



# MICROCHIP

# 25AA320/25LC320/25C320

## 32K SPI™ Bus Serial EEPROM

### DEVICE SELECTION TABLE

Part Number	Vcc Range	Max. Clock Frequency	Temp. Ranges
25AA320	1.8-5.5V	1 MHz	I
25LC320	2.5-5.5V	2 MHz	I,E
25C320	4.5-5.5V	3 MHz	I,E

### FEATURES

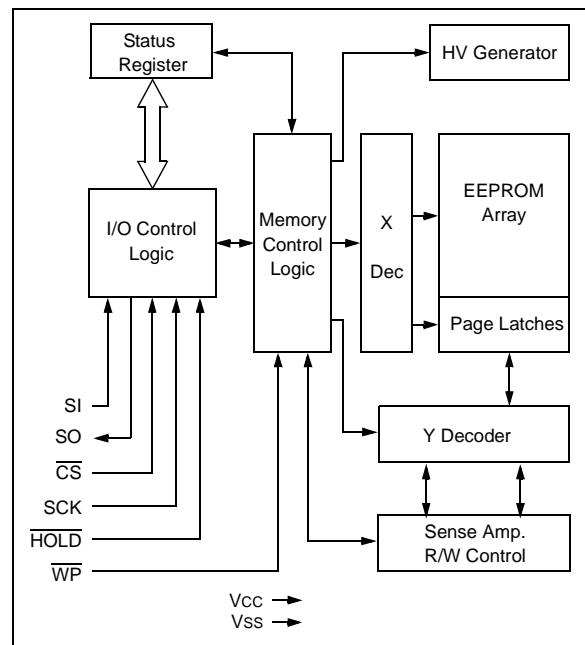
- Low power CMOS technology
  - Write current: 3 mA maximum
  - Read current: 500 µA typical
  - Standby current: 500 nA typical
- 4096 x 8-bit organization
- 32 byte page
- Write cycle time: 5 ms maximum
- Self-timed ERASE and WRITE cycles
- Block write protection
  - Protect none, 1/4, 1/2 or all of array
- Built-in write protection
  - Power on/off data protection circuitry
  - Write enable latch
  - Write protect pin
- Sequential read
- High reliability
  - Endurance: 100K E/W cycles
  - Data retention: > 200 years
  - ESD protection: > 4000V
- 8-pin PDIP, SOIC and TSSOP packages
- 14-lead TSSOP package
- Temperature ranges supported:
  - Industrial (I): -40°C to +85°C
  - Automotive (E): -40°C to +125°C

### DESCRIPTION

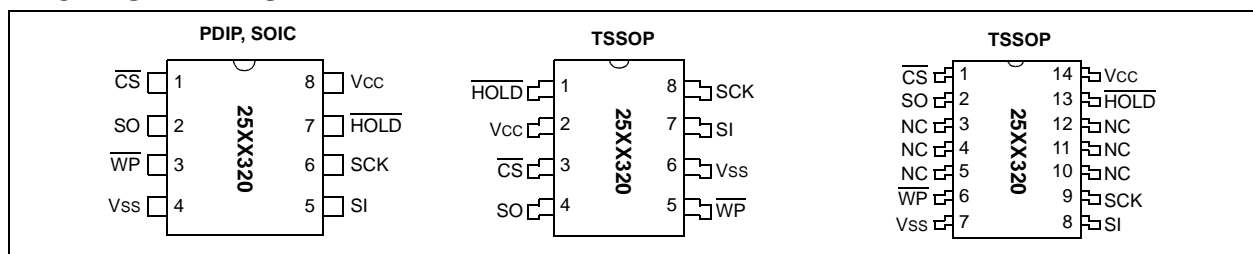
The Microchip Technology Inc. 25AA320/25LC320/25C320 (25XX320\*) are 32 Kbit serial Electrically Erasable PROMs. The memory is accessed via a simple Serial Peripheral Interface™ (SPI™) compatible serial bus. The bus signals required are a clock input (SCK) plus separate data in (SI) and data out (SO) 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.

### BLOCK DIAGRAM



### PACKAGE TYPES



\*25XX320 is used in this document as a generic part number for the 25AA320/25LC320/25C320 devices. SPI™ is a trademark of Motorola Inc.

# 25AA320/25LC320/25C320

## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings†

VCC.....	7.0V
All inputs and outputs w.r.t. VSS .....	-0.6V to VCC+1.0V
Storage temperature .....	-65°C to 150°C
Ambient temperature under bias .....	-65°C to 125°C
Soldering temperature of leads (10 seconds) .....	+300°C
ESD protection on all pins .....	4KV

† NOTICE: Stresses above those listed under '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.

### 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	
			Automotive (E):	T <sub>AMB</sub> = -40°C to +125°C	V <sub>CC</sub> = 2.5V to 5.5V	
Param. No.	Sym.	Characteristics	Min.	Max.	Units	Conditions
D1	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> )
D2	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> )
D3	V <sub>IL1</sub>	Low level input voltage	-0.3	0.8	V	V <sub>CC</sub> ≥ 2.7V ( <b>Note</b> )
D4	V <sub>IL2</sub>		-0.3	0.3 V <sub>CC</sub>	V	V <sub>CC</sub> < 2.7V ( <b>Note</b> )
D5	V <sub>OL</sub>	Low level output voltage	—	0.2	V	I <sub>OL</sub> = 1.0 mA, V <sub>CC</sub> < 2.5V
D6	V <sub>OH</sub>	High level output voltage	V <sub>CC</sub> -0.5	—	V	I <sub>OH</sub> = -400 μA
D7	I <sub>LI</sub>	Input leakage current	-10	10	μA	$\overline{CS}$ = V <sub>CC</sub> , V <sub>IN</sub> = V <sub>SS</sub> TO V <sub>CC</sub>
D8	I <sub>LO</sub>	Output leakage current	-10	10	μA	$\overline{CS}$ = V <sub>CC</sub> , V <sub>OUT</sub> = V <sub>SS</sub> TO V <sub>CC</sub>
D9	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> )
D10	I <sub>CC</sub> Read	Operating Current	—	1	mA	V <sub>CC</sub> = 5.5V; F <sub>CLK</sub> = 3.0 MHz; SO = Open
D11	I <sub>CC</sub> Write		—	500	μA	V <sub>CC</sub> = 2.5V; F <sub>CLK</sub> = 2.0 MHz; SO = Open
D12	I <sub>CCS</sub>	Standby Current	—	5	mA	V <sub>CC</sub> = 5.5V
			—	3	mA	V <sub>CC</sub> = 2.5V
			—	5	μA	$\overline{CS}$ = V <sub>CC</sub> = 5.5V, Inputs tied to V <sub>CC</sub> or V <sub>SS</sub>
			—	1	μA	$\overline{CS}$ = V <sub>CC</sub> = 2.5V, Inputs tied to V <sub>CC</sub> or V <sub>SS</sub>

