23A1024/23LC1024

1Mbit SPI Serial SRAM with SDI and SQI Interface

Device Selection Table

Part Number	Vcc Range	Temp. Ranges	Dual I/O (SDI)	Quad I/O (SQI)	Max. Clock Frequency	Packages
23A1024	1.7-2.2V	I, E	Yes	Yes	20 MHz(1)	SN, ST, P
23LC1024	2.5-5.5V	I, E	Yes	Yes	20 MHz(1)	SN, ST, P

Note 1: 16 MHz for E-temp.

Features

- SPI Bus Interface:
  - SPI compatible
  - SDI (dual) and SQI (quad) compatible
  - 20 MHz Clock rate for all modes
- Low-Power CMOS Technology:
  - Read Current: 3 mA at 5.5V, 20 MHz
  - Standby Current: 4 μA at +85°C
- Unlimited Read and Write Cycles
- Zero Write Time
- 128K x 8-bit Organization:
  - 32-byte page
- Byte, Page and Sequential Mode for Reads and Writes
- High Reliability
- Temperature Ranges Supported:
  - Industrial (I): -40°C to +85°C
  - Automotive (E): -40°C to +125°C
- RoHS Compliant
- 8 Lead SOIC, TSSOP and PDIP Packages

Pin Function Table

Name	Function
$\overline{CS}$	Chip Select Input Pin
SO/SIO1	Serial Output/SDI/SQI Pin
SIO2	SQI Pin
VSS	Ground Pin
SI/SIO0	Serial Input/SDI/SQI Pin
SCK	Serial Clock Pin
$\overline{HOLD}$/SIO3	Hold/SQI Pin
VCC	Power Supply Pin

Description

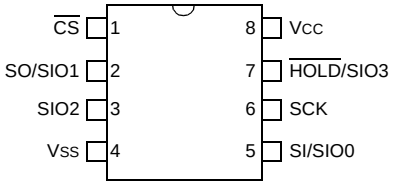
The Microchip Technology Inc. 23A1024/23LC1024 are 1 Mbit Serial SRAM devices. The memory is accessed via a simple Serial Peripheral Interface (SPI) compatible serial bus. The bus signals required are a clock input (SCK), a data in line (SI) and a data out line (SO). Access to the device is controlled through a Chip Select ($\overline{CS}$) input. Additionally, SDI (Serial Dual Interface) and SQI (Serial Quad Interface) is supported if your application needs faster data rates.

This device also supports unlimited reads and writes to the memory array.

The 23A1024/23LC1024 is available in standard packages including 8-lead SOIC, PDIP and advanced 8-lead TSSOP.

Package Types (not to scale)

SOIC/TSSOP/PDIP



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1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings (†)

VCC.....6.5V

All Inputs and Outputs w.r.t. VSS ..... -0.3V to VCC +0.3V

Storage Temperature.....-65°C to +150°C

Ambient Temperature under Bias.....-40°C to +125°C

† 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): TA = -40°C to +85°C Automotive (E): TA = -40°C to +125°C				
Param. No.	**Sym.**	**Characteristic**	**Min.**	**Typ.(3)**	**Max.**	**Units**	**Test Conditions**
D001	VCC	Supply Voltage	1.7	—	2.2	V	23A1024
			2.5		5.5	V	23LC1024
D002	VIH	High-level Input Voltage	0.7VCC	—	VCC + 0.3	V	
D003	VIL	Low-level Input Voltage	-0.3	—	0.2 VCC	V	23A1024
					0.1 VCC	V	23LC1024
D004	VOL	Low-level Output Voltage	—	—	0.2	V	IOL = 1 mA
D005	VOH	High-level Output Voltage	VCC - 0.5	—	—	V	IOH = -400 µA
D006	ILI	Input Leakage Current	—	—	±1	µA	$\overline{CS}$ = VCC, VIN = VSS OR VCC
D007	ILO	Output Leakage Current	—	—	±1	µA	$\overline{CS}$ = VCC, VOUT = VSS OR VCC
D008	ICC Read	Operating Current	—	1	10	mA	FCLK = 20 MHz; SO = O, 2.2V
				3	10	mA	FCLK = 20 MHz; SO = O, 5.5V
D009	ICCS	Standby Current	—	1	4	µA	$\overline{CS}$ = VCC = 2.2V, Inputs tied to VCC or VSS, I-Temp
				—	12	µA	$\overline{CS}$ = VCC = 2.2V, Inputs tied to VCC or VSS, E-Temp
				4	10	µA	$\overline{CS}$ = VCC = 5.5V, Inputs tied to VCC or VSS, I-Temp
				—	20	µA	$\overline{CS}$ = VCC = 5.5V, Inputs tied to VCC or VSS, E-Temp
D010	CINT	Input Capacitance	—	—	7	pF	VCC = 5.0V, f = 1 MHz, T_A = 25°C **(Note 1)**
D011	VDR	RAM Data Retention Voltage	—	1.0	—	V	**(Note 2)**

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

2: This is the limit to which VCC can be lowered without losing RAM data. This parameter is periodically sampled and not 100% tested.

3: Typical measurements taken at room temperature.

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TABLE 1-2: AC CHARACTERISTICS

AC CHARACTERISTICS			Industrial (I): TA = -40°C to +85°C Automotive (E): TA = -40°C to +125°C			
Param. No.	**Sym.**	**Characteristic**	**Min.**	**Max.**	**Units**	**Test Conditions**
1	FCLK	Clock Frequency	—	20	MHz	I-Temp
				16	MHz	E-Temp
2	TCSS	$\overline{CS}$ Setup Time	25	—	ns	I-Temp
			32	—	ns	E-Temp
3	TCSH	$\overline{CS}$ Hold Time	50	—	ns	
4	TCSD	$\overline{CS}$ Disable Time	25	—	ns	I-Temp
			32	—	ns	E-Temp
5	TSU	Data Setup Time	10	—	ns	
6	THD	Data Hold Time	10	—	ns	
7	TR	CLK Rise Time	—	20	ns	**(Note 1)**
8	TF	CLK Fall Time	—	20	ns	**(Note 1)**
9	THI	Clock High Time	25	—	ns	I-Temp
			32	—	ns	E-Temp
10	TLO	Clock Low Time	25	—	ns	I-Temp
			32	—	ns	E-Temp
11	TCLD	Clock Delay Time	25	—	ns	I-Temp
			32	—	ns	E-Temp
12	TV	Output Valid from Clock Low	—	25	ns	I-Temp
				32	ns	E-Temp
13	THO	Output Hold Time	0	—	ns	**(Note 1)**
14	TDIS	Output Disable Time	—	20	ns	
15	THS	$\overline{HOLD}$ Setup Time	10	—	ns	
16	THH	$\overline{HOLD}$ Hold Time	10	—	ns	
17	THZ	$\overline{HOLD}$ Low to Output High-Z	10	—	ns	
18	THV	$\overline{HOLD}$ High to Output Valid	—	50	ns	

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

TABLE 1-3: AC TEST CONDITIONS

AC Waveform	
Input Pulse Level	0.1 VCC to 0.9 VCC
Input Rise/Fall Time	5 ns
C_L = 30 pF	—
Timing Measurement Reference Level	
Input	0.5 VCC
Output	0.5 VCC

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FIGURE 1-1: HOLD TIMING

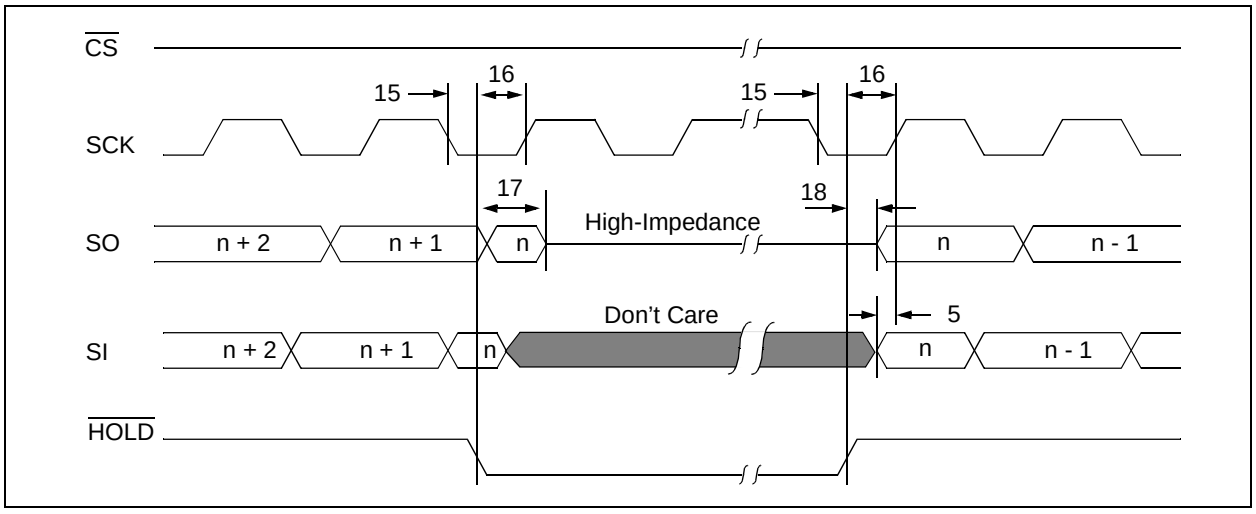


FIGURE 1-2: SERIAL INPUT TIMING (SPI MODE)

