

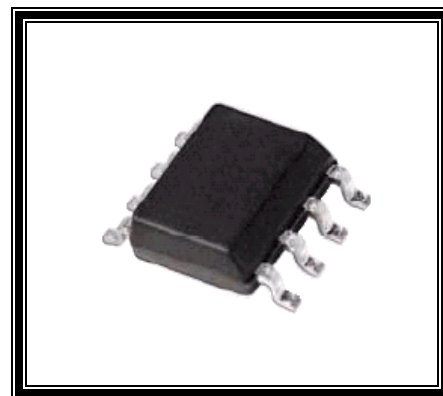
Features

- Saifun NROM™ Cell
- Serial Peripheral Interface (SPI) Compatible, Supports SPI Modes 0 (0,0) and 3 (1,1)
- Byte and Page Write Operation:
 - 1024 pages (256 Bytes/Page)
 - Single Byte or Page Write Cycle in 10ms Typical
- Single Supply Voltage: 2.7V to 3.6V
- 25MHz Clock Rate
- Block Write Protection: Protect Quarter, Half or Entire Array
- Write Protect Pin and Write Disable Instructions of Both Hardware and Software Data Protection
- 100,000 Erase Cycles (Minimum)
- More than 20-Year Data Retention
- Low-power Standby Current (less than 1μA)
- 8-SOIC Narrow Package
- MLF Leadless Package
- Temperature Range:
 - Industrial: -40°C to +85°C
 - Commercial: 0°C to +70°C



SA25C020 Advanced Information

2Mb EEPROM with 25MHz SPI Bus Interface



<http://www.saifun.com>

Saifun NROM™ is a trademark of Saifun Semiconductors Ltd.

General Description

The SA25C020 is a 2Mb (512K X 4) CMOS non-volatile serial EEPROM. This device fully conforms to the SPI 4-wire protocol, is enabled through the Chip Select (CSb) pin, and uses Clock (SCK), Data-in (SI) and Data-out (SO) pins to synchronously control data transfer between the SPI microcontroller and the Serial EEPROM.

The memory can be written from 1 up to 256 bytes at a time via the Byte / Page Write (PW) instruction.

The memory consists of 1024 pages or 262,144 bytes.

Each device requires only a 3.0V power supply (2.7 V to 3.6 V) for both read and write functions. Internally generated and regulated voltages are provided for the program and erase operations. The SA25C020 does not require a V_{PP} supply.

The HOLDb pin may be used to suspend any serial communication without resetting the serial sequence. In addition, the serial interface allows a minimal-pin-count packaging designed to simplify PC board layout requirements and offers the designer a variety of low-voltage and low-power options.

The SA25C020 is available in a space-saving, 8-lead narrow SOIC package

The SA25C020 is part of the SPI EEPROM family. It is designed to work with any SPI-compatible, high-speed microcontroller, and offers both hardware (WPb pin) and Software ("block protect") data protection. For example, programming a 2-bit code into the status register prevents program with top $\frac{1}{4}$, top $\frac{1}{2}$ or entire array write protection and enables block write protection. Separate program enable and program disable instructions are provided for additional data protection. Hardware data protection is provided via the WPb pin to protect against inadvertent write attempts to the status register.

Saifun's SPI Serial EEPROM products are designed and tested for applications requiring high endurance and low power consumption for a continuously reliable non-volatile solution for all markets.

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Memory Organization

The memory is organized in the following manner:

- 262,144 bytes (8 bits each)
- 1024 pages (256 bytes each)

Each byte or page can be individually written with the bits programmed from 1 to 0 and from 0 to 1.

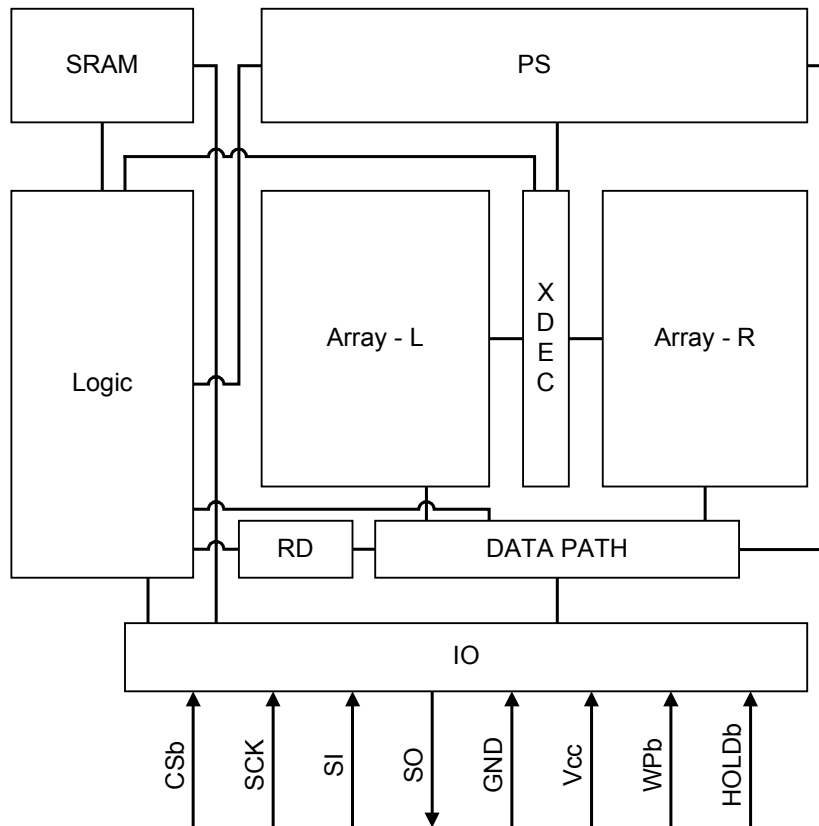


Figure 1. SA25C020 Block Diagram

Connection Diagrams

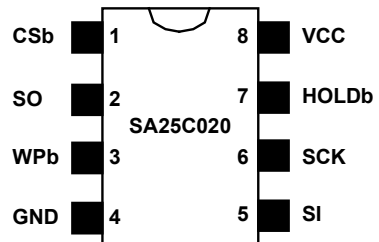


Figure 2. SOIC 8 (150 mil)/PDIP/MLF Package (Top View)

Table 1. Pin Names

Pin Name	Signal Name
CSb	Chip Select
SCK	Serial Data Clock
SI	Serial Data Input
SO	Serial Data Output
GND	Ground
V _{CC}	Power Supply
WPb	Write Protect
HOLDb	Suspend Serial Input

Ordering Information

<u>SA</u>	<u>25</u>	<u>C</u>	<u>XX</u>	<u>L</u>	<u>E</u>	<u>PP</u>	<u>F</u>	<u>X</u>	Letter	Description
									Blank X	Tube Tape and Reel
									Blank F	Non Lead Free Lead Free
							Package		N MN MLF	8-pin DIP 8-pin SOIC (150 mil) 8-lead MLF
							Temp. Range		Blank E	0 to 70 C -40 to +85 C
							Voltage Operating Range		L	2.7 V to 3.6 V
							Density		020	2 Mb with Write Protect
									C	CMOS
							Interface		25	SPI-2 Wires
									SA	Saifun Non-Volatile Memory