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

# 25AA320/25LC320/25C320

## 1.2 AC Characteristics

AC Characteristics			Industrial (I): Automotive (E):	T <sub>AMB</sub> = -40°C to +85°C T <sub>AMB</sub> = -40°C to +125°C	V <sub>CC</sub> = 1.8V to 5.5V V <sub>CC</sub> = 2.5V to 5.5V	
Param. No.	Sym.	Characteristic	Min.	Max.	Units	Conditions
1	FCLK	Clock Frequency	—	3	MHz	V <sub>CC</sub> = 4.5V to 5.5V
			—	2	MHz	V <sub>CC</sub> = 2.5V to 5.5V
			—	1	MHz	V <sub>CC</sub> = 1.8V to 5.5V
2	T <sub>CSS</sub>	$\overline{\text{CS}}$ Setup Time	100	—	ns	V <sub>CC</sub> = 4.5V to 5.5V
			250	—	ns	V <sub>CC</sub> = 2.5V to 5.5V
			500	—	ns	V <sub>CC</sub> = 1.8V to 5.5V
3	T <sub>CSH</sub>	$\overline{\text{CS}}$ Hold Time	150	—	ns	V <sub>CC</sub> = 4.5V to 5.5V
			250	—	ns	V <sub>CC</sub> = 2.5V to 5.5V
			475	—	ns	V <sub>CC</sub> = 1.8V to 5.5V
4	T <sub>CSD</sub>	$\overline{\text{CS}}$ Disable Time	500	—	ns	—
5	TSU	Data Setup Time	30	—	ns	V <sub>CC</sub> = 4.5V to 5.5V
			50	—	ns	V <sub>CC</sub> = 2.5V to 5.5V
			50	—	ns	V <sub>CC</sub> = 1.8V to 5.5V
6	THD	Data Hold Time	50	—	ns	V <sub>CC</sub> = 4.5V to 5.5V
			100	—	ns	V <sub>CC</sub> = 2.5V to 5.5V
			100	—	ns	V <sub>CC</sub> = 1.8V to 5.5V
7	TR	CLK Rise Time	—	2	μs	(Note 1)
8	TF	CLK Fall Time	—	2	μs	(Note 1)
9	THI	Clock High Time	150	—	ns	V <sub>CC</sub> = 4.5V to 5.5V
			230	—	ns	V <sub>CC</sub> = 2.5V to 5.5V
			475	—	ns	V <sub>CC</sub> = 1.8V to 5.5V
10	TLO	Clock Low Time	150	—	ns	V <sub>CC</sub> = 4.5V to 5.5V
			230	—	ns	V <sub>CC</sub> = 2.5V to 5.5V
			475	—	ns	V <sub>CC</sub> = 1.8V to 5.5V
11	TCLD	Clock Delay Time	50	—	ns	—
12	TCLE	Clock Enable Time	50	—	ns	—
13	TV	Output Valid from Clock Low	—	150	ns	V <sub>CC</sub> = 4.5V to 5.5V
			—	230	ns	V <sub>CC</sub> = 2.5V to 5.5V
			—	—	ns	V <sub>CC</sub> = 1.8V to 5.5V
14	THO	Output Hold Time	0	—	ns	(Note 1)
15	TDIS	Output Disable Time	—	200	ns	V <sub>CC</sub> = 4.5V to 5.5V (Note 1)
			—	250	ns	V <sub>CC</sub> = 2.5V to 5.5V (Note 1)
			—	—	ns	V <sub>CC</sub> = 1.8V to 5.5V
16	THS	$\overline{\text{HOLD}}$ Setup Time	100	—	ns	V <sub>CC</sub> = 4.5V to 5.5V
			100	—	ns	V <sub>CC</sub> = 2.5V to 5.5V
			200	—	ns	V <sub>CC</sub> = 1.8V to 5.5V
17	THH	$\overline{\text{HOLD}}$ Hold Time	100	—	ns	V <sub>CC</sub> = 4.5V to 5.5V
			100	—	ns	V <sub>CC</sub> = 2.5V to 5.5V
			200	—	ns	V <sub>CC</sub> = 1.8V to 5.5V
18	THZ	$\overline{\text{HOLD}}$ Low to Output High-Z	100	—	ns	V <sub>CC</sub> = 4.5V to 5.5V (Note 1)
			150	—	ns	V <sub>CC</sub> = 2.5V to 5.5V (Note 1)
			200	—	ns	V <sub>CC</sub> = 1.8V to 5.5V
19	THV	$\overline{\text{HOLD}}$ High to Output Valid	100	—	ns	V <sub>CC</sub> = 4.5V to 5.5V
			150	—	ns	V <sub>CC</sub> = 2.5V to 5.5V
			200	—	ns	V <sub>CC</sub> = 1.8V to 5.5V
20	TWC	Internal Write Cycle Time	—	5	ms	—
21	—	Endurance	100K	—	E/W Cycles	(Note 2)