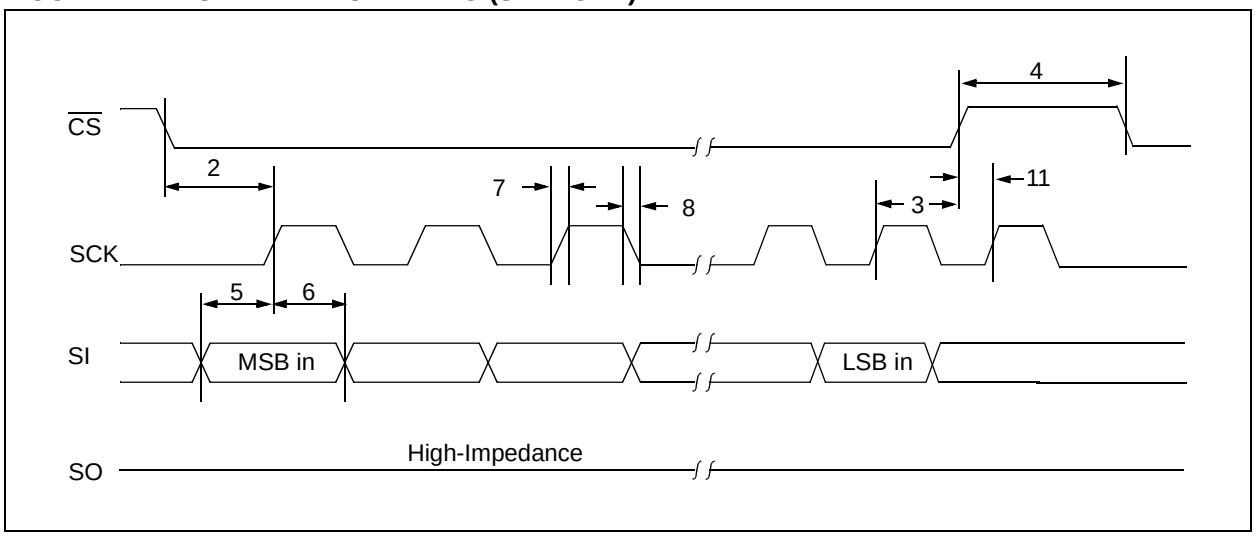
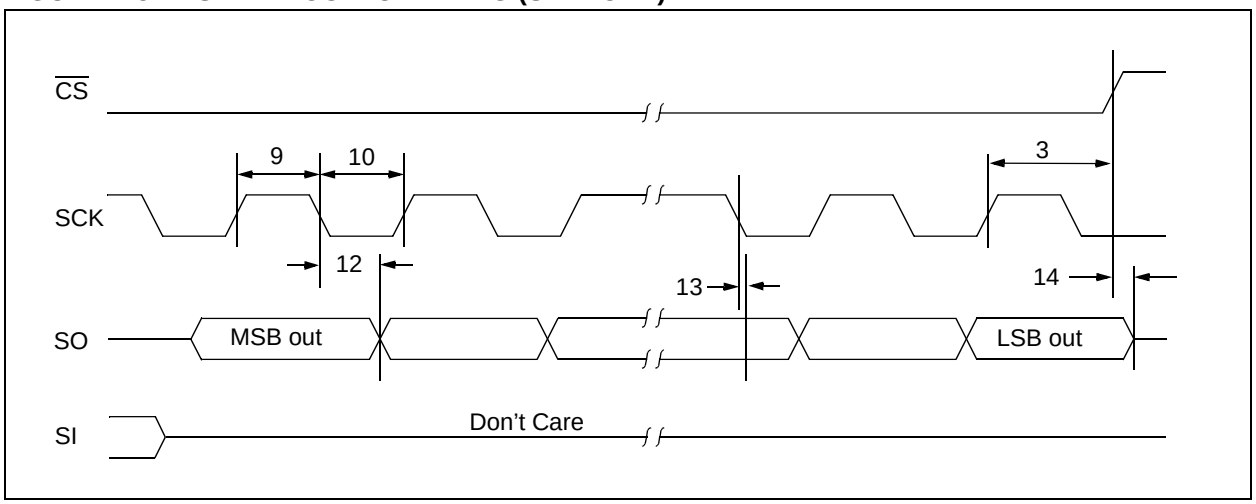


FIGURE 1-3: SERIAL OUTPUT TIMING (SPI MODE)



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2.0 FUNCTIONAL DESCRIPTION

2.1 Principles of Operation

The 23A1024/23LC1024 is an 1 Mbit Serial SRAM designed to interface directly with the Serial Peripheral Interface (SPI) port of many of today's popular microcontroller families, including Microchip's PIC® microcontrollers. It may also interface with microcontrollers that do not have a built-in SPI port by using discrete I/O lines programmed properly in firmware to match the SPI protocol. In addition, the 23A1024/23LC1024 is capable of operation in SDI and SQI modes. In SDI mode, the SI and SO data lines are bidirectional, allowing the transfer of two bits per clock pulse. In SQI mode, two additional data lines enable the transfer of four bits per clock pulse.

The 23A1024/23LC1024 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 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.

2.2 Modes of Operation

The 23X1024 has three modes of operation that are selected by setting bits 7 and 6 in the MODE register. The modes of operation are Byte, Page and Burst.

Byte Operation – is selected when bits 7 and 6 in the MODE register are set to `00`. In this mode, the read/write operations are limited to only one byte. The Command followed by the 24-bit address is clocked into the device and the data to/from the device is transferred on the next eight clocks (Figure 2-1, Figure 2-2).

Page Operation – is selected when bits 7 and 6 in the MODE register are set to `10`. The 23X1024 has 4096 pages of 32 bytes. In this mode, the read and write operations are limited to within the addressed page (the address is automatically incremented internally). If the data being read or written reaches the page boundary, then the internal address counter will increment to the start of the page (Figure 2-3, Figure 2-4).

Sequential Operation – is selected when bits 7 and 6 in the MODE register are set to `01`. Sequential operation allows the entire array to be written to and read from. The internal address counter is automatically incremented and page boundaries are ignored. When the internal address counter reaches the end of the array, the address counter will roll over to `0x00000` (Figure 2-5, Figure 2-6).

2.3 Read Sequence

The device is selected by pulling $\overline{CS}$ low. The 8-bit `READ` instruction is transmitted to the 23A1024/23LC1024 followed by the 24-bit address, with the first seven MSB's 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.

If operating in Sequential mode, 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 (1FFFFh), the address counter rolls over to address 00000h, allowing the read cycle to be continued indefinitely. The read operation is terminated by raising the $\overline{CS}$ pin.

2.4 Write Sequence

Prior to any attempt to write data to the 23A1024/23LC1024, the device must be selected by bringing $\overline{CS}$ low.

Once the device is selected, the Write command can be started by issuing a `WRITE` instruction, followed by the 24-bit address, with the first seven MSB's of the address being "don't care" bits, and then the data to be written. A write is terminated by the $\overline{CS}$ being brought high.

If operating in Page mode, after the initial data byte is shifted in, additional bytes can be shifted into the device. The Address Pointer is automatically incremented. This operation can continue for the entire page (32 bytes) before data will start to be overwritten.

If operating in Sequential mode, after the initial data byte is shifted in, additional bytes can be clocked into the device. The internal Address Pointer is automatically incremented. When the Address Pointer reaches the highest address (1FFFFh), the address counter rolls over to (00000h). This allows the operation to continue indefinitely, however, previous data will be overwritten.

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TABLE 2-1: INSTRUCTION SET

Instruction Name	Instruction Format	Hex Code	Description
READ	0000 0011	0x03	Read data from memory array beginning at selected address
WRITE	0000 0010	0x02	Write data to memory array beginning at selected address
EDIO	0011 1011	0x3B	Enter Dual I/O access (enter SDI bus mode)
EQIO	0011 1000	0x38	Enter Quad I/O access (enter SQI bus mode)
RSTIO	1111 1111	0xFF	Reset Dual and Quad I/O access (revert to SPI bus mode)
RDMR	0000 0101	0x05	Read Mode Register
WRMR	0000 0001	0x01	Write Mode Register

FIGURE 2-1: BYTE READ SEQUENCE (SPI MODE)

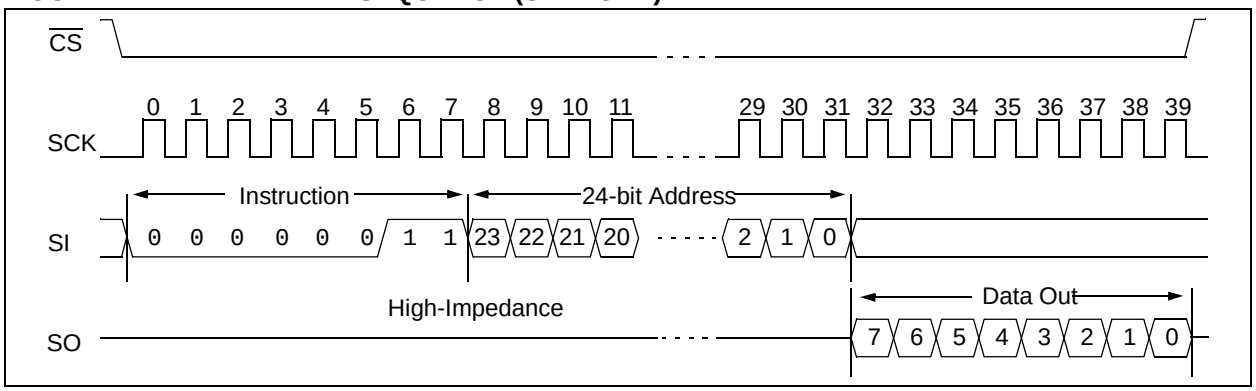
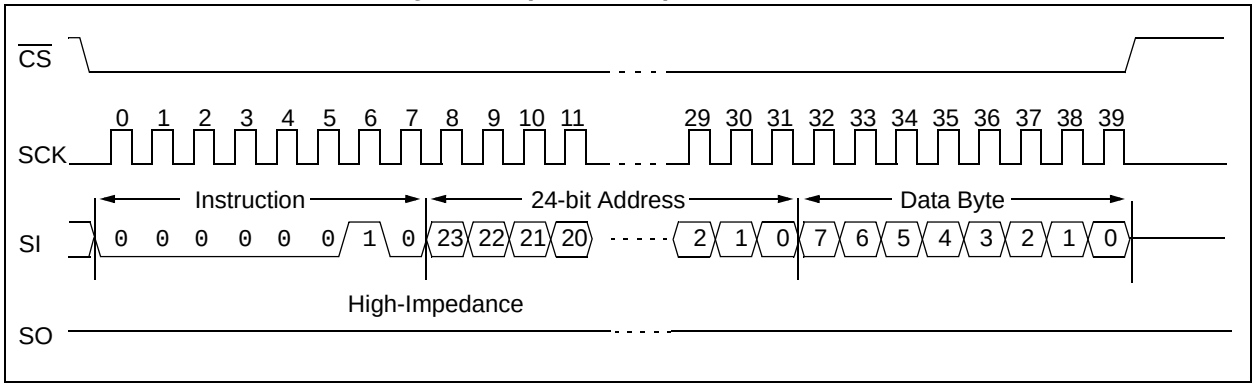