Figure 3. SA25C020 Ordering Information

Product Specifications

Absolute Maximum Ratings

Storage Temperature	-65 °C to +150 °C
All input or output voltages with respect to Ground	4.5 V to -0.3 V
Lead Temperature (Soldering, 10 seconds)	+235 °C

ESD/Latch Up Specification (JEDEC 8 Spec)

Human Body Model	Minimum 4 KV
Machine Model	Minimum 500 V
Charge Device Model	Minimum 1 KV
Latch Up	100 mA on all pins +125°C

Operating Conditions

Operating Temperature:	
SA25C020	0 °C to +70 °C
SA25C020 E	-40 °C to +85 °C
Positive Power Supply:	
SA25C020	2.7 V to 3.6 V

DC Characteristics

Applicable over recommended operating range from $T_{AI} = -40\text{ }^{\circ}\text{C}$ to $85\text{ }^{\circ}\text{C}$, $V_{CC} = 2.7\text{--}3.6\text{ V}$.

Table 2. DC Characteristics

Symbol	Parameter	Test Conditions	Limits			Unit
			Min	Typ*	Max	
V_{CC}	Supply Voltage		2.7	3	3.6	V
I_{CC1}	Active Power Supply Current (Read)	$SCK = 0.1V_{CC}/0.9 V_{CC} @ 25\text{ MHz}$		9	12	mA
I_{CC2}	Active Power Supply Current (Page Write)	$CSb = V_{CC}$			15	mA
I_{CC3}	Active Power Supply Current (WRSR)	$CSb = V_{CC}$			15	mA
I_{SB}	Standby Current	$V_{CC} = 3.6\text{ V}$, $CSb = V_{CC}$			1	μA
I_{IL}	Input Leakage Current	$V_{IN} = \text{GND to } V_{CC}$			1	μA
I_{OL}	Output Leakage Current	$V_{IN} = \text{GND to } V_{CC}$			1	μA
V_{IL}	Input Low Voltage		-0.3		$0.3 V_{CC}$	V
V_{IH}	Input High Voltage		$0.7 V_{CC}$		$V_{CC} + 0.5$	V
V_{OH}	Output High Voltage	$I_{OH} = -0.1\text{ mA}$	$V_{CC} - 0.2$			V
V_{OL}	Output Low Voltage	$I_{OL} = 1.6\text{ mA}$; $V_{CC} = 2.7\text{ V}$			0.4	V

*Typical values are at $T_{AI} = 25\text{ }^{\circ}\text{C}$ and 3 V .

AC Test Conditions

Table 3. AC Test Conditions

Symbol	Parameter	25 MHz			Unit
		Min	Typ	Max	
F _{SCK}	SCK Clock Frequency	D.C.		25	MHz
t _{CRT}	Clock Rise Time (Slew Rate)	0.1			V/ns
t _{CFT}	Clock Fall Time (Slew Rate)	0.1			V/ns
t _{WH}	SCK High Time	18			ns
t _{WL}	SCK Low Time	18			ns
t _{CS}	CSb High Time	100			ns
t _{CS} ^{**}	CSb Setup Time	10			ns
t _{CSH} ^{**}	CSb HOLD Time	10			ns
t _{HD} ^{**}	HOLD _b Setup Time	10			ns
t _{CD} ^{**}	HOLD _b Hold Time	10			ns
t _V	Output Valid	0		15	ns
t _{HO}	Output Hold Time	0			ns
t _{HD:DAT}	Data in Hold Time	5			ns
t _{SU:DAT}	Data in Setup Time	5			ns
t _{LZ} ^{**}	HOLD _b to Output Low Z			15	ns
t _{HZ} ^{**}	HOLD _b to Output High Z			20	ns
t _{DIS} ^{**}	Output Disable Time			15	ns
t _{WPS} ^{**}	Write Protect Setup Time	20			ns
t _{WPH} ^{**}	Write Protect Hold Time	100			ns
t _{PW} [*]	Byte or Page Write		10	15	ms
t _{RES}	Release SP Mode			1000	ns
Endurance		100K			Erase cycles

* 256 bytes in the checkerboard programming formation.

** Value guaranteed by characterization, not 100% tested in production

Timing Diagrams

All timing diagrams are based on SPI protocol modes 0 and 1.

