

## 1 Mbit SPI Serial SRAM with Battery Backup and SDI Interface

### Device Selection Table

Part Number	Vcc Range	Dual I/O (SDI)	Battery Backup	Maximum Clock Frequency	Packages
23LCV1024	2.5V-5.5V	Yes	Yes	20 MHz	P, SN, ST

### Features

- SPI-Compatible Bus Interface:
  - 20 MHz clock rate
  - SPI/SDI mode
- Low-Power CMOS Technology:
  - Read Current: 3 mA at 5.5V, 20 MHz
  - Standby Current: 4  $\mu$ A at +85°C
- Unlimited Read and Write Cycles
- External Battery Backup Support
- Zero Write Time
- 128K x 8-bit Organization:
  - 32-byte page
- Byte, Page and Sequential Mode for Reads and Writes
- High Reliability
- Temperature Range Supported:
  - Industrial: -40°C to +85°C
- Pb-Free and RoHS Compliant, Halogen Free

### Packages

- 8-Lead PDIP
- 8-Lead SOIC
- 8-Lead TSSOP

### Pin Function Table

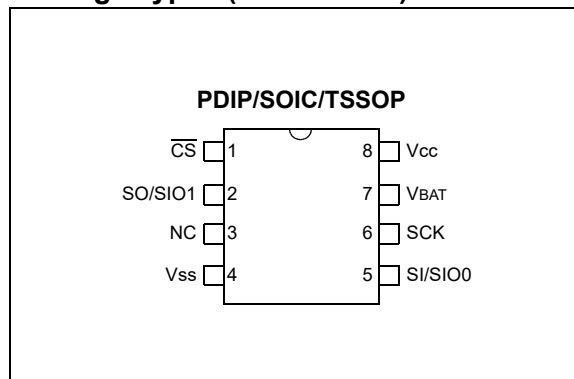
Name	Function
CS	Chip Select Input
SO/SIO1	Serial Output/SDI Pin
Vss	Ground
SI/SIO0	Serial Input/SDI Pin
SCK	Serial Clock
VBAT	External Backup Supply Input
VCC	Power Supply

### Description

The Microchip Technology Inc. 23LCV1024 is a 1-Mbit Serial SRAM device. 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 ( $\overline{\text{CS}}$ ) input. Additionally, Serial Dual Interface (SDI) is supported if the application needs faster data rates.

This device also supports unlimited reads and writes to the memory array and supports data backup via an external battery/coin cell connected to VBAT (pin 7).

### Package Types (not to scale)



# 23LCV1024

## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings (†)

V <sub>CC</sub> .....	6.5V
All inputs and outputs w.r.t. V <sub>SS</sub> .....	-0.3V to V <sub>CC</sub> +0.3V
Storage temperature .....	-65°C to +150°C
Ambient temperature under bias .....	-40°C to +85°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): T <sub>A</sub> = -40°C to +85°C				
Param. No.	Symbol	Characteristic	Min.	Typ. <sup>(1)</sup>	Max.	Units	Test Conditions
D001	V <sub>CC</sub>	Supply Voltage	2.5	—	5.5	V	23LCV1024
D002	V <sub>IH</sub>	High-Level Input Voltage	0.7 V <sub>CC</sub>	—	V <sub>CC</sub> +0.3	V	
D003	V <sub>IL</sub>	Low-Level Input Voltage	-0.3	—	0.10 x V <sub>CC</sub>	V	23LCV1024
D004	V <sub>OL</sub>	Low-Level Output Voltage	—	—	0.2	V	I <sub>OL</sub> = 1 mA
D005	V <sub>OH</sub>	High-Level Output Voltage	V <sub>CC</sub> -0.5	—	—	V	I <sub>OH</sub> = -400 μA
D006	I <sub>LI</sub>	Input Leakage Current	—	—	±1	μA	$\overline{CS} = V_{CC}$ , V <sub>IN</sub> = V <sub>SS</sub> or V <sub>CC</sub>
D007	I <sub>LO</sub>	Output Leakage Current	—	—	±1	μA	$\overline{CS} = V_{CC}$ , V <sub>OUT</sub> = V <sub>SS</sub> or V <sub>CC</sub>
D008	I <sub>CC Read</sub>	Operating Current	—	3	10	mA	F <sub>CLK</sub> = 20 MHz; S <sub>O</sub> = Open, 5.5V
D009	I <sub>CCS</sub>	Standby Current	—	4	10	μA	$\overline{CS} = V_{CC} = 5.5V$ , Inputs tied to V <sub>CC</sub> or V <sub>SS</sub>
D010	C <sub>INT</sub>	Input Capacitance	—	—	7	pF	V <sub>CC</sub> = 0V, f = 1 MHz, T <sub>A</sub> = +25°C (Note 1)
D011	V <sub>DR</sub>	RAM Data Retention Voltage	—	1.0	—	V	Note 2
D012	V <sub>TRIP</sub>	V <sub>BAT</sub> Change Over	1.6	1.8	2.0	V	Typical at T <sub>A</sub> = +25°C (Note 1)
D013	V <sub>BAT</sub>	V <sub>BAT</sub> Voltage Range	1.4	—	3.6	V	Note 1
D014	I <sub>BAT</sub>	V <sub>BAT</sub> Current	—	1	—	μA	Typical at 2.5V, T <sub>A</sub> = +25°C (Note 1)

**Note 1:** This parameter is periodically sampled and not 100% tested. Typical measurements taken at room temperature (+25°C).

**2:** This is the limit to which V<sub>DD</sub> can be lowered without losing RAM data. This parameter is periodically sampled and not 100% tested.

TABLE 1-2: AC CHARACTERISTICS

AC CHARACTERISTICS			Industrial (I):TA = -40°C to +85°C			
Param. No.	Symbol	Characteristic	Min.	Max.	Units	Test Conditions
1	FCLK	Clock Frequency	—	20	MHz	
2	Tcss	$\overline{CS}$ Setup Time	25	—	ns	
3	Tcsh	$\overline{CS}$ Hold Time	50	—	ns	
4	TcSD	$\overline{CS}$ Disable Time	25	—	ns	
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	
10	TLO	Clock Low Time	25	—	ns	
11	TCLD	Clock Delay Time	25	—	ns	
12	TV	Output Valid from Clock Low	—	25	ns	
13	THO	Output Hold Time	0	—	ns	Note 1
14	TDIS	Output Disable Time	—	20	ns	

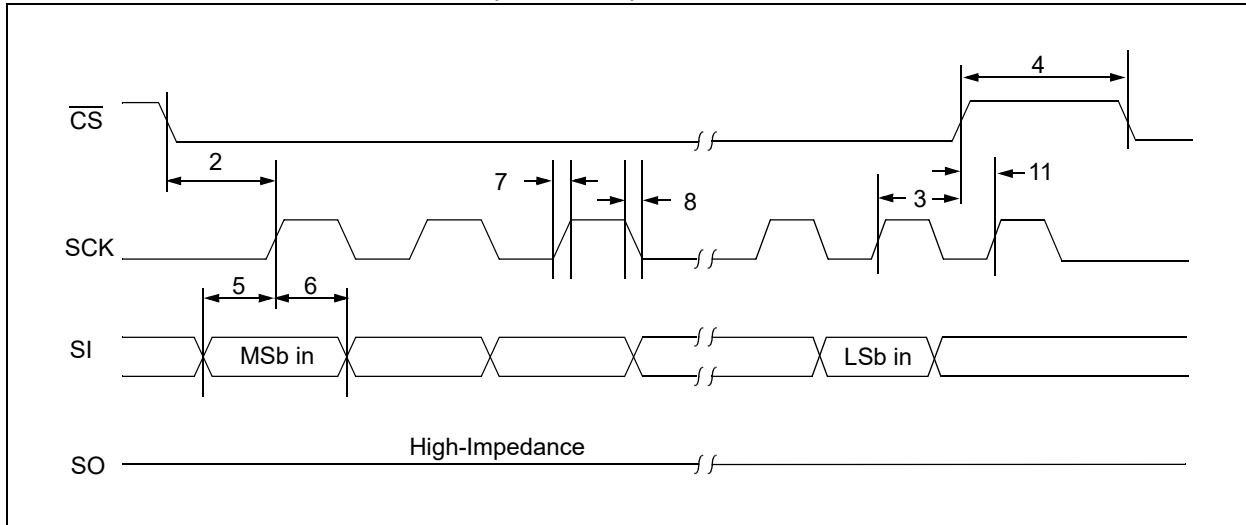
**Note 1:** This parameter is periodically sampled and not 100% tested.