FIGURE 2-2: BYTE WRITE SEQUENCE (SPI MODE)



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FIGURE 2-3: PAGE READ SEQUENCE (SPI MODE)

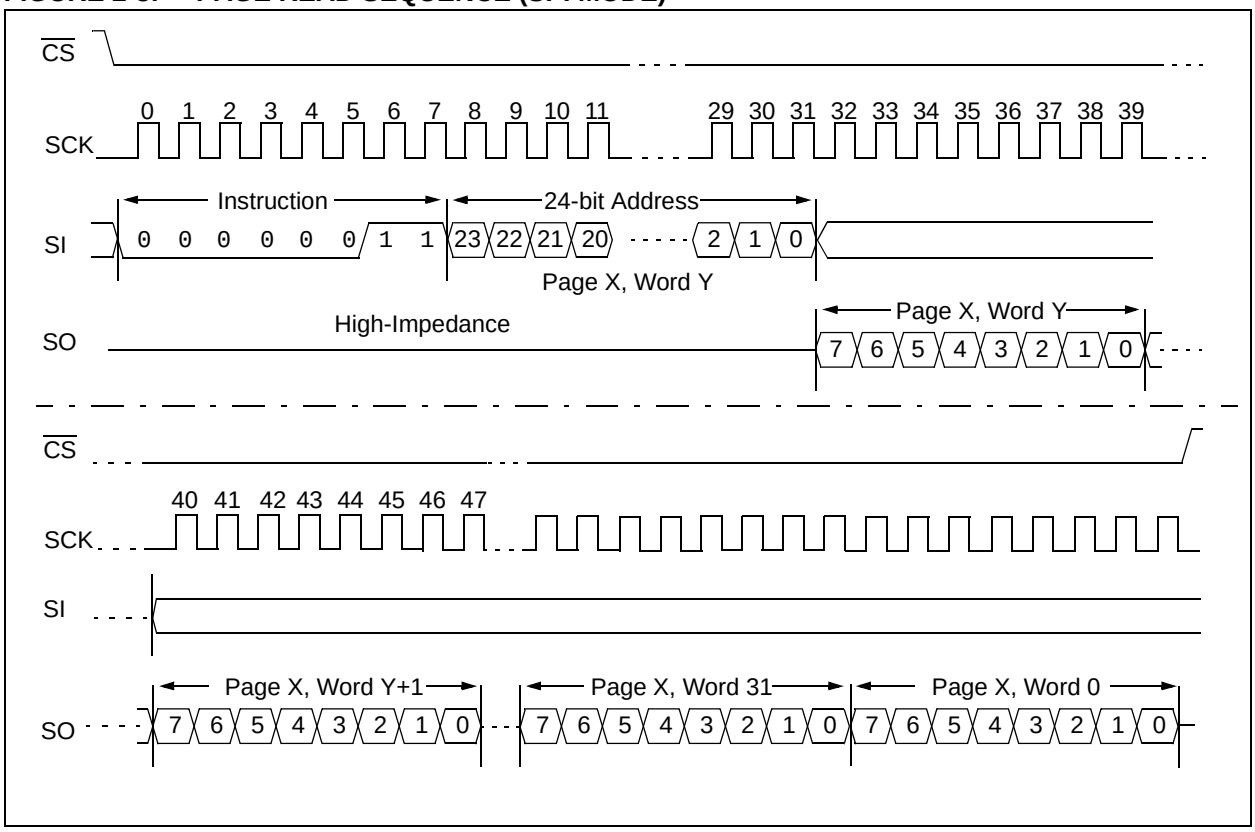
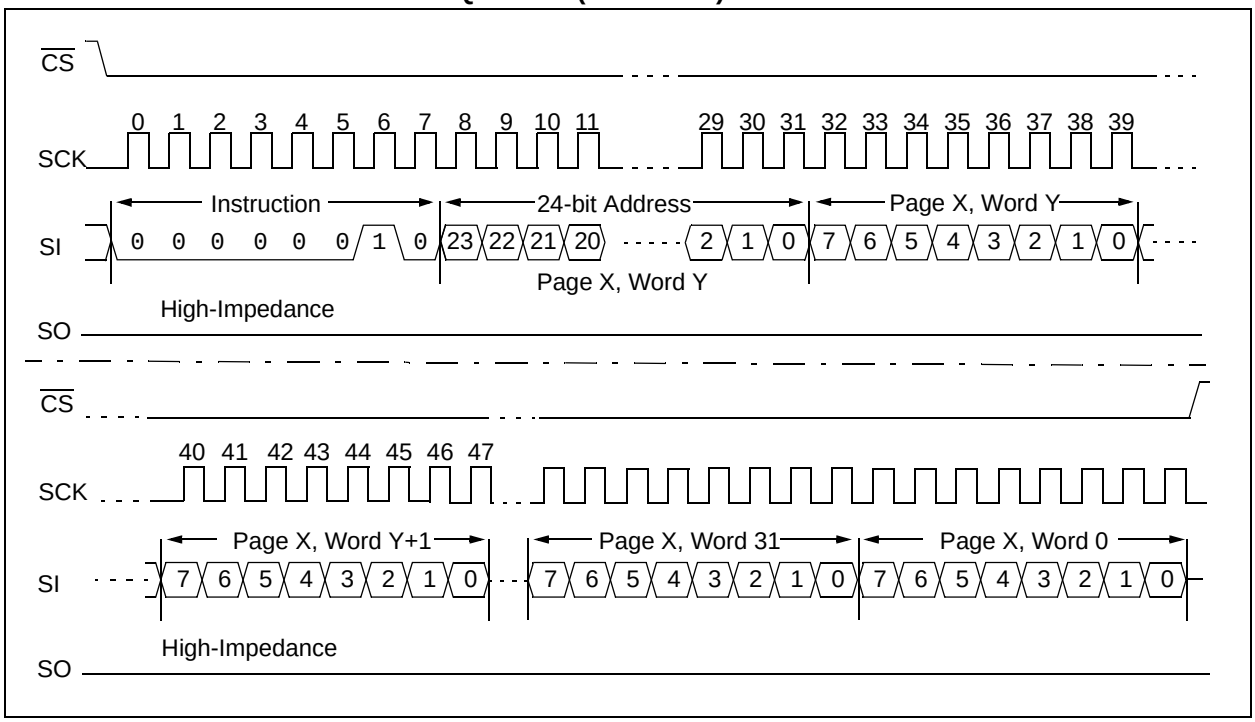
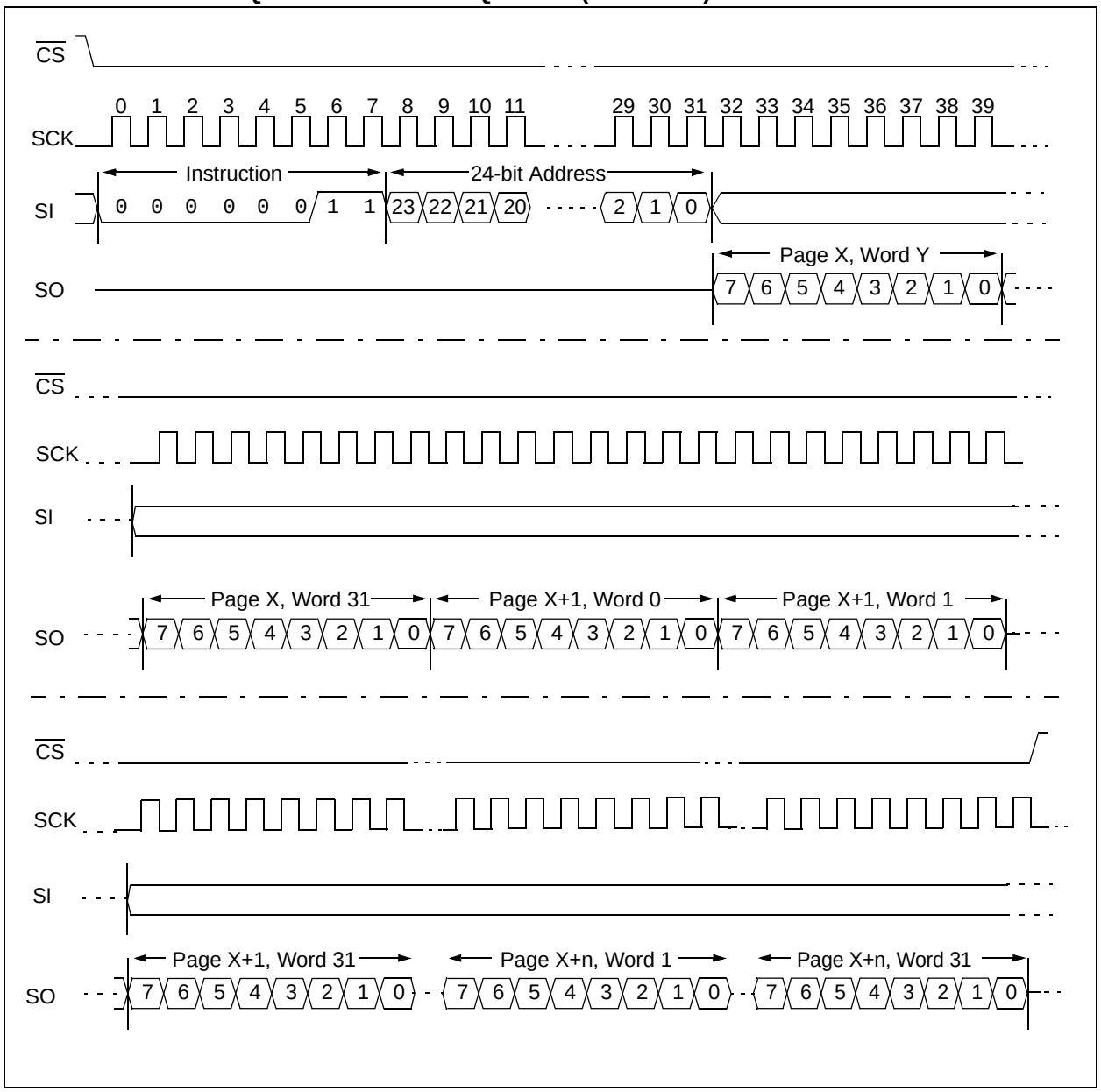


