

DFRSOFT EXAMPLE 3 Designing a Failure-Free Accelerated Test

Plan accelerated tests for a failure-free DMT to demonstrate that a plastic-packaged IC will meet its reliability objective of 400 FITs (or MTBF =2.5 Million Hrs.) at the 90% confidence level. Estimate the sample size required and test times needed to show that this component is failure-free of any high temperature testing. Use the acceleration factor found on the prior DFRSOFT Example 1 of 77.66. In that example recall we used an activation energy of 0.7eV and test temperatures of 110 and use of 40C with a 15C junction rise.

If the test starts on January 3, 2011 at 5PM, When will it be completed?

SOLUTION: To design the accelerated testing portion, first estimate a practical test duration. For example, we can target the test to last about a 1000 hours for. Once we have fixed the test time, we next must estimate a statistically significant sample size at the 90% confidence level. We now use a single-sided chi-square estimate for sample size planning where the sample size N is given by

$$N(HTOL)=\chi^2(90\%, 2Y+2)/2\lambda A t$$

For example,

Y=0 Failures

$$\chi^2(90\%, 2)=4.605$$

$$\lambda=400 \text{ FITs}=4.0 \times 10^{-7} \text{ failure/hour}$$

A=77.66 (from Example 9.4)

t=1000 Hours=

Thus,

$$N=4.605/(2 \times 4 \times 10^{-7} \times 77.66 \times 1000)=74 \text{ devices}$$

Using this same approach for the other tests, the results are summarized below.

Summary of Test Plan

Accelerated Test	Acceleration Factor	Test Time	FITs	Sample Size
HTOL	77.66	1000	400	74

DfRSOft Method 1 – Go to Test Plan Worksheet Area J11

SAMPLE PLANNING		
QUANTITY	ENTER QUANTITY VALUE	RESULTS N Sample Size
Test Time	1000	74.12390848
FITs	400	
AF (Acc Fac)	77.66	Dev. Hrs
Conf %	90	5756462.733
No. Failures	0	

Note you can also add failures here

DfRSOft Method 2 Go to Test Plan Worksheet Area A10

Chi Square Life Test Time Estimate		
Value	Enter	Results
MTBF target (Hrs.)	2,500,000	= 400 FITs
Num Test Units	74	Test Time
Num Failures Allowed	0	Results
Confidence Level %	90	998.3156636
Duty Cycle in %	100	in Hours <input type="text" value=""/>
Use Temp (C)	55	
Test Temp Stress (C)	125	Accel Factor
Act Eng (eV)	0.7	77.65845237

If the test starts on January 3, 2011 at 5PM, When will it be completed?

Go to area N32

See Results using test plan calander

Solution is 2/14/11 at 9AM

Enter start time
in Green Area

Enter Test Hours
in Green Area

HANDY SCHEDULE PLAN TOOL			Today's Date :	04/09/11
	DATE mm/dd/yy	TIME Ex: 10:00 AM	Test Days	Test Hours
START TIME	01/03/11	5:00:00 PM	41.67	1000
FINISH TIME	02/14/11	9:00:00 AM		
START TIME	01/03/11	5:00:00 PM		
MEAS TIME			0.00	0
TEST LENGTH			41.67	1000
FINISH TIME	02/14/11	9:00:00 AM		

Read Result of Date and Time