TABLE 1-3: AC TEST CONDITIONS

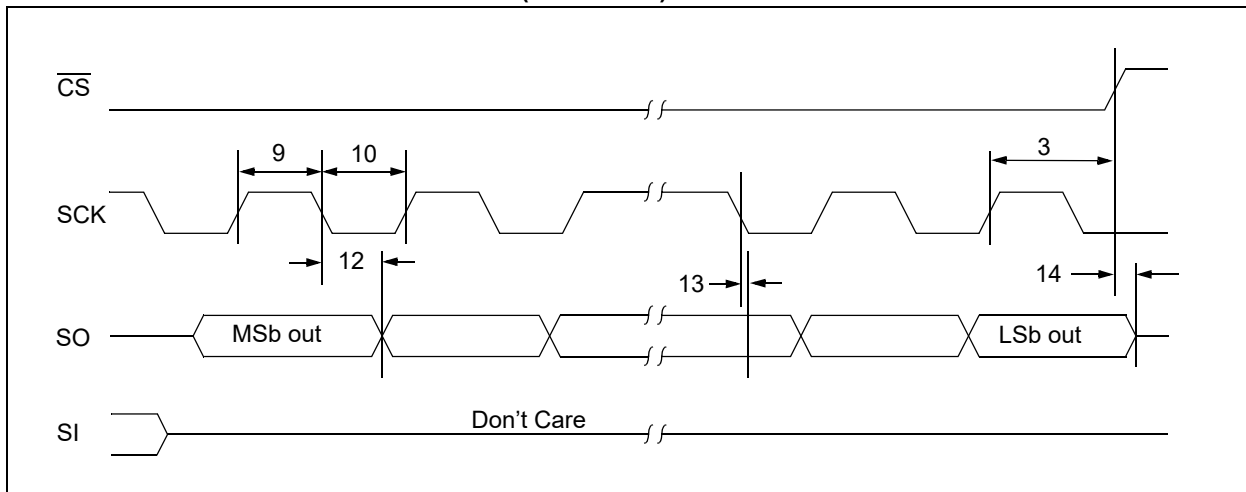
AC Waveform:	
Input pulse level	0.1 Vcc to 0.9 Vcc
Input rise/fall time	5 ns
Operating temperature	-40°C to +85°C
CL = 30 pF	—
Timing Measurement Reference Level:	
Input	0.5 Vcc
Output	0.5 Vcc

# 23LCV1024

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



**FIGURE 1-2: SERIAL OUTPUT TIMING (SPI MODE)**



## 2.0 FUNCTIONAL DESCRIPTION

### 2.1 Principles of Operation

The 23LCV1024 is a 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<sup>®</sup> 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 23LCV1024 is also capable of operating in SDI (or dual SPI) mode.

The 23LCV1024 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  $\overline{\text{CS}}$  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 23LCV1024 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 are transferred on the next eight clocks (see Figure 2-1 and Figure 2-2).

**Page Operation** – is selected when bits 7 and 6 in the MODE register are set to 10. The 23LCV1024 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 (see Figure 2-3 and 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 (see Figure 2-5 and Figure 2-6).

### 2.3 Read Sequence

The device is selected by pulling  $\overline{\text{CS}}$  low. The 8-bit READ instruction is transmitted to the 23LCV1024 followed by the 24-bit address, with the first seven MSb's of the address being a "don't care" bit. 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 CS pin.

### 2.4 Write Sequence

Prior to any attempt to write data to the 23LCV1024, the device must be selected by bringing  $\overline{\text{CS}}$  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 a "don't care" bit and then the data to be written. A write is terminated by the  $\overline{\text{CS}}$  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.

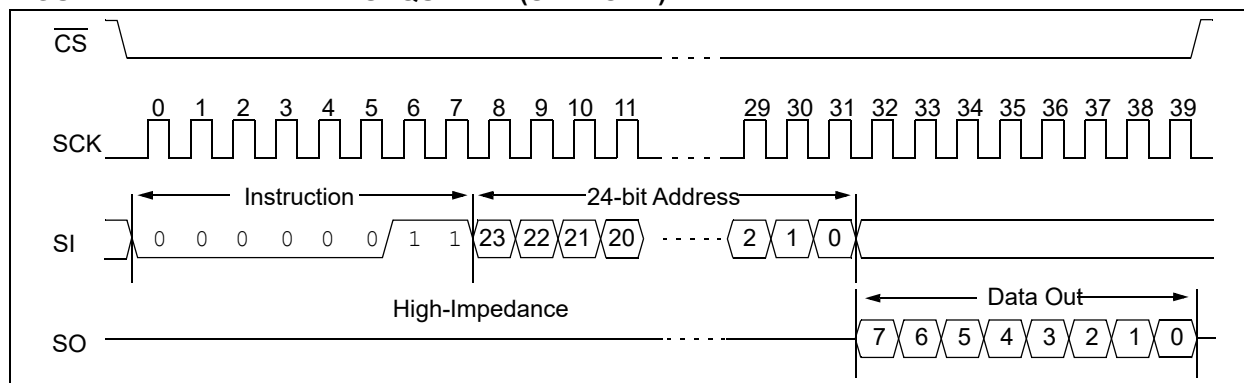
If operating in Sequential mode, after the initial data byte is shifted in, additional bytes can be clocked into the device. The internal Address Pointer is automatically incremented. When the Address Pointer reaches the highest address (1FFFFh), the address counter rolls over to (00000h). This allows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

# 23LCV1024

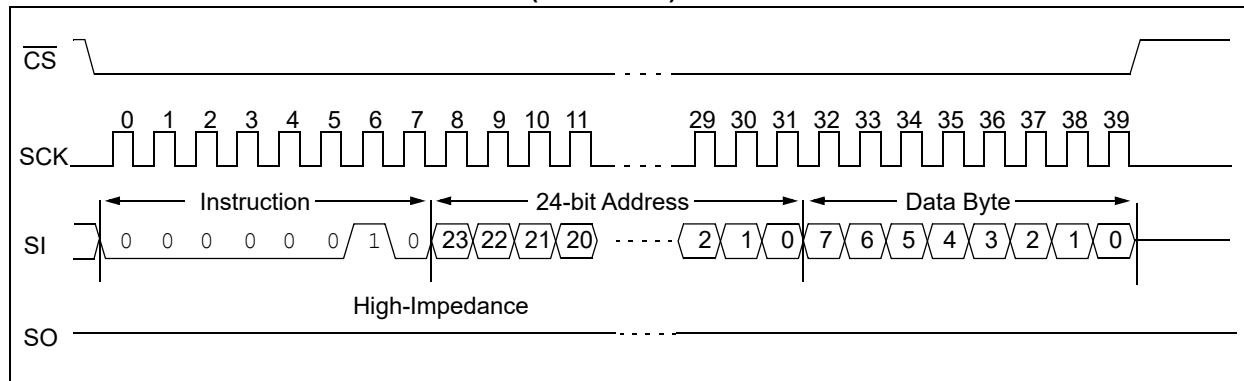
**TABLE 2-1: INSTRUCTION SET**

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
RSTIO	1111 1111	0xFF	Reset Dual I/O access
RDMR	0000 0101	0x05	Read Mode Register
WRMR	0000 0001	0x01	Write Mode Register

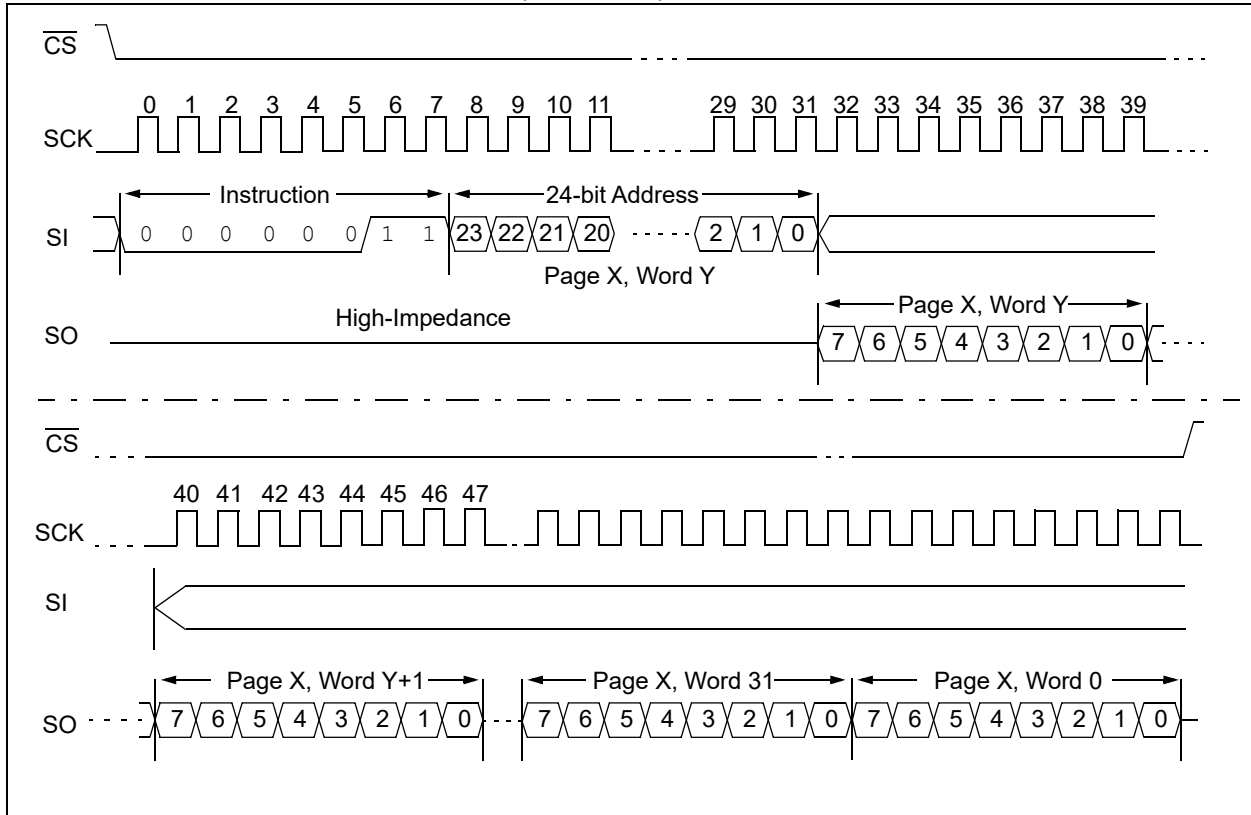
**FIGURE 2-1: BYTE READ SEQUENCE (SPI MODE)**



