

KOREA 2021

DISCOVERY SUMMIT

EXPLORING DATA
INSPIRING INNOVATION



Semiconductor data analysis and visualization using JMP add-ins

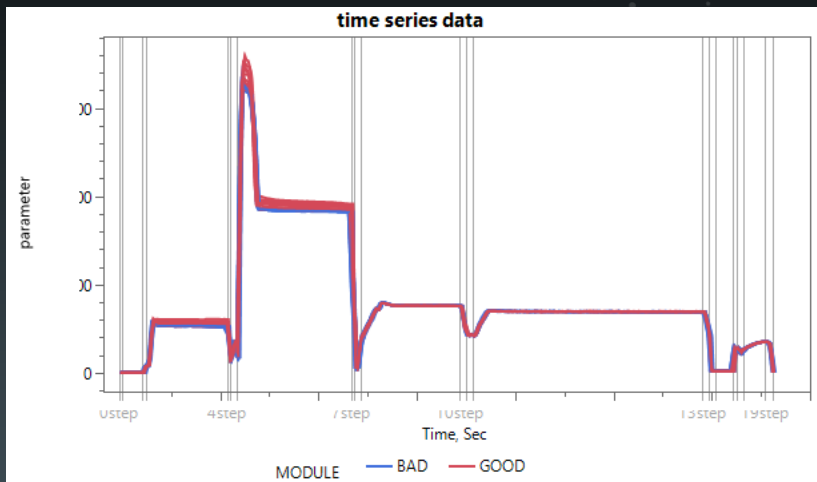
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Technical Leader, SKhynix



Semiconductor data analysis and visualization using JMP add-ins

- Semiconductor FDC Time Series Data
- Statistical Data Analysis
- Data Visualization
- User Friendly Interface : One Page Summary Report
- Benefits of JMP Add-ins

Semiconductor FDC Time Series Data



N Steps
~ dozens

N Rows
~ thousands

N Data Tables

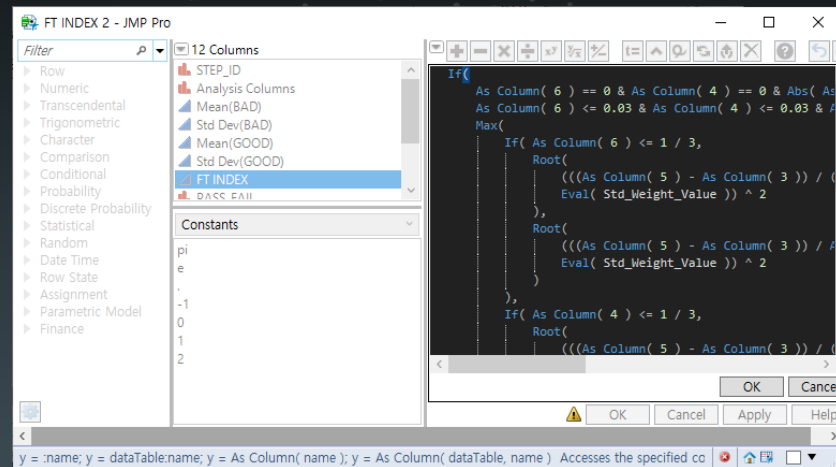
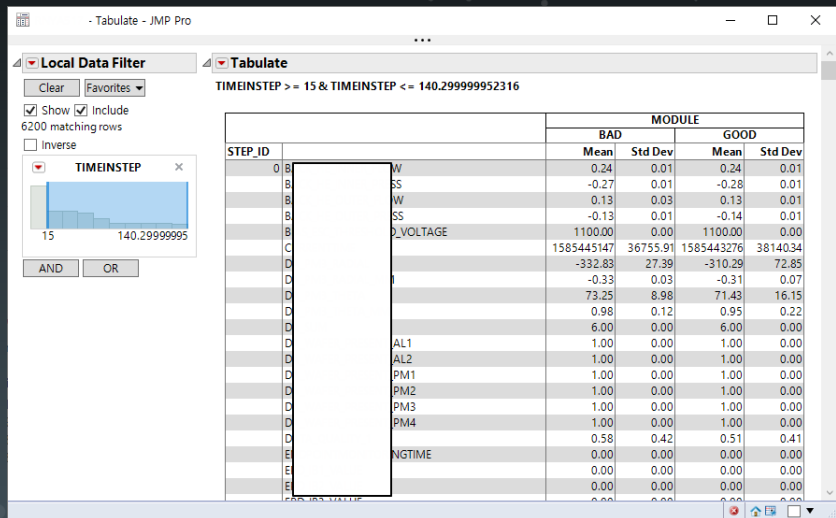
N Columns ~ hundreds

