

## 8K SPI™ Bus Serial EEPROM

### Device Selection Table

| Part Number | Vcc Range | Page Size | Temp. Ranges | Packages      |
|-------------|-----------|-----------|--------------|---------------|
| 25LC080A    | 2.5-5.5V  | 16 Byte   | I, E         | P, SN, ST, MS |
| 25AA080A    | 1.8-5.5V  | 16 Byte   | I            | P, SN, ST, MS |
| 25LC080B    | 2.5-5.5V  | 32 Byte   | I, E         | P, SN, ST, MS |
| 25AA080B    | 1.8-5.5V  | 32 Byte   | I            | P, SN, ST, MS |

### Features

- Max. clock 10 MHz
- Low-power CMOS technology
- 1024 x 8-bit organization
- 16 byte page ('A' version devices)
- 32 byte page ('B' version devices)
- Write cycle time: 5 ms max.
- Self-timed ERASE and WRITE cycles
- Block write protection
  - Protect none, 1/4, 1/2 or all of array
- Built-in write protection
  - Power-on/off data protection circuitry
  - Write enable latch
  - Write-protect pin
- Sequential read
- High reliability
  - Endurance: 1,000,000 erase/write cycles
  - Data retention: > 200 years
  - ESD protection: > 4000V
- Temperature ranges supported;
  - Industrial (I): -40°C to +85°C
  - Automotive (E): -40°C to +125°C

### Pin Function Table

| Name              | Function           |
|-------------------|--------------------|
| $\overline{CS}$   | Chip Select Input  |
| SO                | Serial Data Output |
| $\overline{WP}$   | Write-Protect      |
| Vss               | Ground             |
| SI                | Serial Data Input  |
| SCK               | Serial Clock Input |
| $\overline{HOLD}$ | Hold Input         |
| Vcc               | Supply Voltage     |

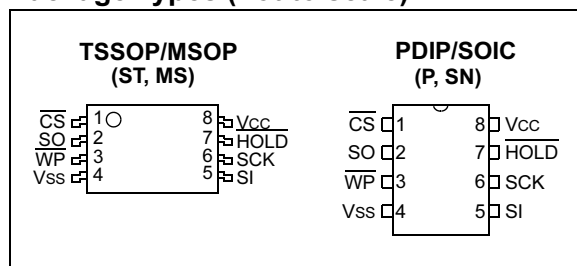
### Description

The Microchip Technology Inc. 25AA080A/B, 25LC080A/B (25XX080A/B\*) are 8 Kbit Serial Electrically Erasable PROMs. The memory is accessed via a simple Serial Peripheral Interface™ (SPI™) compatible serial bus. The bus signals required are a clock input (SCK) plus separate data in (SI) and data out (SO) lines. Access to the device is controlled through a Chip Select ( $\overline{CS}$ ) input.

Communication to the device can be paused via the hold pin (HOLD). While the device is paused, transitions on its inputs will be ignored, with the exception of chip select, allowing the host to service higher priority interrupts.

The 25XX080A/B is available in standard packages including 8-lead PDIP and SOIC, and advanced packaging including 8-lead MSOP, and 8-lead TSSOP. Pb-free (Pure Matte Sn) finish is also available.

### Package Types (not to scale)



SPI is a registered trademark of Motorola Semiconductor.

\*25XX080A/B is used in this document as a generic part number for the 25AA080A/B, 25LC080A/B.

# 25XX080A/B

## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings (†)

|                                                     |                                |
|-----------------------------------------------------|--------------------------------|
| V <sub>CC</sub> .....                               | 7.0V                           |
| All inputs and outputs w.r.t. V <sub>SS</sub> ..... | -0.6V to V <sub>CC</sub> +1.0V |
| Storage temperature .....                           | -65°C to 150°C                 |
| Ambient temperature under bias .....                | -65°C to 125°C                 |
| ESD protection on all pins .....                    | 4 kV                           |

† NOTICE: Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational listings of this specification is not implied. Exposure to maximum rating conditions for an extended period of time may affect device reliability.

**TABLE 1-1: DC CHARACTERISTICS**

| DC CHARACTERISTICS |                       |                                               | Industrial (I): T <sub>AMB</sub> = -40°C to +85°C V <sub>CC</sub> = 1.8V to 5.5V<br>Automotive (E): T <sub>AMB</sub> = -40°C to +125°C V <sub>CC</sub> = 2.5V to 5.5V |                     |       |                                                                                                                                         |
|--------------------|-----------------------|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Param. No.         | Sym.                  | Characteristic                                | Min.                                                                                                                                                                  | Max.                | Units | Test Conditions                                                                                                                         |
| D001               | V <sub>IH1</sub>      | High-level input voltage                      | 2.0                                                                                                                                                                   | V <sub>CC</sub> +1  | V     | V <sub>CC</sub> ≥ 2.7V ( <b>Note</b> )                                                                                                  |
| D002               | V <sub>IH2</sub>      |                                               | 0.7 V <sub>CC</sub>                                                                                                                                                   | V <sub>CC</sub> +1  | V     | V <sub>CC</sub> < 2.7V ( <b>Note</b> )                                                                                                  |
| D003               | V <sub>IL1</sub>      | Low-level input voltage                       | -0.3                                                                                                                                                                  | 0.8                 | V     | V <sub>CC</sub> ≥ 2.7V ( <b>Note</b> )                                                                                                  |
| D004               | V <sub>IL2</sub>      |                                               | -0.3                                                                                                                                                                  | 0.2 V <sub>CC</sub> | V     | V <sub>CC</sub> < 2.7V ( <b>Note</b> )                                                                                                  |
| D005               | V <sub>OL</sub>       | Low-level output voltage                      | —                                                                                                                                                                     | 0.4                 | V     | I <sub>OL</sub> = 2.1 mA                                                                                                                |
| D006               | V <sub>OL</sub>       |                                               | —                                                                                                                                                                     | 0.2                 | V     | I <sub>OL</sub> = 1.0 mA, V <sub>CC</sub> < 2.5V                                                                                        |
| D007               | V <sub>OH</sub>       | High-level output voltage                     | V <sub>CC</sub> -0.5                                                                                                                                                  | —                   | V     | I <sub>OH</sub> = -400 μA                                                                                                               |
| D008               | I <sub>LI</sub>       | Input leakage current                         |                                                                                                                                                                       | ±1                  | μA    | $\overline{\text{CS}}$ = V <sub>CC</sub> , V <sub>IN</sub> = V <sub>SS</sub> TO V <sub>CC</sub>                                         |
| D009               | I <sub>LO</sub>       | Output leakage current                        |                                                                                                                                                                       | ±1                  | μA    | $\overline{\text{CS}}$ = V <sub>CC</sub> , V <sub>OUT</sub> = V <sub>SS</sub> TO V <sub>CC</sub>                                        |
| D010               | C <sub>INT</sub>      | Internal Capacitance (all inputs and outputs) | —                                                                                                                                                                     | 7                   | pF    | T <sub>AMB</sub> = 25°C, CLK = 1.0 MHz, V <sub>CC</sub> = 5.0V ( <b>Note</b> )                                                          |
| D011               | I <sub>CC</sub> Read  | Operating Current                             | —                                                                                                                                                                     | 6                   | mA    | V <sub>CC</sub> = 5.5V; F <sub>CLK</sub> = 10.0 MHz; SO = Open                                                                          |
|                    |                       |                                               | —                                                                                                                                                                     | 2.5                 | mA    | V <sub>CC</sub> = 2.5V; F <sub>CLK</sub> = 5.0 MHz; SO = Open                                                                           |
| D012               | I <sub>CC</sub> Write |                                               | —                                                                                                                                                                     | 3                   | mA    | V <sub>CC</sub> = 5.5V                                                                                                                  |
| D013               | I <sub>CCS</sub>      | Standby Current                               | —                                                                                                                                                                     | 5                   | μA    | $\overline{\text{CS}}$ = V <sub>CC</sub> = 5.5V, Inputs tied to V <sub>CC</sub> or V <sub>SS</sub> , T <sub>AMB</sub> = -40°C TO +125°C |
|                    |                       |                                               | —                                                                                                                                                                     | 1                   | μA    | $\overline{\text{CS}}$ = V <sub>CC</sub> = 2.5V, Inputs tied to V <sub>CC</sub> or V <sub>SS</sub> , T <sub>AMB</sub> = -40°C TO +85°C  |

