

HOWTO Analyse Results from ASIC Test

Peter Kaiser, peter@easy-asic.de

07. October 2005

This document is released under GNU FDL
(<http://www.gnu.org/>)

Copyright (c) 2005 Peter Kaiser.
Permission is granted to copy, distribute and/or modify this document
under the terms of the GNU Free Documentation License, Version 1.2
or any later version published by the Free Software Foundation;
with no Invariant Sections, no Front-Cover Texts, and no Back-Cover Texts.

Abstract

As a result of wafer or component test in ASIC production, the test machine produces thousands of tonnes measurement results. But the engineer needs a short report, may be with histogram, to rise the yield and improve the design.

With the formulas in this paper, the engineer can import the test results to Open Office spreadsheet and calculate the average, standard deviation and CPK values. These results are the base to find the right screw to improve the yield.

The only thing left to do, is to convert the log file from test, may be with a perl script, to a comma separated value (CSV) list, which can be imported to Open Office.

1. Define the Limits

In the first table, all the upper and lower limits for each test step must be defined:

	A	B	C	D	
1	ASIC Project	Einstein IV			
2	Test Specification	V 2.3	26. Sept. 2005		
3					
4	Test Number	Parameter	Lower Limit	Upper Limit	Units
5	1	Idd	0	5,50E-03	A
6	2	Vreg	9,5	10,5	V
7	3	Ron	95	105	Ohm
8	4	Dout	14	20	Pulses
9	...				
10					
11	CPK Limits	Lower Limit	Upper Limit	Cell Color	
12	inadequate	0	1		
13	sufficient	1	1,5		
14	good	1,5			

Define names for all limits of the tests.

Command: Select cell B 5
 Insert ==> Name ==> Define: T1L

This assigns the value from cell B 10, in our case "0" to the variable "T1L". Repeat this for every limit. We need this variables later as references.

2. Import the Comma Separated Values (CSV) List

The list should have each ASIC in a row and the measurement results in columns:

```
"ASIC No";"P X";"P Y";"T 1";"T 2";"T 3";"T 4";"Digi T 1"  
1;1;1;0,0056;10,4;104;17;"pass"  
2;1;2;0,0049;9,4;102;17;"pass"  
3;1;3;0,0043;11,5;102;18;"pass"  
4;2;1;0,0024;10;102;17;"pass"  
5;2;2;0,01;9;103;17;"fail"  
6;2;3;0,0054;10,1;103;17;"pass"
```

Import this file to the second table:

Command: File ==> Open

For more information on CSV lists look at wikipedia:

http://en.wikipedia.org/wiki/Comma-separated_values

3. Apply the Formulas

After obtaining the formulas, the resulting table will look like this:

ASIC Project	Einstein IV							
ASIC Version	4a							
Test Program	V 2.4							
Wafer	w12345.4							
Test Date	26. Sept. 05							
Test Time	15:30:00							
ASIC No	Position X	Position Y	Test 1	Test 2	Test 3	Test 4	Digi Test 1	
1	1	1	5,60E-03	10,4	103	17	pass	
2	1	2	4,90E-03	9,4	102	17	pass	
3	1	3	4,30E-03	11,5	102	18	pass	
4	2	1	2,40E-03	10,0	102	17	pass	
5	2	2	1,00E-02	9,0			fail	
6	2	3	5,40E-03	10,1	103	17	pass	
Lower limit			0	9,5	95	14		
Upper limit			5,50E-03	10,5	105	20		
Total tested			6	6	5	5	6	
Fail no			2	3	0	0	1	
Fail %			33,33%	50,00%	0,00%	0,00%	16,67%	
Average			5,43E-03	10,07	102,4	17,20		
deviation			2,30E-03	0,79	0,49	0,40		
CPK value			0,01	0,18	1,77	2,33		

3.1 Mark limit violations

To mark violations in a color, we can use “Conditional Formating” Every color needs its own “Cell Style”

Command: Format ==> Stylist ==> Right mouse button : Add

Create: Value_to_Low, Value_to_High, Value_Missing

Now assign the new “Cell Style” a background color.

Now select all values in a column from the same test.

Command: `Format ==> Conditional Formating`

Assign the limits from table “Limits” with the “Cell Style”, e. g. Value_to_High, to the cells

3.2 Count the tested values

`COUNT(D10:D15)` or for the digital test `COUNT(D10:D15)`

3.3 Count number of fails

We need a “Shadow” table, with a “1” in a cell for each fail.

```
If(((Test_Results.D14<T1L)OR(Test_Results.D14>T1U))AND
(Test_Results.D14<>" " );1;0)
```

`SUM(Shadow.D10:D15)`

3.4 Calculate the percentage of fails

`D21/D20`

3.5 Calculate the average

`AVERAGE(D10:D15)`

3.6 Calculate the standard deviation

`DEVIATION(D10:D15)`

3.7 Calculate the CPK value

`MIN((D24-D17)/(3*D25);(D18-D24)/(3*D25))`

To mark the cells in color, use “Conditional Formating”

4.0 Jobs to do

How to create a histogram.

Perl script to convert test machine output.