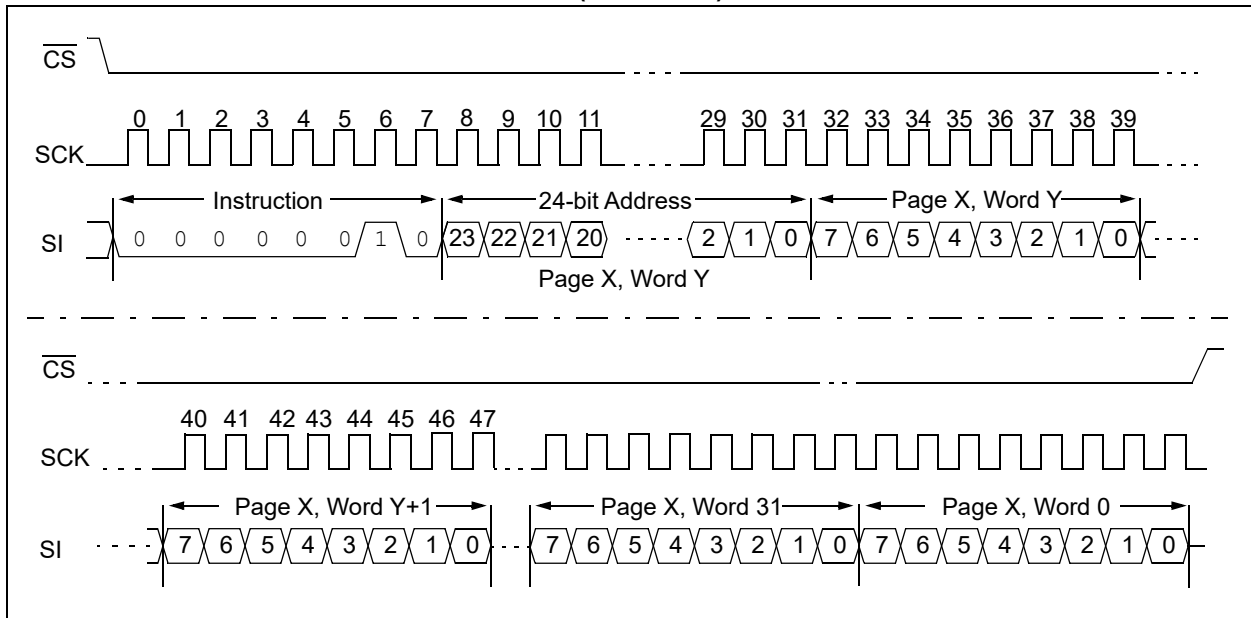
**FIGURE 2-2: BYTE WRITE SEQUENCE (SPI MODE)**



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

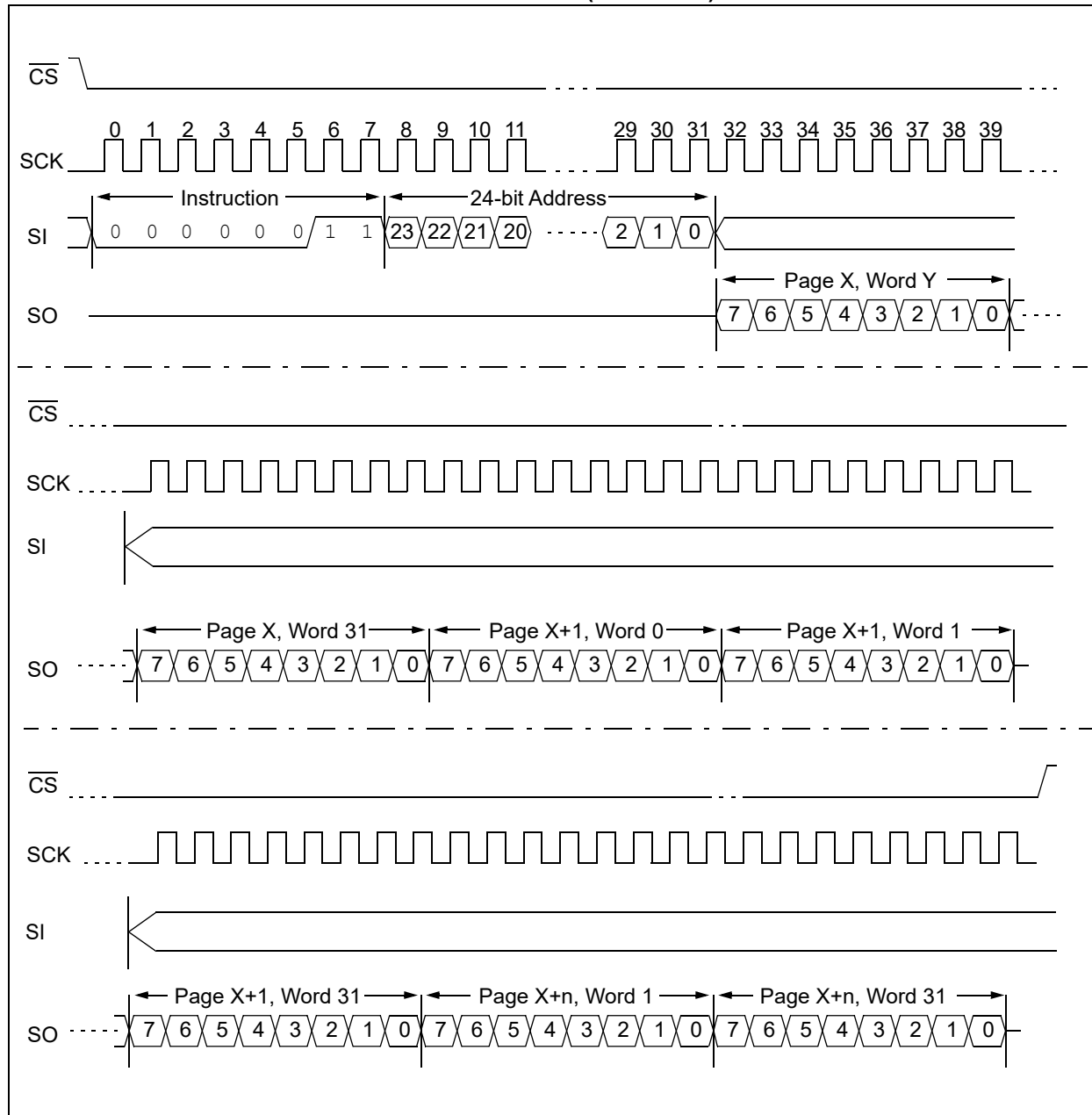


**FIGURE 2-4: PAGE WRITE SEQUENCE (SPI MODE)**



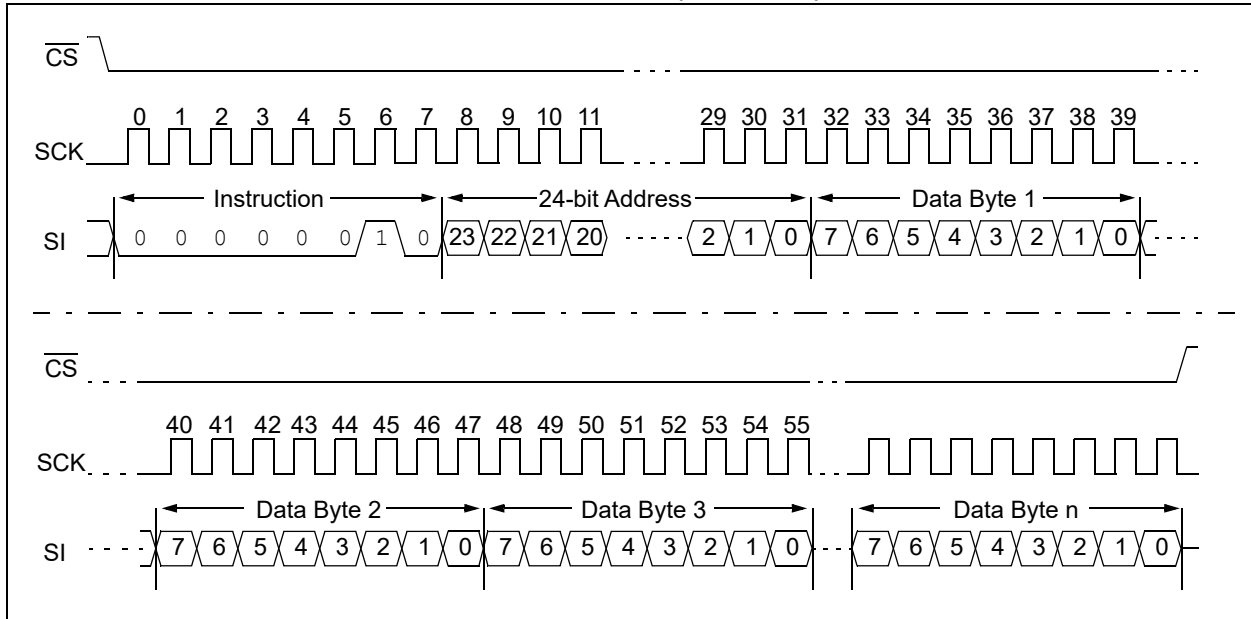
# 23LCV1024

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





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



# 23LCV1024

## 2.5 Read Mode Register Instruction (RDMR)

The Read Mode Register instruction ( $R_{DMR}$ ) 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

**Note 1:** W/R = writable/readable

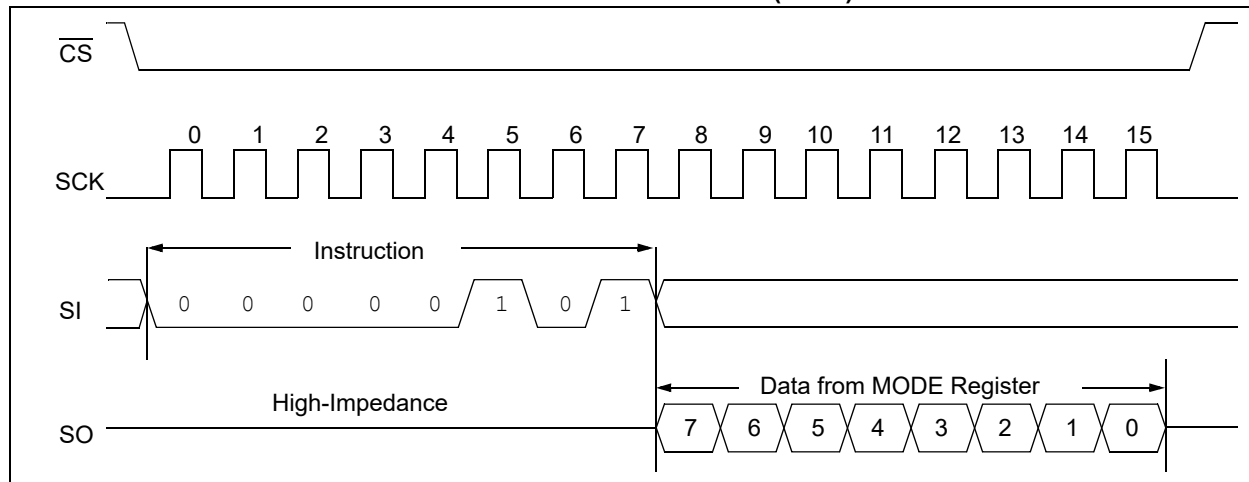
The mode bits indicate the operating mode of the SRAM. The possible modes of operation are:

- 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  $R_{DMR}$  timing sequence.