	B04	B05	B06	B07	B08	B09
1	5187988	-1.1291504	-0.007629395	0.051879883	0.25024414	0.2225831
2	0354004	-1.1291504	0.010681152	0.051879883	0.23803711	0.2225831
3	8828125	-1.1291504	0.022888104	0.051879883	13.848877	10.51
4	5340576	-1.159668	0.0045776367	0.048828125	119.7739	79.937
5	0354004	-1.1291504	0.01373201	0.051879883	120.21494	80.096
6	0354004	-1.1291504	0.012207031	0.051879883	120.10498	80.12
7	5187988	-1.1291504	0.0076293945	0.051879883	120.06636	80.059
8	8828125	-1.1291504	0.016784668	0.051879883	120.05615	80.041
9	7302246	-1.1291504	0.010681152	0.051879883	120.03784	80.0
10	5187988	-1.1291504	-0.018310547	0.051879883	120.03784	80.0
11	0354004	-1.1291504	0.0076293945	0.051879883	120.03174	80.0
12	7302246	-1.1291504	0.024414062	0.051879883	120.01953	80.02
13	0354004	-1.1291504	0.024414062	0.051879883	120.01243	80.01
14	5340576	-1.1291504	0	0.051879883	120.01953	80.01
15	5340576	-1.1291504	-0.0015258079	0.051879883	120.007324	80.01
16	5493164	-1.159668	0.018310547	0.05493164	120.01343	80.01
17	5493164	-1.159668	0.018310547	0.05493164	120.01343	80.01
18	0354004	-1.1291504	-0.006103516	0.048828125	120.01343	80.01
19	5645752	-1.1291504	-0.019836426	0.051879883	120.01343	80.02
20	5645752	-1.1291504	-0.019836426	0.051879883	120.01343	80.01
21	5493164	-1.1291504	0.009155273	0.051879883	120.00122	80.01
22	5493164	-1.1291504	-0.012207031	0.051879883	120.00122	80.01
23	5187988	-1.1291504	0.012207031	0.051879883	120.00122	80.01
24	5187988	-1.1291504	0.030517578	0.051879883	120.00122	80.00
25	0354004	-1.1291504	0.016784668	0.051879883	119.99512	80.01
26	8828125	-1.1291504	0	0.051879883	120.00122	80.01
27	0354004	-1.159668	0.0289917	0.051879883	120.00122	80.00

Good vs Bad Wafer Comparison
→ Statistical Data Analysis Using JMP
: Sorting Issue Step & Parameter

