Serial EEPROM
Powered for Automotive

- Robust Design
- World Class Quality
- Wafer-Level Burn In
- Zero Field Defects

Engine Control (Powertrain)
Air Bag
ABS
Entertainment System

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Microchip Serial EEPROM Memory Products

What is the best way to build a zero-defect automobile? By using zero-defect components. How, then does one achieve zero-defect components? The quality must be designed-in; manufactured-in; and any remaining defects tested out.

Microchip Technology has developed industry-leading processes for each step in the design, manufacturing and testing phases of its serial EEPROMs, and has become one of the most respected leaders in supply of these devices to the automotive industry – worldwide.

Zero field returns for bit failures during the past several years, across several billion units shipped, is testimony to Microchip's commitment to quality and reliability. This along with Microchip's broad EEPROM portfolio and commitment to excellence in support and delivery, ensures a one-stop solution for truly robust, world class products.

Microchip Serial EEPROM Advantages
- Long history in Automotive Sector – proven, tried and trusted
- Long Product Life Cycle
- Custom parts to suit your needs
- Excellent delivery
- Microchip owned fab
- In-house testing and assembly
- Industry's shortest lead times
- Excellent engineering and customer support
- Wide selection of packages (SOT-23, SC-70, T-DFN, MSOP)
- Complete tools support

Quality
- Microchip delivers highest quality EEPROMs in the world
- World-class line yields (over 99%)
- ISO/TS16949-compliant
- Industry leader with triple test flow – Every cell of every part is tested three times
- Zero PPM field bit fails
- Record PPM levels across nearly a billion EEPROMs shipped every year
- Statistical Process Control and continuous improvement procedures in all facilities
- Robustness and reliability designed in

Performance
- ESD Protection at all pins >4 kV
- ESD Induced Latch Up Protection Ensures device protection against transients with respect to VDD and GND
- Brown-Out Reset – Protects devices from false writes during BOR
- Input Filters – Better Noise Immunity
- Data Retention >200 Years
- Endurance in excess of 1M cycles
- E-Temp and custom made H-Temp parts available
- Industry’s Fastest SPI bus at 20 MHz
- Lowest operating current

Extended Temperatures
- I-Temp: -40°C to 150°C
- E-Temp: -40°C to 125°C
- H-Temp: -40°C to 85°C

Innovative Packages and Die
- PDIP, SOIC, DFN, TSSOP-DFN, MSOP, SOT-23, SC70, Die and Wafer

Tools
- MPLAB® Starter Kit for Serial Memory Products
- Total Endurance™ Software
- Verilog and IBIS Models
- Microchip Advanced Parts Selector (MAPS)

All Major Bus Types
- I²C™ 24LCXX
- Microwire 93LCXX
- SPI 25LCXX
- UNI/O™ 11LCXX

Complete Product Lines
- Density: 128 bits to 1 Mbit
- Speed: Up to 20 MHz

Operating Voltages
- VL: 1.5V-3.6V
- AA: 1.7-5.5V
- LC: 2.5-5.5V
- C: 4.5-5.5V

Reliability
- High Endurance: 1 Million E/W Cycles
- Data Retention: Over 200 Years

Higher Quality
- QS9000; ISO/TS16949
- AEC-Q100 Compliant
- Pb-Free Parts
- RoHS Compliant
- Long Product Life Cycles
Microchip’s Triple Test Flow is currently the most robust testing procedure for serial EEPROM devices in the industry. It tests each cell of each die three times and also performs extensive E/W endurance and data retention tests to ensure quality and reliability.

Infant mortality of Microchip serial EEPROMs is among the lowest in the industry due to this extensive testing, excellent fabrication and highly reliable memory cell design.

**Traditional Burn-in (Old Technology)**

General purpose non-specific testing procedure for random logic cells

- Non-specific and untargeted testing mechanism – Increases failure rates.
- Expensive, time consuming and inefficient.
- Introduces defect modes like bent leads and EOS that sometimes go undetected.

**Microchip’s Triple Test and Wafer-level Burn-in Procedure**

Moving beyond traditional burn-in to wafer level burn-in with the Triple Test Flow specifically targeted for memory cells has helped create the industry’s most reliable memory products.

- Extensive Testing – Every cell in every die is tested three times, including specific endurance and data retention tests to ensure highest quality.
- HVST, LVHF and TVPP tests target specific defects.
- Perfected testing mechanism streamlined with our fabrication technology ensures highest efficiency, fastest lead times and lowest costs.
- Insight into failure modes along with flexible test flow ensures continues improvement.

