Total Endurance™ v5.00
Quick Start Guide

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INTRODUCTION

Total Endurance software is a simple-to-use, yet powerful, software tool to help system designers determine the endurance of Microchip EEPROMs in a given application. The software will calculate the expected endurance based on the conditions entered by the user.

INSTALLING THE SOFTWARE

You can find Total Endurance v5.00 on Microchip's web site, www.microchip.com. When you have downloaded Total Endurance v5.00 Install.exe, simply launch the setup file and follow the instructions.

USING TOTAL ENDURANCE

There are four main parts of the screen: (See screen sample)

Options

The options area allows you to choose whether or not you want to calculate endurance up to a specific period of time ("Application life") or if you want the Total Endurance software to calculate how long it will take to get to a specific failure rate (PPM). If it takes longer than 41 years to get to the failure rate you have specified, then the program will calculate out to 41 years and then display the actual failure rate at that time.

You can also select the x-axis display of the graph – either "Cycles" or "Time".

Endurance Parameters

Here the parameters are entered that the Total Endurance software will use to calculate the expected failure rate. Select the device you want using the "Product Family" and "Device Selection" drop-down menus.

Next, select the operating voltage of your application (the V_{DD} supply level of the EEPROM), and the ambient temperature of the application (temperature has a strong effect on endurance).

Depending on what you selected in options, you can enter the application life (or PPM level) you need the Total Endurance software to calculate.

Select the String length (number of bytes being written during the Write command, use 1 for byte writes). And finally, the number of times those bytes are written per day.

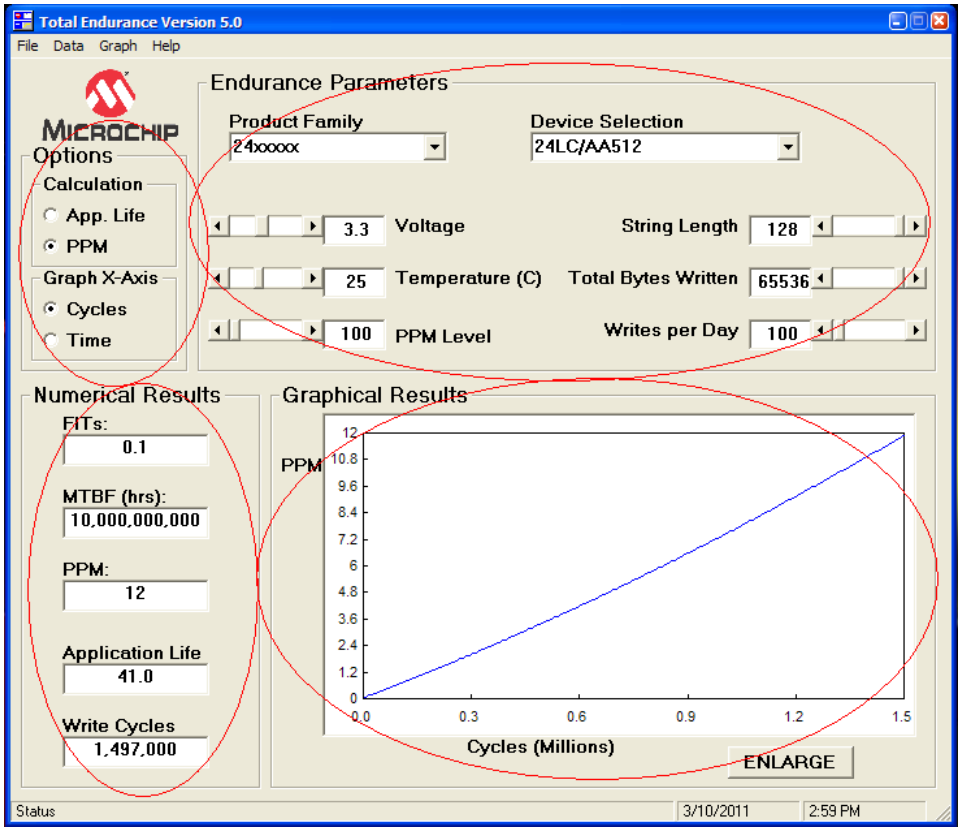
Numerical Results

This area provides the results of your calculation in numerical form. It shows the failure rate in FITs (Failure in Time) and PPM (Parts Per Million), calculates the MTBF (Mean Time Between Failure), gives the life of the application (calculated if you have asked Total Endurance software to calculate up to a certain PPM failure rate), and calculates the number of write cycles you are performing over the life of your application.

Graphic Results

This shows the failure rate over time (or cycles) up to the lifetime (calculated or entered) of the application. The **Enlarge** button displays a full-screen version of the graph.

FAILURE RATE OVER TIME



ARCHITECTURE

Microchip employs two different array architectures in its EEPROM devices. The difference between the two involves what happens during the write cycle when less than a full page is written. To the end user, this change does not affect communication; it only affects how endurance is specified.

Byte Architecture

Microchip's old EEPROM architecture was a byte architecture that allowed the user to do a true byte write where only the byte(s) being addressed were modified during the write cycle. The number of bytes being programmed in this architecture could be anywhere from one single byte to an entire page.

Page Architecture

Microchip's new EEPROM architecture is page based and forces the entire page to undergo a write cycle even when individual bytes are addressed. This design supports pseudo byte writes (or multiple bytes of less than a full page) so the new devices can be used as a replacement for older devices with no code changes required. All writes to a page now refresh all of the bytes of the page whether the specific bytes are addressed or not.

With the new page architecture, the entire page is read into latches at the beginning of the Write command. As data is received, it is loaded into the appropriate latches to replace the old data. At the end of the Write command, the entire page is written using the data in the latches. This is essentially a read-modify-write operation on the entire page.

Because the entire page endures a write cycle during each write operation, endurance is specified per page.

How does this affect me?

Most applications should not encounter any issues when moving between these two architectures due to the high endurance of Microchip EEPROM technology.

Microchip recommends that byte writes be minimized, and for the MCU to buffer the data and performs either a whole page write, or writes as many bytes in one Write command as possible.

A side benefit of performing a page write vs. a multiple of individual byte writes is a reduction in average power consumption; also the total system write time is reduced by doing fewer total writes. AN1028, "*Recommended Usage of Microchip I^2C™ Serial EEPROM Devices,*" covers a number of examples showing the code efficiencies and reduction in time taken between writing individual bytes vs. an entire page.

The data below was collected on actual Microchip devices. It shows that the endurance is very high for Microchip serial EEPROMS and that most users should not have any endurance concerns.

NOTES:

NOTES:

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