**Note:** This parameter is periodically sampled and not 100% tested.

**TABLE 1-2: AC CHARACTERISTICS**

| AC CHARACTERISTICS |                  |                                     | Industrial (I): T <sub>AMB</sub> = -40°C to +85°C V <sub>CC</sub> = 1.8V to 5.5V<br>Automotive (E): T <sub>AMB</sub> = -40°C to +125°C V <sub>CC</sub> = 2.5V to 5.5V |      |       |                                        |
|--------------------|------------------|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|----------------------------------------|
| Param. No.         | Sym.             | Characteristic                      | Min.                                                                                                                                                                  | Max. | Units | Test Conditions                        |
| 1                  | FCLK             | Clock Frequency                     | —                                                                                                                                                                     | 10   | MHz   | 4.5V ≤ V <sub>CC</sub> ≤ 5.5V          |
|                    |                  |                                     | —                                                                                                                                                                     | 5    | MHz   | 2.5V ≤ V <sub>CC</sub> < 4.5V          |
|                    |                  |                                     | —                                                                                                                                                                     | 3    | MHz   | 1.8V ≤ V <sub>CC</sub> < 2.5V          |
| 2                  | T <sub>CSS</sub> | $\overline{\text{CS}}$ Setup Time   | 50                                                                                                                                                                    | —    | ns    | 4.5V ≤ V <sub>CC</sub> ≤ 5.5V          |
|                    |                  |                                     | 100                                                                                                                                                                   | —    | ns    | 2.5V ≤ V <sub>CC</sub> < 4.5V          |
|                    |                  |                                     | 150                                                                                                                                                                   | —    | ns    | 1.8V ≤ V <sub>CC</sub> < 2.5V          |
| 3                  | T <sub>CSH</sub> | $\overline{\text{CS}}$ Hold Time    | 100                                                                                                                                                                   | —    | ns    | 4.5V ≤ V <sub>CC</sub> ≤ 5.5V          |
|                    |                  |                                     | 200                                                                                                                                                                   | —    | ns    | 2.5V ≤ V <sub>CC</sub> < 4.5V          |
|                    |                  |                                     | 250                                                                                                                                                                   | —    | ns    | 1.8V ≤ V <sub>CC</sub> < 2.5V          |
| 4                  | T <sub>CSD</sub> | $\overline{\text{CS}}$ Disable Time | 50                                                                                                                                                                    | —    | ns    | —                                      |
| 5                  | T <sub>su</sub>  | Data Setup Time                     | 10                                                                                                                                                                    | —    | ns    | 4.5V ≤ V <sub>CC</sub> ≤ 5.5V          |
|                    |                  |                                     | 20                                                                                                                                                                    | —    | ns    | 2.5V ≤ V <sub>CC</sub> < 4.5V          |
|                    |                  |                                     | 30                                                                                                                                                                    | —    | ns    | 1.8V ≤ V <sub>CC</sub> < 2.5V          |
| 6                  | T <sub>HD</sub>  | Data Hold Time                      | 20                                                                                                                                                                    | —    | ns    | 4.5V ≤ V <sub>CC</sub> ≤ 5.5V          |
|                    |                  |                                     | 40                                                                                                                                                                    | —    | ns    | 2.5V ≤ V <sub>CC</sub> < 4.5V          |
|                    |                  |                                     | 50                                                                                                                                                                    | —    | ns    | 1.8V ≤ V <sub>CC</sub> < 2.5V          |
| 7                  | T <sub>R</sub>   | CLK Rise Time                       | —                                                                                                                                                                     | 500  | ns    | (Note 1)                               |
| 8                  | T <sub>F</sub>   | CLK Fall Time                       | —                                                                                                                                                                     | 500  | ns    | (Note 1)                               |
| 9                  | T <sub>HI</sub>  | Clock High Time                     | 50                                                                                                                                                                    | —    | ns    | 4.5V ≤ V <sub>CC</sub> ≤ 5.5V          |
|                    |                  |                                     | 100                                                                                                                                                                   | —    | ns    | 2.5V ≤ V <sub>CC</sub> < 4.5V          |
|                    |                  |                                     | 150                                                                                                                                                                   | —    | ns    | 1.8V ≤ V <sub>CC</sub> < 2.5V          |
| 10                 | T <sub>LO</sub>  | Clock Low Time                      | 50                                                                                                                                                                    | —    | ns    | 4.5V ≤ V <sub>CC</sub> ≤ 5.5V          |
|                    |                  |                                     | 100                                                                                                                                                                   | —    | ns    | 2.5V ≤ V <sub>CC</sub> < 4.5V          |
|                    |                  |                                     | 150                                                                                                                                                                   | —    | ns    | 1.8V ≤ V <sub>CC</sub> < 2.5V          |
| 11                 | T <sub>CLD</sub> | Clock Delay Time                    | 50                                                                                                                                                                    | —    | ns    | —                                      |
| 12                 | T <sub>CLE</sub> | Clock Enable Time                   | 50                                                                                                                                                                    | —    | ns    | —                                      |
| 13                 | T <sub>V</sub>   | Output Valid from Clock Low         | —                                                                                                                                                                     | 50   | ns    | 4.5V ≤ V <sub>CC</sub> ≤ 5.5V          |
|                    |                  |                                     | —                                                                                                                                                                     | 100  | ns    | 2.5V ≤ V <sub>CC</sub> < 4.5V          |
|                    |                  |                                     | —                                                                                                                                                                     | 160  | ns    | 1.8V ≤ V <sub>CC</sub> < 2.5V          |
| 14                 | T <sub>HO</sub>  | Output Hold Time                    | 0                                                                                                                                                                     | —    | ns    | (Note 1)                               |
| 15                 | T <sub>DIS</sub> | Output Disable Time                 | —                                                                                                                                                                     | 40   | ns    | 4.5V ≤ V <sub>CC</sub> ≤ 5.5V (Note 1) |
|                    |                  |                                     | —                                                                                                                                                                     | 80   | ns    | 2.5V ≤ V <sub>CC</sub> < 4.5V (Note 1) |
|                    |                  |                                     | —                                                                                                                                                                     | 160  | ns    | 1.8V ≤ V <sub>CC</sub> < 2.5V (Note 1) |
| 16                 | T <sub>HS</sub>  | $\overline{\text{HOLD}}$ Setup Time | 20                                                                                                                                                                    | —    | ns    | 4.5V ≤ V <sub>CC</sub> ≤ 5.5V          |
|                    |                  |                                     | 40                                                                                                                                                                    | —    | ns    | 2.5V ≤ V <sub>CC</sub> < 4.5V          |
|                    |                  |                                     | 80                                                                                                                                                                    | —    | ns    | 1.8V ≤ V <sub>CC</sub> < 2.5V          |

**Note 1:** This parameter is periodically sampled and not 100% tested.

**2:** This parameter is not tested but ensured by characterization. For endurance estimates in a specific application, please consult the Total Endurance™ Model which can be obtained from our web site: [www.microchip.com](http://www.microchip.com).

**3:** T<sub>WC</sub> begins on the rising edge of  $\overline{\text{CS}}$  after a valid write sequence and ends when the internal write cycle is complete.

# 25XX080A/B

**TABLE 1-2: AC CHARACTERISTICS (CONTINUED)**

| AC CHARACTERISTICS |                 |                                               | Industrial (I): T <sub>AMB</sub> = -40°C to +85°C V <sub>CC</sub> = 1.8V to 5.5V<br>Automotive (E): T <sub>AMB</sub> = -40°C to +125°C V <sub>CC</sub> = 2.5V to 5.5V |      |            |                                               |
|--------------------|-----------------|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------|-----------------------------------------------|
| Param. No.         | Sym.            | Characteristic                                | Min.                                                                                                                                                                  | Max. | Units      | Test Conditions                               |
| 17                 | T <sub>HH</sub> | $\overline{\text{HOLD}}$ Hold Time            | 20                                                                                                                                                                    | —    | ns         | 4.5V ≤ V <sub>CC</sub> ≤ 5.5V                 |
|                    |                 |                                               | 40                                                                                                                                                                    | —    | ns         | 2.5V ≤ V <sub>CC</sub> < 4.5V                 |
|                    |                 |                                               | 80                                                                                                                                                                    | —    | ns         | 1.8V ≤ V <sub>CC</sub> < 2.5V                 |
| 18                 | T <sub>HZ</sub> | $\overline{\text{HOLD}}$ Low to Output High-Z | 30                                                                                                                                                                    | —    | ns         | 4.5V ≤ V <sub>CC</sub> ≤ 5.5V <b>(Note 1)</b> |
|                    |                 |                                               | 60                                                                                                                                                                    | —    | ns         | 2.5V ≤ V <sub>CC</sub> < 4.5V <b>(Note 1)</b> |
|                    |                 |                                               | 160                                                                                                                                                                   | —    | ns         | 1.8V ≤ V <sub>CC</sub> < 2.5V <b>(Note 1)</b> |
| 19                 | T <sub>HV</sub> | $\overline{\text{HOLD}}$ High to Output Valid | 30                                                                                                                                                                    | —    | ns         | 4.5V ≤ V <sub>CC</sub> ≤ 5.5V                 |
|                    |                 |                                               | 60                                                                                                                                                                    | —    | ns         | 2.5V ≤ V <sub>CC</sub> < 4.5V                 |
|                    |                 |                                               | 160                                                                                                                                                                   | —    | ns         | 1.8V ≤ V <sub>CC</sub> < 2.5V                 |
| 20                 | T <sub>WC</sub> | Internal Write Cycle Time                     | —                                                                                                                                                                     | 5    | ms         | <b>(Note 3)</b>                               |
| 21                 | —               | Endurance                                     | 1,000,000                                                                                                                                                             | —    | E/W Cycles | <b>(Note 2)</b>                               |

**Note 1:** This parameter is periodically sampled and not 100% tested.

**2:** This parameter is not tested but ensured by characterization. For endurance estimates in a specific application, please consult the Total Endurance™ Model which can be obtained from our web site: [www.microchip.com](http://www.microchip.com).

**3:** T<sub>WC</sub> begins on the rising edge of  $\overline{\text{CS}}$  after a valid write sequence and ends when the internal write cycle is complete.

**TABLE 1-3: AC TEST CONDITIONS**

| AC Waveform:                             |                     |
|------------------------------------------|---------------------|
| V <sub>LO</sub> = 0.2V                   | —                   |
| V <sub>HI</sub> = V <sub>CC</sub> - 0.2V | <b>(Note 1)</b>     |
| V <sub>HI</sub> = 4.0V                   | <b>(Note 2)</b>     |
| Timing Measurement Reference Level       |                     |
| Input                                    | 0.5 V <sub>CC</sub> |
| Output                                   | 0.5 V <sub>CC</sub> |

