



# AN602

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## How to get 10 Million Cycles out of your Microchip Serial EEPROM

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### INTRODUCTION

Microchip Technology Incorporated recently became the first manufacturer of Serial EEPROMs to rate the endurance of 1K to 16K 2-Wire protocols and 1K to 4K 3-Wire protocols at 10 million cycles. This gives the highest endurance available from any manufacturer on such a wide range of Serial EEPROMs. Microchip is also the world leader in endurance application support, including Total Endurance™ software, which allows customers to determine exactly what their endurance will be in their application. This application note will explain our 10 million cycle guarantee in the context of Total Endurance and the customer application.

### ENDURANCE

Endurance is the term used to define the number of times an EEPROM-based device can be erased and re-written before an unacceptable failure rate has occurred. Microchip defines an unacceptable failure rate as 2.5%, which is half the "industry standard" (JEDEC) failure rate of 5%.

Microchip uses the industry standard cycling conditions to guarantee 10 million cycles. These are the same conditions used by the major EEPROM manufacturers, unless specifically stated otherwise. The conditions are 25°C block cycle at 5.0V. The data pattern that is written to the device is supplier-dependent. Microchip uses a checkerboard pattern to better simulate actual use.

### 10 MILLION CYCLE GUARENTEE

We take a great deal of data on the endurance of our devices. We run experiments over temperature, voltage, array size, data pattern, cycling type and other erase/write cycling conditions, to continually learn about our products. The data we take is continually fed back into our manufacturing process tracking, and is also used to periodically update our application predictive software, Total Endurance. The lessons that we learn are passed on to our customers.

Microchip has shown many times before that temperature has the strongest effect on endurance. The higher the temperature of your application is, the lower your endurance will be. For example, no EEPROM manufacturer can deliver a product that will achieve 1 million cycles at 125°C, but many can deliver 1 million cycles at room temperature. Microchip can provide 10 million cycles on all our Serial EEPROMs at room temperature, using the standard cycling conditions.

You can ensure the lowest possible failure rate at 10 million cycles by using the EEPROM in ways that are easiest on endurance. Use the lowest temperature possible. Use the lowest voltage possible. Write as few bytes as possible (the number of reads is unlimited), and use page modes if the device you are using has one (Typically all 2-wire protocols have a page mode, but 3-wire protocols do not).

The best way to determine the endurance of your application is to use the Total Endurance software. This will give accurate results over a very wide range of application-specific conditions, including array size, temperature, and voltage (the main effects on cycling).

The most important thing to remember is that endurance is application-specific. Each application will result in a different endurance level, based on the temperature, voltage, and other conditions under which the application operates. Currently Microchip is the only manufacturer to offer such a wide range of tools to help guide the user in his or her application of Serial EEPROMs.

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**Note the following details of the code protection feature on PICmicro® MCUs.**

- The PICmicro family meets the specifications contained in the Microchip Data Sheet.
- Microchip believes that its family of PICmicro microcontrollers is one of the most secure products of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the PICmicro microcontroller in a manner outside the operating specifications contained in the data sheet. The person doing so may be engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as “unbreakable”.
- Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our product.

If you have any further questions about this matter, please contact the local sales office nearest to you.

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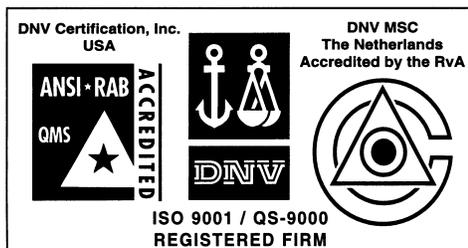
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