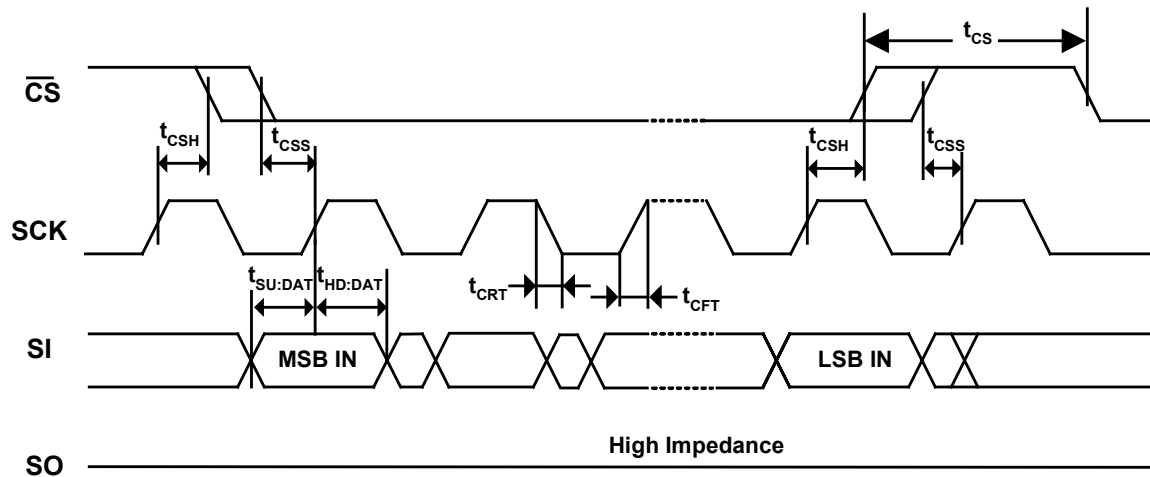


Figure 4. SPI Mode 0 (0,0) Input Timing

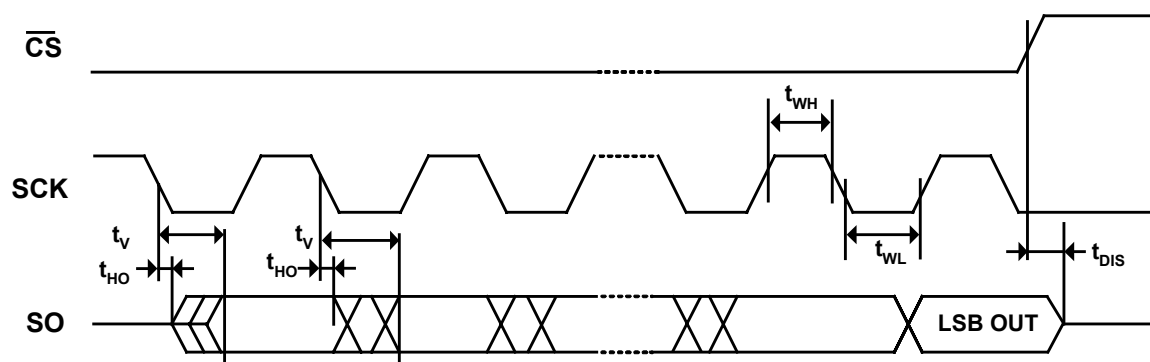


Figure 5. SPI Mode 0 (0,0) Output Timing

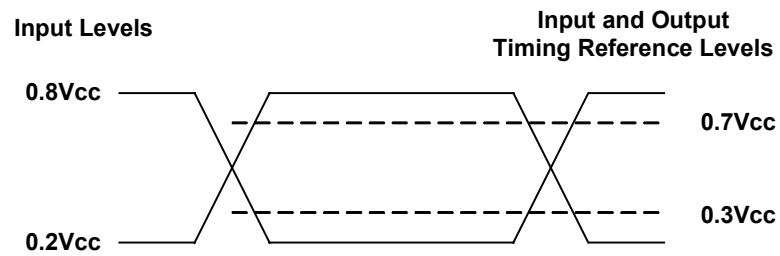


Figure 6. AC Measurements I/O Waveform

Table 4. AC Measurements

Symbol	Parameter	Min	Max	Unit
C_L	Load Capacitance	30		PF
	Input Rise and Fall Times		5	ns
	Input Pulse Voltage	0.2 V_{CC} to 0.8 V_{CC}		V
	Input and Output Timing Reference Voltages	0.3 V_{CC} to 0.7 V_{CC}		V

Signal Description

Chip Select (CSb)

This is an active-low input pin to the device that is generated by the master controlling the device. A low level on this pin selects the device, while a high level deselects the device. All serial communications with the device are enabled only when this pin is held low.

Serial Clock (SCK)

This is an input pin to the device that is generated by the master controlling the device. It is a clock signal that synchronizes the communication between a master and the device. All input information (SI) to the device is latched on the rising edge of this clock input, while output data (SO) from the device is driven after the falling edge of this clock input.

Serial Input (SI)

This is an input pin to the device that is generated by the master controlling the device. The master transfers input information (instruction, addresses and the data to be programmed) into the device serially via this pin. This input information is latched on the rising edge of the SCK.

Serial Output (SO)

This is an output pin from the device that is used to transfer output data to the controlling master. Output data is serially shifted out on this pin after the falling edge of the SCK.

Hold (HOLDb)

This is an active low input pin to the device that is generated by the master controlling the device. When driven low, this pin suspends any current communication with the device. The suspended communication can be resumed by driving this pin high. This feature eliminates the need to re-transmit the entire sequence by enabling the master to resume the communication from where it was left off. This pin should be tied high if this feature is not used. Refer to *Hold Condition*, page 15, for additional details.

Write Protect (WPb)

This is an active low input pin to the device. This pin allows enabling and disabling of writes to the device's memory array and status register. When this pin is held low, writes to the memory array and status register are disabled; when it is held high, they are enabled. Refer to *Write Protect*, page 16, for additional details.

Serial Interface Description

SPI Modes

These devices can be driven by a microcontroller with its SPI peripheral running in either of the two following modes:

- CPOL=0, CPHA=0
- CPOL=1, CPHA=1

In both of these modes, input data is latched on the rising edge of SCK, and output data is available from the falling edge of SCK. The difference between the two modes, as shown in Figure 7, is the clock polarity when the bus master is in Standby mode and is not transferring data, as follows:

- SCK remains at 0 for CPOL = 0, CPHA = 0
- SCK remains at 1 for CPOL = 1, CPHA = 1

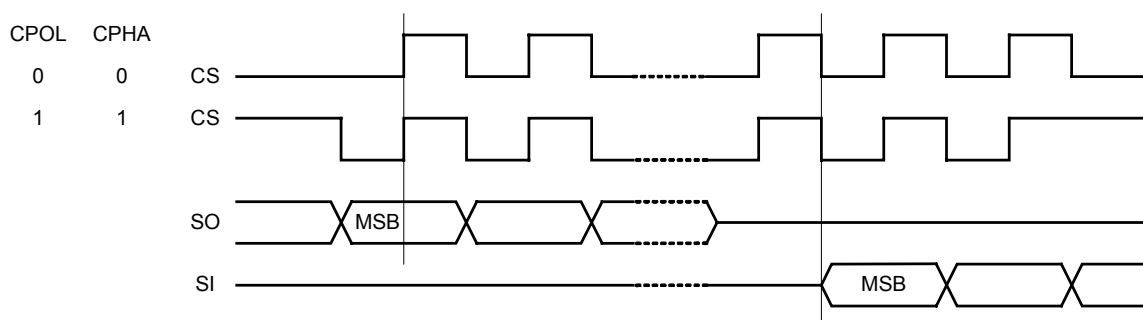


Figure 7. Supported SPI Modes

Master

The device that generates the SCK.

Slave

As the SCK pin is always an input, the SA25C020 always operates as a slave.

Transmitter/Receiver

The SA25C020 has separate pins designated for data transmission and reception.

Serial Opcode

The first byte is received after the device is selected. This byte contains the opcode that defines the operation to be performed (for more details, refer to Table 5, page 17).

Invalid Opcode

If an invalid opcode is received, no data is shifted into the SA25C020, and the serial output pin remains in a high impedance state until a CSb falling edge is detected again, which reinitializes the serial communication.

Chip Select (CSb)

The SA25C020 is selected when the CSb pin is low. When the device is not selected, data is not accepted via the SI pin, and the SO pin remains in a high impedance state.

Hold Condition

The HOLDb pin is used in conjunction with the CSb pin to select the SA25C020. When the device is selected and a serial sequence is underway, HOLDb can be used to pause the serial communication with the master device without resetting the serial sequence.

To enter the hold condition the device must be selected, with CSb low.

As shown in Figure 8, the Hold condition starts on the falling edge of the HOLDb signal, provided that SCK is low. The Hold condition ends on the rising edge of the HOLDb signal, provided that SCK is low. If the falling edge does not coincide with SCK being low, the Hold condition starts only after SCK next goes low. Similarly, if the rising edge does not coincide with SCK being low, the Hold condition ends only after SCK next goes low.

During the Hold condition, SO is high impedance, and SI and SCK are Don't Care. In most cases, the device is kept selected, with CSb driven low, for the entire duration of the Hold condition, which ensures that the internal logic state remains unchanged from the moment it enters the Hold condition.