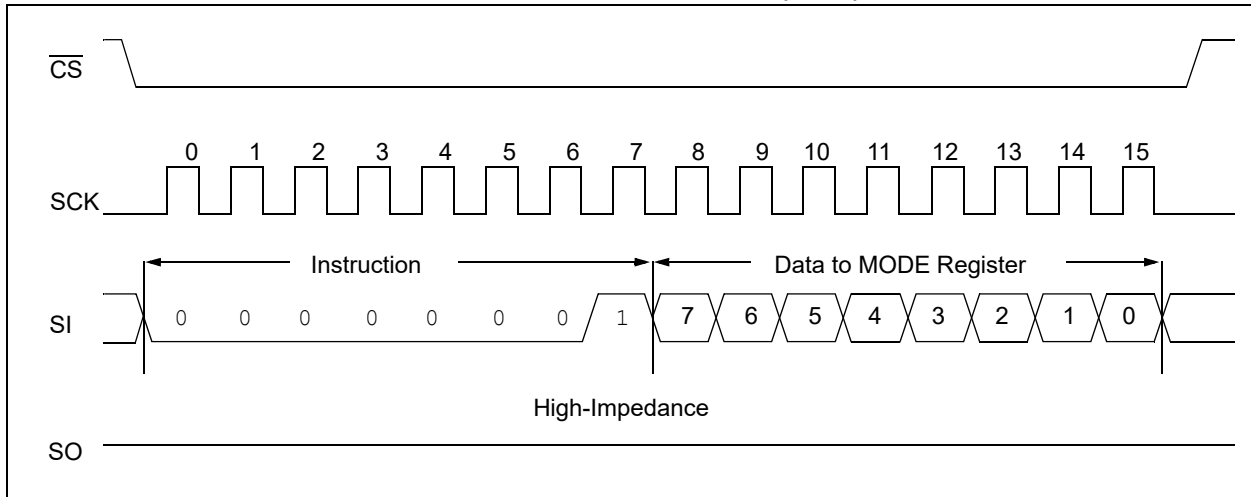
**FIGURE 2-7: READ MODE REGISTER TIMING SEQUENCE (RDMR)**



## 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 23LCV1024 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

# 23LCV1024

## 3.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in [Table 3-1](#).

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

Name	PDIP/SOIC/TSSOP	Function
$\overline{\text{CS}}$	1	Chip Select Input
SO/SIO1	2	Serial Data Output/SDI Pin
NC	3	No Connect
Vss	4	Ground
SI/SIO0	5	Serial Data Input/SDI Pin
SCK	6	Serial Clock Input
VBAT	7	External Backup Supply
VCC	8	Power Supply

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

A low level on this pin selects the device. A high level deselects the device and forces it into Standby mode. 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 CS is required, prior to any sequence being initiated.

### 3.2 Serial Output (SO)

The SO pin is used to transfer data out of the 23LCV1024. During a read cycle, data are shifted out on this pin after the falling edge of the serial clock.

### 3.3 Serial Input (SI)

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

### 3.4 Serial Dual Interface (SIO0, SIO1)

The SIO0 and SIO1 pins are used for SDI mode of operation. Functionality of these I/O pins is shared with SO and SI.

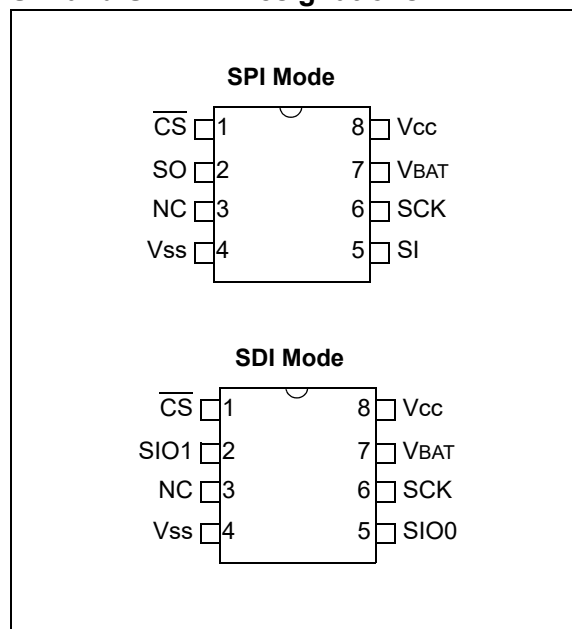
### 3.5 Serial Clock (SCK)

The SCK pin is used to synchronize the communication between a host and the 23LCV1024. 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 are updated after the falling edge of the clock input.

### 3.6 VBAT Supply Input

The VBAT pin is used as an input for external backup supply to maintain SRAM data when VCC is below the VTRIP point. If the VBAT function is not being used, it is recommended to connect this pin to Vss.

### SPI and SDI Pin Designations



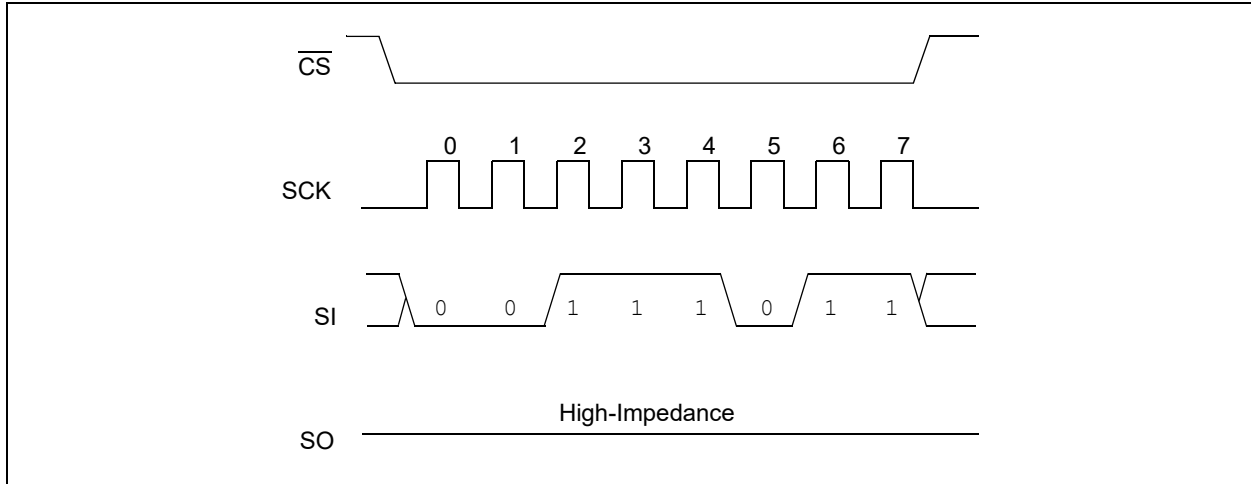
## 4.0 DUAL SERIAL MODE

The 23LCV1024 also supports Serial Dual (SDI) mode of operation when used with compatible host 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.