**Note 1:** For V<sub>CC</sub> ≤ 4.0V

**2:** For V<sub>CC</sub> > 4.0V

**FIGURE 1-1: HOLD TIMING**

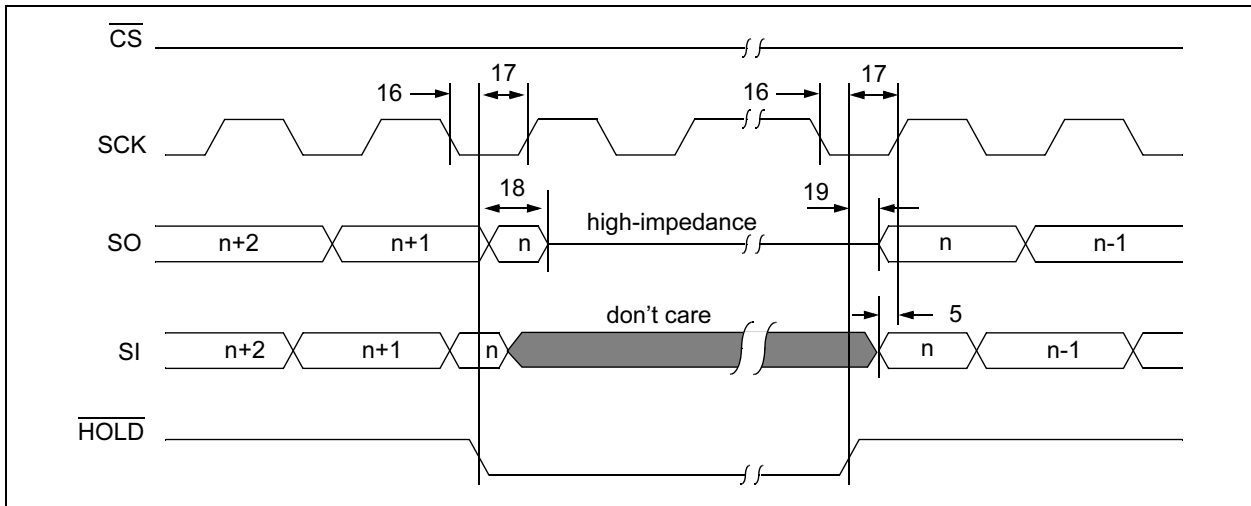


**FIGURE 1-2: SERIAL INPUT TIMING**

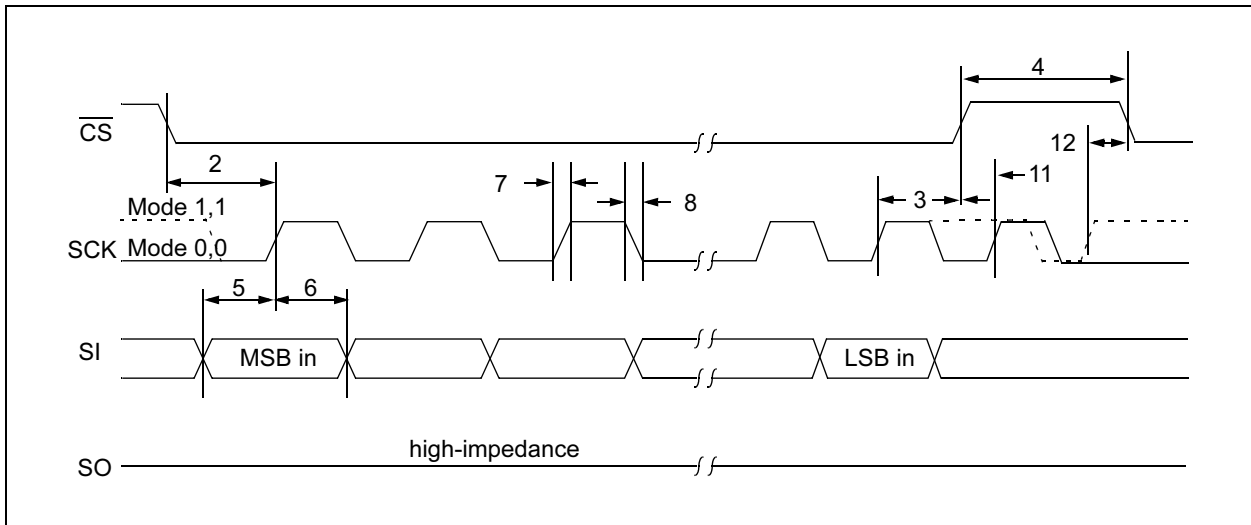
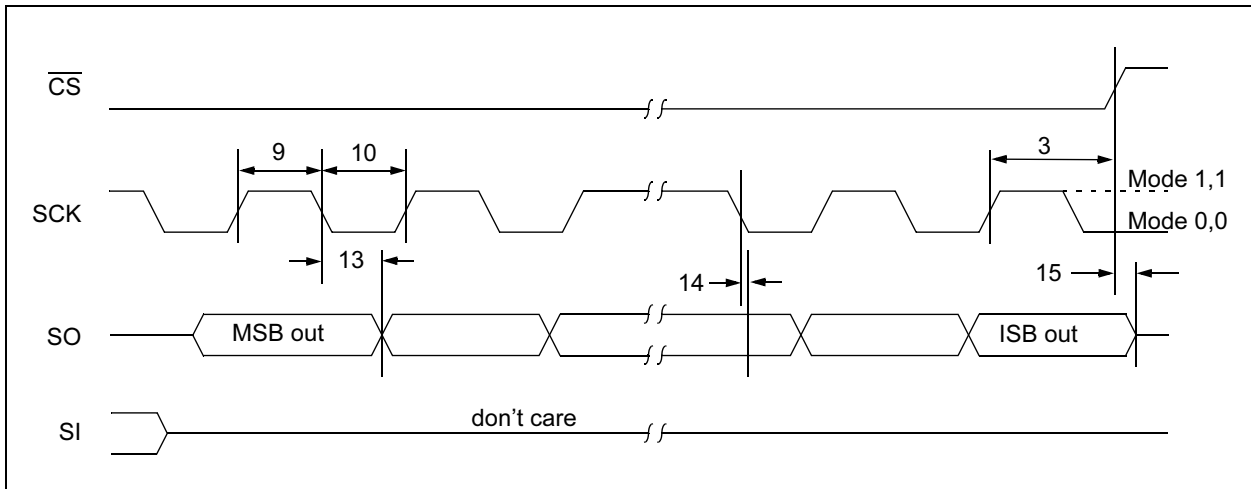


**FIGURE 1-3: SERIAL OUTPUT TIMING**



## 2.0 FUNCTIONAL DESCRIPTION

### 2.1 Principles of Operation

The 25XX080A/B are 1024 byte Serial EEPROMs designed to interface directly with the Serial Peripheral Interface (SPI) Port of many of today's popular microcontroller families, including Microchip's PICmicro® microcontrollers. It may also interface with microcontrollers that do not have a built-in Synchronous Serial Port by using discrete I/O lines programmed properly with the software.

The 25XX080A/B contains an 8-bit instruction register. The device is accessed via the SI pin, with data being clocked in on the rising edge of SCK. The  $\overline{CS}$  pin must be low and the HOLD pin must be high for the entire operation.

Table 2-1 contains a list of the possible instruction bytes and format for device operation. All instructions, addresses, and data are transferred MSB first, LSB last.

Data (SI) is sampled on the first rising edge of SCK after  $\overline{CS}$  goes low. If the clock line is shared with other peripheral devices on the SPI bus, the user can assert the HOLD input and place the 25XX080A/B in 'HOLD' mode. After releasing the  $\overline{HOLD}$  pin, operation will resume from the point when the  $\overline{HOLD}$  was asserted.

### 2.2 Read Sequence

The device is selected by pulling  $\overline{CS}$  low. The 8-bit read instruction is transmitted to the 25XX080A/B followed by the 16-bit address, with the six MSBs of the address being don't care bits. After the correct read instruction and address are sent, the data stored in the memory at the selected address is shifted out on the SO pin. The data stored in the memory at the next address can be read sequentially by continuing to provide clock pulses. The internal address pointer is automatically incremented to the next higher address after each byte of data is shifted out. When the highest address is reached (03FFh), the address counter rolls over to address 0000h allowing the read cycle to be continued indefinitely. The read operation is terminated by raising the  $\overline{CS}$  pin (Figure 2-1).

### 2.3 Write Sequence

Prior to any attempt to write data to the 25XX080A/B, the write enable latch must be set by issuing the WREN instruction (Figure 2-4). This is done by setting  $\overline{CS}$  low and then clocking out the proper instruction into the 25XX080A/B. After all eight bits of the instruction are transmitted, the  $\overline{CS}$  must be brought high to set the write enable latch. If the write operation is initiated immediately after the WREN instruction without  $\overline{CS}$  being brought high, the data will not be written to the array because the write enable latch will not have been properly set.

Once the write enable latch is set, the user may proceed by setting the  $\overline{CS}$  low, issuing a WRITE instruction, followed by the 16-bit address, with the six MSBs of the address being don't care bits, and then the data to be written. Up to 16 bytes (25XX080A) or 32 bytes (25XX080B) of data can be sent to the device before a write cycle is necessary. The only restriction is that all of the bytes must reside in the same page.

**Note:** Page write operations are limited to writing bytes within a single physical page, **regardless** of the number of bytes actually being written. Physical page boundaries start at addresses that are integer multiples of the page buffer size (or 'page size') and, end at addresses that are integer multiples of page size - 1. If a Page Write command attempts to write across a physical page boundary, the result is that the data wraps around to the beginning of the current page (overwriting data previously stored there), instead of being written to the next page as might be expected. It is therefore necessary for the application software to prevent page write operations that would attempt to cross a page boundary.

For the data to be actually written to the array, the  $\overline{CS}$  must be brought high after the Least Significant bit (D0) of the  $n^{th}$  data byte has been clocked in. If  $\overline{CS}$  is brought high at any other time, the write operation will not be completed. Refer to Figure 2-2 and Figure 2-3 for more detailed illustrations on the byte write sequence and the page write sequence respectively. While the write is in progress, the Status Register may be read to check the status of the WPEN, WIP, WEL, BP1 and BP0 bits (Figure 2-6). A read attempt of a memory array location will not be possible during a write cycle. When the write cycle is completed, the write enable latch is reset.

Block Diagram

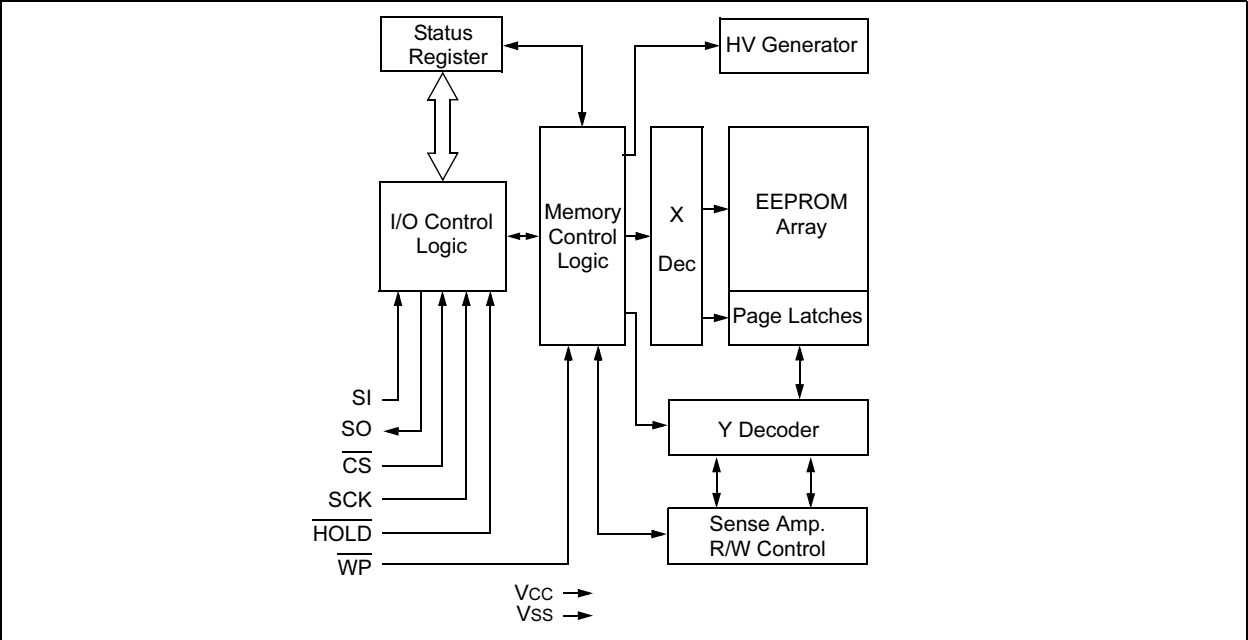
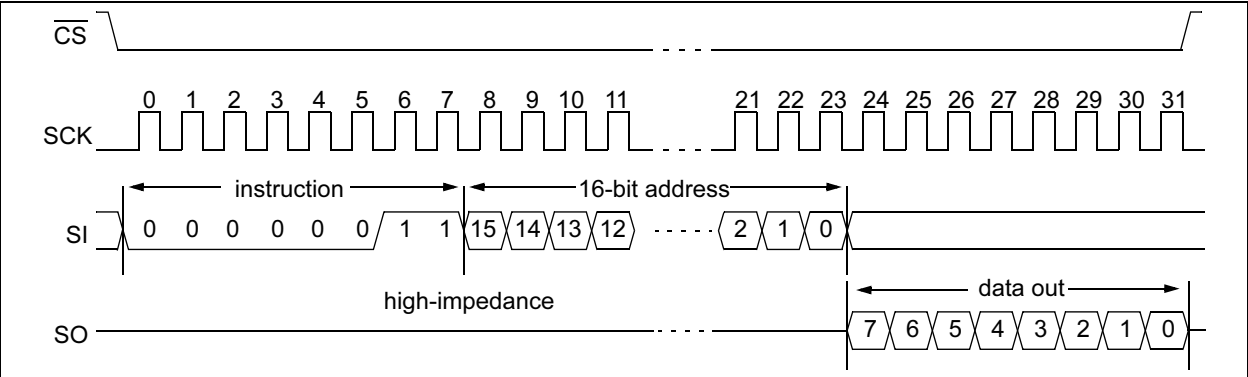


TABLE 2-1: INSTRUCTION SET

| Instruction Name | Instruction Format | Description                                               |
|------------------|--------------------|-----------------------------------------------------------|
| READ             | 0000 0011          | Read data from memory array beginning at selected address |
| WRITE            | 0000 0010          | Write data to memory array beginning at selected address  |
| WRDI             | 0000 0100          | Reset the write enable latch (disable write operations)   |
| WREN             | 0000 0110          | Set the write enable latch (enable write operations)      |
| RDSR             | 0000 0101          | Read Status Register                                      |
| WRSR             | 0000 0001          | Write Status Register                                     |