FIGURE 2-4: PAGE WRITE SEQUENCE (SPI MODE)



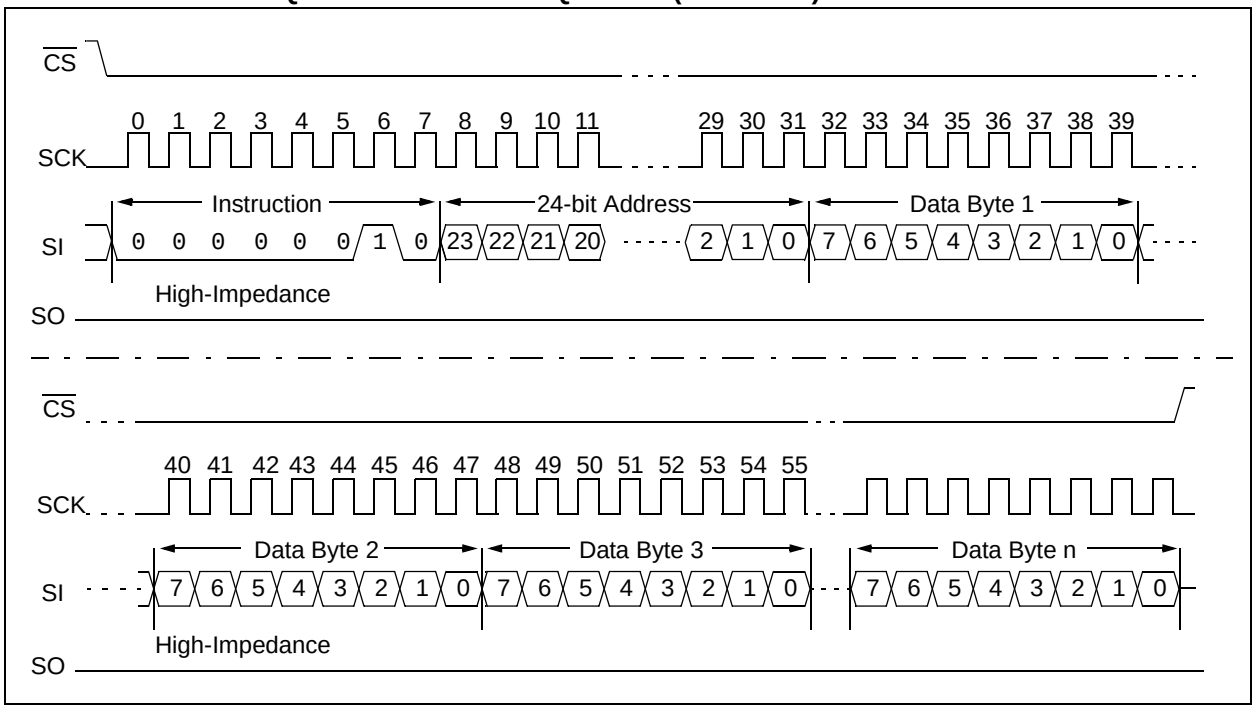
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FIGURE 2-5: SEQUENTIAL READ SEQUENCE (SPI MODE)



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FIGURE 2-6: SEQUENTIAL WRITE SEQUENCE (SPI MODE)



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2.5 Read Mode Register Instruction (RDMR)

The Read Mode Register instruction (RDMR) provides access to the MODE register. The MODE register may be read at any time. The MODE register is formatted as follows:

TABLE 2-2: MODE REGISTER

7	6	5	4	3	2	1	0
W/R	W/R	–	–	–	–	–	–
MODE	MODE	0	0	0	0	0	0
W/R = writable/readable							

The mode bits indicate the operating mode of the SRAM. The possible modes of operation are:

0 0 = Byte mode

1 0 = Page mode

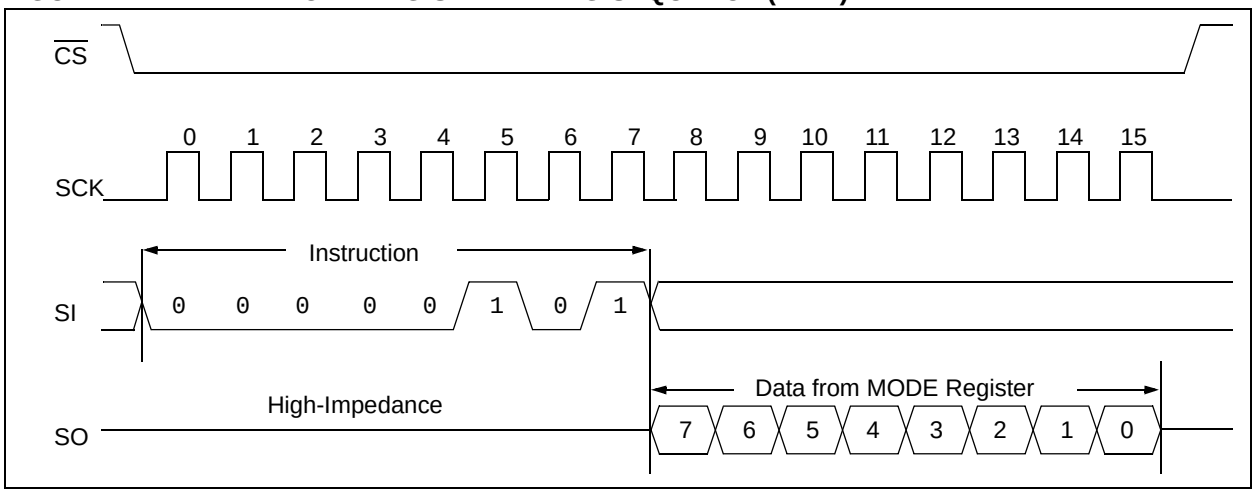
0 1 = Sequential mode (default operation)

1 1 = Reserved

Bits 0 through 5 are reserved and should always be set to '0'.

See Figure 2-7 for the RDMR timing sequence.

FIGURE 2-7: READ MODE REGISTER TIMING SEQUENCE (RDMR)

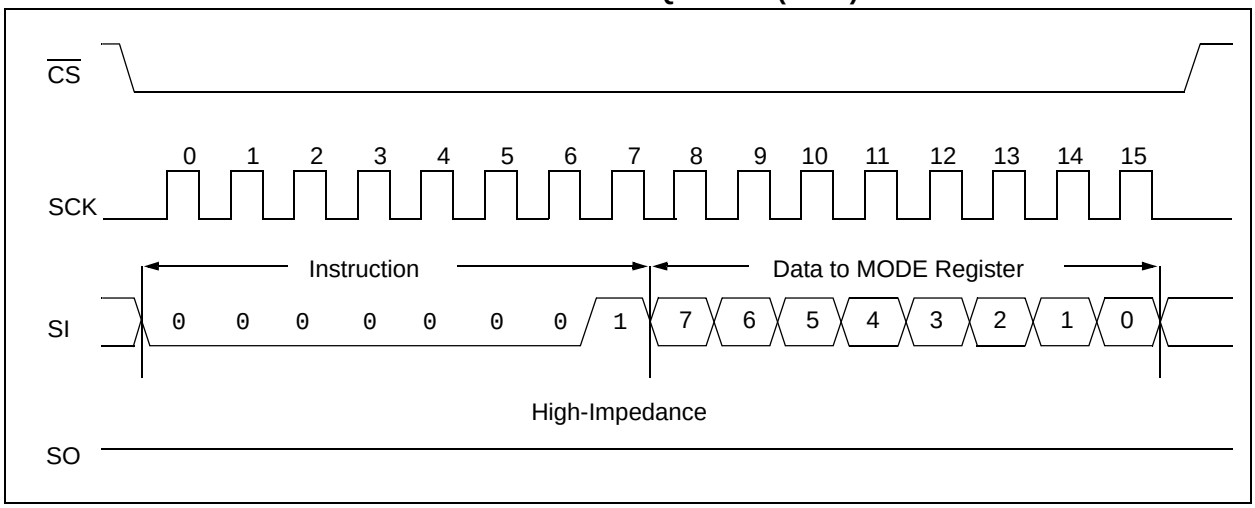


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2.6 Write Mode Register Instruction (WRMR)

The Write Mode Register instruction (WRMR) allows the user to write to the bits in the MODE register as shown in Table 2-2. This allows for setting of the Device operating mode. Several of the bits in the MODE register must be cleared to '0'. See Figure 2-8 for the WRMR timing sequence.