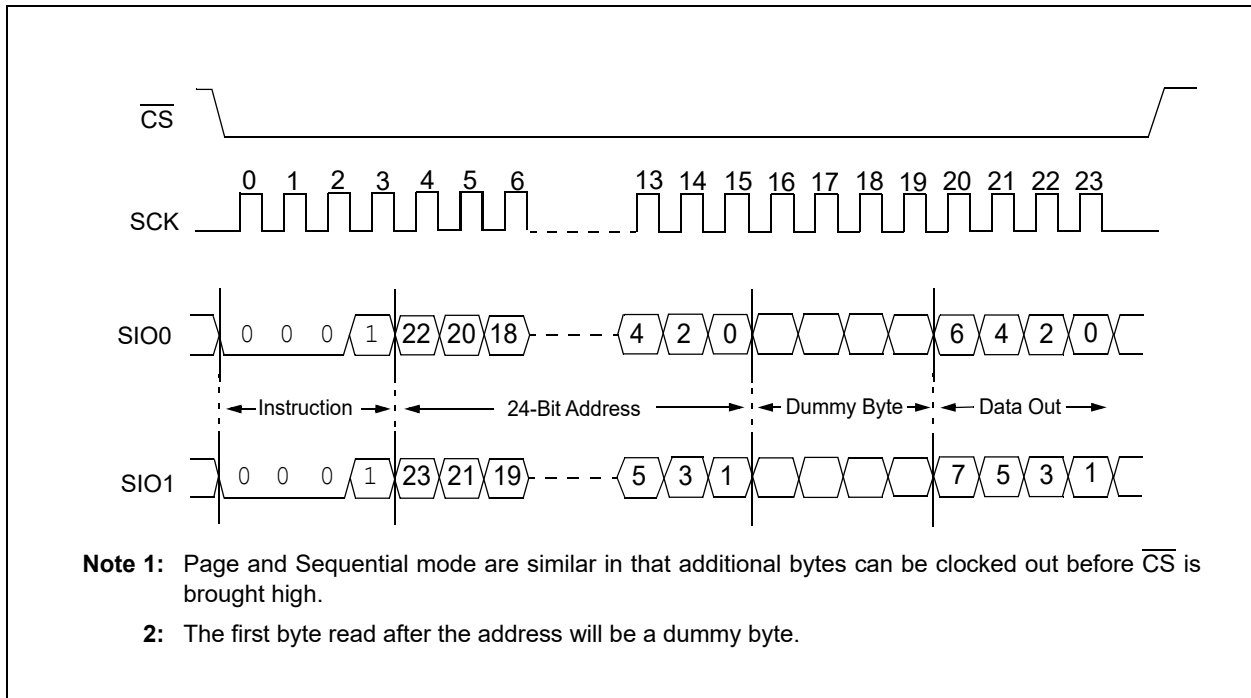
## 4.1 Dual Interface Mode

The 23LCV1024 supports Serial Dual (SDI) mode of operation. To enter SDI mode, the EDIO command must be clocked in (see Figure 4-1). It should be noted that if the microcontroller 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**

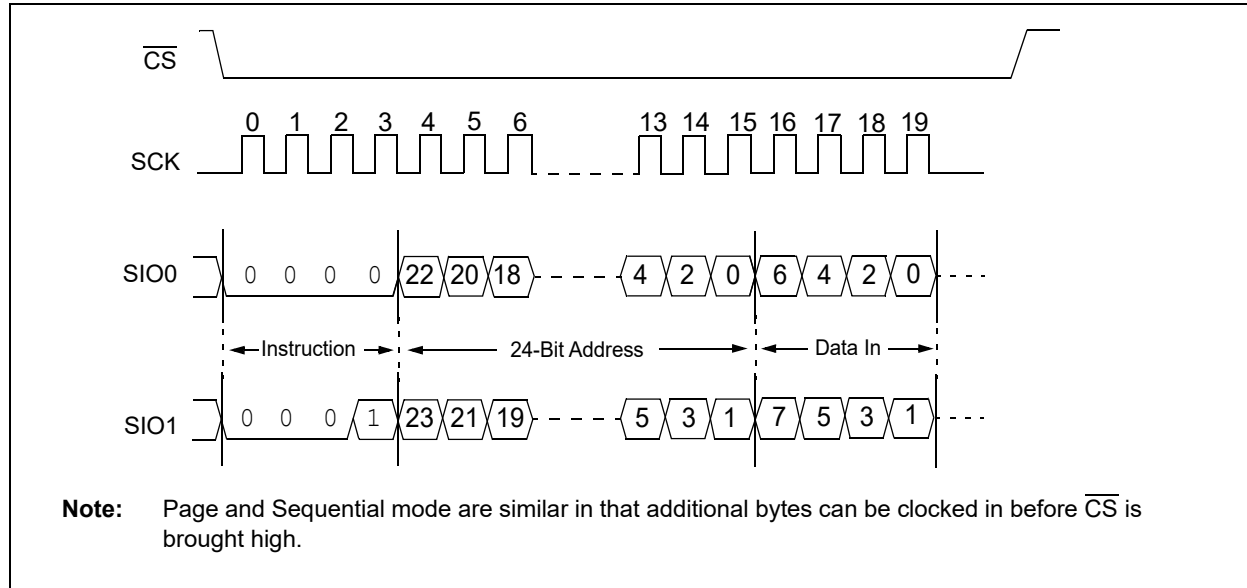


**FIGURE 4-2: BYTE READ MODE SDI**



# 23LCV1024

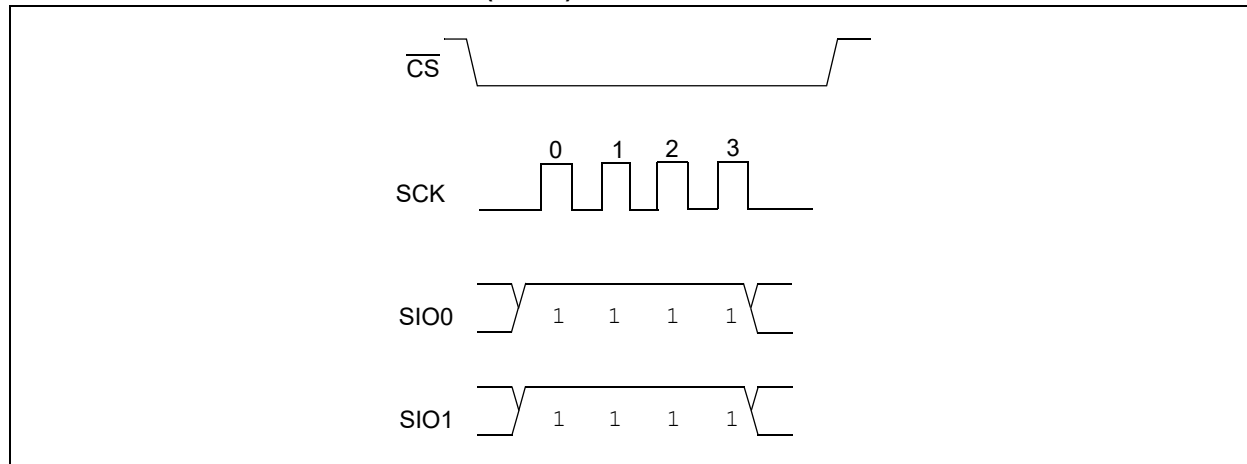
FIGURE 4-3: BYTE WRITE MODE SDI



## 4.2 Exit SDI Mode

To exit from SDI mode, the `RSTIO` command must be issued. The command must be entered in the current device configuration (see [Figure 4-4](#)).

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



## 5.0 VBAT

The 23LCV1024 features an internal switch that will maintain the SRAM contents. In the event that the VCC supply is not available, the voltage applied to the VBAT pin serves as the backup supply.

The VBAT trip point is the point at which the internal switch operates the device from the VBAT supply and is typically 1.8V (VTRIP specification D012). When VCC falls below the VTRIP point, the system will continue to maintain the SRAM contents.

The following conditions apply:

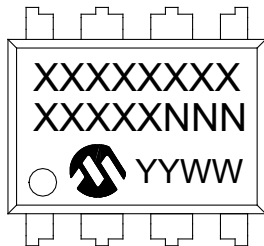
Supply Condition	Read/Write Access	Powered By
$VCC < V_{TRIP}$	No	VBAT
$VCC > V_{TRIP}, VCC < V_{BAT}$	Yes	VCC
$VCC > V_{TRIP}, VCC > V_{BAT}$	Yes	VCC

# 23LCV1024

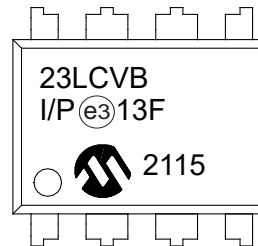
## 6.0 PACKAGING INFORMATION

### 6.1 Package Marking Information

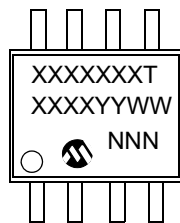
8-Lead PDIP (300 mil)



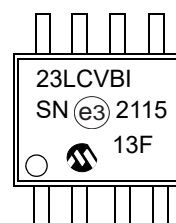
Example



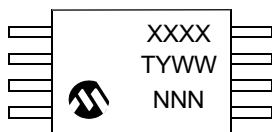
8-Lead SOIC (3.90 mm)



Example



8-Lead TSSOP



Example

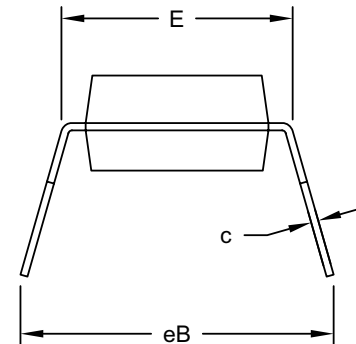
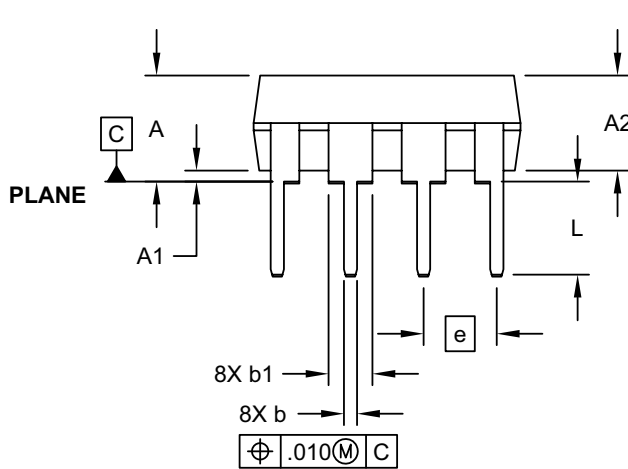
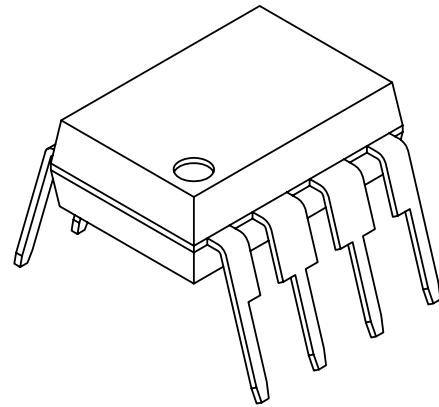
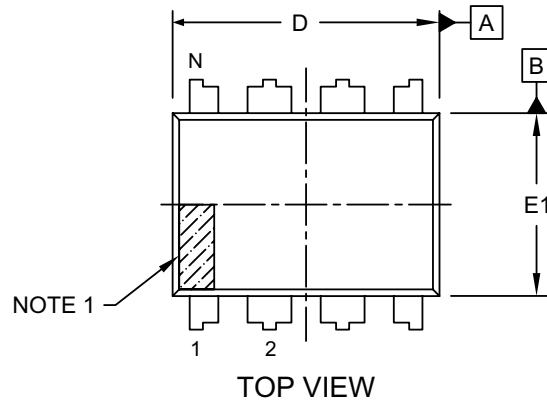


<b>Legend:</b>	XX...X	Part number or part number code
	T	Temperature (I, E)
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code (2 characters for small packages)
	e3	Pb-free JEDEC designator for Matte Tin (Sn)
<b>Note:</b>	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.	
<b>Note:</b>	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.	