FIGURE 2-1: READ SEQUENCE



# 25XX080A/B

**FIGURE 2-2: BYTE WRITE SEQUENCE**

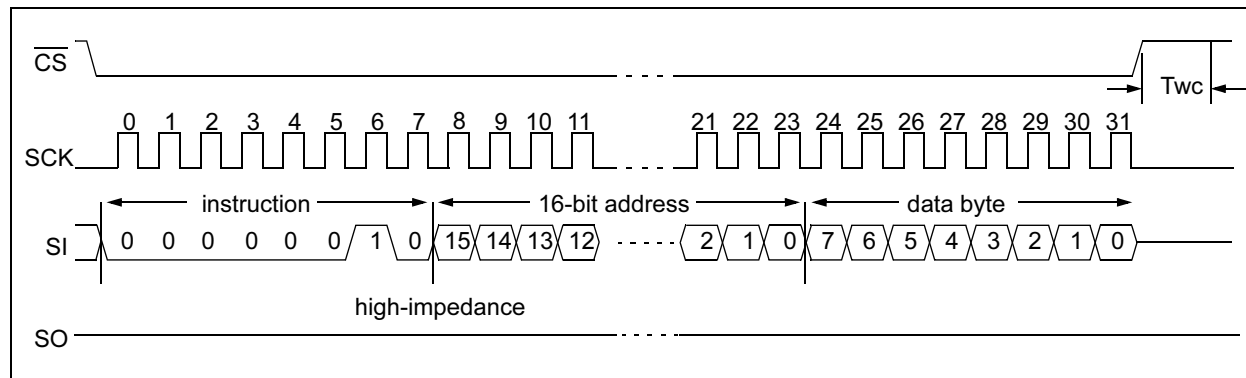
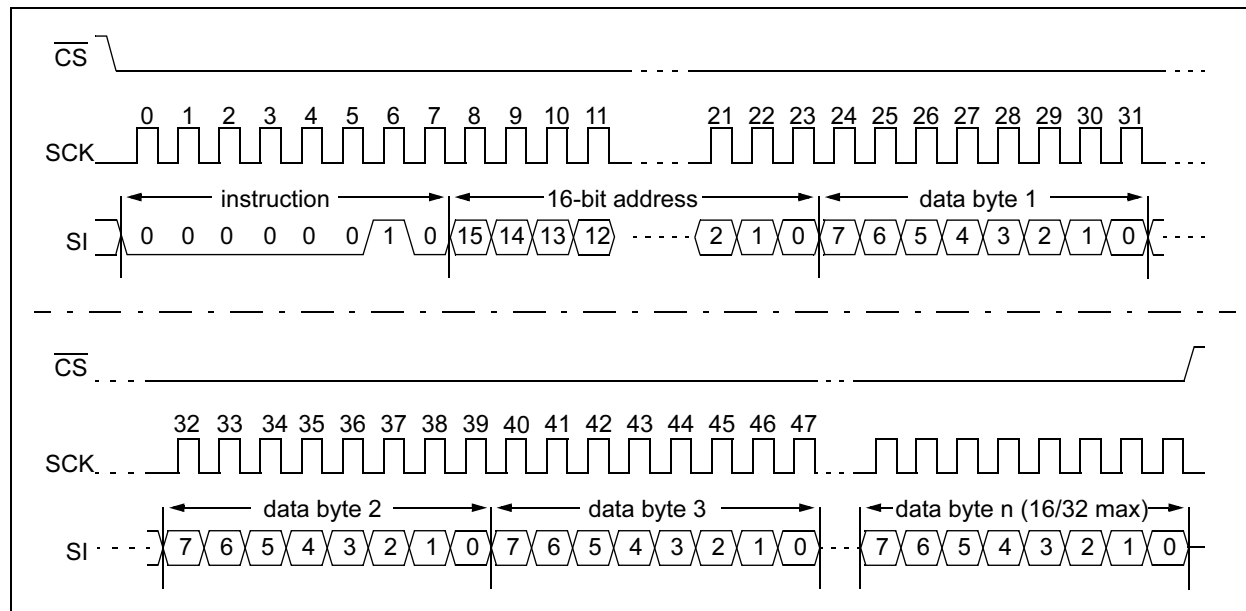


**FIGURE 2-3: PAGE WRITE SEQUENCE**



2.4 Write Enable (WREN) and Write Disable (WRDI)

The 25XX080A/B contains a write enable latch. See Table 2-4 for the Write-Protect Functionality Matrix. This latch must be set before any write operation will be completed internally. The WREN instruction will set the latch, and the WRDI will reset the latch.

The following is a list of conditions under which the write enable latch will be reset:

- Power-up
- WRDI instruction successfully executed
- WRSR instruction successfully executed
- WRITE instruction successfully executed

FIGURE 2-4: WRITE ENABLE SEQUENCE (WREN)

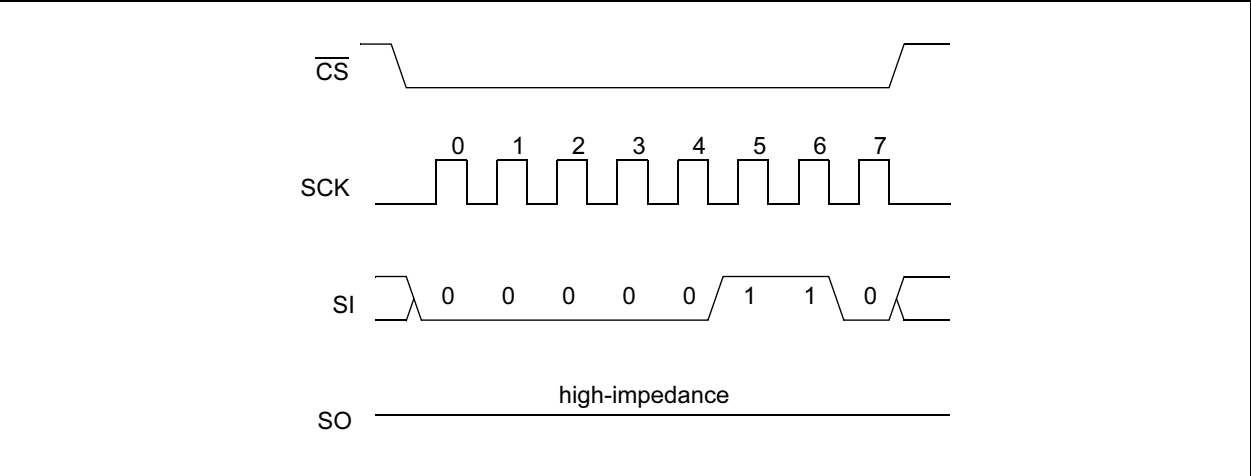
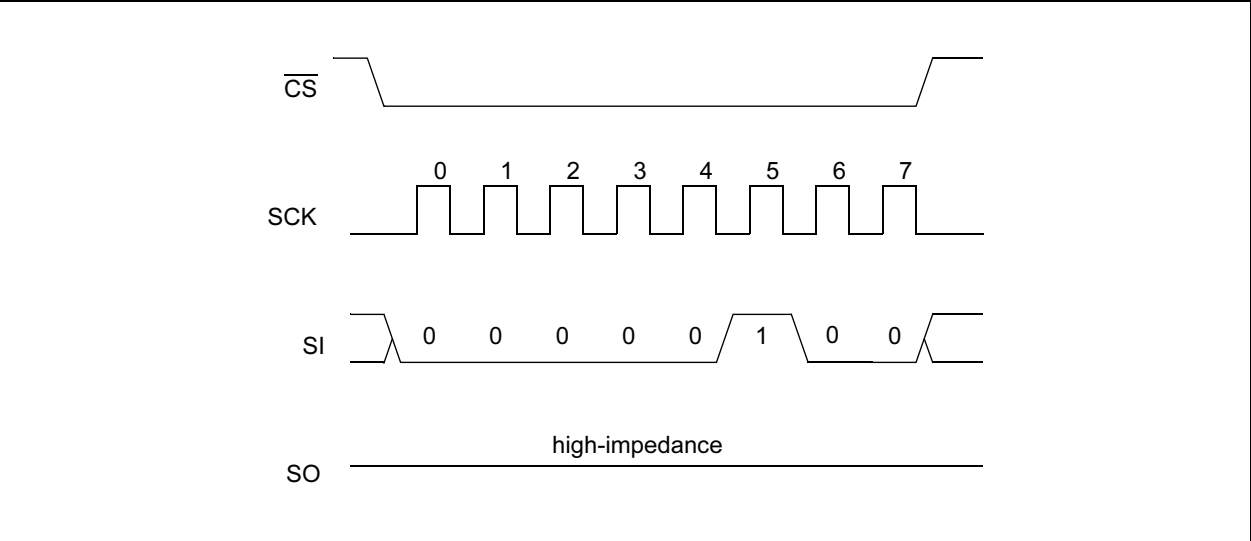


FIGURE 2-5: WRITE DISABLE SEQUENCE (WRDI)



## 2.5 Read Status Register Instruction (RDSR)

The Read Status Register instruction (RDSR) provides access to the Status Register. The Status Register may be read at any time, even during a write cycle. The Status Register is formatted as follows:

**TABLE 2-2: STATUS REGISTER**

| 7                                       | 6 | 5 | 4 | 3   | 2   | 1   | 0   |
|-----------------------------------------|---|---|---|-----|-----|-----|-----|
| W/R                                     | – | – | – | W/R | W/R | R   | R   |
| WPEN                                    | X | X | X | BP1 | BP0 | WEL | WIP |
| W/R = writable/readable. R = read-only. |   |   |   |     |     |     |     |

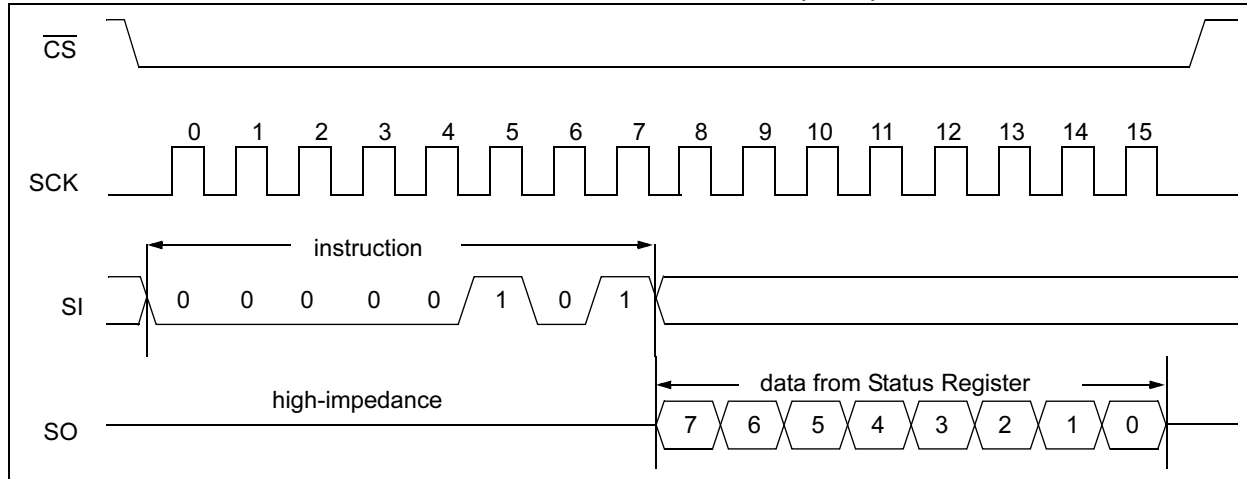
The **Write-In-Process (WIP)** bit indicates whether the 25XX080A/B is busy with a write operation. When set to a '1', a write is in progress, when set to a '0', no write is in progress. This bit is read-only.