FIGURE 2-8: WRITE MODE REGISTER TIMING SEQUENCE (WRMR)



2.7 Power-On State

The 23A1024/23LC1024 powers on in the following state:

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

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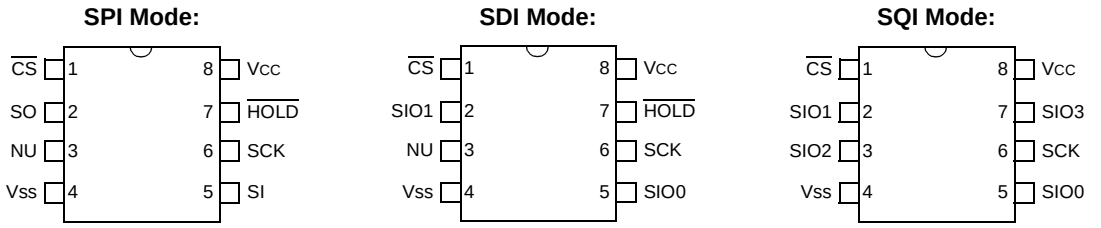
3.0 PIN DESCRIPTIONS

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

TABLE 3-1: PIN FUNCTION TABLE

SOIC/PDIP/TSSOP	Symbol	Description
1	$\overline{CS}$	Chip Select Input
2	SO/SIO1	Serial Output (SPI)/Serial I/O 1 (SDI)/Serial I/O 1 (SQI)
3	SIO2	Serial I/O 2 (SQI)
4	VSS	Ground
5	SI/SIO0	Serial Input (SPI)/Serial I/O 0 (SDI)/Serial I/O 0 (SQI)
6	SCK	Serial Clock Input
7	$\overline{HOLD}$/SIO3	Hold/Serial I/O 3
8	VCC	Power Supply

FIGURE 3-1: SPI, SDI and SQI Pin Configurations



Note: Pin 3 is not used in SPI and SDI modes, and should not be left floating (see **Section 3.3 "Serial I/O (SIO2)"**).

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

A low level on this pin selects the device. A high level deselects the device and forces it into Standby mode. When the device is deselected, SO goes to the high-impedance state, allowing multiple parts to share the same SPI bus. After power-up, a low level on $\overline{CS}$ is required, prior to any sequence being initiated.

3.2 Serial Output, Serial I/O (SO/SIO1)

The SO/SIO1 pin is used to transfer data out of the 23A1024/23LC1024 when the SPI bus is being used. When in SDI or SQI bus modes, the SO/SIO1 pin is a bidirectional I/O pin. Data is shifted out on this pin after the falling edge of the serial clock, and it is latched in on the rising edge of the serial clock.

3.3 Serial I/O 2 (SIO2)

The SIO2 pin is a bidirectional I/O pin used only in SQI mode. If not using SQI bus mode, this pin should not be left floating. Deciding to pull the SIO2 pin high would allow successful recovery of the bus from SQI bus mode in case an accidental EQIO command has been registered.

3.4 Serial Input, Serial I/O 0 (SI/SIO0)

The SI pin is used to transfer data into the device when the SPI bus is being used. When in SDI or SQI bus modes, the SI/SIO0 pin is a bidirectional I/O pin.

3.5 Serial Clock (SCK)

The SCK is used to synchronize the communication between a master and the 23A1024/23LC1024. 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, Serial I/O 3 ($\overline{HOLD}$/SIO3)

When the device is in SQI bus mode, pin HOLD/SIO3 is a bidirectional I/O pin. When in SPI or SDI bus modes, the pin has the $\overline{HOLD}$ function.

The $\overline{HOLD}$ pin is used to suspend transmission to the 23A1024/23LC1024 while in the middle of a serial sequence without having to avoid retransmitting the entire sequence over again. It must be held high any time this function is not being used. Once the device is

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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 should be brought low while SCK is low, otherwise the HOLD function will not be invoked until the next SCK high-to-low transition. The 23A1024/23LC1024 must remain selected during this sequence. The SI and SCK levels are “don’t cares” during the time the device is paused and any transitions on these pins will be ignored. To resume serial communication, $\overline{\text{HOLD}}$ should be brought high while the SCK pin is low, otherwise serial communication will not be resumed until the next SCK high-to-low transition.

The SO line will tri-state immediately upon a high-to low transition of the $\overline{\text{HOLD}}$ pin, and will begin outputting again immediately upon a subsequent low-to-high transition of the $\overline{\text{HOLD}}$ pin, independent of the state of SCK.

Hold functionality is not available when operating in SQI bus mode.

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4.0 DUAL AND QUAD SERIAL MODE

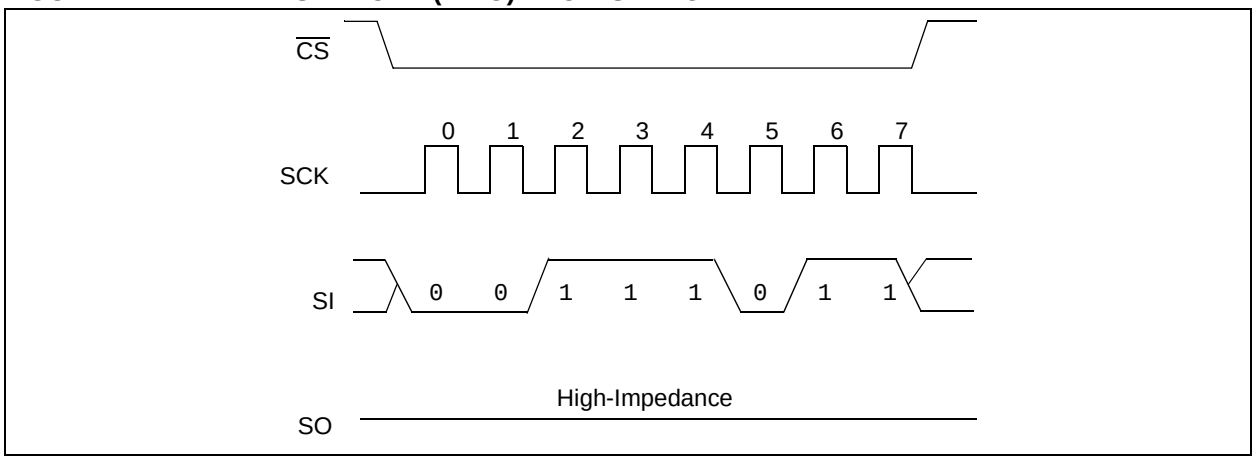
The 23A1024/23LC1024 also supports SDI (Serial Dual) and SQI (Serial Quad) mode of operation when used with compatible master devices. As a convention for SDI mode of operation, two bits are entered per clock using the SIO0 and SIO1 pins. Bits are clocked MSB first.

For SQI mode of operation, four bits of data are entered per clock, or one nibble per clock. The nibbles are clocked MSB first.

4.1 Dual Interface Mode

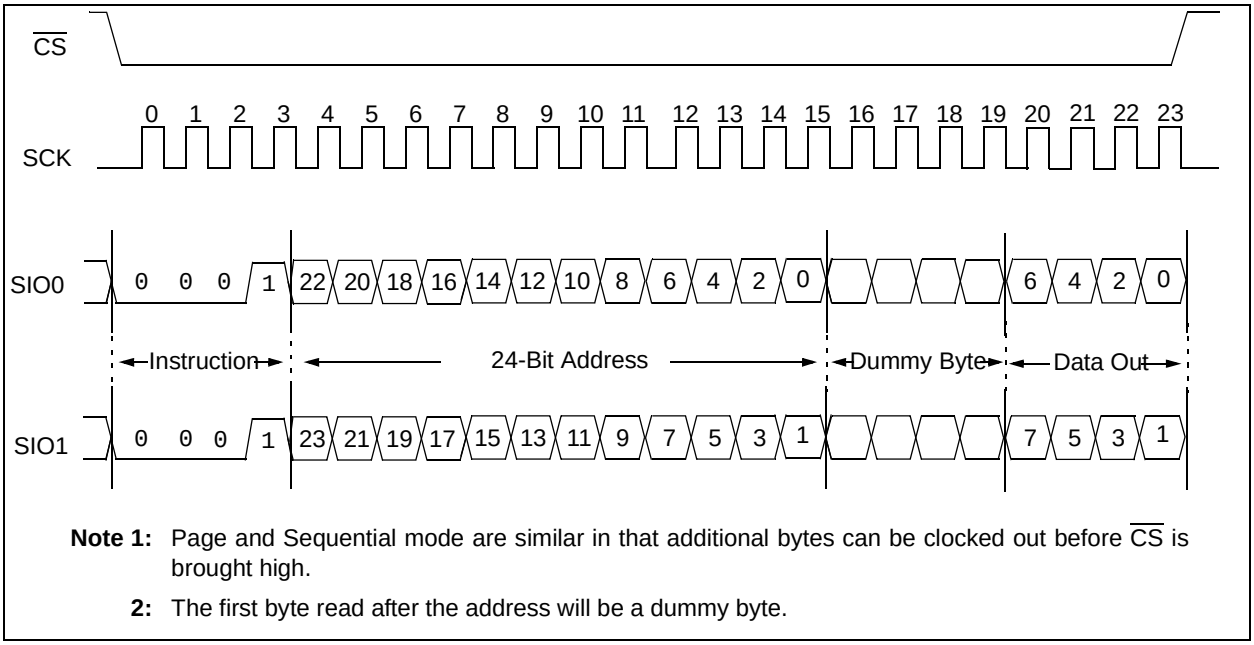
The 23A1024/23LC1024 supports Serial Dual Input (SDI) mode of operation. To enter SDI mode the EDIO command must be clocked in (Figure 4-1). It should be noted that if the MCU resets before the SRAM, the user will need to determine the serial mode of operation of the SRAM and reset it accordingly. Byte read and write sequence in SDI mode is shown in Figure 4-2 and Figure 4-3.