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

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

# 25AA320/25LC320/25C320

FIGURE 1-1: HOLD TIMING

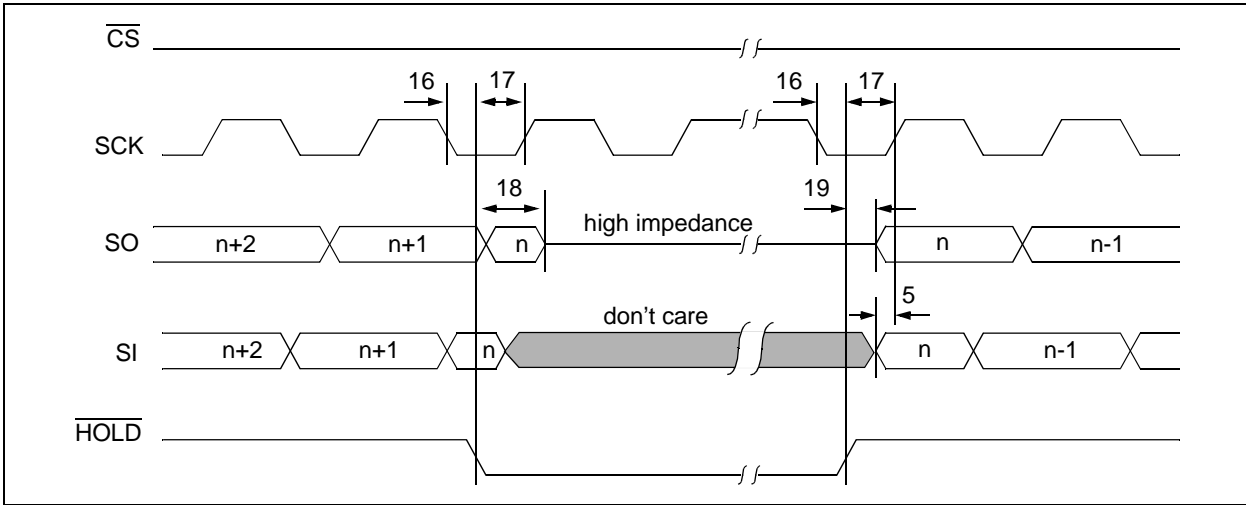


FIGURE 1-2: SERIAL INPUT TIMING

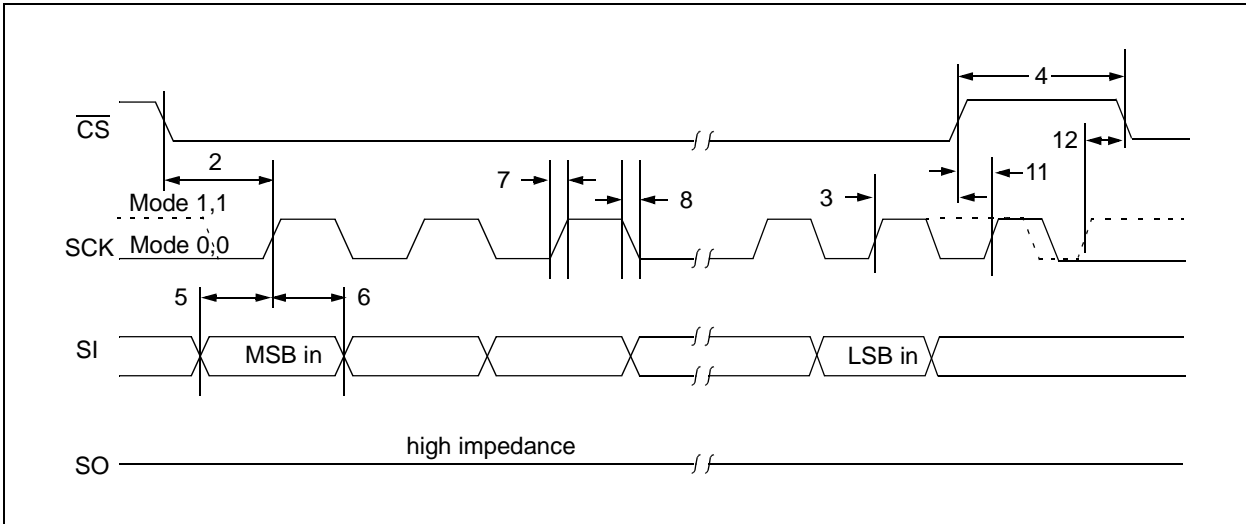
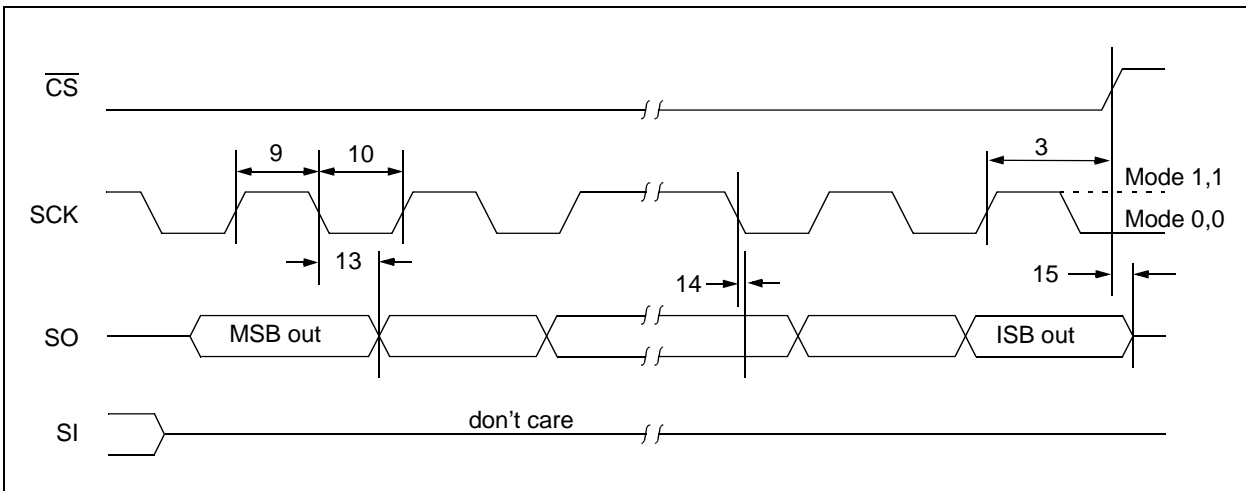


FIGURE 1-3: SERIAL OUTPUT TIMING



# 25AA320/25LC320/25C320

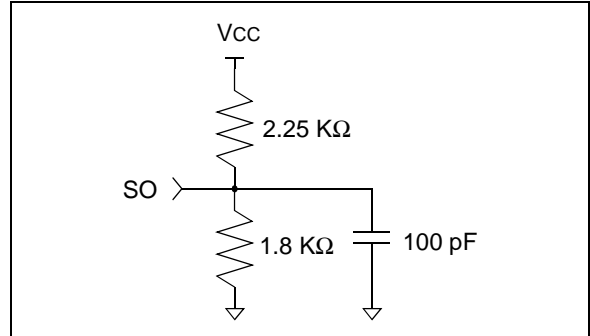
## 1.3 AC Test Conditions

AC Waveform:	
VLO = 0.2V	—
VHI = VCC - 0.2V	(Note 1)
VHI = 4.0V	(Note 2)
Timing Measurement Reference Level	
Input	0.5 VCC
Output	0.5 VCC

**Note 1:** For  $V_{CC} \leq 4.0V$

**Note 2:** For  $V_{CC} > 4.0V$

FIGURE 1-4: AC TEST CIRCUIT



# 25AA320/25LC320/25C320

## 2.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in Table 2-1.

TABLE 2-1: PIN FUNCTION TABLE

Name	PDIP	SOIC	8-pin TSSOP	14-lead TSSOP	Description
$\overline{\text{CS}}$	1	1	3	1	Chip Select Input
SO	2	2	4	2	Serial Data Output
NC	—	—	—	3,4,5	Not Connected
$\overline{\text{WP}}$	3	3	5	6	Write Protect Pin
Vss	4	4	6	7	Ground
SI	5	5	7	8	Serial Data Input
SCK	6	6	8	9	Serial Clock Input
NC	—	—	—	10,11,12	Not Connected
$\overline{\text{HOLD}}$	7	7	1	13	Hold Input
Vcc	8	8	2	14	Supply Voltage

### 2.1 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.

### 2.2 Serial Output (SO)

The SO pin is used to transfer data out of the 25XX320. During a read cycle, data is shifted out on this pin after the falling edge of the serial clock.

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

This pin is used in conjunction with the WPEN bit in the status register to prohibit writes to the non-volatile bits in the status register. When  $\overline{\text{WP}}$  is low and WPEN is high, writing to the non-volatile bits in the status register is disabled. All other operations function normally. When  $\overline{\text{WP}}$  is high, all functions, including writes to the non-volatile 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 25XX320 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.

### 2.4 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.

### 2.5 Serial Clock (SCK)

The SCK is used to synchronize the communication between a master and the 25XX320. 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.

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

The  $\overline{\text{HOLD}}$  pin is used to suspend transmission to the 25XX320 while in the middle of a serial sequence without having to re-transmit 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 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 25XX320 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, 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.

# 25AA320/25LC320/25C320

## 3.0 FUNCTIONAL DESCRIPTION

### 3.1 Principles Of Operation

The 25XX320 are 4096 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 PIC16C6X/7X microcontrollers. It may also interface with microcontrollers that do not have a built-in SPI port by using discrete I/O lines programmed properly with the software.

The 25XX320 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  $\overline{HOLD}$  pin must be high for the entire operation.

Table 3-1 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 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  $\overline{HOLD}$  input and place the 25XX320 in 'HOLD' mode. After releasing the  $\overline{HOLD}$  pin, operation will resume from the point when the  $\overline{HOLD}$  was asserted.

### 3.2 Read Sequence

The device is selected by pulling  $\overline{CS}$  low. The 8-bit read instruction is transmitted to the 25XX320 followed by the 16-bit address, with the four 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 (0FFFh), 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 3-1).