The **Write Enable Latch (WEL)** bit indicates the status of the write enable latch and is read only. When set to a '1', the latch allows writes to the array or the Status Register, when set to a '0', the latch prohibits writes to the array or the Status Register. The state of this bit can always be updated via the WREN or WRDI commands regardless of the state of write protection on the Status Register. These commands are shown in Figure 2-4 and Figure 2-5.

The **Block Protection (BP0 and BP1)** bits indicate which blocks are currently write-protected. These bits are set by the user issuing the WRSR instruction, which is in Figure 2-7. These bits are nonvolatile and are shown in Table 2-3.

See Figure 2-6 for the RDSR timing sequence.

**FIGURE 2-6: READ STATUS REGISTER TIMING SEQUENCE (RDSR)**



## 2.6 Write Status Register Instruction (WRSR)

The Write Status Register instruction (WRSR) allows the user to write to the nonvolatile bits in the Status Register as shown in Table 2-2. The user is able to select one of four levels of protection for the array by writing to the appropriate bits in the Status Register. The array is divided up into four segments. The user has the ability to write-protect none, one, two or all four of the segments of the array. The partitioning is controlled as shown in Table 2-3.

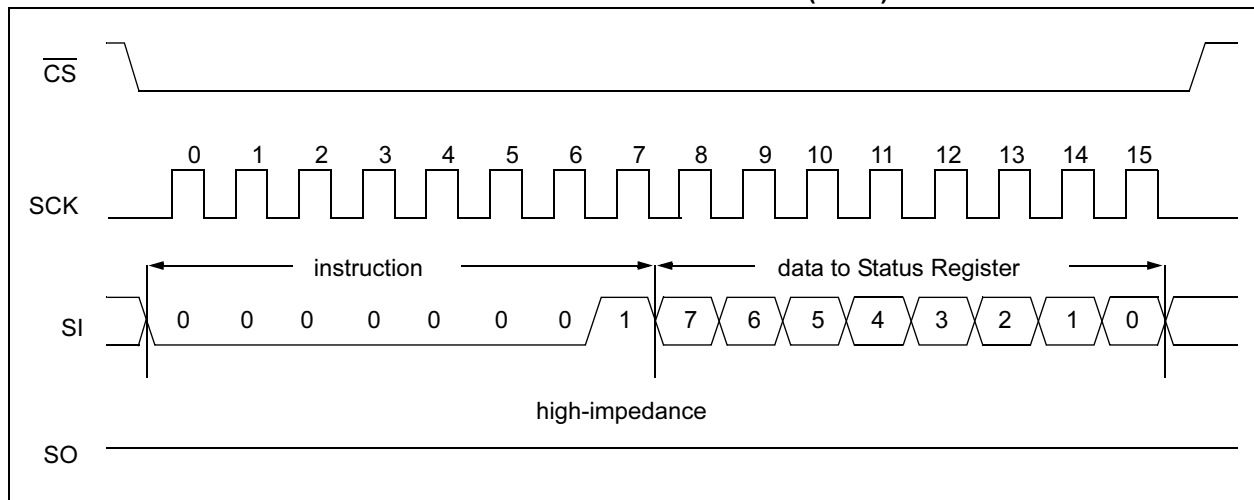
The Write-Protect Enable (WPEN) bit is also a nonvolatile bit that is available as an enable bit for the  $\overline{WP}$  pin. The Write-Protect ( $\overline{WP}$ ) pin and the Write-Protect Enable (WPEN) bit in the Status Register control the programmable hardware write-protect feature. Hardware write protection is enabled when  $\overline{WP}$  pin is low and the WPEN bit is high. Hardware write protection is disabled when either the  $\overline{WP}$  pin is high or the WPEN bit is low. When the chip is hardware write-protected, only writes to nonvolatile bits in the Status Register are disabled. See Table 2-4 for a matrix of functionality on the WPEN bit.

See Figure 2-7 for the WRSR timing sequence.

**TABLE 2-3: ARRAY PROTECTION**

| BP1 | BP0 | Array Addresses Write-Protected |
|-----|-----|---------------------------------|
| 0   | 0   | none                            |
| 0   | 1   | upper 1/4<br>(0300h - 03FFh)    |
| 1   | 0   | upper 1/2<br>(0200h - 03FFh)    |
| 1   | 1   | all<br>(0000h - 03FFh)          |

**FIGURE 2-7: WRITE STATUS REGISTER TIMING SEQUENCE (WRSR)**



# 25XX080A/B

## 2.7 Data Protection

The following protection has been implemented to prevent inadvertent writes to the array:

- The write enable latch is reset on power-up
- A write enable instruction must be issued to set the write enable latch
- After a byte write, page write or Status Register write, the write enable latch is reset
- $\overline{CS}$  must be set high after the proper number of clock cycles to start an internal write cycle
- Access to the array during an internal write cycle is ignored and programming is continued

## 2.8 Power-On State

The 25XX080A/B powers on in the following state:

- The device is in low-power Standby mode ( $\overline{CS} = 1$ )
- The write enable latch is reset
- SO is in high-impedance state
- A high-to-low-level transition on  $\overline{CS}$  is required to enter active state

**TABLE 2-4: WRITE-PROTECT FUNCTIONALITY MATRIX**

| WEL<br>(SR bit 1) | WPEN<br>(SR bit 7) | $\overline{WP}$<br>(pin 3) | Protected Blocks | Unprotected Blocks | Status Register |
|-------------------|--------------------|----------------------------|------------------|--------------------|-----------------|
| 0                 | x                  | x                          | Protected        | Protected          | Protected       |
| 1                 | 0                  | x                          | Protected        | Writable           | Writable        |
| 1                 | 1                  | 0 (low)                    | Protected        | Writable           | Protected       |
| 1                 | 1                  | 1 (high)                   | Protected        | Writable           | Writable        |

x = don't care

### 3.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in Table 3-1.

**TABLE 3-1: PIN FUNCTION TABLE**

| Name                     | Pin Number | Function           |
|--------------------------|------------|--------------------|
| $\overline{\text{CS}}$   | 1          | Chip Select Input  |
| SO                       | 2          | Serial Data Output |
| $\overline{\text{WP}}$   | 3          | Write-Protect Pin  |
| Vss                      | 4          | Ground             |
| SI                       | 5          | Serial Data Input  |
| SCK                      | 6          | Serial Clock Input |
| $\overline{\text{HOLD}}$ | 7          | Hold Input         |
| VCC                      | 8          | Supply Voltage     |

#### 3.1 Chip Select ( $\overline{\text{CS}}$ )

A low level on this pin selects the device. A high level deselects the device and forces it into Standby mode. However, a programming cycle which is already initiated or in progress will be completed, regardless of the  $\overline{\text{CS}}$  input signal. If  $\overline{\text{CS}}$  is brought high during a program cycle, the device will go into Standby mode as soon as the programming cycle is complete. When the device is deselected, SO goes to the high-impedance state, allowing multiple parts to share the same SPI bus. A low-to-high transition on  $\overline{\text{CS}}$  after a valid write sequence initiates an internal write cycle. After power-up, a low level on  $\overline{\text{CS}}$  is required prior to any sequence being initiated.

#### 3.2 Serial Output (SO)

The SO pin is used to transfer data out of the 25XX080A/B. During a read cycle, data is shifted out on this pin after the falling edge of the serial clock.

#### 3.3 Write-Protect ( $\overline{\text{WP}}$ )

This pin is used in conjunction with the WPEN bit in the Status Register to prohibit writes to the nonvolatile bits in the Status Register. When  $\overline{\text{WP}}$  is low and WPEN is high, writing to the nonvolatile bits in the Status Register is disabled. All other operations function normally. When  $\overline{\text{WP}}$  is high, all functions, including writes to the nonvolatile bits in the Status Register operate normally. If the WPEN bit is set,  $\overline{\text{WP}}$  low during a Status Register write sequence will disable writing to the Status Register. If an internal write cycle has already begun,  $\overline{\text{WP}}$  going low will have no effect on the write.

The  $\overline{\text{WP}}$  pin function is blocked when the WPEN bit in the Status Register is low. This allows the user to install the 25XX080A/B in a system with  $\overline{\text{WP}}$  pin grounded and still be able to write to the Status Register. The  $\overline{\text{WP}}$  pin functions will be enabled when the WPEN bit is set high.

#### 3.4 Serial Input (SI)

The SI pin is used to transfer data into the device. It receives instructions, addresses and data. Data is latched on the rising edge of the serial clock.

#### 3.5 Serial Clock (SCK)

The SCK is used to synchronize the communication between a master and the 25XX080A/B. Instructions, addresses or data present on the SI pin are latched on the rising edge of the clock input, while data on the SO pin is updated after the falling edge of the clock input.

#### 3.6 Hold ( $\overline{\text{HOLD}}$ )

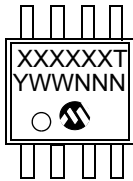
The  $\overline{\text{HOLD}}$  pin is used to suspend transmission to the 25XX080A/B while in the middle of a serial sequence without having to retransmit the entire sequence again. It must be held high any time this function is not being used. Once the device is selected and a serial sequence is underway, the  $\overline{\text{HOLD}}$  pin may be pulled low to pause further serial communication without resetting the serial sequence. The  $\overline{\text{HOLD}}$  pin must be brought low while SCK is low, otherwise the HOLD function will not be invoked until the next SCK high-to-low transition. The 25XX080A/B must remain selected during this sequence. The SI, SCK and SO pins are in a high impedance state during the time the device is paused and transitions on these pins will be ignored. To resume serial communication,  $\overline{\text{HOLD}}$  must be brought high while the SCK pin is low, otherwise serial communication will not resume. Lowering the HOLD line at any time will tri-state the SO line.