FIGURE 4-1: ENTER SDI MODE (EDIO) FROM SPI MODE



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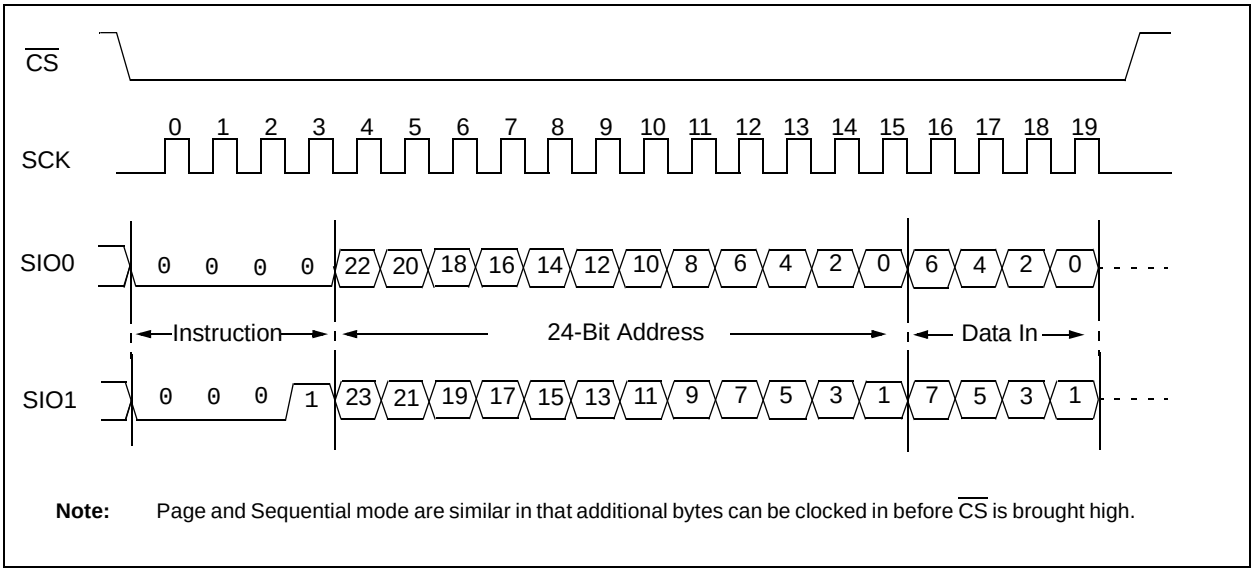
FIGURE 4-2: BYTE READ MODE SDI



Note 1: Page and Sequential mode are similar in that additional bytes can be clocked out before $\overline{CS}$ is brought high.

2: The first byte read after the address will be a dummy byte.

FIGURE 4-3: BYTE WRITE MODE SDI



Note: Page and Sequential mode are similar in that additional bytes can be clocked in before $\overline{CS}$ is brought high.

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4.2 Quad Interface Mode

In addition to the Serial Dual interface (SDI) mode of operation Serial Quad Interface (SQI) is also supported. In this mode the HOLD functionality is not available. To enter SQI mode the EQIO command must be clocked in (Figure 4-4).

FIGURE 4-4: ENTER SQI MODE (EQIO) FROM SPI MODE

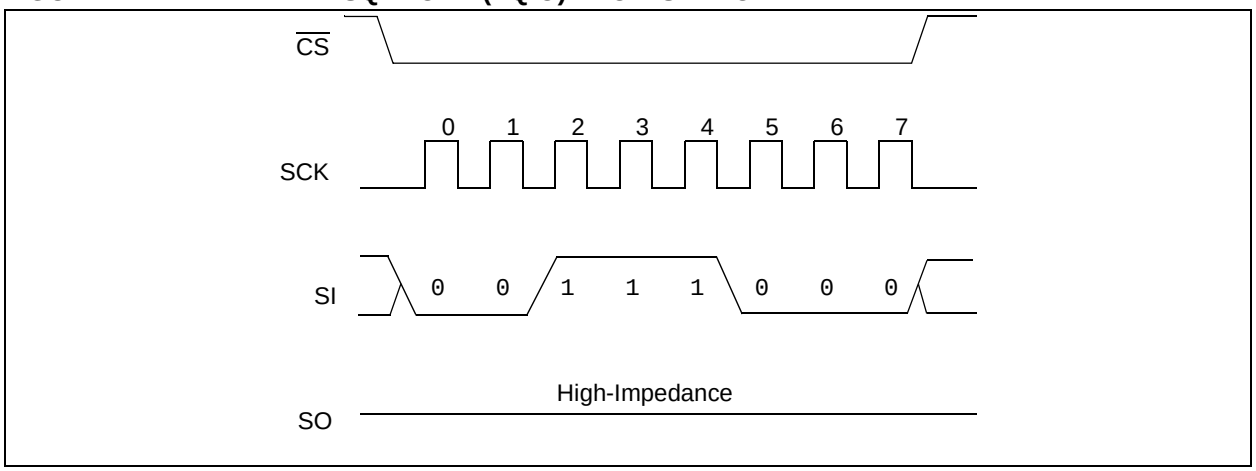
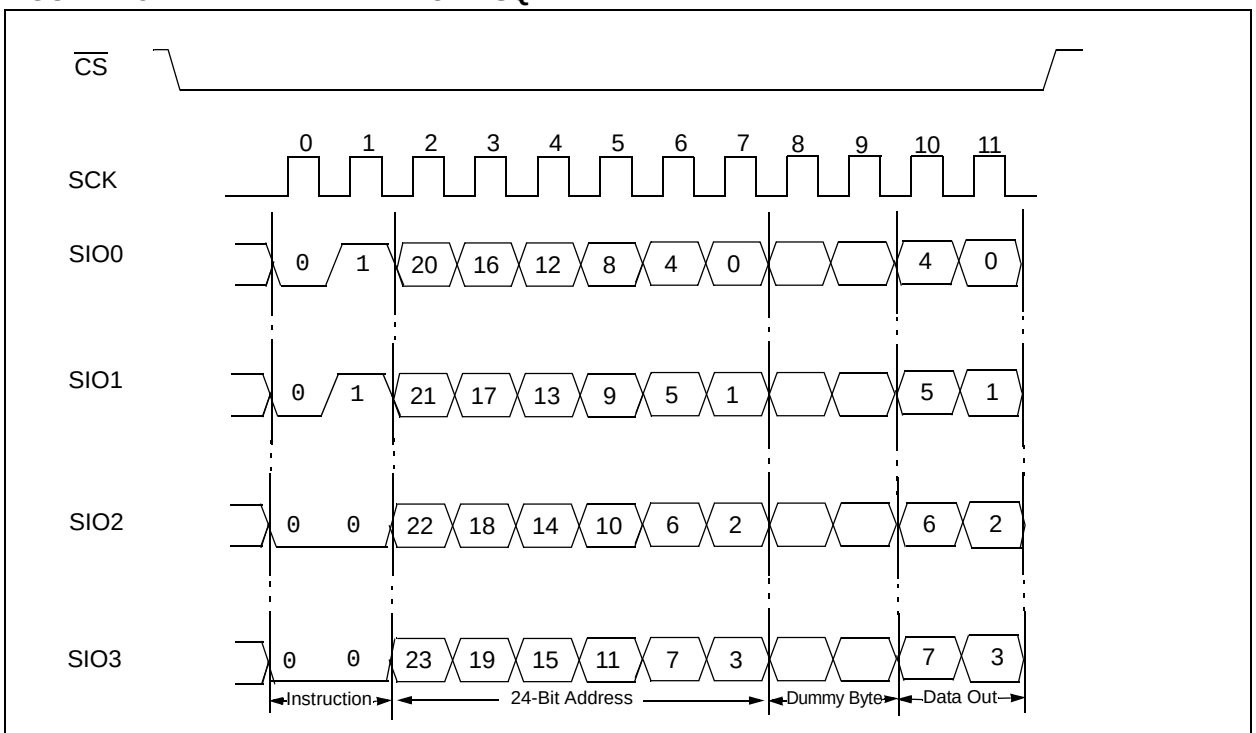


FIGURE 4-5: BYTE READ MODE SQI

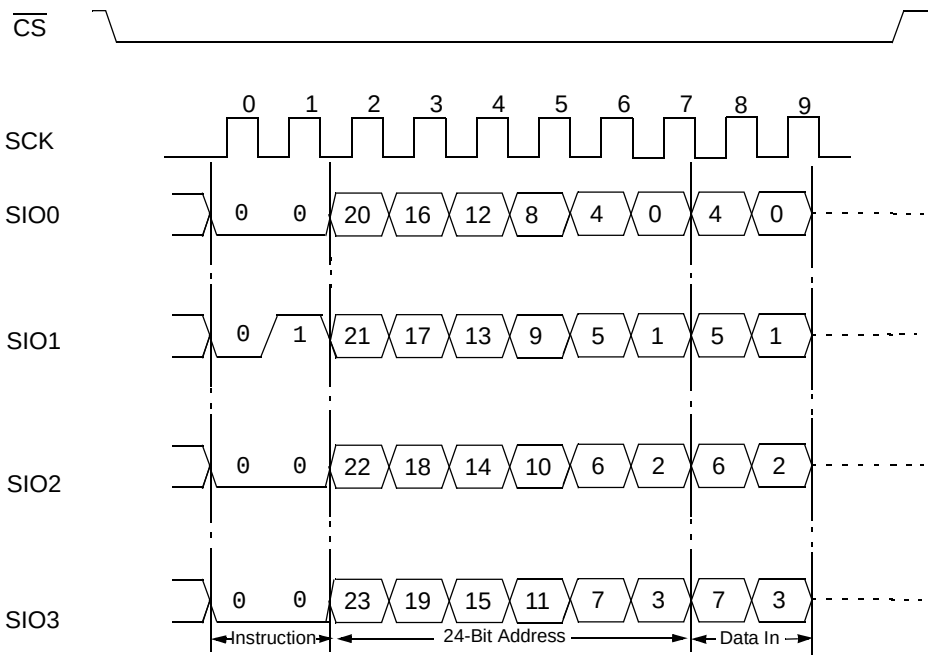


Note 1: Page and Sequential mode is similar in that additional bytes can be clocked out before $\overline{CS}$ is brought high.

2: The first byte read after the address will be a dummy byte.

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FIGURE 4-6: BYTE WRITE MODE SQI

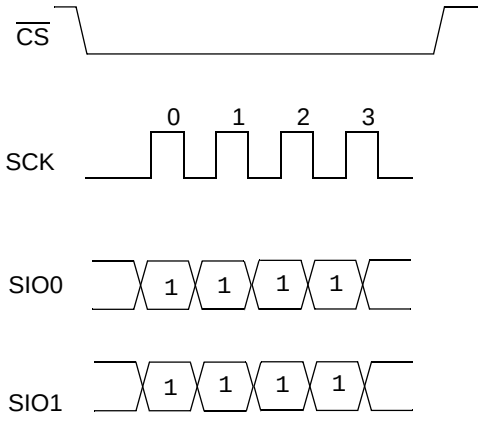


Note: Page and Sequential mode are similar in that additional bytes can be clocked out before $\overline{CS}$ is brought high.