### 3.3 Write Sequence

Prior to any attempt to write data to the 25XX320, the write enable latch must be set by issuing the WREN instruction (Figure 3-4). This is done by setting  $\overline{CS}$  low and then clocking out the proper instruction into the 25XX320. 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 four MSBs of the address being don't care bits, and then the data to be written. Up to 32 bytes of data can be sent to the 25XX320 before a write cycle is necessary. The only restriction is that all of the bytes must reside in the same page. A page address begins with XXXX XXXX XXX0 0000 and ends with XXXX XXXX XXX1 1111. If the internal address counter reaches XXXX XXXX XXX1 1111 and the clock continues, the counter will roll back to the first address of the page and overwrite any data in the page that may have been written.

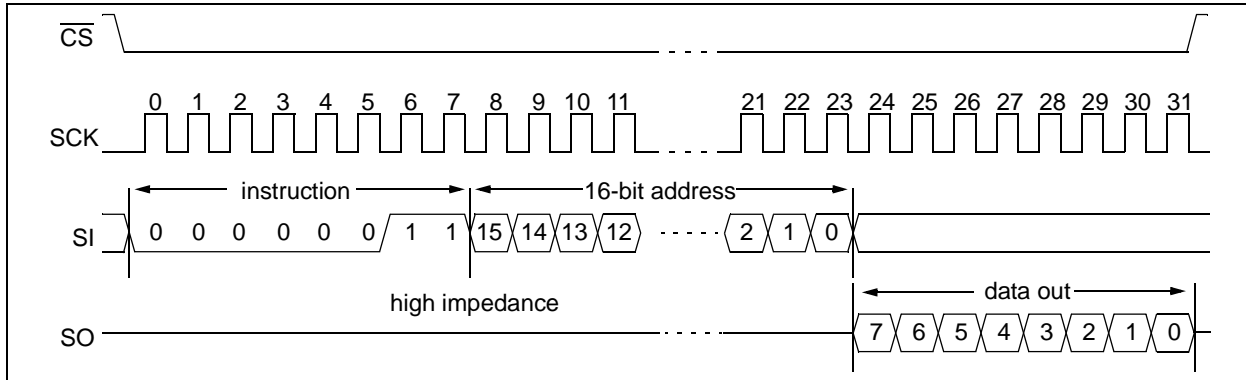
For the data to be actually written to the array, the  $\overline{CS}$  must be brought high after the least significant bit ( $D_0$ ) of the  $n^{th}$  data byte has been clocked in. If  $\overline{CS}$  is brought high at any other time, the write operation will not be completed. Refer to Figure 3-2 and Figure 3-3 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 3-6). 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.

TABLE 3-1: INSTRUCTION SET

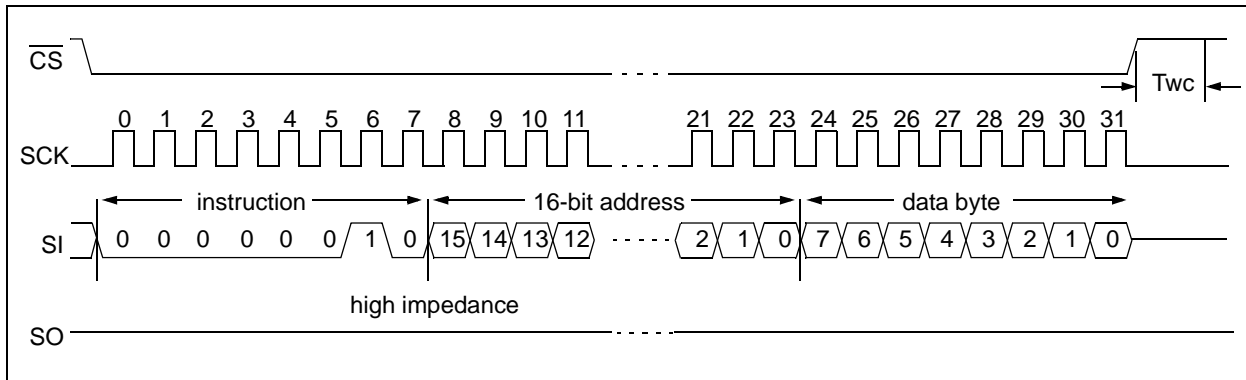
Instruction Name	Instruction Format	Description
READ	0000 0011	Read data from memory array beginning at selected address
WRITE	0000 0010	Write data to memory array beginning at selected address
WRDI	0000 0100	Reset the write enable latch (disable write operations)
WREN	0000 0110	Set the write enable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