# 25XX080A/B

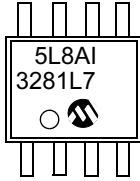
## 4.0 PACKAGING INFORMATION

### 4.1 Package Marking Information

8-Lead MSOP (150 mil)

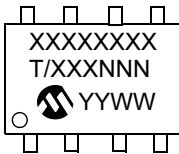


Example:

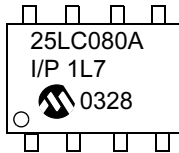


| MSOP 1st Line Marking Codes |          |              |
|-----------------------------|----------|--------------|
| Device                      | std mark | Pb-free mark |
| 25AA080A                    | 5A8A     | G5A8A        |
| 25AA080B                    | 5A8B     | G5A8B        |
| 25LC080A                    | 5L8A     | G5L8A        |
| 25LC080B                    | 5L8B     | G5L8B        |

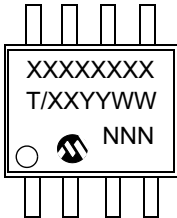
8-Lead PDIP



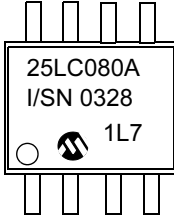
Example:



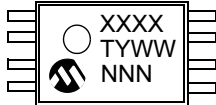
8-Lead SOIC



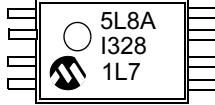
Example:



8-Lead TSSOP



Example:

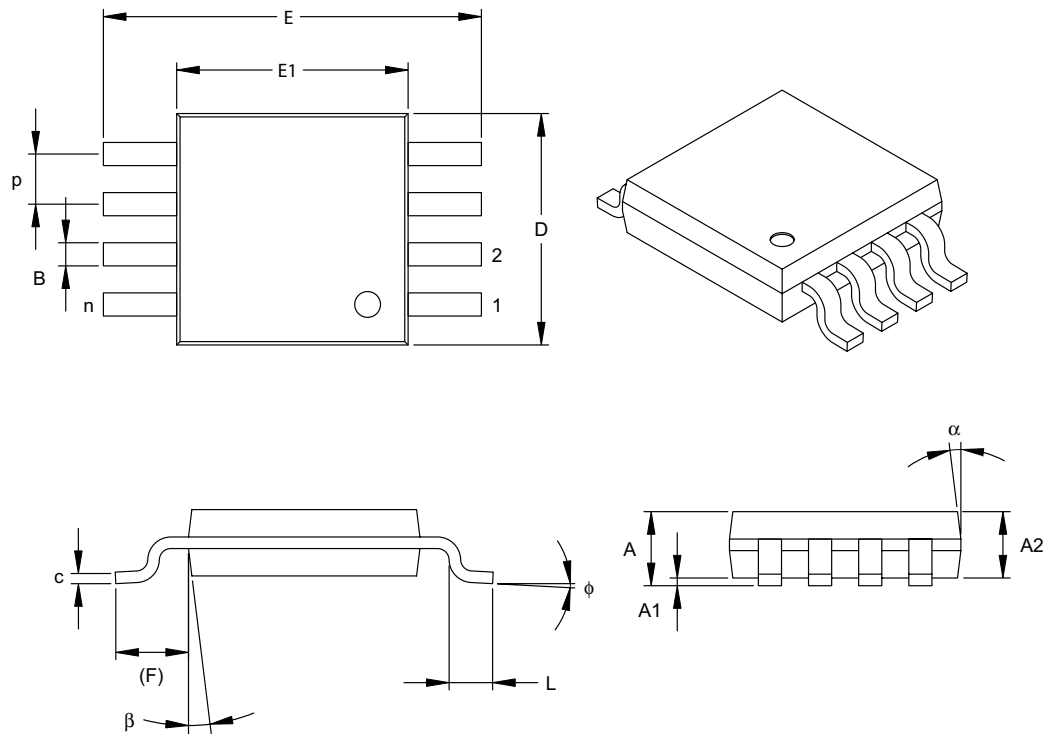


| TSSOP 1st Line Marking Codes |          |              |
|------------------------------|----------|--------------|
| Device                       | std mark | Pb-free mark |
| 25AA080A                     | 5A8A     | NA8A         |
| 25AA080B                     | 5A8B     | NA8B         |
| 25LC080A                     | 5L8A     | NL8A         |
| 25LC080B                     | 5L8B     | NL8B         |

|                |        |                                                                                                  |
|----------------|--------|--------------------------------------------------------------------------------------------------|
| <b>Legend:</b> | XX...X | Part number                                                                                      |
|                | T      | Temperature (I, E)                                                                               |
|                | Blank  | Commercial                                                                                       |
|                | YY     | Year code (last 2 digits of calendar year) except TSSOP and MSOP which use only the last 1 digit |
|                | WW     | Week code (week of January 1 is week '01')                                                       |
|                | NNN    | Alphanumeric traceability code                                                                   |

**Note:** Custom marking available.

## 8-Lead Plastic Micro Small Outline Package (MS) (MSOP)



| Units                    |    | INCHES    |      |      | MILLIMETERS* |      |      |
|--------------------------|----|-----------|------|------|--------------|------|------|
| Dimension Limits         |    | MIN       | NOM  | MAX  | MIN          | NOM  | MAX  |
| Number of Pins           | n  | 8         |      |      | 8            |      |      |
| Pitch                    | p  | .026 BSC  |      |      | 0.65 BSC     |      |      |
| Overall Height           | A  | -         | -    | .043 | -            | -    | 1.10 |
| Molded Package Thickness | A2 | .030      | .033 | .037 | 0.75         | 0.85 | 0.95 |
| Standoff                 | A1 | .000      | -    | .006 | 0.00         | -    | 0.15 |
| Overall Width            | E  | .193 TYP. |      |      | 4.90 BSC     |      |      |
| Molded Package Width     | E1 | .118 BSC  |      |      | 3.00 BSC     |      |      |
| Overall Length           | D  | .118 BSC  |      |      | 3.00 BSC     |      |      |
| Foot Length              | L  | .016      | .024 | .031 | 0.40         | 0.60 | 0.80 |
| Footprint (Reference)    | F  | .037 REF  |      |      | 0.95 REF     |      |      |
| Foot Angle               | φ  | 0°        | -    | 8°   | 0°           | -    | 8°   |
| Lead Thickness           | c  | .003      | .006 | .009 | 0.08         | -    | 0.23 |
| Lead Width               | B  | .009      | .012 | .016 | 0.22         | -    | 0.40 |
| Mold Draft Angle Top     | α  | 5°        | -    | 15°  | 5°           | -    | 15°  |
| Mold Draft Angle Bottom  | β  | 5°        | -    | 15°  | 5°           | -    | 15°  |

\*Controlling Parameter

Notes:

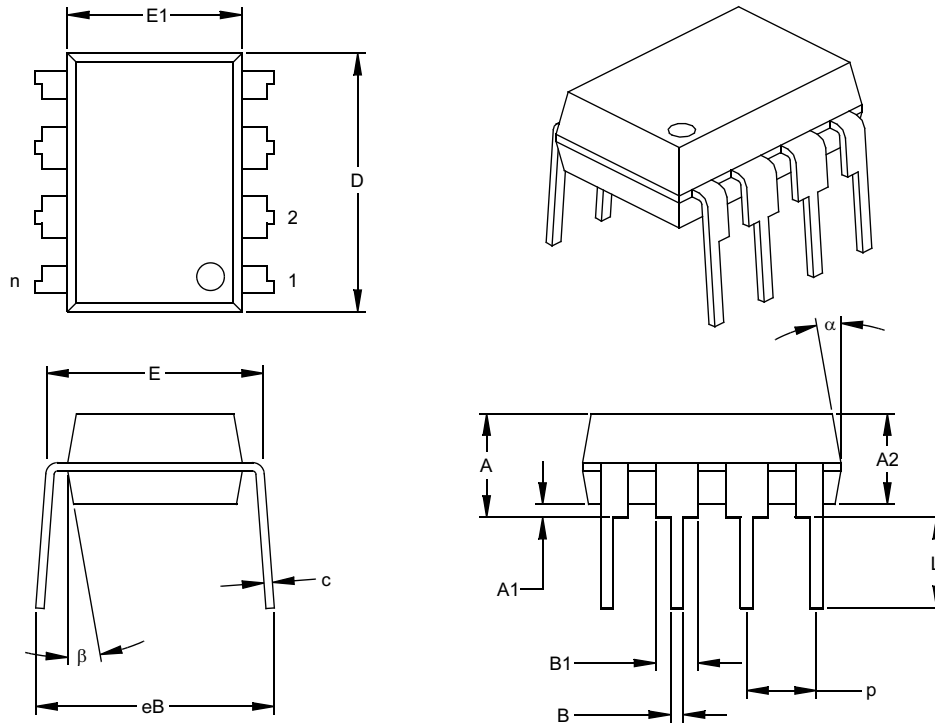
Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" (0.254mm) per side.

JEDEC Equivalent: MO-187

Drawing No. C04-111

# 25XX080A/B

## 8-Lead Plastic Dual In-line (P) – 300 mil (PDIP)



| Units                      |        | INCHES* |      |      | MILLIMETERS |      |       |
|----------------------------|--------|---------|------|------|-------------|------|-------|
| Dimension                  | Limits | MIN     | NOM  | MAX  | MIN         | NOM  | MAX   |
| Number of Pins             | n      |         | 8    |      |             | 8    |       |
| Pitch                      | p      |         | .100 |      |             | 2.54 |       |
| Top to Seating Plane       | A      | .140    | .155 | .170 | 3.56        | 3.94 | 4.32  |
| Molded Package Thickness   | A2     | .115    | .130 | .145 | 2.92        | 3.30 | 3.68  |
| Base to Seating Plane      | A1     | .015    |      |      | 0.38        |      |       |
| Shoulder to Shoulder Width | E      | .300    | .313 | .325 | 7.62        | 7.94 | 8.26  |
| Molded Package Width       | E1     | .240    | .250 | .260 | 6.10        | 6.35 | 6.60  |
| Overall Length             | D      | .360    | .373 | .385 | 9.14        | 9.46 | 9.78  |
| Tip to Seating Plane       | L      | .125    | .130 | .135 | 3.18        | 3.30 | 3.43  |
| Lead Thickness             | c      | .008    | .012 | .015 | 0.20        | 0.29 | 0.38  |
| Upper Lead Width           | B1     | .045    | .058 | .070 | 1.14        | 1.46 | 1.78  |
| Lower Lead Width           | B      | .014    | .018 | .022 | 0.36        | 0.46 | 0.56  |
| Overall Row Spacing        | § eB   | .310    | .370 | .430 | 7.87        | 9.40 | 10.92 |
| Mold Draft Angle Top       | α      | 5       | 10   | 15   | 5           | 10   | 15    |
| Mold Draft Angle Bottom    | β      | 5       | 10   | 15   | 5           | 10   | 15    |

\* Controlling Parameter

§ Significant Characteristic

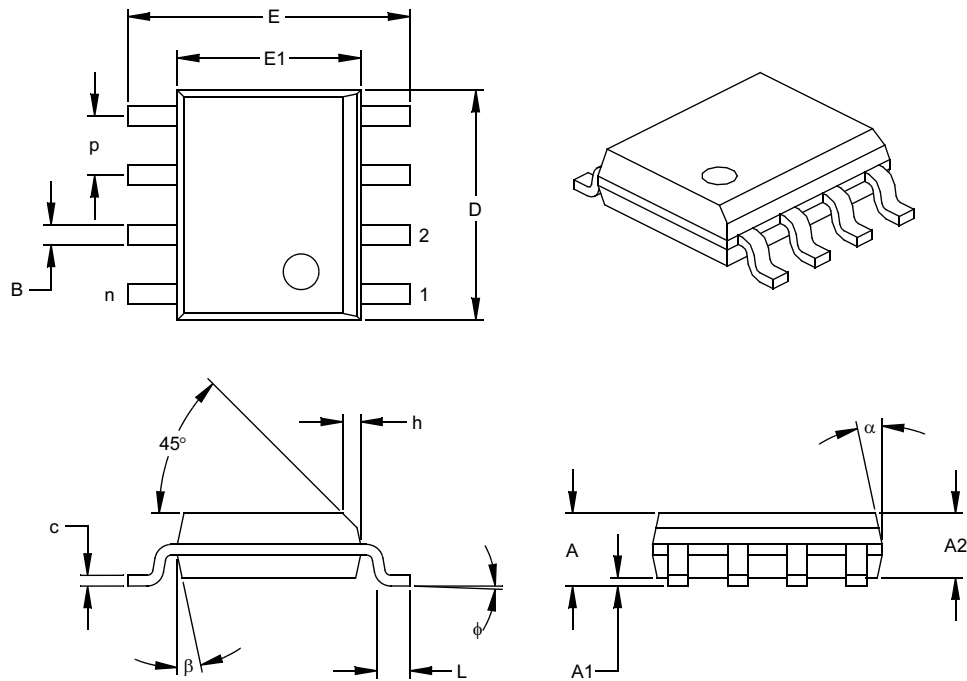
### Notes:

Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" (0.254mm) per side.