NOTE:

Driving CSb high while HOLDb is still low is not a legal operation.

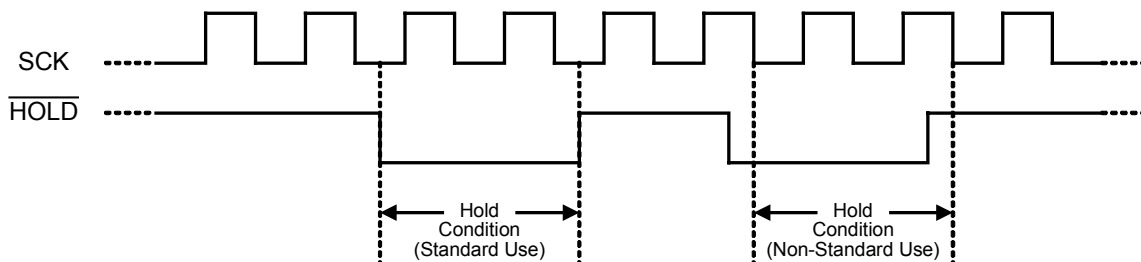


Figure 8. Hold Condition

Write Protect

The WPb pin enables write operations to the status register when held high. When the WPb pin is brought low and the WPBEN bit is 1, all write operations to the status register are inhibited (for more details, refer to Table 9, page 21). If WPb goes low while CSb is still low, the write to the status register is interrupted. If the internal write cycle has already been initiated, WPb going low has no effect on any write operations to the status register. The WPb pin function is blocked when the WPBEN bit in the status register is 0, which enables the user to install the SA25C020 in a system with the WPb pin tied to ground but still able to write to the status register. All WPb pin functions are enabled when the WPBEN bit is set to 1.

Functional Description

Instructions

Figure 9 presents a schematic diagram of the SA25C020 's SPI serial interface.

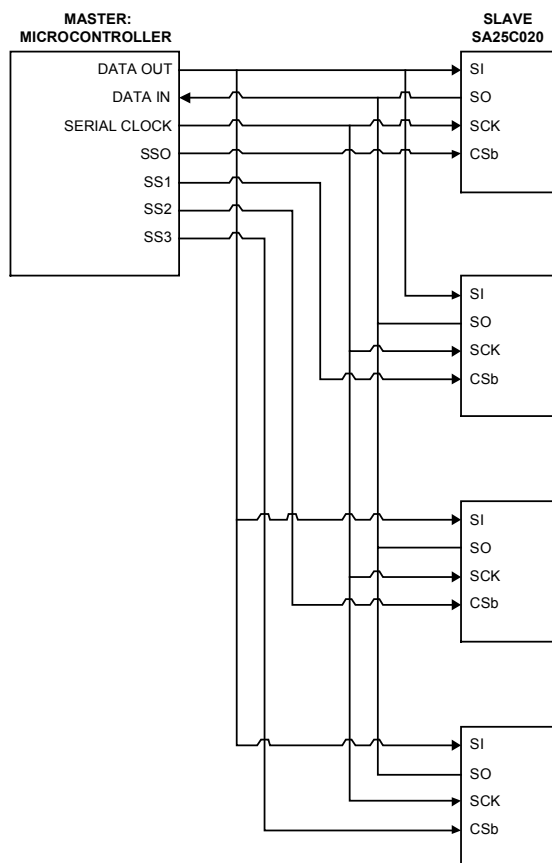


Figure 9. SPI Serial Interface

The SA25C020 's SPI consists of an 8-bit instruction register that decodes a specific instruction to be executed. Thirteen different instructions (called *opcodes*) are incorporated in the device for various operations. Table 5 lists the instruction set and the format for proper operation. All opcodes, array addresses and data are transferred in an MSB-first-LSB-last fashion. Detailed information about each of these opcodes is provided for the individual instruction descriptions in the sections that follow.

Table 5. Instruction Set

Instruction Name	Instruction Format	Operation
WREN	0000 0110	Set Write Enable Latch
WRDI	0000 0100	Reset Write Enable Latch
RDSR	0000 0101	Read Status Register
WRSR	0000 0001	Write Status Register
READ	0000 0011	Read Data from Memory Array
Byte or Page Write	0000 0010	Write Data to Memory Array
READ_ID	1010 1011 +3 dummy bytes	Read ID

In addition to the instruction register, the device also contains an 8-bit status register that can be accessed by RDSR and WRSR instructions. The byte defines the Block Write Protection (BP1 and BP0) levels, Write Enable (WEN) status, Busy/Rdy (/RDY) status and Hardware Write Protect (WPBEN) status of the device. Table 6 illustrates the format of the status register.

Table 6. Status Register Format

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit1	Bit 0
WPBEN	X	X	X	BP1	BP0	WEN	/RDY

Read Status Register (RDSR)

The RDSR instruction provides read access to the status register. The BUSY/RDY and WREN statuses of the device can also be determined by this instruction. In addition, the Block Write Protection bits indicate the extent of protection employed. In order to determine the status of the device, the value of the /RDY bit can be continuously polled before sending any write instruction.

Table 7. Read Status Register Definition

Bit	Definition
Bit 0 (/RDY)	Bit 0 = 0 (/RDY) indicates that the device is READY. Bit 0 = 1 indicates that a write cycle is in progress.
Bit 1 (WEN)	Bit 1 = 0 indicates that the device is not write enabled. Bit 1 = 1 indicates that the device is write enabled.
Bit 2 (BP0)	Block Write Protect Bit 0
Bit 3 (BP1)	Block Write Protect Bit 1
Bit 7 (WPBEN)	Write Protect Mode Enable Bit

Bit 7 (WPBEN) is Hardware Write Protect mode. If this bit is a 1, this mode is enabled and the status register is write protected.

Bits 6 through 4 are always 0.

Bit 3 (BP1) and Bit 2 (BP0) together indicate a Block Write Protection previously sent to the device.

Bits 0 and 1 are 1 during an internal write cycle.

Bit 1 (WEN) indicates the Write Enable status of the device. This bit is read by executing an RDSR instruction. If this bit is 1, the device is write enabled; if it is 0, it is write disabled.

Bit 0 (/RDY) indicates the Busy/Ready status of the device. This bit is a read-only bit and is read by executing an RDSR instruction. If this bit is 1, the device is busy doing a Program or Erase cycle; if it is 0, the device is ready.

The RDSR command requires the following sequence:

1. The CSb pin is pulled low to select the device and the RDSR opcode is transmitted on the SI pin.
2. The data on the SI pin becomes Don't Care.
3. The data from the status register is shifted out on the SO pins, with the D7 bit first and the D0 bit last, as shown in Figure 10.