# 25AA320/25LC320/25C320

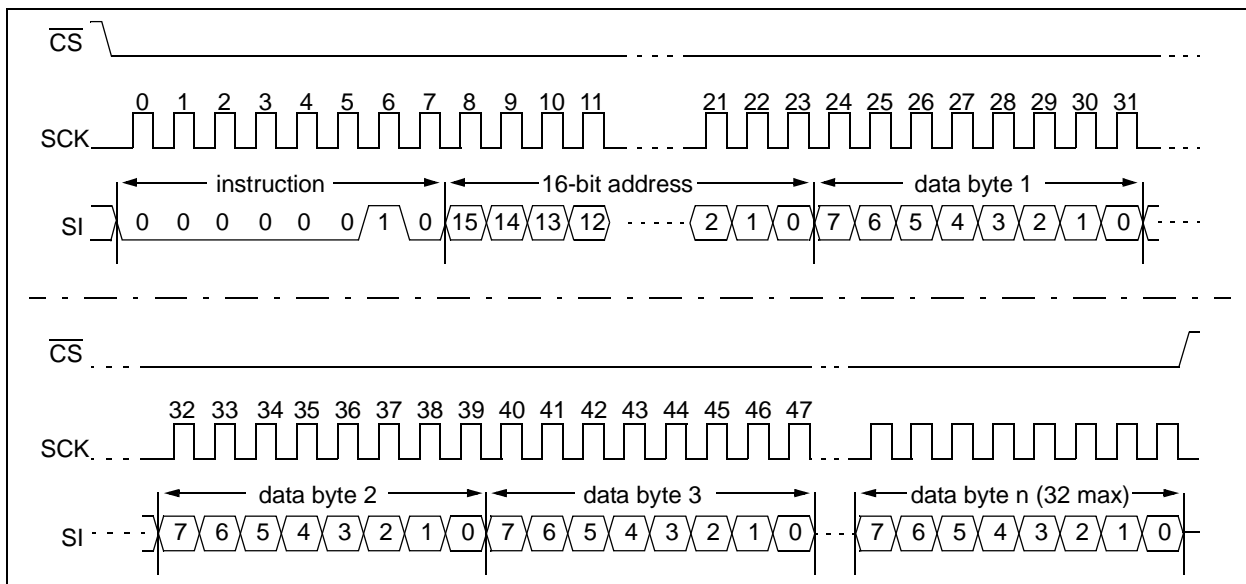
**FIGURE 3-1: READ SEQUENCE**



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



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





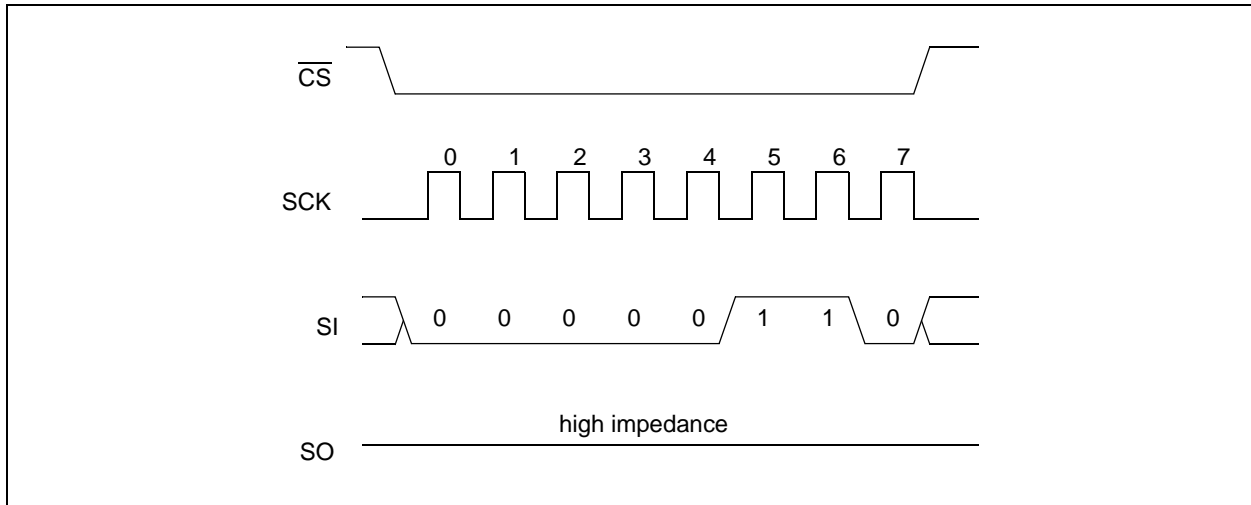
## 3.4 Write Enable (WREN) and Write Disable (WRDI)

The 25XX320 contains a write enable latch. See Table 3-3 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.

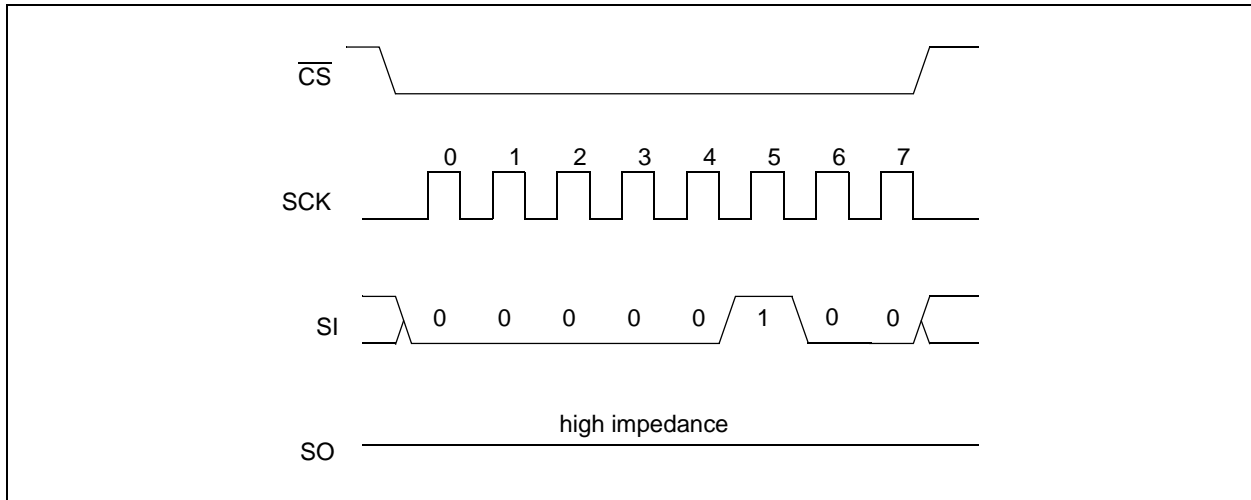
The following is a list of conditions under which the write enable latch will be reset:

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

**FIGURE 3-4: WRITE ENABLE SEQUENCE**



**FIGURE 3-5: WRITE DISABLE SEQUENCE**



# 25AA320/25LC320/25C320

## 3.5 Read Status Register (RDSR)

The Read Status Register (RDSR) instruction 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:

7	6	5	4	3	2	1	0
WPEN	X	X	X	BP1	BP0	WEL	WIP

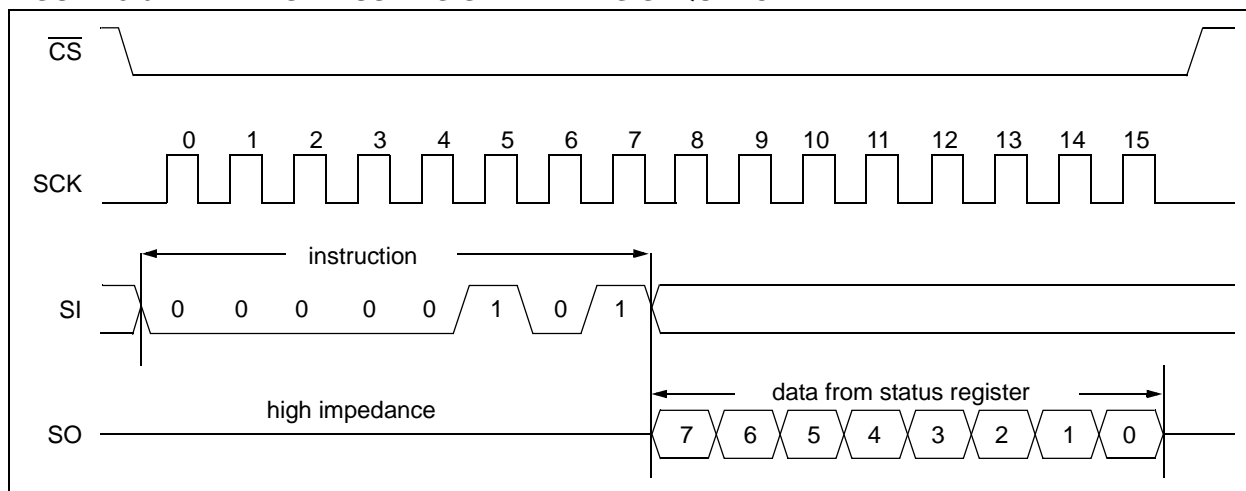
The **Write-In-Process (WIP)** bit indicates whether the 25XX320 is busy with a write operation. When set to a '1', a write is in progress, when set to a '0', no write is in progress. This bit is read only.

The **Write Enable Latch (WEL)** bit indicates the status of the write enable latch. When set to a '1', the latch allows writes to the array, when set to a '0', the latch prohibits writes to the array. 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. This bit is read only.

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. These bits are non-volatile.

See Figure 3-6 for the RDSR timing sequence.

**FIGURE 3-6: READ STATUS REGISTER TIMING SEQUENCE**



## 3.6 Write Status Register (WRSR)

The Write Status Register (WRSR) instruction allows the user 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 3-2.