Statistical Data Analysis

JMP Tabulate(Group By) ~ Statistical Values



Index (Statistical Formula)
→ Difference btwn Good and Bad

Statistical Data Analysis

Subset1_dt1 - Tabulate - JMP Pro

FT Index - Tabulate
PASS_FAIL = PASS, FAIL

Local Data Filter

Analysis Columns	STEP_ID				
	0	3	6	9	12
	FT INDEX	FT INDEX	FT INDEX	FT INDEX	FT INDEX
	Mean	Mean	Mean	Mean	Mean
A01	2.22	2.64	2.02	1.05	1.17
A02	2.22	2.22	2.22	2.22	2.22
A03	2.22	1.86	1.88	1.50	1.08
A04	2.22	2.22	2.22	2.22	2.22
A05	2.22	2.22	2.22	2.22	2.22
A11	2.78	2.08	2.08	2.07	2.08
A12	2.66	1.93	1.93	1.92	1.93
A13	1.81	1.61	1.60	1.60	1.60
A14	1.80	1.60	1.60	1.60	1.60
A15	2.22	2.22	2.22	2.22	2.22
A16	2.22	2.22	2.22	2.22	2.22
A17	2.22	2.22	2.22	2.22	2.22
A18	2.22	2.22	2.22	2.22	2.22
A19	2.22	2.22	2.22	2.22	2.22
A20	2.22	2.22	2.22	2.22	2.22
A21	2.22	2.22	2.22	2.22	2.22
A22	1.03	1.07	1.36	3.17	1.19
A25	2.22	2.22	0.08	2.22	1.05
A26	2.22	5.59	8.84	1.09	1.10
A27	2.22	5.28	6.86	1.09	1.01
A28	2.22	5.80	11.05	1.00	1.07
A29	2.22	2.26	2.51	1.08	1.07
A30	1.22	7.23	15.70	1.05	1.15
A31	1.54	1.16	1.08	1.08	1.04
A32	2.22	2.22	2.22	2.22	2.22

Subset1_dt1 - Tabulate - JMP Pro

Local Data Filter
Clear Favorites

FT Index - Tabulate
PASS_FAIL = FAIL

Show Include
25 matching rows
 Inverse

PASS_FAIL (3)
PASS FAIL

AND OR

Analysis Columns	STEP_ID				
	0	3	6	9	12
	FT INDEX	FT INDEX	FT INDEX	FT INDEX	FT INDEX
	Mean	Mean	Mean	Mean	Mean
A22	.	.	.	3.17	.
A26	.	5.59	8.84	.	.
A27	.	5.28	6.86	.	.
A28	.	5.80	11.05	.	.
A30	.	7.23	15.70	.	.
B19	4.06	.	.	.	.
B20	10.54	5.09	.	.	.
B21	3.77	.	.	.	.
B25	11.39	.	.	.	.
B26	3.48	.	.	.	.
C17	.	.	6.13	.	.
C18	.	.	9.58	.	.
C19	.	.	6.11	.	.
C26	4.29	.	.	.	.
C53	5.14	5.14	5.15	5.17	5.21
C57	.	.	.	3.17	.

605 rows have been excluded.

- ➔ 3, 6 Step & E*** Parameters,
- ➔ 0 Step & G*** Parameters

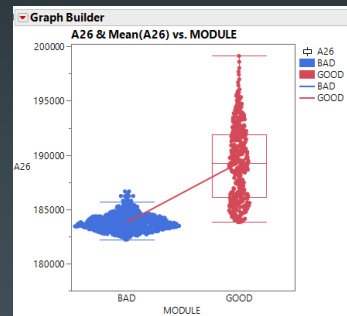
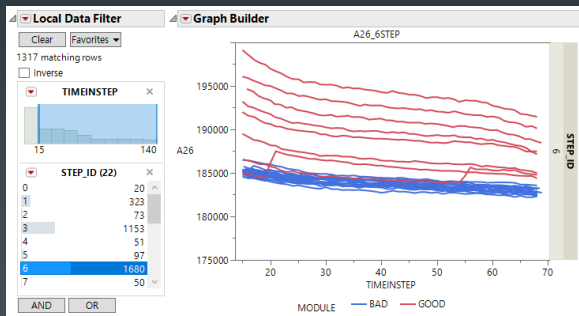
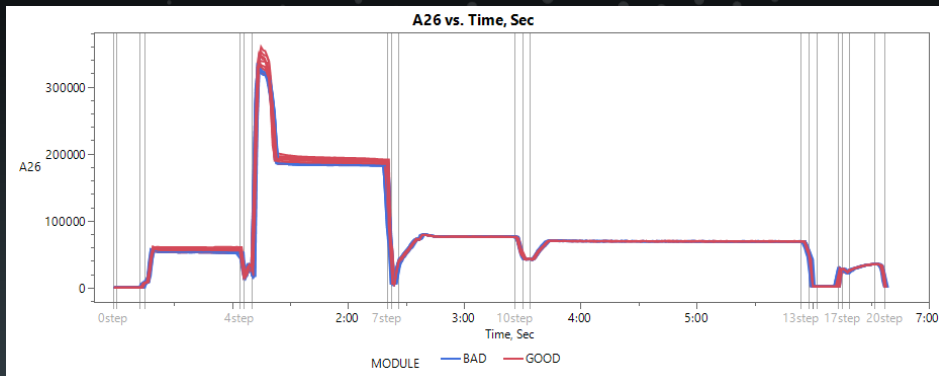
Data Visualization