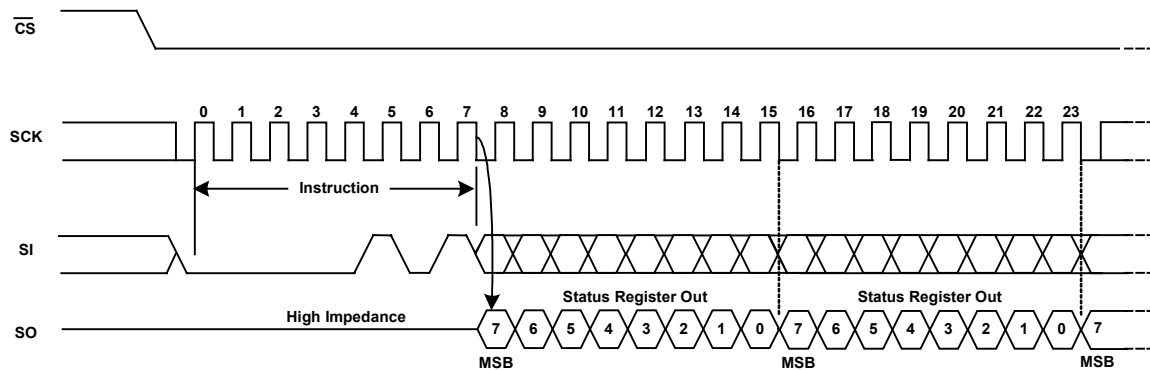


Figure 10. Read Status Register (RDSR) Instruction Sequence

Write Enable (WREN)

The device powers up in the Write Disable state when V_{CC} is applied. All programming instructions must be preceded by a WREN instruction. The instruction sequence is shown in Figure 11, with SO in high impedance.

Write Disable (WRDI)

To protect the device against inadvertent writes, the WRDI instruction disables all programming modes. The WRDI instruction is independent of the WP pin's status. The WREN instruction should be executed after the WRDI instruction to re-enable all programming modes. The instruction sequence is shown in Figure 12, with SO in high impedance.

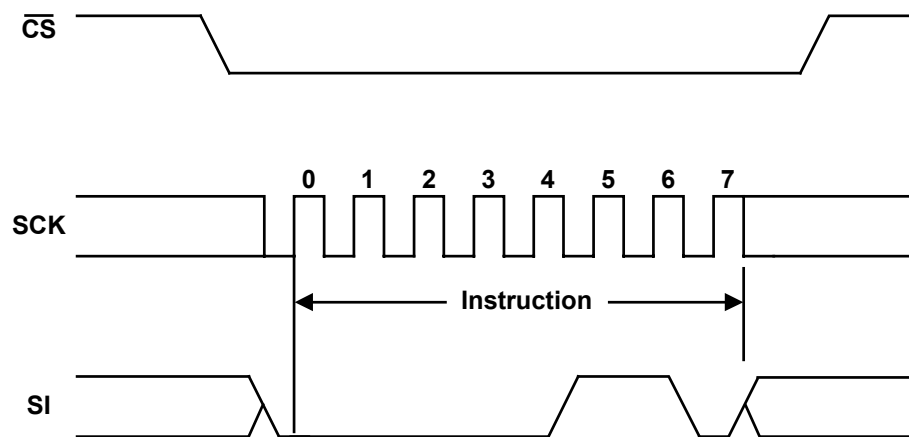


Figure 11. Write Enable (WREN) Instruction Sequence

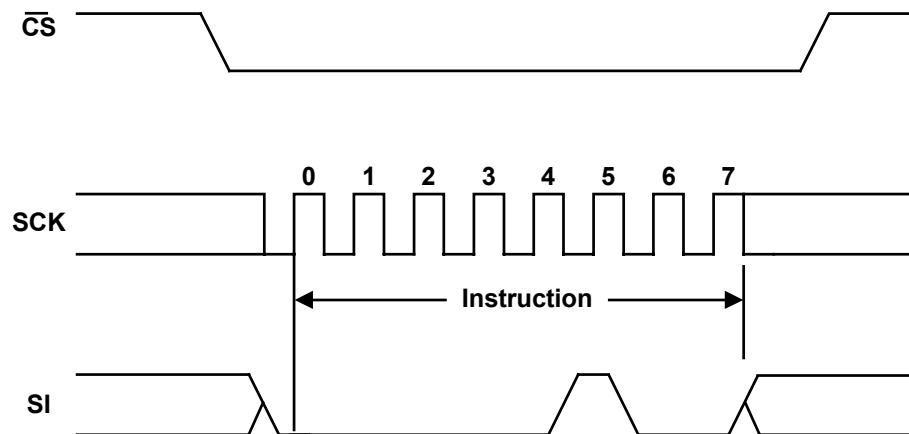


Figure 12. Write Disable (WRDI) Instruction Sequence

Write Status Register (WRSR)

The WRSR instruction enables the user to select one of four levels of protection. The SA25C020 is divided into four array segments. The top quarter, top half or all of the memory segments can be protected (for more details, refer to Table 8). The data within a selected segment is therefore read-only.

Table 8. Block Write Protect Bits

Level	Status Register Bits		Array Addresses Protected
	BP1	BP0	
0	0	0	None
1/4	0	1	30000 - 3FFFF
1/2	1	0	20000 - 3FFFF
All	1	1	00000 - 3FFFF

The WRSR instruction (as shown in Table 9) also allows the user to enable or disable the WPb pin via the WPBEN bit. Hardware write protection is enabled when the WPb pin is low and the WPBEN bit is 1, and disabled when either the WP pin is high or the WPBEN bit is 0. When the device is hardware write protected, writes to the status register are disabled.

NOTE:

When the WPBEN bit is hardware write protected, it cannot be changed back to 0 while the WPb pin is held low.

Table 9. WPBEN Operation

WPb	WPBEN	WEN	Protected Blocks	Un-protected Blocks	Status Register
X	0	0	Protected	Protected	Protected
X	0	1	Protected	Writeable	Writeable
Low	1	0	Protected	Protected	Protected
Low	1	1	Protected	Writeable	Protected
High	X	0	Protected	Protected	Protected
High	X	1	Protected	Writeable	Writeable

The WRSR instruction is enabled:

1. When the WPb pin is held high and the device has been previously write enabled via the WREN instruction.
2. When the WPb pin is held low, the WPBEN bit is 0 and the device has been previously write enabled via the WREN instruction.

The WRSR command requires the following sequence:

1. The CSb pin is pulled low to select the device.

2. The WRSR opcode is then transmitted on the SI pin, followed by the data to be programmed.

The instruction sequence is shown in Figure 13.