JEDEC Equivalent: MS-001

Drawing No. C04-018

## 8-Lead Plastic Small Outline (SN) – Narrow, 150 mil (SOIC)



| Units                    |        | INCHES* |      |      | MILLIMETERS |      |      |
|--------------------------|--------|---------|------|------|-------------|------|------|
| Dimension                | Limits | MIN     | NOM  | MAX  | MIN         | NOM  | MAX  |
| Number of Pins           | n      |         | 8    |      |             | 8    |      |
| Pitch                    | p      |         | .050 |      |             | 1.27 |      |
| Overall Height           | A      | .053    | .061 | .069 | 1.35        | 1.55 | 1.75 |
| Molded Package Thickness | A2     | .052    | .056 | .061 | 1.32        | 1.42 | 1.55 |
| Standoff §               | A1     | .004    | .007 | .010 | 0.10        | 0.18 | 0.25 |
| Overall Width            | E      | .228    | .237 | .244 | 5.79        | 6.02 | 6.20 |
| Molded Package Width     | E1     | .146    | .154 | .157 | 3.71        | 3.91 | 3.99 |
| Overall Length           | D      | .189    | .193 | .197 | 4.80        | 4.90 | 5.00 |
| Chamfer Distance         | h      | .010    | .015 | .020 | 0.25        | 0.38 | 0.51 |
| Foot Length              | L      | .019    | .025 | .030 | 0.48        | 0.62 | 0.76 |
| Foot Angle               | φ      | 0       | 4    | 8    | 0           | 4    | 8    |
| Lead Thickness           | c      | .008    | .009 | .010 | 0.20        | 0.23 | 0.25 |
| Lead Width               | B      | .013    | .017 | .020 | 0.33        | 0.42 | 0.51 |
| Mold Draft Angle Top     | α      | 0       | 12   | 15   | 0           | 12   | 15   |
| Mold Draft Angle Bottom  | β      | 0       | 12   | 15   | 0           | 12   | 15   |

\* Controlling Parameter  
§ Significant Characteristic

### Notes:

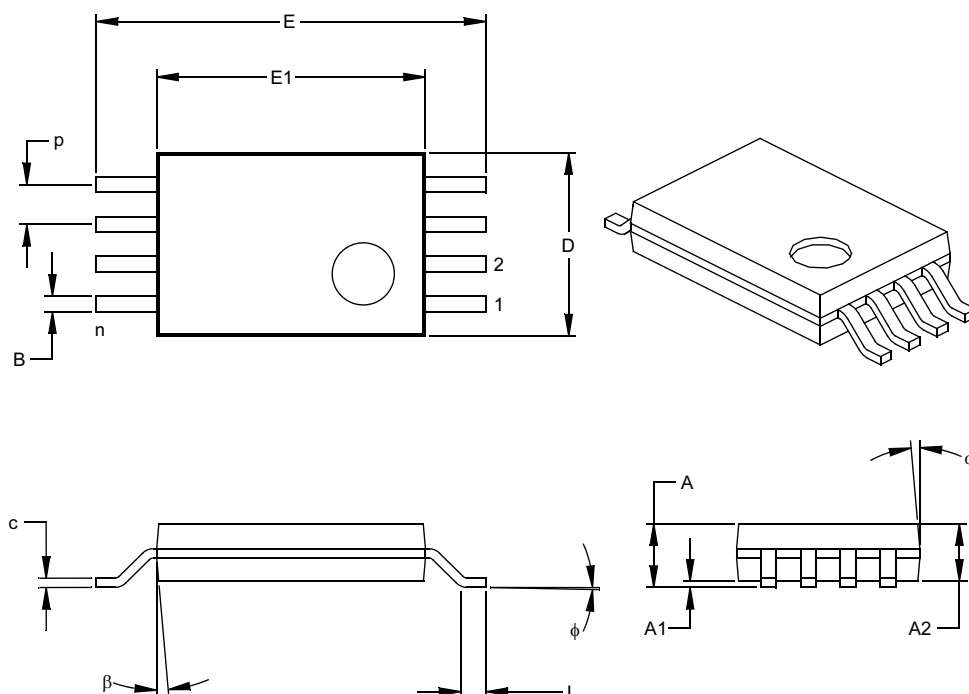
Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" (0.254mm) per side.

JEDEC Equivalent: MS-012

Drawing No. C04-057

# 25XX080A/B

## 8-Lead Plastic Thin Shrink Small Outline (ST) – 4.4 mm (TSSOP)



| Units                    |    | INCHES |      |      | MILLIMETERS* |      |      |
|--------------------------|----|--------|------|------|--------------|------|------|
| Dimension Limits         |    | MIN    | NOM  | MAX  | MIN          | NOM  | MAX  |
| Number of Pins           | n  |        | 8    |      |              | 8    |      |
| Pitch                    | p  |        | .026 |      |              | 0.65 |      |
| Overall Height           | A  |        |      | .043 |              |      | 1.10 |
| Molded Package Thickness | A2 | .033   | .035 | .037 | 0.85         | 0.90 | 0.95 |
| Standoff §               | A1 | .002   | .004 | .006 | 0.05         | 0.10 | 0.15 |
| Overall Width            | E  | .246   | .251 | .256 | 6.25         | 6.38 | 6.50 |
| Molded Package Width     | E1 | .169   | .173 | .177 | 4.30         | 4.40 | 4.50 |
| Molded Package Length    | D  | .114   | .118 | .122 | 2.90         | 3.00 | 3.10 |
| Foot Length              | L  | .020   | .024 | .028 | 0.50         | 0.60 | 0.70 |
| Foot Angle               | φ  | 0      | 4    | 8    | 0            | 4    | 8    |
| Lead Thickness           | c  | .004   | .006 | .008 | 0.09         | 0.15 | 0.20 |
| Lead Width               | B  | .007   | .010 | .012 | 0.19         | 0.25 | 0.30 |
| Mold Draft Angle Top     | α  | 0      | 5    | 10   | 0            | 5    | 10   |
| Mold Draft Angle Bottom  | β  | 0      | 5    | 10   | 0            | 5    | 10   |

\* Controlling Parameter

§ Significant Characteristic

### Notes:

Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .005" (0.127mm) per side.

JEDEC Equivalent: MO-153

Drawing No. C04-086

## ON-LINE SUPPORT

Microchip provides on-line support on the Microchip World Wide Web site.

The web site is used by Microchip as a means to make files and information easily available to customers. To view the site, the user must have access to the Internet and a web browser, such as Netscape® or Microsoft® Internet Explorer. Files are also available for FTP download from our FTP site.

### Connecting to the Microchip Internet Web Site

The Microchip web site is available at the following URL:

**[www.microchip.com](http://www.microchip.com)**

The file transfer site is available by using an FTP service to connect to:

**<ftp://ftp.microchip.com>**

The web site and file transfer site provide a variety of services. Users may download files for the latest Development Tools, Data Sheets, Application Notes, User's Guides, Articles and Sample Programs. A variety of Microchip specific business information is also available, including listings of Microchip sales offices, distributors and factory representatives. Other data available for consideration is:

- Latest Microchip Press Releases
- Technical Support Section with Frequently Asked Questions
- Design Tips
- Device Errata
- Job Postings
- Microchip Consultant Program Member Listing
- Links to other useful web sites related to Microchip Products
- Conferences for products, Development Systems, technical information and more
- Listing of seminars and events

## SYSTEMS INFORMATION AND UPGRADE HOT LINE

The Systems Information and Upgrade Line provides system users a listing of the latest versions of all of Microchip's development systems software products. Plus, this line provides information on how customers can receive the most current upgrade kits. The Hot Line Numbers are:

1-800-755-2345 for U.S. and most of Canada, and

1-480-792-7302 for the rest of the world.

042003

# 25AA080A/B, 25LC080A/B

---

## READER RESPONSE

It is our intention to provide you with the best documentation possible to ensure successful use of your Microchip product. If you wish to provide your comments on organization, clarity, subject matter, and ways in which our documentation can better serve you, please FAX your comments to the Technical Publications Manager at (480) 792-4150.

Please list the following information, and use this outline to provide us with your comments about this document.

To: Technical Publications Manager  
RE: Reader Response  
Total Pages Sent \_\_\_\_\_  
From: Name \_\_\_\_\_  
Company \_\_\_\_\_  
Address \_\_\_\_\_  
City / State / ZIP / Country \_\_\_\_\_  
Telephone: (\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_ FAX: (\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_

Application (optional):

Would you like a reply? \_\_\_Y \_\_\_N

Device: 25AA080A/B, 25LC080A/B Literature Number: DS21808B

Questions:

1. What are the best features of this document?

---

---

2. How does this document meet your hardware and software development needs?

---

---

3. Do you find the organization of this document easy to follow? If not, why?

---

---

4. What additions to the document do you think would enhance the structure and subject?

---

---

5. What deletions from the document could be made without affecting the overall usefulness?

---

---

6. Is there any incorrect or misleading information (what and where)?

---

---

7. How would you improve this document?

---

---

## PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office.

| <u>PART NO.</u>   | <u>X</u>    | <u>-</u>                                     | <u>X</u>   | <u>/XX</u> | <u>X</u>    |
|-------------------|-------------|----------------------------------------------|------------|------------|-------------|
| Device            | Tape & Reel |                                              | Temp Range | Package    | Lead Finish |
| Device            | 25AA080A    | 8 Kbit, 1.8V, 16 Byte Page SPI Serial EEPROM |            |            |             |
|                   | 25AA080B    | 8 Kbit, 1.8V, 32 Byte Page SPI Serial EEPROM |            |            |             |
|                   | 25LC080A    | 8 Kbit, 2.5V, 16 Byte Page SPI Serial EEPROM |            |            |             |
|                   | 25LC080B    | 8 Kbit, 2.5V, 32 Byte Page SPI Serial EEPROM |            |            |             |
| Tape & Reel       | Blank       | = Standard packaging                         |            |            |             |
|                   | T           | = Tape and Reel                              |            |            |             |
| Temperature Range | I           | = -40°C to+85°C                              |            |            |             |
|                   | E           | = -40°C to+125°C                             |            |            |             |
| Package           | MS          | = Plastic MSOP (Micro Small Outline), 8-lead |            |            |             |
|                   | P           | = Plastic DIP (300 mil body), 8-lead         |            |            |             |
|                   | SN          | = Plastic SOIC (150 mil body), 8-lead        |            |            |             |
|                   | ST          | = TSSOP, 8-lead                              |            |            |             |
| Lead Finish       | Blank       | = Standard 63% / 37% Sn/Pb                   |            |            |             |
|                   | G           | = Matte Tin (Pure Sn)                        |            |            |             |

**Examples:**

a) 25AA080A-I/MS = 8 Kbit, 16-byte page, 1.8V Serial EEPROM, Industrial temp., MSOP package

b) 25AA080B-I/STG = 8 Kbit, 32-byte page, 1.8V Serial EEPROM, Industrial temp., TSSOP package, Pb-free

c) 25AA080AT-I/SN = 8 Kbit, 16-byte page, 1.8V Serial EEPROM, Industrial temp., Tape & Reel, SOIC package

d) 25LC080A-I/MSG = 8 Kbit, 16-byte page, 2.5V Serial EEPROM, Industrial temp., MSOP package, Pb-free

e) 25LC080BT-I/SN = 8 Kbit, 32-byte page, 2.5V Serial EEPROM, Industrial temp., Tape & Reel, SOIC package

f) 25LC080BT-I/ST = 8 Kbit, 32-byte page, 2.5V Serial EEPROM, Industrial temp., Tape & Reel, TSSOP package

## Sales and Support

### Data Sheets

Products supported by a preliminary Data Sheet may have an errata sheet describing minor operational differences and recommended workarounds. To determine if an errata sheet exists for a particular device, please contact one of the following:

1. Your local Microchip sales office
2. The Microchip Corporate Literature Center U.S. FAX: (480) 792-7277
3. The Microchip Worldwide Site ([www.microchip.com](http://www.microchip.com))

Please specify which device, revision of silicon and Data Sheet (include Literature #) you are using.

