.0	15.0	15.0	15.0	14.5	15.0
2	14.0	11.0	13.0	10.5	8.0	5.6	5.0	10.0
3	7.0	17.5	17.5	17.2	16.5	16.5	16.5	18.5
4	13.0	20.0	16.0	13.5	14.1	17.5	10.5	17.0
5	14.5	15.5	14.5	14.0	11.5	13.5	13.5	14.2
6	15.0	12.3	16.5	14.5	15.5	19.0	14.0	8.0
7	17.0	14.0	18.0	17.0	16.4	17.0	17.5	12.5
8	11.5	11.7	12.0	11.5	16.5	12.0	12.5	11.5
9	14.5	14.0	14.5	15.5	10.5	16.0	16.0	15.5
10	15.0	15.0	14.5	14.8	14.0	12.0	15.0	16.5
11	13.0	13.0	13.0	13.0	12.6	11.0	13.5	12.5
12	15.5	15.0	12.0	14.6	12.0	15.0	12.0	17.0
13	11.5	16.0	16.0	15.0	16.5	15.5	15.0	15.0
14	18.5	15.5	13.0	15.0	15.0	14.5	12.0	16.5
15	14.5	12.0	13.0	15.0	12.0	11.5	16.5	14.9
16	11.5	16.0	12.0	16.0	11.5	11.5	11.7	11.5
17	12.6	11.5	12.5	14.5	11.0	10.5	15.5	14.0
18	13.5	14.0	5.0	11.0	9.0	9.0	10.5	14.5
19	11.0	10.5	12.0	16.5	13.5	11.5	13.5	15.5
20	15.0	16.0	16.5	14.5	14.5	13.5	13.5	12.0
21	12.0	14.0	12.0	12.5	12.0	14.5	13.0	17.5
22	12.5	10.0	12.5	13.5	13.3	13.5	12.5	12.5
23	11.5	12.0	10.5	11.5	17.5	12.0	13.0	12.0
24	12.8	8.5	11.5	15.0	11.5	12.5	13.5	14.0
25	9.0	13.5	12.0	13.5	13.5	12.2	12.5	12.5
26	14.3	14.5	14.0	12.0	12.5	14.0	9.5	11.5
27	10.0	13.0	11.2	16.5	12.5	13.0	12.5	13.0
28	15.5	13.3	16.5	11.5	13.0	14.0	11.5	11.5
29	18.0	13.0	9.0	14.0	11.0	13.5	13.0	11.0
30	11.7	13.5	7.0	15.0	14.5	14.5	17.0	12.0
31	12.0	13.0	11.5	12.7	10.5	15.0	13.5	14.0
32	13.5	13.5	14.5	13.5	12.5	14.0	12.7	9.5
33	12.0	12.0	18.5	13.0	12.0	13.5	12.0	12.0
34	14.0	13.0	10.0	12.0	13.5	12.0	14.0	14.5
35	12.2	8.5	11.5	14.0	13.5	13.0	16.5	12.0
36	13.3	9.5	14.0	12.5	12.5	13.0	14.5	13.0
37	9.5	12.0	13.5	12.5	13.0	13.5	13.3	9.5
38	12.0	13.8	16.0	12.5	12.0	12.0	11.5	12.5
39	14.0	11.5	17.5	12.0	13.2	11.5	15.0	13.0
40	10.5	13.0	13.6	16.0	13.0	13.0	14.0	13.0
41	10.0	14.0	13.5	12.2	12.5	14.5	13.0	15.5
42	11.0	16.0	14.0	14.3	16.0	14.5	11.0	11.5
43	10.5	14.4	15.0	14.0	14.0	13.0	14.5	14.5
44	15.0	15.5	10.5	14.0	16.0	15.0	12.0	13.0
45	15.0	16.0	13.5	13.0	14.0	13.4	11.0	13.5
46	13.0	12.0	13.0	12.5	14.1	13.5	17.0	13.0
47	14.5	14.5	11.0	12.5	9.5	12.0	14.5	8.0
48	13.8	12.5	13.5	12.5	10.0	11.0	7.0	14.5
49	10.0	15.0	10.0	13.0	13.7	13.5	14.0	12.5
50	14.0	9.0	10.0	9.0	11.5	13.0	14.5	14.5
51	11.6	11.5	13.5	14.5	14.0	14.0	15.5	17.5
52	18.0	11.0	15.5	12.0	13.5	13.1	11.5	12.0
53	12.2	11.0	9.5	17.0	11.5	14.5	12.0	11.5
54	16.5	12.0	12.4	10.0	11.5	11.5	11.0	11.0
55	14.7	15.0	14.0	14.5	17.5	15.5	14.5	15.5
56	9.5	16.0	14.8	16.0	15.5	15.5	15.5	13.0
57	17.5	20.0	14.0	14.0	18.0	16.5	16.2	17.5
58	10.5	11.0	13.2	16.5	12.0	13.0	14.0	5.5
59	14.5	8.5	15.5	16.5	15.5	18.0	13.0	11.0
60	13.9	6.0	10.0	13.0	13.5	15.0	14.0	10.0
61	15.0	13.1	9.0	16.0	19.0	12.5	14.0	15.5
62	15.0	10.5	16.0	9.5	16.0	12.0	13.5	5.5
63	7.5	10.5	10.5	14.0	10.5	10.3	9.5	13.0