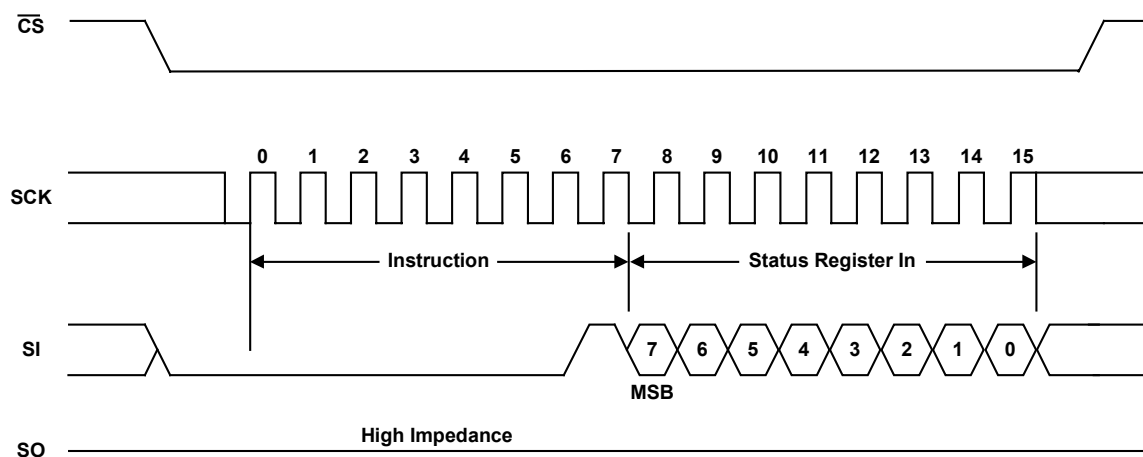


Figure 13. Write Status Register (WRSR) Instruction Sequence

Read Data Bytes (READ)

Reading the memory via the serial SPI link requires the following sequence:

1. After the CSb line is pulled low to select the device, the READ opcode is transmitted via the SI line, followed by the 3-byte address to be read (address bits A23 to A18 are Don't Care).
2. Upon completion, any data on the SI line is ignored.
3. The data (D7-D0) at the specified address is then shifted out onto the SO line. Each bit is shifted out at a maximum SCK frequency of F_{SCK} .

If only one byte is to be read, the CSb line should be driven high after the data comes out. The READ sequence can be continued, as the byte address is automatically incremented and data continues to shift out. When the highest address is reached, the address counter rolls over to the lowest address, enabling the entire memory to be read in one continuous READ cycle. The instruction sequence is shown in Figure 14.

Driving CSb high terminates the READ instruction, which can be done at any time during data output. Any READ instruction executed while an Erase, Program or WRSR cycle is in progress is rejected without having any effect on the cycle in progress.

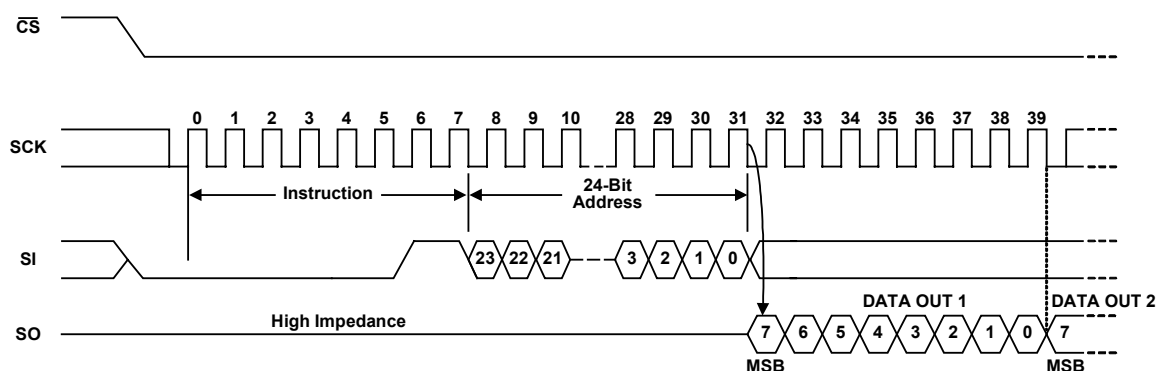


Figure 14. Read (READ) Instruction Sequence

Byte or Page Write (PW)

The Byte or Page Write instruction allows bytes to be programmed and erased in the memory (changing bits from 1 to 0 and from 0 to 1). In order to program to the SA25C020, two separate instructions must be executed. The device must first be write enabled via the WREN instruction, and then a Byte or Page Write sequence (which consists of four bytes plus data) may be executed. The address of the memory locations to be written must be outside the protected address field location selected by the Block Write Protection level. During an internal Write cycle, all commands are ignored except the RDSR instruction.

A Byte or Page Write instruction requires the following sequence:

After the CSb line is pulled low to select the device, the WRITE opcode is transmitted via the SI line, followed by the byte address and the data (D7-D0) to be written.

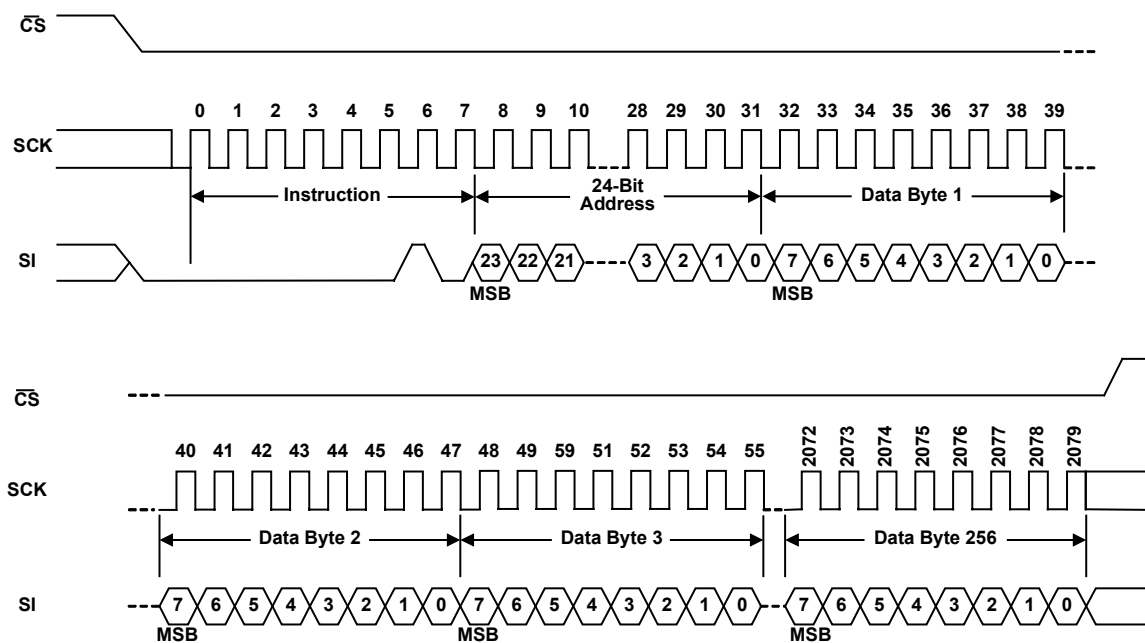
Programming starts after the CSb pin is brought high. The CSb pin's low-to-high transition must occur during the SCK low time, immediately after the clock in the D0 (LSB) data bit. The instruction sequence is shown in Figure 15, page 25.