### New Customer Notification System

Register on our web site ([www.microchip.com/cn](http://www.microchip.com/cn)) to receive the most current information on our products.

NOTES:

---

**Note the following details of the code protection feature on Microchip devices:**

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families 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 Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is 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 products. Attempts to break microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

---

Information contained in this publication regarding device applications and the like is intended through suggestion only and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. No representation or warranty is given and no liability is assumed by Microchip Technology Incorporated with respect to the accuracy or use of such information, or infringement of patents or other intellectual property rights arising from such use or otherwise. Use of Microchip's products as critical components in life support systems is not authorized except with express written approval by Microchip. No licenses are conveyed, implicitly or otherwise, under any intellectual property rights.

**Trademarks**

The Microchip name and logo, the Microchip logo, Accuron, dsPIC, KEELoQ, MPLAB, PIC, PICmicro, PICSTART, PRO MATE and PowerSmart are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

AmpLab, FilterLab, microID, MXDEV, MXLAB, PICMASTER, SEEVAL and The Embedded Control Solutions Company are registered trademarks of Microchip Technology Incorporated in the U.S.A.

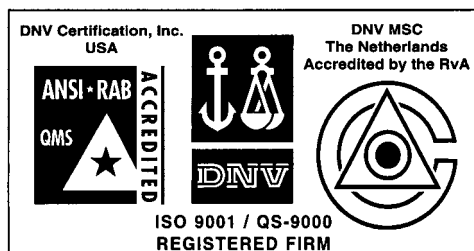
Application Maestro, dsPICDEM, dsPICDEM.net, ECAN, ECONOMONITOR, FanSense, FlexROM, fuzzyLAB, In-Circuit Serial Programming, ICSP, ICEPIC, microPort, Migratable Memory, MPASM, MPLIB, MPLINK, MPSIM, PICKit, PICDEM, PICDEM.net, PowerCal, PowerInfo, PowerMate, PowerTool, rLAB, rPIC, Select Mode, SmartSensor, SmartShunt, SmartTel and Total Endurance are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

Serialized Quick Turn Programming (SQTP) is a service mark of Microchip Technology Incorporated in the U.S.A.

All other trademarks mentioned herein are property of their respective companies.

© 2003, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

 Printed on recycled paper.



*Microchip received QS-9000 quality system certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona in July 1999 and Mountain View, California in March 2002. The Company's quality system processes and procedures are QS-9000 compliant for its PICmicro® 8-bit MCUs, KEELoQ® code hopping devices, Serial EEPROMs, microperipherals, non-volatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001 certified.*

## WORLDWIDE SALES AND SERVICE

### AMERICAS

#### Corporate Office

2355 West Chandler Blvd.  
Chandler, AZ 85224-6199  
Tel: 480-792-7200 Fax: 480-792-7277  
Technical Support: 480-792-7627  
Web Address: <http://www.microchip.com>

#### Atlanta

3780 Mansell Road, Suite 130  
Alpharetta, GA 30022  
Tel: 770-640-0034 Fax: 770-640-0307

#### Boston

2 Lan Drive, Suite 120  
Westford, MA 01886  
Tel: 978-692-3848 Fax: 978-692-3821

#### Chicago

333 Pierce Road, Suite 180  
Itasca, IL 60143  
Tel: 630-285-0071 Fax: 630-285-0075

#### Dallas

4570 Westgrove Drive, Suite 160  
Addison, TX 75001  
Tel: 972-818-7423 Fax: 972-818-2924

#### Detroit

Tri-Atria Office Building  
32255 Northwestern Highway, Suite 190  
Farmington Hills, MI 48334  
Tel: 248-538-2250 Fax: 248-538-2260

#### Kokomo

2767 S. Albright Road  
Kokomo, IN 46902  
Tel: 765-864-8360 Fax: 765-864-8387

#### Los Angeles

18201 Von Karman, Suite 1090  
Irvine, CA 92612  
Tel: 949-263-1888 Fax: 949-263-1338

#### Phoenix

2355 West Chandler Blvd.  
Chandler, AZ 85224-6199  
Tel: 480-792-7966 Fax: 480-792-4338

#### San Jose

Microchip Technology Inc.  
2107 North First Street, Suite 590  
San Jose, CA 95131  
Tel: 408-436-7950 Fax: 408-436-7955

#### Toronto

6285 Northam Drive, Suite 108  
Mississauga, Ontario L4V 1X5, Canada  
Tel: 905-673-0699 Fax: 905-673-6509

### ASIA/PACIFIC

#### Australia

Microchip Technology Australia Pty Ltd  
Marketing Support Division  
Suite 22, 41 Rawson Street  
Epping 2121, NSW  
Australia  
Tel: 61-2-9868-6733 Fax: 61-2-9868-6755

#### China - Beijing

Microchip Technology Consulting (Shanghai)  
Co., Ltd., Beijing Liaison Office  
Unit 915  
Bei Hai Wan Tai Bldg.  
No. 6 Chaoyangmen Beidajie  
Beijing, 100027, No. China  
Tel: 86-10-85282100 Fax: 86-10-85282104

#### China - Chengdu

Microchip Technology Consulting (Shanghai)  
Co., Ltd., Chengdu Liaison Office  
Rm. 2401-2402, 24th Floor,  
Ming Xing Financial Tower  
No. 88 TIDU Street  
Chengdu 610016, China  
Tel: 86-28-86766200 Fax: 86-28-86766599

#### China - Fuzhou

Microchip Technology Consulting (Shanghai)  
Co., Ltd., Fuzhou Liaison Office  
Unit 28F, World Trade Plaza  
No. 71 Wusi Road  
Fuzhou 350001, China  
Tel: 86-591-7503506 Fax: 86-591-7503521

#### China - Hong Kong SAR

Microchip Technology Hongkong Ltd.  
Unit 901-6, Tower 2, Metroplaza  
223 Hing Fong Road  
Kwai Fong, N.T., Hong Kong  
Tel: 852-2401-1200 Fax: 852-2401-3431

#### China - Shanghai

Microchip Technology Consulting (Shanghai)  
Co., Ltd.  
Room 701, Bldg. B  
Far East International Plaza  
No. 317 Xian Xia Road  
Shanghai, 200051  
Tel: 86-21-6275-5700 Fax: 86-21-6275-5060

#### China - Shenzhen

Microchip Technology Consulting (Shanghai)  
Co., Ltd., Shenzhen Liaison Office  
Rm. 1812, 18/F, Building A, United Plaza  
No. 5022 Binhe Road, Futian District  
Shenzhen 518033, China  
Tel: 86-755-82901380 Fax: 86-755-8295-1393

#### China - Qingdao

Rm. B505A, Fullhope Plaza,  
No. 12 Hong Kong Central Rd.  
Qingdao 266071, China  
Tel: 86-532-5027355 Fax: 86-532-5027205

#### India

Microchip Technology Inc.  
India Liaison Office  
Marketing Support Division  
Divyasree Chambers  
1 Floor, Wing A (A3/A4)  
No. 11, O'Shaughnessy Road  
Bangalore, 560 025, India  
Tel: 91-80-2290061 Fax: 91-80-2290062

#### Japan

Microchip Technology Japan K.K.  
Benex S-1 6F  
3-18-20, Shinyokohama  
Kohoku-Ku, Yokohama-shi  
Kanagawa, 222-0033, Japan  
Tel: 81-45-471-6166 Fax: 81-45-471-6122

#### Korea

Microchip Technology Korea  
168-1, Youngbo Bldg. 3 Floor  
Samsung-Dong, Kangnam-Ku  
Seoul, Korea 135-882  
Tel: 82-2-554-7200 Fax: 82-2-558-5932 or  
82-2-558-5934

#### Singapore

Microchip Technology Singapore Pte Ltd.  
200 Middle Road  
#07-02 Prime Centre  
Singapore, 188980  
Tel: 65-6334-8870 Fax: 65-6334-8850

#### Taiwan

Microchip Technology (Barbados) Inc.,  
Taiwan Branch  
11F-3, No. 207  
Tung Hua North Road  
Taipei, 105, Taiwan  
Tel: 886-2-2717-7175 Fax: 886-2-2545-0139

### EUROPE

#### Austria

Microchip Technology Austria GmbH  
Durisolstrasse 2  
A-4600 Wels  
Austria  
Tel: 43-7242-2244-399  
Fax: 43-7242-2244-393

#### Denmark

Microchip Technology Nordic ApS  
Regus Business Centre  
Lautrup høj 1-3  
Ballerup DK-2750 Denmark  
Tel: 45-4420-9895 Fax: 45-4420-9910

#### France

Microchip Technology SARL  
Parc d'Activite du Moulin de Massy  
43 Rue du Saule Trapu  
Batiment A - 1er Etage  
91300 Massy, France  
Tel: 33-1-69-53-63-20 Fax: 33-1-69-30-90-79

#### Germany

Microchip Technology GmbH  
Steinheilstrasse 10  
D-85737 Ismaning, Germany  
Tel: 49-89-627-144-0  
Fax: 49-89-627-144-44

#### Italy

Microchip Technology SRL  
Via Quasimodo, 12  
20025 Legnano (MI)  
Milan, Italy  
Tel: 39-0331-742611 Fax: 39-0331-466781

#### Netherlands

Microchip Technology Netherlands  
P. A. De Biesbosch 14  
NL-5152 SC Drunen, Netherlands  
Tel: 31-416-690399 Fax: 31-416-690340

#### United Kingdom

Microchip Ltd.  
505 Eskdale Road  
Winnersh Triangle  
Wokingham  
Berkshire, England RG41 5TU  
Tel: 44-118-921-5869 Fax: 44-118-921-5820

07/10/03