The Write Protect Enable (WPEN) bit is a non-volatile 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

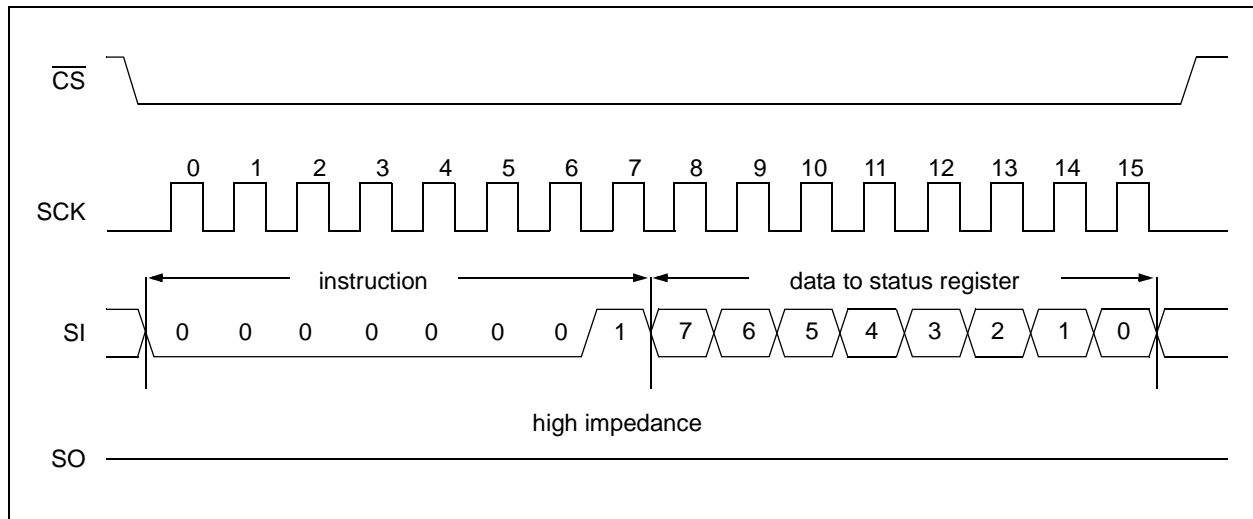
to non-volatile bits in the status register are disabled. See Table 3-3 for a matrix of functionality on the WPEN bit.

See Figure 3-7 for the WRSR timing sequence.

**TABLE 3-2: ARRAY PROTECTION**

BP1	BP0	Array Addresses Write Protected
0	0	none
0	1	upper 1/4 (0C00h - 0FFFh)
1	0	upper 1/2 (0800h - 0FFFh)
1	1	all (0000h - 0FFFh)

**FIGURE 3-7: WRITE STATUS REGISTER TIMING SEQUENCE**



# 25AA320/25LC320/25C320

---

## 3.7 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

## 3.8 Power On State

The 25XX320 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 low level on  $\overline{CS}$  is required to enter active state

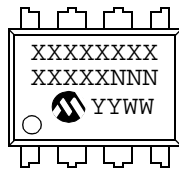
**TABLE 3-3: WRITE PROTECT FUNCTIONALITY MATRIX**

WPEN	$\overline{WP}$	WEL	Protected Blocks	Unprotected Blocks	Status Register
X	X	0	Protected	Protected	Protected
0	X	1	Protected	Writable	Writable
1	Low	1	Protected	Writable	Protected
X	High	1	Protected	Writable	Writable

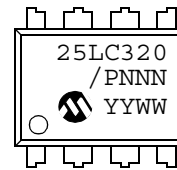
## 4.0 PACKAGING INFORMATION

### 4.1 Package Marking Information

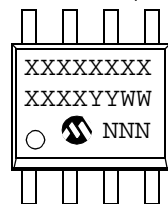
8-Lead PDIP (300 mil)



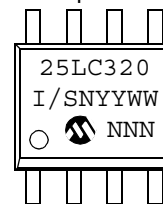
Example:



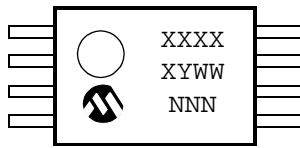
8-Lead SOIC (150 mil)



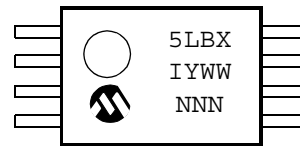
Example:



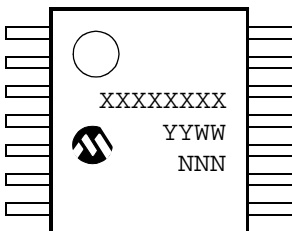
8-Lead TSSOP



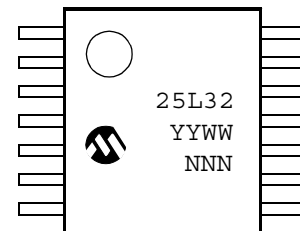
Example:



14-Lead TSSOP



Example:



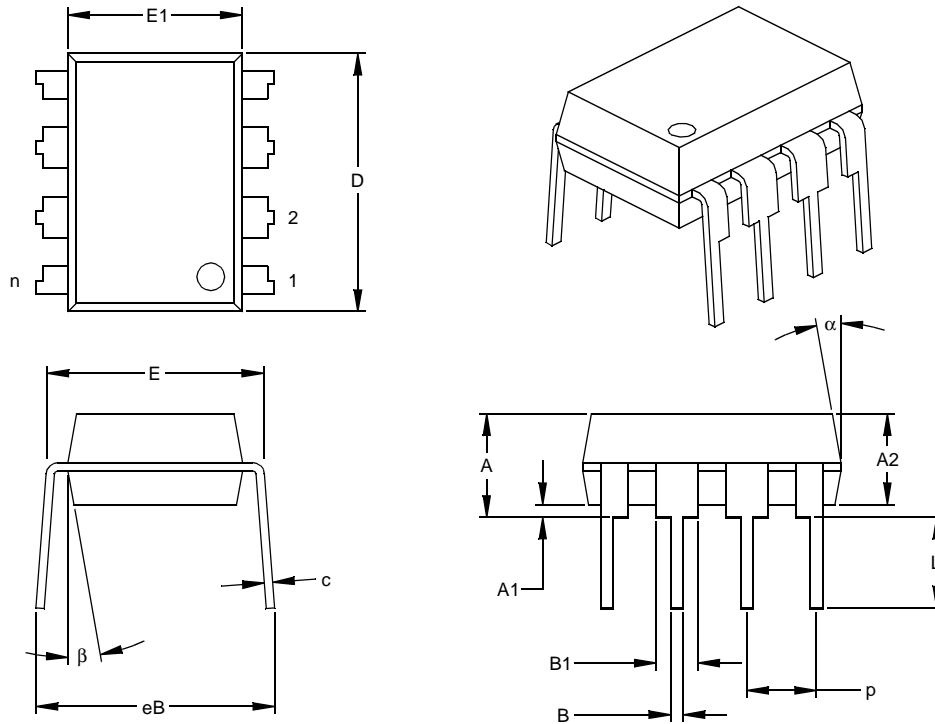
<b>Legend:</b>	XX...X	Customer specific information*
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code

**Note:** In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line thus limiting the number of available characters for customer specific information.

\* Standard marking consists of Microchip part number, year code, week code, and traceability code. For device markings beyond this, certain price adders apply. Please check with your Microchip Sales Office. For QTP devices, any special marking adders are included in QTP price.