4.3 Exit SDI or SQI Mode

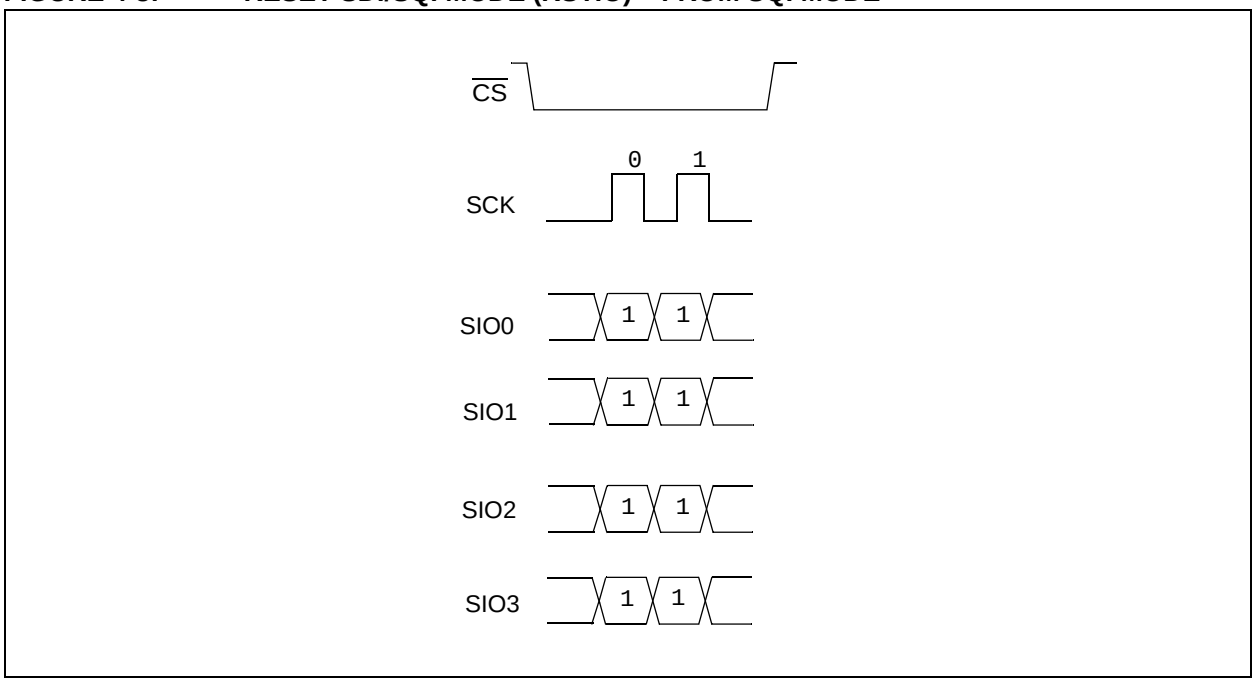
To exit from SDI mode, the RSTIO command must be issued. The command must be entered in the current device configuration, either SDI or SQI, see Figure 4-7 and Figure 4-8.

FIGURE 4-7: RESET SDI MODE (RSTIO) – FROM SDI MODE



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FIGURE 4-8: RESET SDI/SQI MODE (RSTIO) – FROM SQI MODE

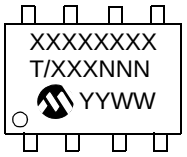


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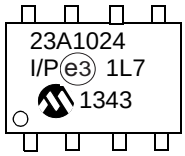
5.0 PACKAGING INFORMATION

5.1 Package Marking Information

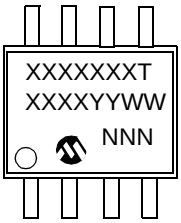
8-Lead PDIP



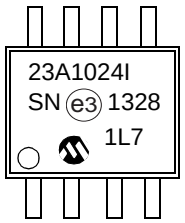
Example:



8-Lead SOIC (3.90 mm)



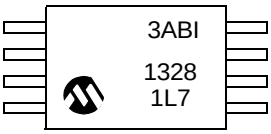
Example:



8-Lead TSSOP



Example:



Part Number	1st Line Marking Codes		
	PDIP	SOIC	TSSOP
23A1024	23A1024	23A1024T	3ABT
23LC1024	23LC1024	23LCBT	3LBT

Note: T = Temperature grade (I, E)

Legend:	XX...X	Part number or part number code
	T	Temperature (I, E)
	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 (2 characters for small packages)
	e3	Pb-free JEDEC® designator for Matte Tin (Sn)

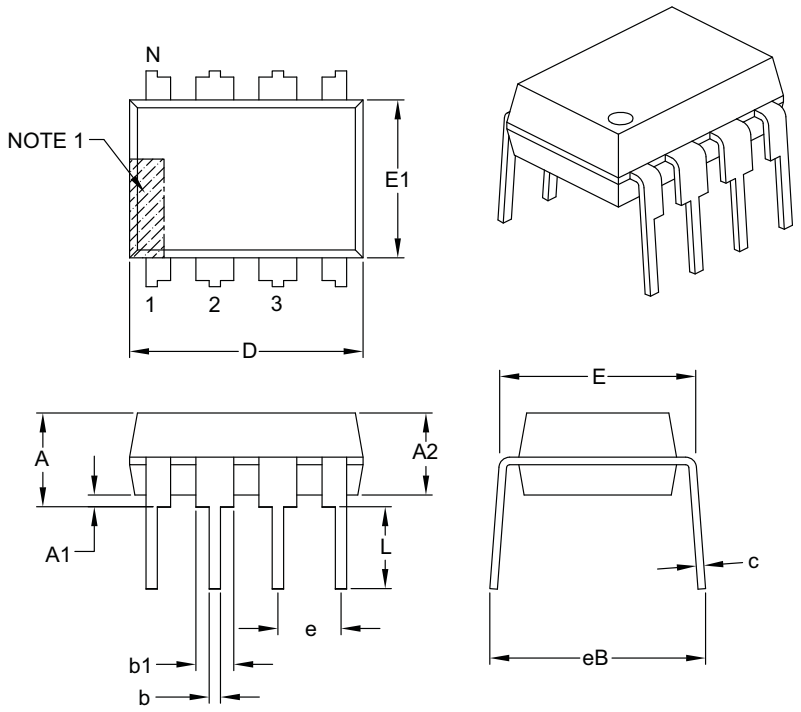
Note: For very small packages with no room for the Pb-free JEDEC® designator e3 , the marking will only appear on the outer carton or reel label.

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.

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8-Lead Plastic Dual In-Line (P) – 300 mil Body [PDIP]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Units		INCHES		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		8	
Pitch	e		.100 BSC	
Top to Seating Plane	A	–	–	.210
Molded Package Thickness	A2	.115	.130	.195
Base to Seating Plane	A1	.015	–	–
Shoulder to Shoulder Width	E	.290	.310	.325
Molded Package Width	E1	.240	.250	.280
Overall Length	D	.348	.365	.400
Tip to Seating Plane	L	.115	.130	.150
Lead Thickness	c	.008	.010	.015
Upper Lead Width	b1	.040	.060	.070
Lower Lead Width	b	.014	.018	.022
Overall Row Spacing §	eB	–	–	.430

Notes:

1. Pin 1 visual index feature may vary, but must be located with the hatched area.
2. § Significant Characteristic.
3. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" per side.
4. Dimensioning and tolerancing per ASME Y14.5M.

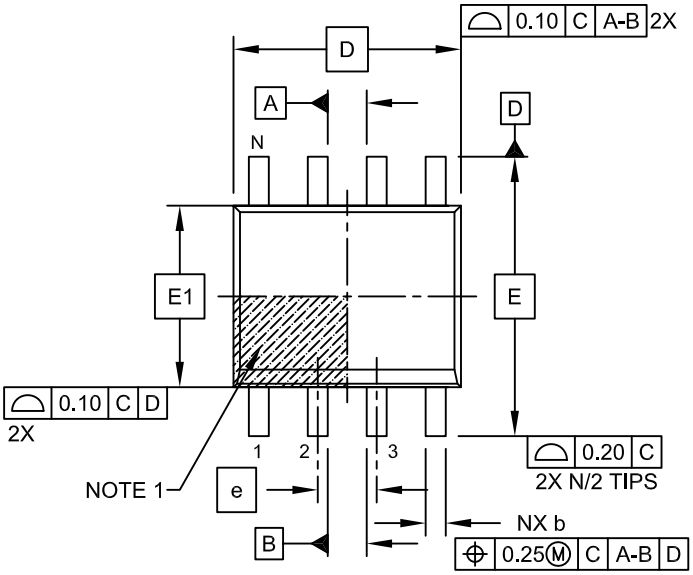
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

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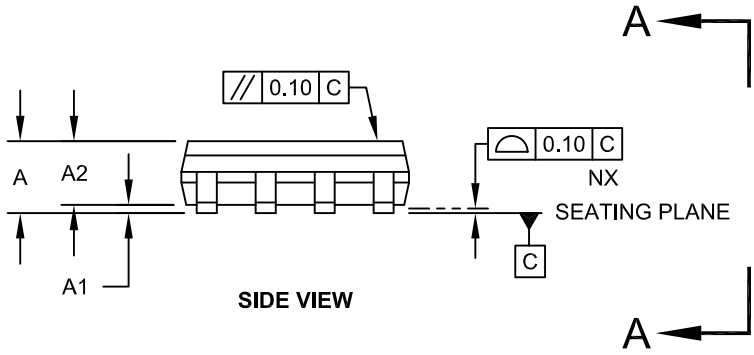
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8-Lead Plastic Small Outline (SN) - Narrow, 3.90 mm Body [SOIC]