As soon as CSb is driven high, the self-timed Write cycle (whose duration is defined as T_{PW}) is initiated. While the Page Write cycle is in progress, the status register may be read to check the value of the Write in Progress (/RDY) bit. The /RDY bit is 1 during the self-timed Page Write cycle, and 0 when it is completed. The Write Enable Latch (WEN) bit is reset at some unspecified time before the cycle is completed.

The SA25C020's PW operation is capable of up to a 256-byte writing, from 1 to 256 bytes at a time (changing bits from 1 to 0 and from 0 to 1), provided that they lie in consecutive addresses on the same page of memory. After each byte is received, the eight low-order address bits are internally incremented by one. If more than 256 bytes of data are transmitted, the address counter rolls over and the previously written data is overwritten. The SA25C020 is automatically returned to the write disable state at the completion of a Write cycle.

NOTES:

1. If the device is not write enabled, the device ignores the PW instruction and returns to the standby state when CSb is brought high. A new CSb falling edge is required to re-initiate the serial communication.
 2. A PW instruction applied to a page that is protected by the Block Protect (BP1, BP0) bits (as described in Table 7, page 18, and Table 8, page 21) is not executed.
-

**Figure 15. Byte or Page Write (PW) Instruction Sequence**

Read Electronic Signature (Read_Id)

The device features an 8-bit Electronic Signature, whose value for the SA25C020 is 11h. This can be read using the RES instruction.

The Read Id instruction always provides access to the Electronic Signature of the device (except while a Byte/Page Write or Write Status Register cycle is in progress). Any Read Id instruction executed while a Byte/Page Write or Write Status Register cycle is in progress is not decoded, and has no effect on the cycle in progress.

The device is first selected by driving CSb low. The instruction code is followed by three dummy bytes, each bit being latched in on SI during the rising edge of SCK.

The 8-bit Electronic Signature, which stored in the memory, is then shifted out on SO, with each bit being shifted out during the falling edge of SCK. The instruction sequence is shown in Figure 16.

Driving CSb high after the Electronic Signature has been read at least once terminates the Read Id instruction. Sending additional clock cycles on SCK, while CSb is driven low causes the Electronic Signature to be output repeatedly.

When CSb is driven high, the device is put into Standby mode. The transition to Standby mode is delayed by t_{RES} , and CSb must remain high for at least $t_{RES}(max)$, as specified in Table 3 on page 10. Once in Standby mode, the device waits to be selected, so that it can receive, decode and execute instructions.

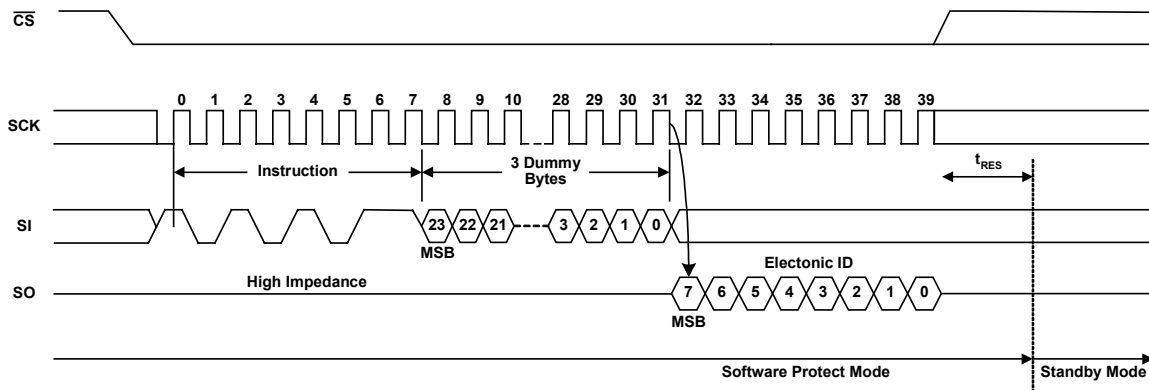


Figure 16. Read Electronic Signature (Read Id) Instruction Sequence

Powerup and Powerdown

The device must not be selected at powerup or powerdown (that is, CSb must follow the voltage applied on V_{CC}) until V_{CC} reaches the correct value, as follows:

- $V_{CC}(\text{min})$ at powerup, and then for a further delay of t_{PU} (as described in Table 10)
- V_{SS} at powerdown

A simple pull-up resistor on CSb can usually be used to insure safe and proper powerup and powerdown. To avoid data corruption and inadvertent write operations during powerup, a Power On Reset (POR) circuit is included. The logic inside the device is held at reset while V_{CC} is less than the POR threshold value (V_{POR}), all operations are disabled and the device does not respond to any instructions.

The device ignores all instructions until a time delay of t_{PU} has elapsed after the moment that V_{CC} rises above the VWI threshold. However, correct operation of the device is not guaranteed if by this time V_{CC} is still below $V_{CC}(\text{min})$. No Write Status Register, Program or Erase instructions should be sent until t_{PU} reaches the minimum V_{CC} threshold after V_{CC} .

At powerup, the device is in Standby mode (not SP mode) and the WEN bit is reset.

Normal precautions must be taken for supply rail decoupling to stabilize the V_{CC} feed. Each device in a system should have the V_{CC} rail decoupled by a suitable capacitor close to the package pins (this capacitor is generally of the order of 0.1 μF).

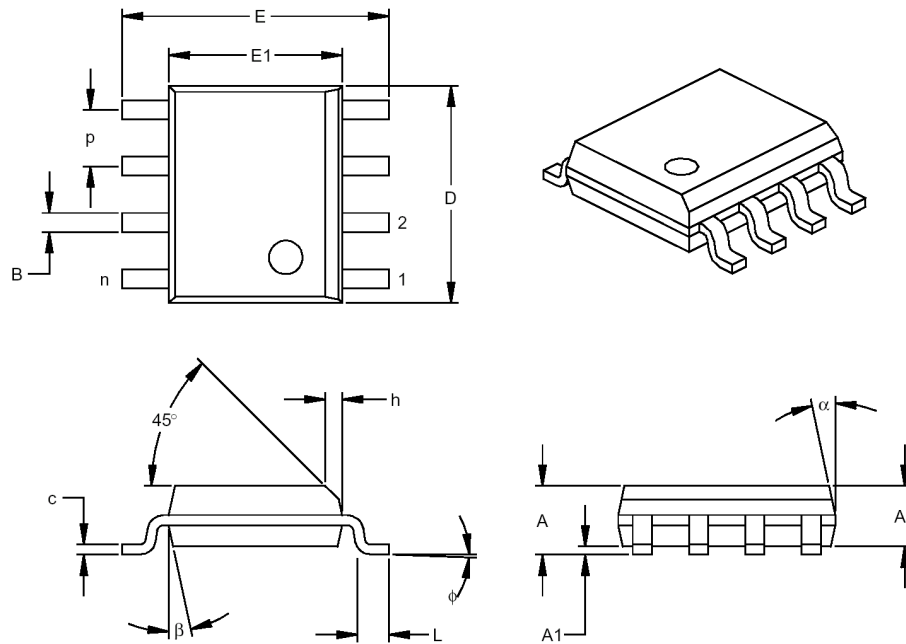
All operations are disabled and the device does not respond to any instructions when V_{CC} drops at powerdown from the operating voltage to below the V_{POR} threshold. (The designer must be aware that if a powerdown occurs while a Write, Program or Erase cycle is in progress, data corruption can result.)