## 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>



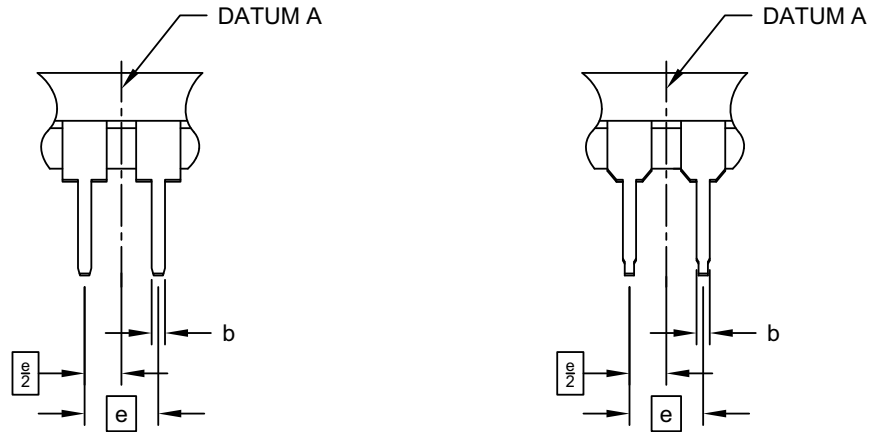
Microchip Technology Drawing No. C04-018-P Rev E Sheet 1 of 2

# 23LCV1024

## 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>

### ALTERNATE LEAD DESIGN (NOTE 5)



Dimension Limits	Units	INCHES		
		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

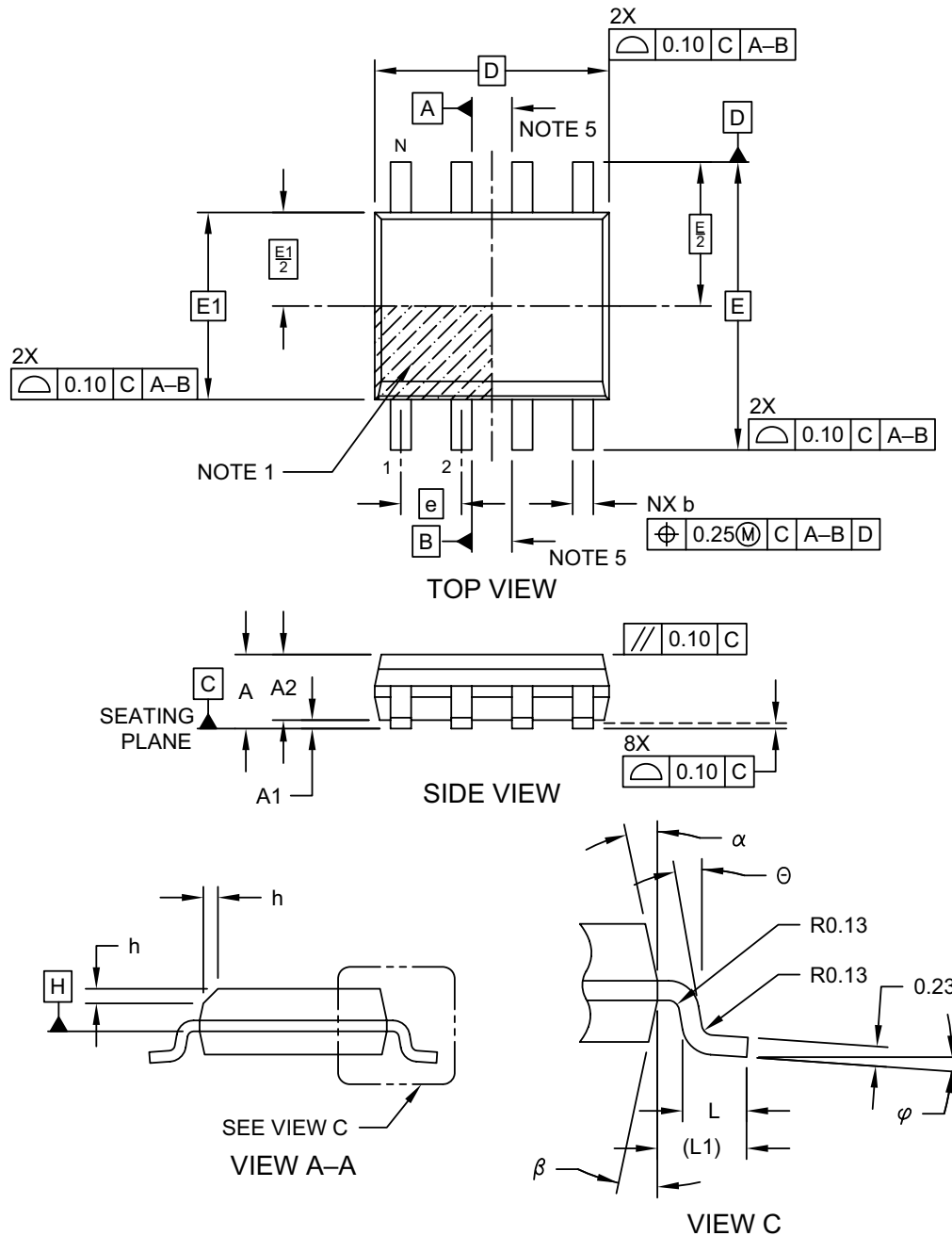
**Notes:**

- Pin 1 visual index feature may vary, but must be located within the hatched area.
- § Significant Characteristic
- Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" per side.
- Dimensioning and tolerancing per ASME Y14.5M  
BSC: Basic Dimension. Theoretically exact value shown without tolerances.
- Lead design above seating plane may vary, based on assembly vendor.

Microchip Technology Drawing No. C04-018-P Rev E Sheet 2 of 2

## 8-Lead Plastic Small Outline (SN) - Narrow, 3.90 mm (.150 In.) Body [SOIC]

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

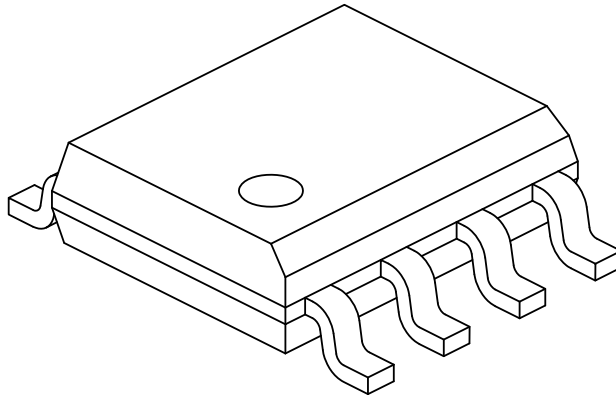


Microchip Technology Drawing No. C04-057-SN Rev F Sheet 1 of 2

# 23LCV1024

## 8-Lead Plastic Small Outline (SN) - Narrow, 3.90 mm (.150 In.) Body [SOIC]

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



Dimension Limits	Units	MILLIMETERS		
		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	$\varphi$	0°	-	8°
Lead Thickness	c	0.17	-	0.25
Lead Width	b	0.31	-	0.51
Mold Draft Angle Top	$\alpha$	5°	-	15°
Mold Draft Angle Bottom	$\beta$	5°	-	15°

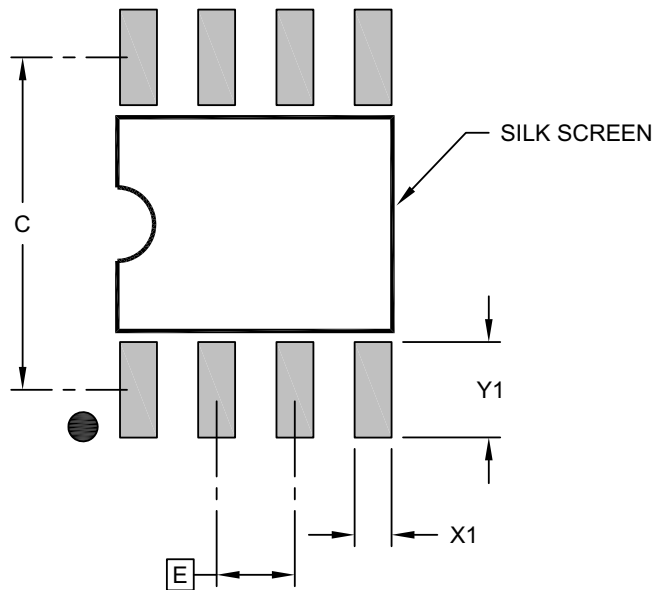
**Notes:**

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  
BSC: Basic Dimension. Theoretically exact value shown without tolerances.  
REF: Reference Dimension, usually without tolerance, for information purposes only.
5. Datums A & B to be determined at Datum H.