**Microchip Serial EEPROM Field Return Data**

- Zero PPM EEPROM returns due to bad bits
- Very low infant mortality (<0.8PPM)
- Industry lowest field return numbers – best suited for automotive applications

**Microchip Serial EEPROM Endurance**

- All devices from supplier A and B failed
- Testing shows zero Microchip EEPROM fails even at 2 million E/W cycles at 85°C

**Main Goals**

- Full verification of data sheet parameters for functional compliance at die and package level.
- Screen out all manufacturing defects to ensure highest quality and reliability.

Microchip tests every cell of every die twice! Then we perform a final test after assembly:

1. **First Wafer Probe:** All die are checked to ensure conformance to data sheet specs. A high temperature sort is performed where all bits are erased and written 5,000 times to weed out any failures, weak cells or single-point defects.
   Retention Bake: A high temperature stress test that helps accelerate charge loss. The wafers are baked at 250°C for up to 24 hours.

2. **Second Wafer Probe:** All die are again tested to make sure that the data from the first wafer probe is still correct – after 5000 E/W cycles and a high-temperature bake. Failed bits are identified as well as cells that have lost any charge throughout the process. These die are also rejected as they may have a propensity to fail.

3. **Assembly and Final Test:** Final test done after assembly. 100% tested while maintaining world class line yields.
Additional Testing Procedures and Tools

Microchip performs additional in-house testing to ensure all parts are of the highest quality and eliminate any devices that show a possibility of failure.

**High Voltage Stress Test (HVST) – (Top View)**

- Burn-Ins and elevated temperatures DO NOT stress leaky devices having defective oxides which will eventually fail.
- HVST test helps detect any cells with defective oxide as shown. These defective devices are discarded.

**Low Voltage High Frequency Test (LVHF) – (Side View)**

- Resistive Interconnects are one of the most common failure mechanisms in any EEPROM technology and can be screened by the LVHF test.
- The highlighted voids cause high resistance interconnects. LVHF, a part of the triple test flow, identifies and rejects devices with this issue.

**Good Die in a Bad Neighborhood (GBN)**

- All good die in the neighborhood of bad die is failed automatically as it shows a possibility of failure.
- Helps improve infant mortality.

**MPLAB® Starter Kit for Serial Memory Products**

(Part Number DV243003)

Increase productivity, reduce time to market and create a rock-solid design using this sophisticated development system. The MPLAB Starter Kit includes everything necessary to quickly program and develop a robust and reliable Serial EEPROM design, and reduce the time required for system integration and hardware/software debug.

**Total Endurance™ Software**

Have you ever wondered:

1. About the reliability and endurance impact of your design decision?
2. How long your EEPROM will last?
3. How you can create the most robust design?

Total Endurance Software provides a comprehensive model that helps estimate the endurance and reliability of Microchip Serial EEPROM devices. The model not only takes in to account the effect of “wear-out” but also looks at the compounding effect of various application environment factors like internal voltages, programming time, dielectric oxide thickness and temperature. By providing operating conditions based on your application, all design trade-offs affecting reliability can now be accurately estimated both graphically and numerically in PPM, FIT and MTBF modes, saving time and ensuring a truly robust design.

**Additional Resources**

Verilog and IBIS Models for I²C™ and SPI
Memory Products Webinars: [http://techtrain.microchip.com/webseminars](http://techtrain.microchip.com/webseminars)
Over 50 different application notes, many with source code options can be found at: [www.microchip.com/appnotes](http://www.microchip.com/appnotes)
Get started with Microchip’s Serial EEPROMs in four easy steps: [www.microchip.com/eeprom](http://www.microchip.com/eeprom)
## Product Specifications

### I²C™ Memory Products

<table>
<thead>
<tr>
<th>Device</th>
<th>Density (Organization)</th>
<th>Max Clock Frequency</th>
<th>Operating Voltage (XX)</th>
<th>Temperature (I, E, H)</th>
<th>Endurance (E/W Cycles)</th>
<th>Data Retention</th>
<th>Write Protect (Hardware)</th>
<th>Write Protect (Hardware)</th>
<th>Packages</th>
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<tbody>
<tr>
<td>24XX00</td>
<td>128 bits (x8)</td>
<td>400 kHz</td>
<td>AA, LC, C</td>
<td>-40°C to +125°C</td>
<td>1M</td>
<td>200 years</td>
<td>No</td>
<td>PDIP, SOIC, TSSOP, SOT-23, 2x3 DFN</td>
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<td>1M</td>
<td>200 years</td>
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<td>1M/10M</td>
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<td>24XX256</td>
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<td>200 years</td>
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<td>1M</td>
<td>200 years</td>
<td>Yes</td>
<td>PDIP, SOJ</td>
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### SPI Memory Products