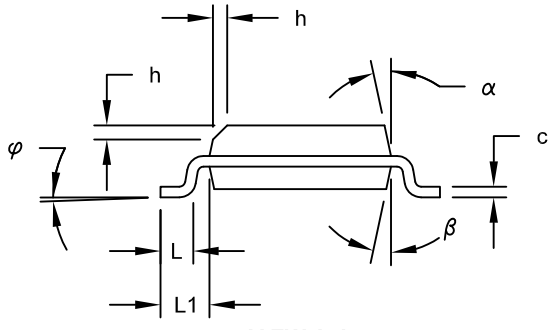
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



TOP VIEW



SIDE VIEW



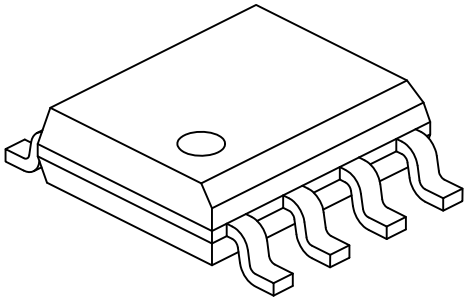
VIEW A-A

Microchip Technology Drawing No. C04-057C Sheet 1 of 2

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8-Lead Plastic Small Outline (SN) - Narrow, 3.90 mm Body [SOIC]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		8	
Pitch	e		1.27 BSC	
Overall Height	A	-	-	1.75
Molded Package Thickness	A2	1.25	-	-
Standoff §	A1	0.10	-	0.25
Overall Width	E		6.00 BSC	
Molded Package Width	E1		3.90 BSC	
Overall Length	D		4.90 BSC	
Chamfer (Optional)	h	0.25	-	0.50
Foot Length	L	0.40	-	1.27
Footprint	L1		1.04 REF	
Foot Angle	φ	0°	-	8°
Lead Thickness	c	0.17	-	0.25
Lead Width	b	0.31	-	0.51
Mold Draft Angle Top	α	5°	-	15°
Mold Draft Angle Bottom	β	5°	-	15°

Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. § Significant Characteristic
3. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm per side.
4. Dimensioning and tolerancing per ASME Y14.5M

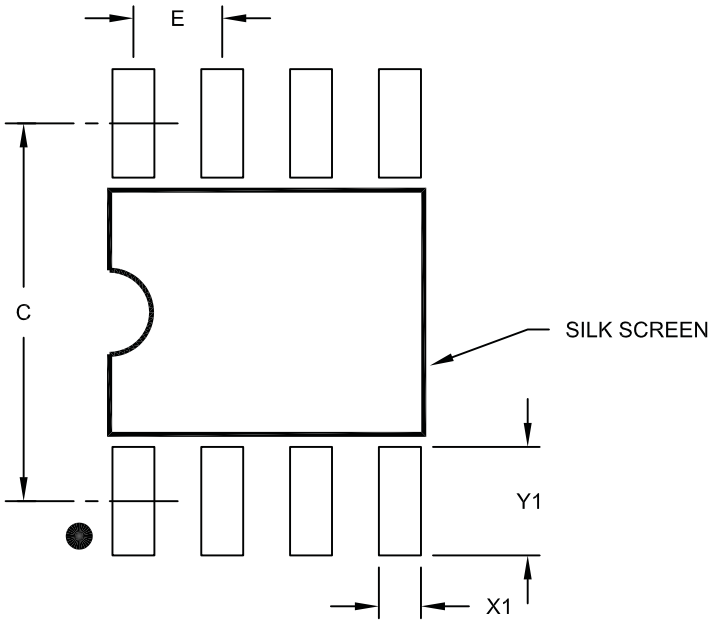
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REF: Reference Dimension, usually without tolerance, for information purposes only.

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8-Lead Plastic Small Outline (SN) – Narrow, 3.90 mm Body [SOIC]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E		1.27 BSC	
Contact Pad Spacing	C		5.40	
Contact Pad Width (X8)	X1			0.60
Contact Pad Length (X8)	Y1			1.55

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

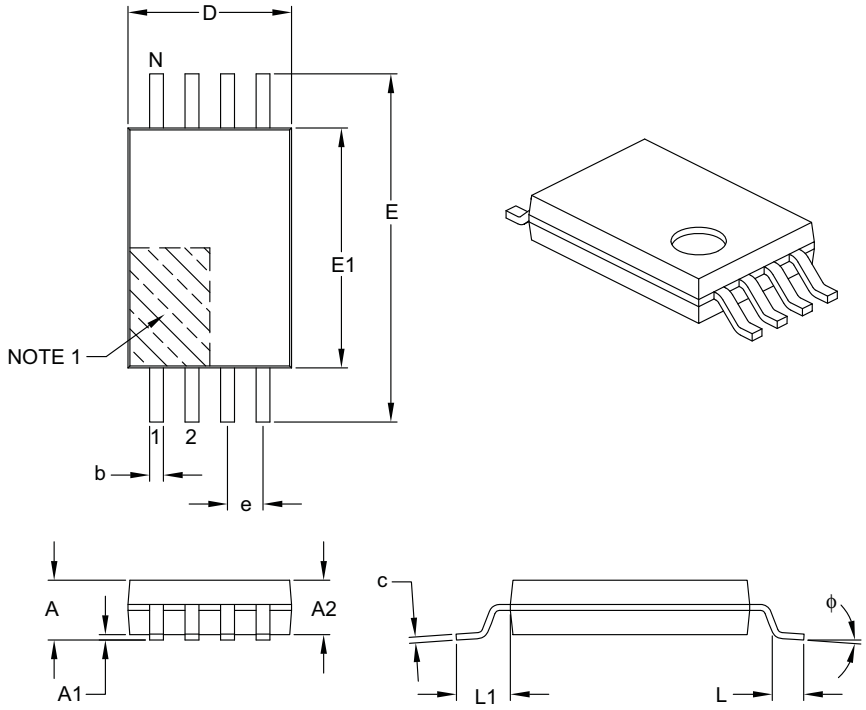
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

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8-Lead Plastic Thin Shrink Small Outline (ST) – 4.4 mm Body [TSSOP]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		8	
Pitch	e		0.65 BSC	
Overall Height	A	–	–	1.20
Molded Package Thickness	A2	0.80	1.00	1.05
Standoff	A1	0.05	–	0.15
Overall Width	E		6.40 BSC	
Molded Package Width	E1	4.30	4.40	4.50
Molded Package Length	D	2.90	3.00	3.10
Foot Length	L	0.45	0.60	0.75
Footprint	L1		1.00 REF	
Foot Angle	ϕ	0°	–	8°
Lead Thickness	c	0.09	–	0.20
Lead Width	b	0.19	–	0.30

Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15 mm per side.
3. Dimensioning and tolerancing per ASME Y14.5M.

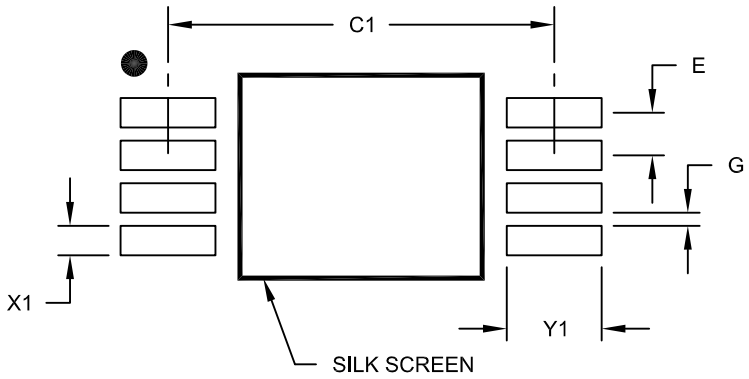
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8-Lead Plastic Thin Shrink Small Outline (ST) - 4.4 mm Body [TSSOP]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E	0.65 BSC		
Contact Pad Spacing	C1		5.90	
Contact Pad Width (X8)	X1			0.45
Contact Pad Length (X8)	Y1			1.45
Distance Between Pads	G	0.20		

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing No. C04-2086A

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APPENDIX A: REVISION HISTORY

Revision A (July 2012)

Initial release.

Revision B (November 2013)

Added E-temp specs.

Revision C (January 2015)

- Updated Features section.
- Updated Description section.
- Updated Section 2.0, Functional Description.
- Updated Table 2-1.
- Updated Section 3.0, Pin Descriptions.
- Updated Table 3-1.
- Updated Section 4.0, Dual and Quad Serial Mode.
- Minor typographical corrections.

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PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office. Not all possible ordering options are shown below..

PART NO.	X	–	X	/XX
Device	Tape & Reel		Temp Range	Package

Device:	23A1024 =		1 Mbit, 1.7 - 2.2V, SPI Serial SRAM
	23LC1024 =		1 Mbit, 2.5 - 5.5V, SPI Serial SRAM
Tape & Reel:	Blank	=	Standard packaging (tube)
	T	=	Tape & Reel
Temperature Range:	I	=	-40°C to +85°C
	E	=	-40°C to +125°C
Package:	SN	=	Plastic SOIC (3.90 mm body), 8-lead
	ST	=	Plastic TSSOP (4.4 mm body), 8-lead
	P	=	Plastic PDIP (300 mil body), 8-lead

Examples:

a) 23A1024-I/ST = 1 Mbit, 1.7-2.2V Serial SRAM, Industrial temp., TSSOP package

b) 23LC1024T-I/SN = 1 Mbit, 2.5-5.5V Serial SRAM, Industrial temp., Tape & Reel, SOIC package

c) 23LC1024-I/P = 1 Mbit, 2.5-5.5V Serial SRAM, Industrial temp., PDIP package

d) 23A1024-E/ST = 1 Mbit, 1.7-2.2V Serial SRAM, Extended temp., TSSOP package

e) 23LC1024T-E/SN = 1 Mbit, 2.5-5.5V Serial SRAM, Extended temp., Tape & Reel, SOIC package

f) 23LC1024-E/P = 1 Mbit, 2.5-5.5V Serial SRAM, Extended temp., PDIP package

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- 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."

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