FT Index - Tabulate

Analysis Columns	STEP_ID			
	3	6	9	12
	FT INDEX	FT INDEX	FT INDEX	FT INDEX
Mean	Mean	Mean	Mean	
A22	.	.	3.17	.
A26	5.59	8.84	.	.
A27	5.28	6.86	.	.
A28	5.80	11.05	.	.
A30	7.23	15.70	.	.
B20	5.09	.	.	.
C17	.	6.13	.	.
C18	.	9.58	.	.
C19	.	6.11	.	.
C53	5.14	5.15	5.17	5.21
C57	.	.	3.17	.

612 rows have been excluded.

Visualization Using Graph Builder



- FT Index = **8.841**
- Mean_1 = 183804.463
- Std_1 = 733.0227
- Pass/Fail : **FAIL**
- Mean_2 = 189295.098
- Std_2 = 3442.2295

User Friendly Interface : One Page Summary Report

FT Index - JMP Pro

FT Index - Condition

1. Data File

ETCH Data File 1

of Sample/jmp

Data File 2 Merge

2. 기 Column

MODULE Group

BAD vs GOOD OK

3. Step Time

- Parameter TIMEINSTEP

- Settling Time (sec) 15

- Settling End Time (sec) 1

Report

FT Index 설정 바로가기

Step Information

선택된 Step Data 삭제 Delete Selected Rows

Step ID

Step ID/NAME

STEP_ID	STEP_NAME	BAD	GOOD	MODULE
0		12	7	
1		0	1	
2		198	97	
3		1	0	
4		34	18	
5		751	376	
6		2	0	
7		1	0	
8		21	10	
9		64	32	
10		1105	553	
11		30	16	
12		1	0	
13		62	32	
14		955	480	
15		1	0	
16		58	26	
17		62	32	
18		2239	1119	
19		0	1	
20		56	28	
		1	0	
		149	73	
		1	0	
		31	16	
		63	29	
		0	1	
		0	1	
		207	102	
		64	31	
		16	8	

233 rows have been excluded.

FT Index - Parameter

4. Parameter

Group 1: BAD
Group 2: GOOD

FDC Trace Parameter

A01
A02
A03
A04
A05
CURRENTTIME
A11
A12
A13
A14
A15
A16
A17
A18
A19
A20

5. FT Index (0)

FT Index 3 (c) Apply

6. Selected Param & Step 시각화

HI Pedia Pop-up (Y/N)
 Setting Time Filter (Y/N)

View Trace Data

vs Step ID vs Step Time vs Overall Time

FT Index Step Report

FT Index Para & Step

View Trace Data, FT Index Report

Overlay Report FT Index Report

FT Index - Report

Data Filter Local Data Filter

Clear Favorites

Show Include 25 matching rows

Inverse

STEP_ID (5)

STEP_ID	Count
0	126
3	126
6	126
9	126
12	126

Distributions PASS_FAIL

Frequencies

Level	Count	Prob
FAIL	25	1.00000
Total	25	1.00000

N Missing 0

1 Levels

FT INDEX

Parameter Grade (1)

E

Pass/Fail Rate

Row %	PASS_FAIL
Parameter Grade	FAIL
E	100.0%

Where (STEP_ID = 0, 3, 6, 9, 12) and (PASS_FAIL = FAIL)
605 rows have been excluded.