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<td>10 MHz</td>
<td>AA, LC, C</td>
<td>-40°C to +125°C</td>
<td>1M</td>
<td>200 years</td>
<td>W, ½, ¼</td>
<td>5 ms</td>
<td>5 mA</td>
<td>1 μA</td>
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<td>25XX02A</td>
<td>2 Kbits (x8)</td>
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<td>AA, LC, C</td>
<td>-40°C to +125°C</td>
<td>1M</td>
<td>200 years</td>
<td>W, ½, ¼</td>
<td>5 ms</td>
<td>5 mA</td>
<td>1 μA</td>
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<tr>
<td>25XX04A</td>
<td>4 Kbits (x8)</td>
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<td>AA, LC, C</td>
<td>-40°C to +125°C</td>
<td>1M</td>
<td>200 years</td>
<td>W, ½, ¼</td>
<td>5 ms</td>
<td>5 mA</td>
<td>1 μA</td>
</tr>
<tr>
<td>25XX08A</td>
<td>8 Kbits (x8)</td>
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<td>AA, LC, C</td>
<td>-40°C to +125°C</td>
<td>1M</td>
<td>200 years</td>
<td>W, ½, ¼</td>
<td>5 ms</td>
<td>5 mA</td>
<td>1 μA</td>
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<tr>
<td>25XX16A</td>
<td>16 Kbits (x8)</td>
<td>10 MHz</td>
<td>AA, LC, C</td>
<td>-40°C to +125°C</td>
<td>1M</td>
<td>200 years</td>
<td>W, ½, ¼</td>
<td>5 ms</td>
<td>5 mA</td>
<td>1 μA</td>
</tr>
<tr>
<td>25XX32A</td>
<td>32 Kbits (x8)</td>
<td>10 MHz</td>
<td>AA, LC, C</td>
<td>-40°C to +125°C</td>
<td>1M</td>
<td>200 years</td>
<td>W, ½, ¼</td>
<td>5 ms</td>
<td>5 mA</td>
<td>1 μA</td>
</tr>
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<td>25XX64A</td>
<td>64 Kbits (x8)</td>
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<td>AA, LC, C</td>
<td>-40°C to +125°C</td>
<td>1M</td>
<td>200 years</td>
<td>W, ½, ¼</td>
<td>5 ms</td>
<td>5 mA</td>
<td>1 μA</td>
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<tr>
<td>25XX128</td>
<td>128 Kbits (x8)</td>
<td>10 MHz</td>
<td>AA, LC, C</td>
<td>-40°C to +125°C</td>
<td>1M</td>
<td>200 years</td>
<td>W, ½, ¼</td>
<td>5 ms</td>
<td>5 mA</td>
<td>1 μA</td>
</tr>
<tr>
<td>25XX256</td>
<td>256 Kbits (x8)</td>
<td>10 MHz</td>
<td>AA, LC, C</td>
<td>-40°C to +125°C</td>
<td>1M</td>
<td>200 years</td>
<td>W, ½, ¼</td>
<td>5 ms</td>
<td>6 mA</td>
<td>1 μA</td>
</tr>
<tr>
<td>25XX512</td>
<td>512 Kbits (x8)</td>
<td>20 MHz</td>
<td>AA, LC, C</td>
<td>-40°C to +125°C</td>
<td>1M</td>
<td>200 years</td>
<td>W, ½, ¼</td>
<td>5 ms</td>
<td>10 mA</td>
<td>1 μA</td>
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<tr>
<td>25XX1024</td>
<td>1 Mbit (x8)</td>
<td>20 MHz</td>
<td>AA, LC, C</td>
<td>-40°C to +125°C</td>
<td>1M</td>
<td>200 years</td>
<td>W, ½, ¼</td>
<td>6 ms</td>
<td>10 mA</td>
<td>1 μA</td>
</tr>
</tbody>
</table>

1. Voltage Range: AA = 1.7 - 5.5V; LC = 2.5-5.5V; C = 4.5-5.5V
2. I = -40°C to 85°C; E = -40°C to 125°C (Automotive); H-Temp (-40°C to 150°C) Parts available in all devices but need to be custom ordered.
3. All Devices are Pb-Free and RoHS Compliant
4. ESD protection > 4 kV (HBM); > 400V (MM) on all pins

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