Table 10. Powerup

Symbol	Parameter	Min.	Max.	Unit
V_{POR}	POR Threshold Value	2.2	2.4	V
t_{PU}	$V_{CC}(\text{min})$ to CS low	2		ms

Physical Dimensions

All measurements are in inches (millimeters), unless otherwise specified.



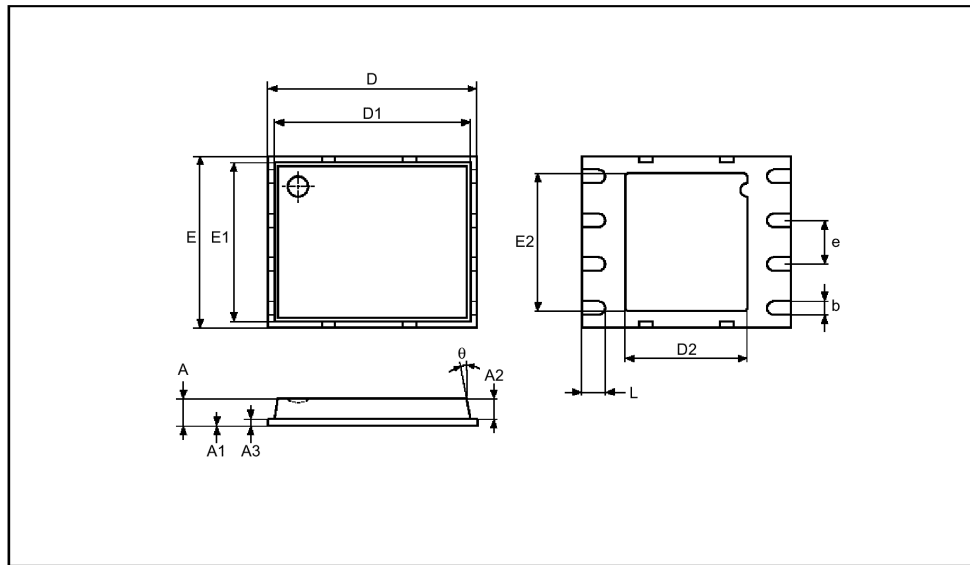
Units		INCHES*			MILLIMETERS		
Dimension Limits		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		8			8	
Pitch	p		.050			1.27	
Overall Height	A	.053	.061	.069	1.35	1.55	1.75
Molded Package Thickness	A2	.052	.056	.061	1.32	1.42	1.55
Standoff §	A1	.004	.007	.010	0.10	0.18	0.25
Overall Width	E	.228	.237	.244	5.79	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.

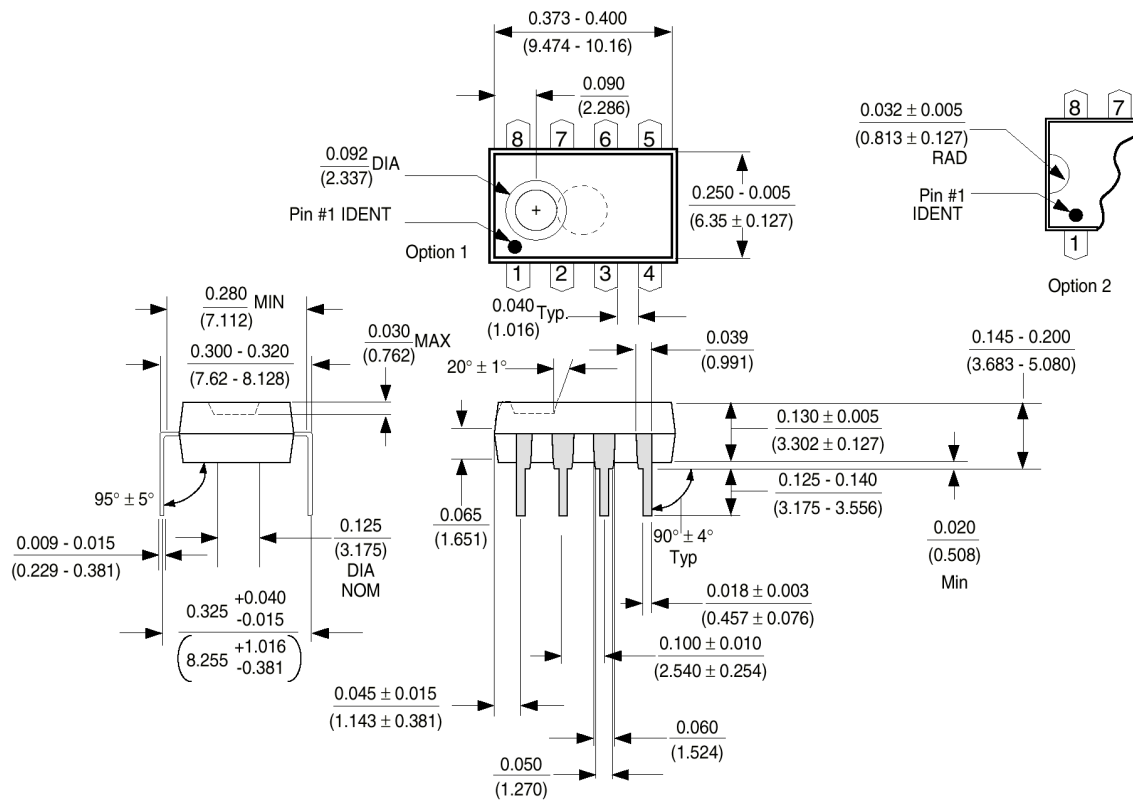
Figure 17. 8-pin SOIC Package



Note: Drawing is not to scale.

Symb.	mm			inches		
	Typ.	Min.	Max.	Typ.	Min.	Max.
A	0.85		1.00	0.0335		0.0394
A1		0.00	0.05		0.0000	0.0020
A2	0.65			0.0256		
A3	0.20			0.0079		
b	0.40	0.35	0.48	0.0157	0.0138	0.0189
D	6.20			0.2400		
D1	5.75			0.2264		
D2	3.40	3.20	3.60	0.1339	0.1260	0.1417
E	5.00			0.1969		
E1	4.75			0.1870		
E2	4.00	3.80	4.20	0.1575	0.1496	0.1654
e	1.27			0.0500		
L	0.60	0.50	0.75	0.0236	0.0197	0.0295
θ			12°			12°

Figure 18. 8-pin MLF Leadless Package

**Figure 19. Molded Dual-in-line Package (N) Package Number N08E**

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Revision History

Rev	Date	Description of Change
0.0	20-July-03	Initial Release

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