Microchip Technology Drawing No. C04-057-SN Rev F Sheet 2 of 2

## 8-Lead Plastic Small Outline (SN) - Narrow, 3.90 mm (.150 In.) 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

Dimension Limits	Units	MILLIMETERS		
		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:**

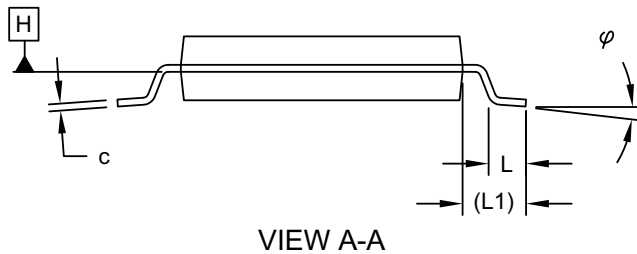
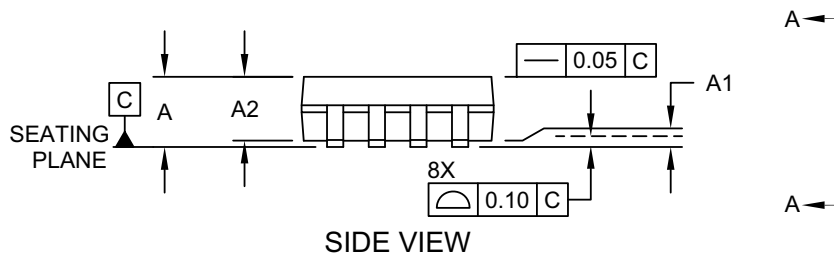
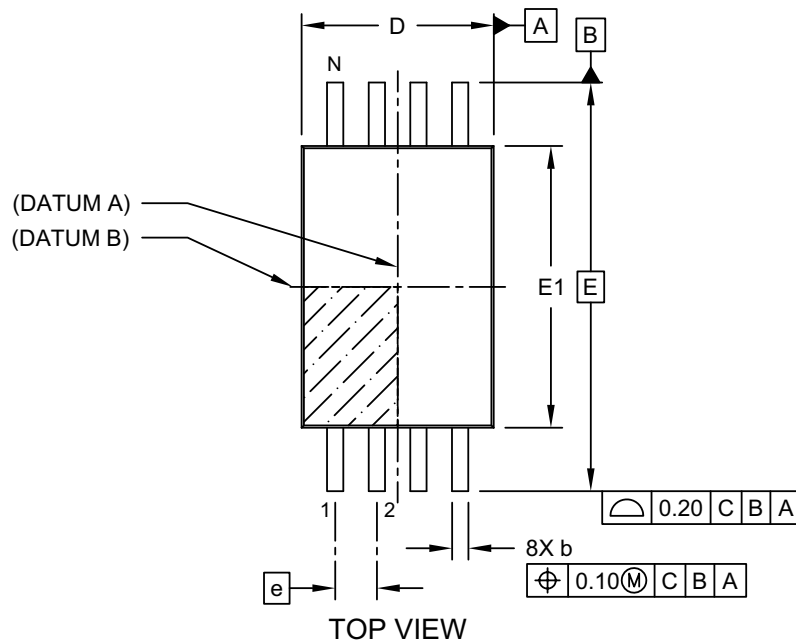
1. Dimensioning and tolerancing per ASME Y14.5M  
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing C04-2057-SN Rev F

# 23LCV1024

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

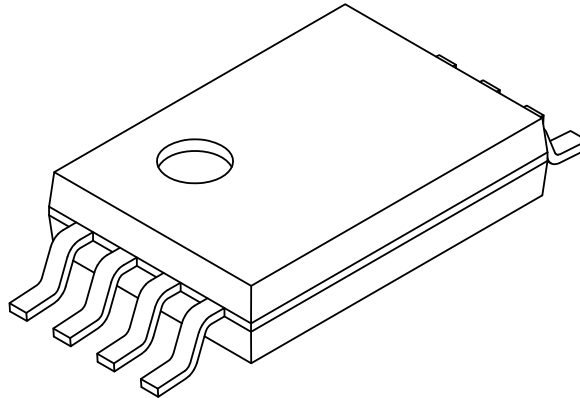
**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Microchip Technology Drawing C04-086 Rev C Sheet 1 of 2

## 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>



Dimension Limits	Units	MILLIMETERS		
		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	-	-
Overall Width	E	6.40 BSC		
Molded Package Width	E1	4.30	4.40	4.50
Overall Length	D	2.90	3.00	3.10
Foot Length	L	0.45	0.60	0.75
Footprint	L1	1.00 REF		
Lead Thickness	c	0.09	-	0.25
Foot Angle	$\varphi$	0°	4°	8°
Lead Width	b	0.19	-	0.30

**Notes:**

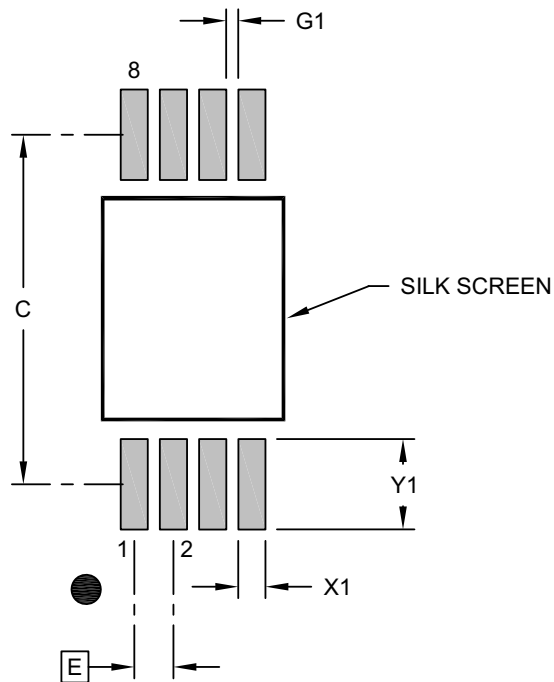
- Pin 1 visual index feature may vary, but must be located within the hatched area.
- Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.20mm per side.
- Dimensioning and tolerancing per ASME Y14.5M  
 BSC: Basic Dimension. Theoretically exact value shown without tolerances.  
 REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-086 Rev C Sheet 2 of 2

# 23LCV1024

## 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

Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Contact Pitch	E	0.65 BSC		
Contact Pad Spacing	C		5.80	
Contact Pad Width (X8)	X1			0.45
Contact Pad Length (X8)	Y1			1.50
Contact Pad to Center Pad (X6)	G1	0.20		

**Notes:**

1. Dimensioning and tolerancing per ASME Y14.5M  
BSC: Basic Dimension. Theoretically exact value shown without tolerances.
2. For best soldering results, thermal vias, if used, should be filled or tented to avoid solder loss during reflow process

Microchip Technology Drawing C04-2086 Rev B



## APPENDIX A: REVISION HISTORY

### Revision B (06/2021)

Removed "Preliminary" status; Updated PDIP, SOIC and TSSOP package drawings.

### Revision A (09/2012)

Initial release of the document.

## THE MICROCHIP WEBSITE

Microchip provides online support via our website at [www.microchip.com](http://www.microchip.com). This website is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the website contains the following information:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQ), technical support requests, online discussion groups, Microchip consultant program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

## CUSTOMER CHANGE NOTIFICATION SERVICE

Microchip's customer notification service helps keep customers current on Microchip products. Subscribers will receive e-mail notification whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.

To register, access the Microchip website at [www.microchip.com](http://www.microchip.com). Under "Support", click on "Customer Change Notification" and follow the registration instructions.

## CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

Customers should contact their distributor, representative or Field Application Engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

**Technical support is available through the website at: <http://microchip.com/support>**

## PRODUCT IDENTIFICATION SYSTEM

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

<u>PART NO.</u>	<u>IXI</u> <sup>(1)</sup>	<u>-X</u>	<u>IXX</u>
Device	Tape and Reel Option	Temperature Range	Package
<p><b>Device:</b> 23LCV1024: 1-Mbit, 2.5V-5.5V,SPI Serial SRAM</p>			
<p><b>Tape and Reel Option:</b> Blank = Standard packaging (tube or tray) T = Tape and Reel<sup>(1)</sup></p>			
<p><b>Temperature Range:</b> I = -40°C to +85°C (Industrial)</p>			
<p><b>Package:</b> P = Plastic Dual In-Line – 300 mil Body, 8-lead (PDIP) SN = Plastic Small Outline - Narrow, 3.90 mm Body, 8-lead (SOIC) ST = Plastic Thin Shrink Small Outline – 4.4 mm, 8-lead (TSSOP)</p>			
			<p><b>Examples:</b></p> <p>a) 23LCV1024-I/P: 1-Mbit, 2.5V-5.5V, Serial SRAM, Industrial Temp., PDIP package</p> <p>b) 23LCV1024-I/SN: 1-Mbit, 2.5V-5.5V, Serial SRAM, Industrial Temp., SOIC package</p> <p>c) 23LCV1024-I/ST: 1-Mbit, 2.5V-5.5V, Serial SRAM, Industrial Temp., TSSOP package</p>
			<p><b>Note 1:</b> Tape and Reel identifier only appears in the catalog part number description. This identifier is used for ordering purposes and is not printed on the device package. Check with your Microchip Sales Office for package availability with the Tape and Reel option..</p>

---

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

- Microchip products meet the specifications contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is secure when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods being used in attempts to breach the code protection features of the Microchip devices. We believe that these methods require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Attempts to breach these code protection features, most likely, cannot be accomplished without violating Microchip's intellectual property rights.
- Microchip is willing to work with any customer who is concerned about the integrity of its code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of its code. Code protection does not mean that we are guaranteeing the product is "unbreakable." Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Information contained in this publication is provided for the sole purpose of designing with and using Microchip products. Information regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications.