# 25AA320/25LC320/25C320

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



Dimension Limits	Units	INCHES*			MILLIMETERS		
		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:

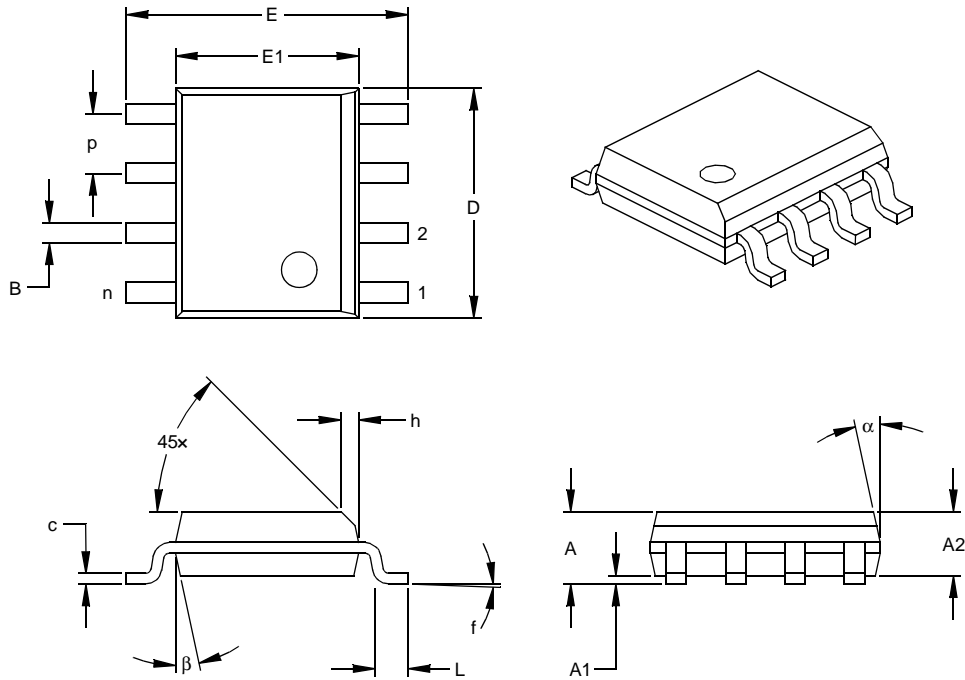
Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" (0.254mm) per side.

JEDEC Equivalent: MS-001

Drawing No. C04-018

# 25AA320/25LC320/25C320

## 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	f	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

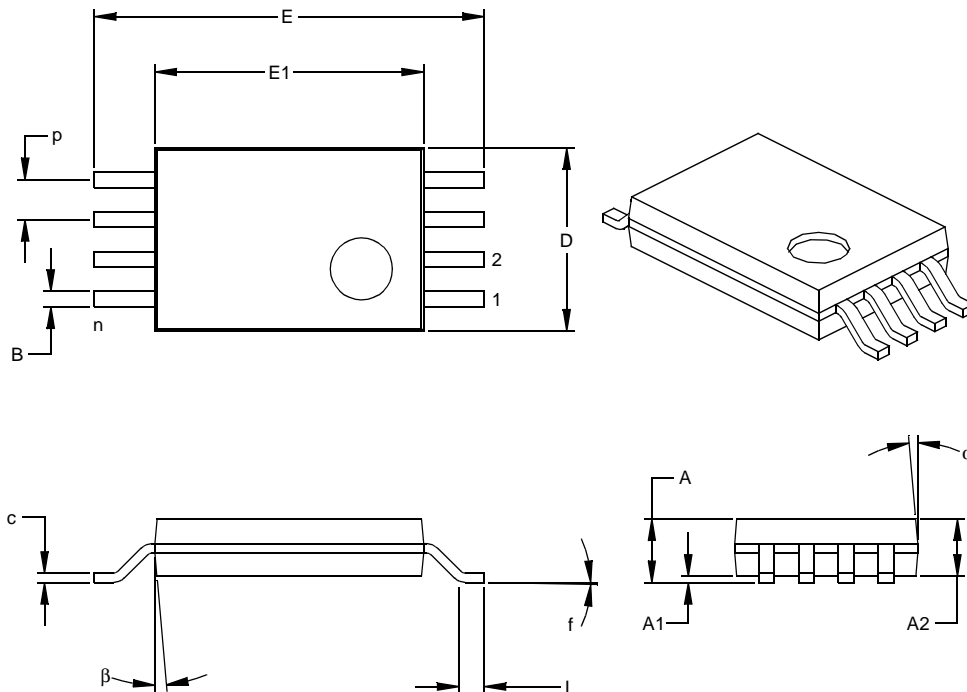
\* Controlling Parameter  
 § Significant Characteristic

**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

# 25AA320/25LC320/25C320

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	f	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

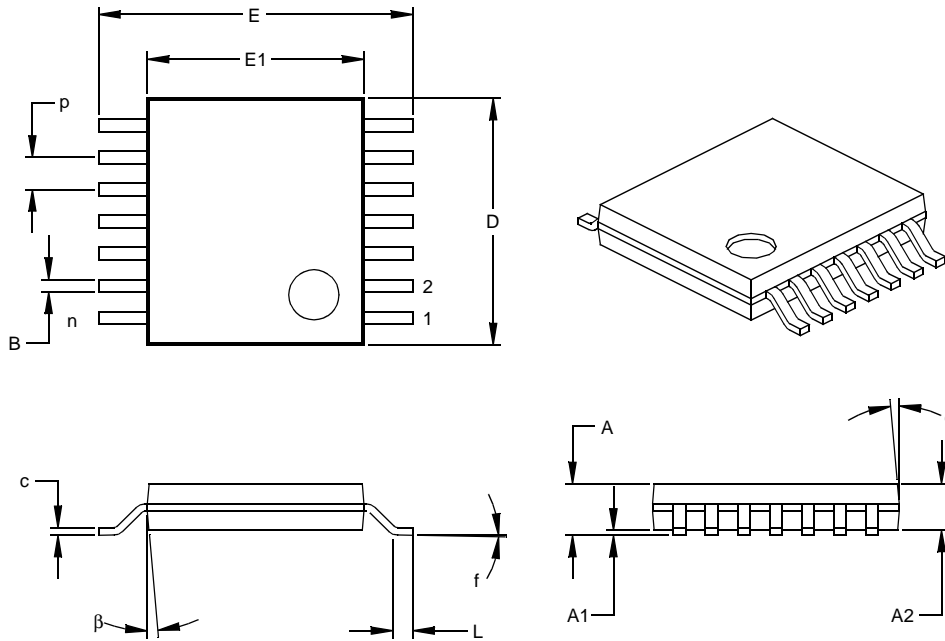
\* Controlling Parameter  
 § Significant Characteristic

**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



# 25AA320/25LC320/25C320

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



Dimension Limits	Units	INCHES			MILLIMETERS*		
		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		14			14	
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	.193	.197	.201	4.90	5.00	5.10
Foot Length	L	.020	.024	.028	0.50	0.60	0.70
Foot Angle	f	0	4	8	0	4	8
Lead Thickness	c	.004	.006	.008	0.09	0.15	0.20
Lead Width	B1	.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. C04-087

# 25AA320/25LC320/25C320

---

## ON-LINE SUPPORT

Microchip provides on-line support on the Microchip World Wide Web (WWW) 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® 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 by using your favorite Internet browser to attach to:

**[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 any currently available 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.

013001

## 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) 792-7578.

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

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

Application (optional):

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

Device: **25AA320/25LC320/25C320**

Literature Number: **DS21227C**

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 data sheet easy to follow? If not, why?