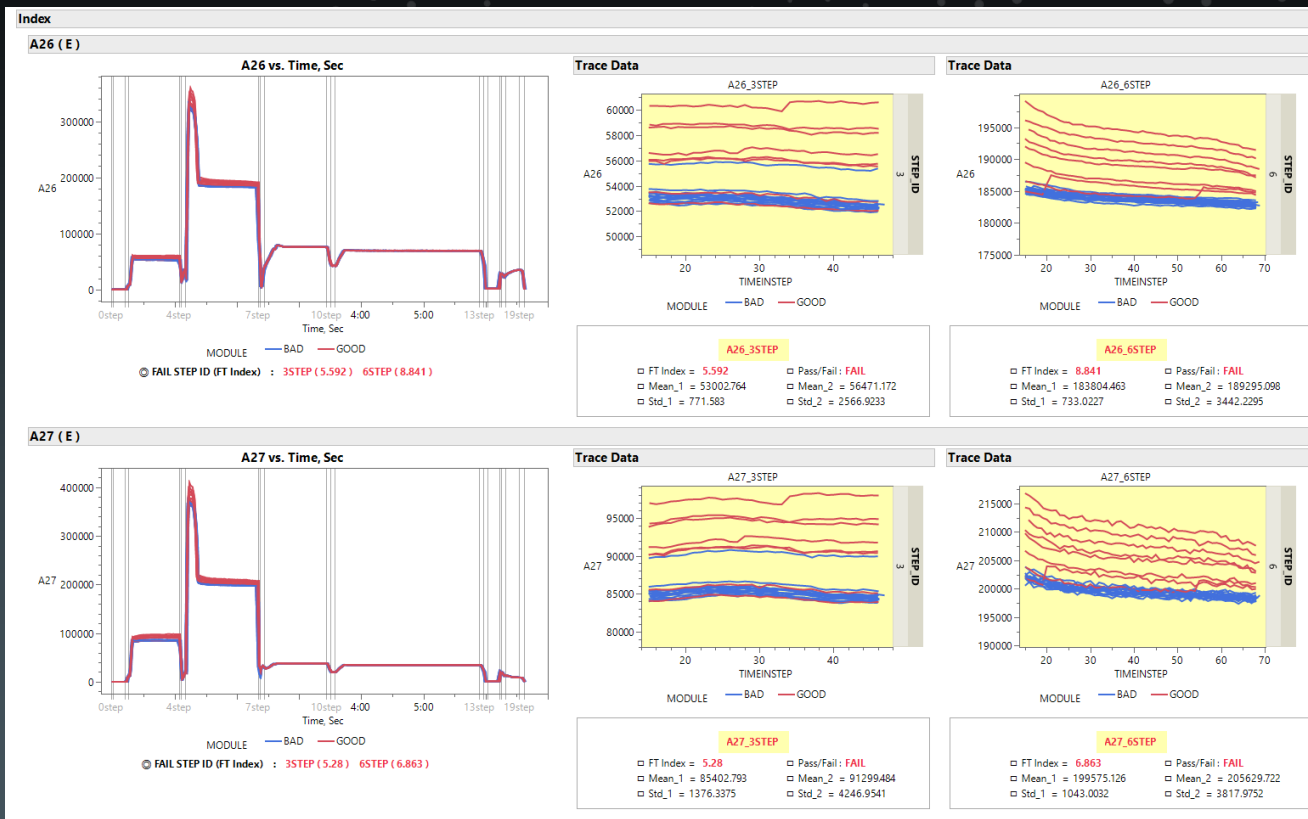
FT Index - Tabulate

Analysis Columns

	0	3	6	9	12
	FT INDEX	FT INDEX	FT INDEX	FT INDEX	FT INDEX
Analysis Columns	Mean	Mean	Mean	Mean	Mean
A22		5.59	8.84		
A26		5.28	6.86		
A27		5.80	11.05		
A28		7.23	15.70		
A30					
B19	4.06				
B20	10.54	9.08			
B21	3.77				
B25	11.39				
B26	3.48				
C17			6.13		
C18			9.58		
C19			6.11		
C26	4.29				
C53	5.14	5.14	5.15	5.17	5.21
C57					3.11

Where (STEP_ID = 0, 3, 6, 9, 12) and (PASS_FAIL = FAIL)
605 rows have been excluded.

User Friendly Interface : One Page Summary Report



Benefits of JMP Add-ins

- Statistical inference, consideration
- Fast and accurate analysis
- Low barriers to entry
- No Table : You don't need to make tables
- No Preprocessing : You have only to push button

KOREA 2021

DISCOVERY
SUMMIT

EXPLORING DATA
INSPIRING INNOVATION

Thank you