THIS INFORMATION IS PROVIDED BY MICROCHIP "AS IS". MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE OR WARRANTIES RELATED TO ITS CONDITION, QUALITY, OR PERFORMANCE.

IN NO EVENT WILL MICROCHIP BE LIABLE FOR ANY INDIRECT, SPECIAL, PUNITIVE, INCIDENTAL OR CONSEQUENTIAL LOSS, DAMAGE, COST OR EXPENSE OF ANY KIND WHATSOEVER RELATED TO THE INFORMATION OR ITS USE, HOWEVER CAUSED, EVEN IF MICROCHIP HAS BEEN ADVISED OF THE POSSIBILITY OR THE DAMAGES ARE FORESEEABLE. TO THE FULLEST EXTENT ALLOWED BY LAW, MICROCHIP'S TOTAL LIABILITY ON ALL CLAIMS IN ANY WAY RELATED TO THE INFORMATION OR ITS USE WILL NOT EXCEED THE AMOUNT OF FEES, IF ANY, THAT YOU HAVE PAID DIRECTLY TO MICROCHIP FOR THE INFORMATION. Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

For information regarding Microchip's Quality Management Systems, please visit [www.microchip.com/quality](http://www.microchip.com/quality).

**Trademarks**

The Microchip name and logo, the Microchip logo, Adaptec, AnyRate, AVR, AVR logo, AVR Freaks, BesTime, BitCloud, chipKIT, chipKIT logo, CryptoMemory, CryptoRF, dsPIC, FlashFlex, flexPWR, HELDO, IGL00, JukeBlox, KeeLoq, Kleer, LANCheck, LinkMD, maXStylus, maXTouch, MediaLB, megaAVR, Microsemi, Microsemi logo, MOST, MOST logo, MPLAB, OptoLyzer, PackeTime, PIC, picoPower, PICSTART, PIC32 logo, PolarFire, Prochip Designer, QTouch, SAM-BA, SenGenuity, SpyNIC, SST, SST Logo, SuperFlash, Symmetricom, SyncServer, Tachyon, TimeSource, tinyAVR, UNI/O, Vectron, and XMEGA are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

AgileSwitch, APT, ClockWorks, The Embedded Control Solutions Company, EtherSynch, FlashTec, Hyper Speed Control, HyperLight Load, IntelliMOS, Libero, motorBench, mTouch, Powermite 3, Precision Edge, ProASIC, ProASIC Plus, ProASIC Plus logo, Quiet-Wire, SmartFusion, SyncWorld, Temux, TimeCesium, TimeHub, TimePictra, TimeProvider, WinPath, and ZL are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Adjacent Key Suppression, AKS, Analog-for-the-Digital Age, Any Capacitor, AnyIn, AnyOut, Augmented Switching, BlueSky, BodyCom, CodeGuard, CryptoAuthentication, CryptoAutomotive, CryptoCompanion, CryptoController, dsPICDEM, dsPICDEM.net, Dynamic Average Matching, DAM, ECAN, Espresso T1S, EtherGREEN, IdealBridge, In-Circuit Serial Programming, ICSP, INICnet, Intelligent Paralleling, Inter-Chip Connectivity, JitterBlocker, maxCrypto, maxView, memBrain, Mindi, MiWi, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICkit, PICtail, PowerSmart, PureSilicon, QMatrix, REAL ICE, Ripple Blocker, RTAX, RTG4, SAM-ICE, Serial Quad I/O, simpleMAP, SimpliPHY, SmartBuffer, SMART-I.S., storClad, SQI, SuperSwitcher, SuperSwitcher II, Switchtec, SynchroPHY, Total Endurance, TSHARC, USBCheck, VariSense, VectorBlox, VeriPHY, ViewSpan, WiperLock, XpressConnect, and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

The Adaptec logo, Frequency on Demand, Silicon Storage Technology, and Symmcom are registered trademarks of Microchip Technology Inc. in other countries.

GestIC is a registered trademark of Microchip Technology Germany II GmbH & Co. KG, a subsidiary of Microchip Technology Inc., in other countries.

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

© 2012-2021, Microchip Technology Incorporated, All Rights Reserved.

ISBN: 978-1-5224-8275-8



# MICROCHIP

## 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:  
<http://www.microchip.com/support>  
Web Address:  
[www.microchip.com](http://www.microchip.com)

#### Atlanta

Duluth, GA  
Tel: 678-957-9614  
Fax: 678-957-1455

#### Austin, TX

Tel: 512-257-3370

#### Boston

Westborough, MA  
Tel: 774-760-0087  
Fax: 774-760-0088

#### Chicago

Itasca, IL  
Tel: 630-285-0071  
Fax: 630-285-0075

#### Dallas

Addison, TX  
Tel: 972-818-7423  
Fax: 972-818-2924

#### Detroit

Novi, MI  
Tel: 248-848-4000

#### Houston, TX

Tel: 281-894-5983

#### Indianapolis

Noblesville, IN  
Tel: 317-773-8323  
Fax: 317-773-5453  
Tel: 317-536-2380

#### Los Angeles

Mission Viejo, CA  
Tel: 949-462-9523  
Fax: 949-462-9608  
Tel: 951-273-7800

#### Raleigh, NC

Tel: 919-844-7510

#### New York, NY

Tel: 631-435-6000

#### San Jose, CA

Tel: 408-735-9110  
Tel: 408-436-4270

#### Canada - Toronto

Tel: 905-695-1980  
Fax: 905-695-2078

### ASIA/PACIFIC

**Australia - Sydney**  
Tel: 61-2-9868-6733

**China - Beijing**  
Tel: 86-10-8569-7000

**China - Chengdu**  
Tel: 86-28-8665-5511

**China - Chongqing**  
Tel: 86-23-8980-9588

**China - Dongguan**  
Tel: 86-769-8702-9880

**China - Guangzhou**  
Tel: 86-20-8755-8029

**China - Hangzhou**  
Tel: 86-571-8792-8115

**China - Hong Kong SAR**  
Tel: 852-2943-5100

**China - Nanjing**  
Tel: 86-25-8473-2460

**China - Qingdao**  
Tel: 86-532-8502-7355

**China - Shanghai**  
Tel: 86-21-3326-8000

**China - Shenyang**  
Tel: 86-24-2334-2829

**China - Shenzhen**  
Tel: 86-755-8864-2200

**China - Suzhou**  
Tel: 86-186-6233-1526

**China - Wuhan**  
Tel: 86-27-5980-5300

**China - Xian**  
Tel: 86-29-8833-7252

**China - Xiamen**  
Tel: 86-592-2388138

**China - Zhuhai**  
Tel: 86-756-3210040

### ASIA/PACIFIC

**India - Bangalore**  
Tel: 91-80-3090-4444

**India - New Delhi**  
Tel: 91-11-4160-8631

**India - Pune**  
Tel: 91-20-4121-0141

**Japan - Osaka**  
Tel: 81-6-6152-7160

**Japan - Tokyo**  
Tel: 81-3-6880-3770

**Korea - Daegu**  
Tel: 82-53-744-4301

**Korea - Seoul**  
Tel: 82-2-554-7200

**Malaysia - Kuala Lumpur**  
Tel: 60-3-7651-7906

**Malaysia - Penang**  
Tel: 60-4-227-8870

**Philippines - Manila**  
Tel: 63-2-634-9065

**Singapore**  
Tel: 65-6334-8870

**Taiwan - Hsin Chu**  
Tel: 886-3-577-8366

**Taiwan - Kaohsiung**  
Tel: 886-7-213-7830

**Taiwan - Taipei**  
Tel: 886-2-2508-8600

**Thailand - Bangkok**  
Tel: 66-2-694-1351

**Vietnam - Ho Chi Minh**  
Tel: 84-28-5448-2100

### EUROPE

**Austria - Wels**  
Tel: 43-7242-2244-39  
Fax: 43-7242-2244-393

**Denmark - Copenhagen**  
Tel: 45-4485-5910  
Fax: 45-4485-2829

**Finland - Espoo**  
Tel: 358-9-4520-820

**France - Paris**  
Tel: 33-1-69-53-63-20  
Fax: 33-1-69-30-90-79

**Germany - Garching**  
Tel: 49-8931-9700

**Germany - Haan**  
Tel: 49-2129-3766400

**Germany - Heilbronn**  
Tel: 49-7131-72400

**Germany - Karlsruhe**  
Tel: 49-721-625370

**Germany - Munich**  
Tel: 49-89-627-144-0  
Fax: 49-89-627-144-44

**Germany - Rosenheim**  
Tel: 49-8031-354-560

**Israel - Ra'anana**  
Tel: 972-9-744-7705

**Italy - Milan**  
Tel: 39-0331-742611  
Fax: 39-0331-466781

**Italy - Padova**  
Tel: 39-049-7625286

**Netherlands - Drunen**  
Tel: 31-416-690399  
Fax: 31-416-690340

**Norway - Trondheim**  
Tel: 47-7288-4388

**Poland - Warsaw**  
Tel: 48-22-3325737

**Romania - Bucharest**  
Tel: 40-21-407-87-50

**Spain - Madrid**  
Tel: 34-91-708-08-90  
Fax: 34-91-708-08-91

**Sweden - Gothenberg**  
Tel: 46-31-704-60-40

**Sweden - Stockholm**  
Tel: 46-8-5090-4654

**UK - Wokingham**  
Tel: 44-118-921-5800  
Fax: 44-118-921-5820