Sample	Obs 1	Obs 2	Obs 3	Obs 4	Obs 5	Obs 6	Obs 7	Obs 8
64	17.5	14.0	14.0	17.5	13.5	13.5	8.5	11.0
65	10.5	12.0	12.5	12.3	10.5	11.5	11.5	19.5
66	14.0	10.5	15.2	8.5	10.5	17.0	10.5	13.0
67	17.0	17.4	20.0	16.5	16.5	16	15.5	12.5
68	16.0	16.5	18.0	15.5	15.0	14.0	14.5	14.5
69	14.5	15.0	15.0	22.5	17	14.6	15	15
70	11.0	13.5	11.5	4.5	9.0	14.5	10.9	8.5
71	13.5	12.0	11.5	4	13	15.5	11	7
72	10.0	9.0	8.5	12.6	4.5	11.5	12.0	14.5
73	12.5	9.5	11.5	9	14.5	9.5	7	12.6
74	7.0	8.0	13.5	12.0	13.5	17.0	11.5	9.5
75	8.0	10.0	14.5	19	11	11.4	9.5	10.5
76	14.5	9.0	19.0	11.0	13.0	13.0	15.2	13.0
77	13.9	13.5	17.0	17.5	14.5	11.5	14	16
78	15.5	10.5	11.5	10.5	12.0	10.5	17.5	11.5
79	9.0	13.5	3.5	9.5	10.5	12.5	4.5	5.3
80	14.0	14.0	14.0	16.2	20.5	14.5	11.5	11.5
81	8.5	5.5	9.7	11.5	13.5	11.5	11.5	12.0
82	11.5	12.0	16.5	14.1	12.0	7.5	11.0	14.0
83	16.5	9.5	10.5	10.5	6.5	11.2	13.0	15.5
84	16.0	14.0	12.5	14.5	8.5	20.5	17.0	8.0
85	12.0	11.2	11.5	13.5	14.0	10.0	19.0	11.5
86	10.5	7.5	10.5	10.5	7.5	10.5	8.5	12.5
87	13.5	13.5	13.5	13.0	13.0	13.5	12.7	3.5
88	21.5	15.5	17.0	10.5	14.5	16.0	15.0	17.9
89	11.5	12.2	12.5	20.0	12.5	10.0	9.0	13.5
90	12.5	12.5	10.3	7.5	12.0	18.5	10.0	9.0
91	13.0	20.5	15.3	12.0	15.0	9.0	11.0	17.0
92	9.0	11.0	16.3	13.0	11.5	12.0	8.5	19.5
93	12.3	12.0	17.0	12.5	5.5	12.0	12.5	14.5
94	18.0	9.0	12.0	11.0	19.5	14.0	16.0	13.1
95	13.5	18.5	17.0	12.2	9.0	17.0	13.5	11.5
96	17.5	11.5	4.5	9.0	7.5	12.5	9.5	7.0
97	11.0	12.0	12.5	11.0	18.0	8.5	13.5	11.5
98	10.0	6.0	15.0	12.5	12.0	11.5	12.0	12.0
99	8.5	17.0	11.5	10.0	14.0	9.5	10.5	12.0
100	12.0	14.5	16.0	14.0	14.0	14.5	15.0	18.5
101	16.5	4.5	11.7	6.5	5.0	12.5	8.5	8.5
102	3.5	10.5	10.0	5.0	9.5	6.0	8.5	15.5
103	11.5	17.0	12.0	12.0	12.0	12.0	11.0	12.5
104	5.0	5.0	5.0	5.0	15.5	5.5	4.5	5.5
105	13.0	11.5	4.5	10.0	7.2	15.0	13.5	16.5
106	12.5	9.0	4.5	6.5	9.0	10.5	9.0	11.0
107	10.5	13.0	13.0	8.0	12.5	13.0	11.5	9.5
108	4.0	2.5	3.0	3.8	5.5	2.5	10.5	5.5
109	6.0	6.0	9.0	6.5	3.0	5.0	6.0	3.8
110	9.5	12.0	9.5	3.0	11.8	7.5	10.5	10.5
111	12.0	12.5	13.2	12.0	8.0	11.5	14.0	12.0
112	13.0	10.5	12.5	14.5	13.5	12.0	13.5	13.5
113	11.9	12.5	10.5	13.0	10.5	11.5	13.0	15.5
114	13.5	8.0	5.5	9.5	8.0	9.5	7.5	8.5
115	7.0	7.0	7.5	10.0	7.5	5.0	5.5	8.0
116	13.0	15.0	12.5	13.0	10.0	11.0	13.5	14.0
117	10.5	5.5	9.3	12.5	11.5	11.5	7.5	10.0
118	6.0	9.0	9.0	9.5	10.5	10.0	12.0	8.0
119	6.5	9.0	8.5	9.5	10.0	10.3	7.5	9.0
120	16.0	7.5	4.0	4.5	8.0	4.0	4.0	9.7
121	9.0	9.5	9.0	16.5	4.5	5.2	8.5	9.5
122	5.5	8.4	5.5	7.5	18.5	6.0	6.0	6.0
123	5.5	6.0	5.5	5.5	5.0	5.5	10.0	4.0
124	5.0	5.5	5.5	6.1	7.0	13.0	7.5	5.0
125	16.5	12.0	7.0	8.0	11.0	15.3	12.5	5.5
126	5.5	9.5	10.0	10.5	9.0	9.5	9.5	10.5

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

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

Concerns and Recommendations

- Operator dependent
- Number of samples
- Random result of 4.0
- More experts on DOE

Thecasesolutions.com