---

---

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

---

---

5. What deletions from the data sheet 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?

---

---

8. How would you improve our software, systems, and silicon products?

---

---

# 25AA320/25LC320/25C320

---

NOTES:

NOTES:

# 25AA320/25LC320/25C320

## PRODUCT IDENTIFICATION SYSTEM

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

PART NO.		X	/XX
Device	Temperature Range		Package
<b>Device:</b>	25AA320:	32 Kbit 1.8V SPI Serial EEPROM	
	25AA320T:	32 Kbit 1.8V SPI Serial EEPROM (Tape and Reel)	
	25AA320X	32-bit 1.8V SPI Serial EEPROM in alternate pinout (ST only)	
	25AA320XT	32-bit 1.8V SPI Serial EEPROM in alternate pinout Tape and Reel (ST only)	
	25LC320:	32 Kbit 2.5V SPI Serial EEPROM	
	25LC320T:	32 Kbit 2.5V SPI Serial EEPROM (Tape and Reel)	
	25LC320X	32-bit 1.8V SPI Serial EEPROM in alternate pinout (ST only)	
	25LC320XT	32-bit 1.8V SPI Serial EEPROM in alternate pinout Tape and Reel (ST only)	
	25C320:	32 Kbit 5V SPI Serial EEPROM	
	25C320T:	32 Kbit 5V SPI Serial EEPROM (Tape and Reel)	
	25C320X	32-bit 1.8V SPI Serial EEPROM in alternate pinout (ST only)	
	25C320XT	32-bit 1.8V SPI Serial EEPROM in alternate pinout Tape and Reel (ST only)	
<b>Temperature Range:</b>	I =	-40°C to +85°C	
	E =	-40°C to +125°C	
<b>Package:</b>	P =	Plastic DIP (300 mil body), 8-lead	
	SN =	Plastic SOIC (150 mil body), 8-lead	
	ST =	Plastic TSSOP (4.4 mm body), 8-lead	
	ST14 =	Plastic TSSOP (4.4 mm body), 14-lead	

Examples:

- a) 25LC320-I/SN: Industrial Temp., SOIC package
- b) 25LC320T-I/SN: Tape and Reel, Industrial Temp., SOIC package
- c) 25LC320-E/SN: Extended Temp., SOIC package
- d) 25C320-I/SN: Industrial Temp., SOIC package
- e) 25C320T-I/SN: Tape and Reel, Industrial Temp., SOIC package
- f) 25C320-I/ST: Industrial Temp., TSSOP package
- g) 25C320-E/SN: Extended Temp., SOIC 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.

“All rights reserved. Copyright © 2001, Microchip Technology Incorporated, USA. Information contained in this publication regarding device applications and the like is intended through suggestion only and may be superseded by updates. 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. The Microchip logo and name are registered trademarks of Microchip Technology Inc. in the U.S.A. and other countries. All rights reserved. All other trademarks mentioned herein are the property of their respective companies. No licenses are conveyed, implicitly or otherwise, under any intellectual property rights.”

## Trademarks

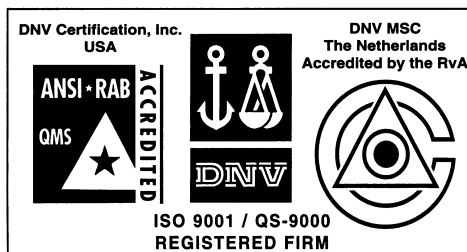
The Microchip name, logo, PIC, PICmicro, PICMASTER, PICSTART, PRO MATE, KEELOQ, SEEVAL, MPLAB and The Embedded Control Solutions Company are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

Total Endurance, ICSP, In-Circuit Serial Programming, FilterLab, MXDEV, microID, FlexROM, fuzzyLAB, MPASM, MPLINK, MPLIB, PICDEM, ICEPIC, Migratable Memory, FanSense, ECONOMONITOR, Select Mode and microPort are trademarks of Microchip Technology Incorporated in the U.S.A.

Serialized Quick Term 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.

© 2001, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.



*Microchip received QS-9000 quality system certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona in July 1999. The Company's quality system processes and procedures are QS-9000 compliant for its PICmicro® 8-bit MCUs, KEELOQ® code hopping devices, Serial EEPROMs and microperipheral 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>

#### Rocky Mountain

2355 West Chandler Blvd.  
Chandler, AZ 85224-6199  
Tel: 480-792-7966 Fax: 480-792-7456

#### Atlanta

500 Sugar Mill Road, Suite 200B  
Atlanta, GA 30350  
Tel: 770-640-0034 Fax: 770-640-0307

#### Austin

Analog Product Sales  
8303 MoPac Expressway North  
Suite A-201  
Austin, TX 78759  
Tel: 512-345-2030 Fax: 512-345-6085

#### Boston

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

#### Boston

Analog Product Sales  
Unit A-8-1 Millbrook Tarry Condominium  
97 Lowell Road  
Concord, MA 01742  
Tel: 978-371-6400 Fax: 978-371-0050

#### 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

#### Dayton

Two Prestige Place, Suite 130  
Miamisburg, OH 45342  
Tel: 937-291-1654 Fax: 937-291-9175

#### Detroit

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

#### Los Angeles

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

#### Mountain View

Analog Product Sales  
1300 Terra Bella Avenue  
Mountain View, CA 94043-1836  
Tel: 650-968-9241 Fax: 650-967-1590

#### New York

150 Motor Parkway, Suite 202  
Hauppauge, NY 11788  
Tel: 631-273-5305 Fax: 631-273-5335

#### 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  
Suite 22, 41 Rawson Street  
Epping 2121, NSW  
Australia  
Tel: 61-2-9868-6733 Fax: 61-2-9868-6755

#### China - Beijing

Microchip Technology Beijing Office  
Unit 915  
New China Hong Kong Manhattan Bldg.  
No. 6 Chaoyangmen Beidajie  
Beijing, 100027, No. China  
Tel: 86-10-85282100 Fax: 86-10-85282104

#### China - Shanghai

Microchip Technology Shanghai Office  
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

#### Hong Kong

Microchip Asia Pacific  
RM 2101, Tower 2, Metroplaza  
223 Hing Fong Road  
Kwai Fong, N.T., Hong Kong  
Tel: 852-2401-1200 Fax: 852-2401-3431

#### India

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

#### Japan

Microchip Technology Intl. Inc.  
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

### ASIA/PACIFIC (continued)

#### Korea

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

#### Singapore

Microchip Technology Singapore Pte Ltd.  
200 Middle Road  
#07-02 Prime Centre  
Singapore, 188980  
Tel: 65-334-8870 Fax: 65-334-8850

#### Taiwan

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

### EUROPE

#### Denmark

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

#### France

Arizona 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

Arizona Microchip Technology GmbH  
Gustav-Heinemann Ring 125  
D-81739 Munich, Germany  
Tel: 49-89-627-144 0 Fax: 49-89-627-144-44

#### Germany

Analog Product Sales  
Lochhamer Strasse 13  
D-82152 Martinsried, Germany  
Tel: 49-89-895650-0 Fax: 49-89-895650-22

#### Italy

Arizona Microchip Technology SRL  
Centro Direzionale Colleoni  
Palazzo Taurus 1 V. Le Colleoni 1  
20041 Agrate Brianza  
Milan, Italy  
Tel: 39-039-65791-1 Fax: 39-039-6899883

#### United Kingdom

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

01/30/01

All rights reserved. © 2001 Microchip Technology Incorporated. Printed in the USA. 5/01  Printed on recycled paper.

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, except as maybe explicitly expressed herein, under any intellectual property rights. The Microchip logo and name are registered trademarks of Microchip Technology Inc. in the U.S.A. and other countries. All rights reserved. All other trademarks mentioned herein are the property of their respective companies.