

256-Kbit SPI Bus Low-Power Serial SRAM

Device Selection Table

Part Number	Vcc Range	Page Size	Temperature Ranges	Packages
23K256	2.7V-3.6V	32 Byte	I, E	P, SN, ST
23A256	1.5V-1.95V	32 Byte	I	P, SN, ST

Features

- Maximum Clock 20 MHz
- Low-Power CMOS Technology:
 - Read Current: 3 mA at 1 MHz
 - Standby Current: 4 μ A maximum at +85°C
- 32,768 x 8-bit Organization
- 32-Byte Page
- $\overline{\text{HOLD}}$ Pin
- Flexible Operating Modes:
 - Byte read and write
 - Page mode (32-Byte Page)
 - Sequential mode
- Sequential Read/Write
- High Reliability
- Temperature Ranges Supported:
 - Industrial (I): -40°C to +85°C
 - Extended (E): -40°C to +125°C
- Pb-Free and RoHS Compliant, Halogen Free
- Automotive AEC-Q100 Qualified

Pin Function Table

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

Description

The Microchip Technology Inc. 23X256 are 256-Kbit 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) plus separate data in (SI) and data out (SO) lines. Access to the device is controlled through a Chip Select (CS) input.

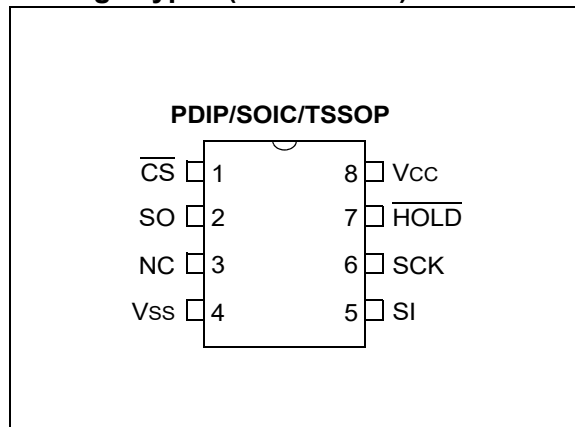
Communication to the device can be paused via the hold pin ($\overline{\text{HOLD}}$). While the device is paused, transitions on its inputs will be ignored, with the exception of Chip Select, allowing the host to service higher priority interrupts.

Note: 23X256 is used in this document as a generic part number for the 23A256/23K256 devices.

Packages

- 8-lead PDIP
- 8-lead SOIC
- 8-lead TSSOP

Package Types (not to scale)



1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings (†)

VCC.....	4.5V
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
ESD protection on all pins.....	2kV

† **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 Extended (E): TA = -40°C to +125°C				
Param. No.	Symbol	Characteristic	Minimum	Typical ⁽¹⁾	Maximum	Units	Test Conditions
D001	VCC	Supply Voltage	1.5	—	1.95	V	23A256 (I-Temp)
D001	VCC	Supply Voltage	2.7	—	3.6	V	23K256 (I,E-Temp)
D002	V _{IH}	High-Level Input Voltage	0.7 VCC	—	VCC +0.3	V	
D003	V _{IL}	Low-Level Input Voltage	-0.3	—	0.2xVCC	V	
			-0.3	—	0.15xVCC	V	23K256 (E-Temp)
D004	V _{OL}	Low-Level Output Voltage	—	—	0.2	V	I _{OL} = 1 mA
D005	V _{OH}	High-Level Output Voltage	VCC -0.5	—	—	V	I _{OH} = -400 μA
D006	I _{LI}	Input Leakage Current	—	—	±0.5	μA	$\overline{CS} = VCC, V_{IN} = VSS \text{ OR } VCC$
D007	I _{LO}	Output Leakage Current	—	—	±0.5	μA	$\overline{CS} = VCC, V_{OUT} = VSS \text{ OR } VCC$
D008	I _{CC Read}	Operating Current	—	—	3	mA	F _{CLK} = 1 MHz; SO = 0
			—	—	6	mA	F _{CLK} = 10 MHz; SO = 0
			—	—	10	mA	F _{CLK} = 20 MHz; SO = 0
D009	I _{CCS}	Standby Current	—	0.2	1	μA	$\overline{CS} = VCC = 1.8V, \text{ Inputs tied to } VCC \text{ or } VSS$
			—	1	4	μA	$\overline{CS} = VCC = 3.6V, \text{ Inputs tied to } VCC \text{ or } VSS$
			—	5	10	μA	$\overline{CS} = VCC = 3.6V, \text{ Inputs tied to } VCC \text{ or } VSS @ +125^\circ C$
D010	C _{INT}	Input Capacitance			7	pF	VCC = 0V, f = 1 MHz, Ta = +25°C (Note 1)
D011	V _{DR}	RAM Data Retention Voltage	—	1.2	—	V	Note 2

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_{DD} 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 Extended (E): TA = -40°C to +125°C			
Param. No.	Symbol	Characteristic	Minimum	Maximum	Units	Test Conditions
1	FCLK	Clock Frequency	—	10	MHz	VCC = 1.5V (I-Temp)
			—	16	MHz	VCC = 1.8V (I-Temp)
			—	16	MHz	VCC = 3.0V (E-Temp)
			—	20	MHz	VCC = 3.0V (I-Temp)
2	TCSS	$\overline{\text{CS}}$ Setup Time	50	—	ns	VCC = 1.5V (I-Temp)
			32	—	ns	VCC = 1.8V (I-Temp)
			32	—	ns	VCC = 3.0V (E-Temp)
			25	—	ns	VCC = 3.0V (I-Temp)
3	TCSH	$\overline{\text{CS}}$ Hold Time	50	—	ns	VCC = 1.5V (I-Temp)
			50	—	ns	VCC = 1.8V (I-Temp)
			50	—	ns	VCC = 3.0V (E-Temp)
			50	—	ns	VCC = 3.0V (I-Temp)
4	TCSD	$\overline{\text{CS}}$ Disable Time	50	—	ns	VCC = 1.5V (I-Temp)
			32	—	ns	VCC = 1.8V (I-Temp)
			32	—	ns	VCC = 3.0V (E-Temp)
			25	—	ns	VCC = 3.0V (I-Temp)
5	Tsu	Data Setup Time	10	—	ns	VCC = 1.5V (I-Temp)
			10	—	ns	VCC = 1.8V (I-Temp)
			10	—	ns	VCC = 3.0V (E-Temp)
			10	—	ns	VCC = 3.0V (I-Temp)
6	THD	Data Hold Time	10	—	ns	VCC = 1.5V (I-Temp)
			10	—	ns	VCC = 1.8V (I-Temp)
			10	—	ns	VCC = 3.0V (E-Temp)
			10	—	ns	VCC = 3.0V (I-Temp)
7	TR	CLK Rise Time	—	2	us	Note 1
8	TF	CLK Fall Time	—	2	us	Note 1
9	THI	Clock High Time	50	—	ns	VCC = 1.5V (I-Temp)
			32	—	ns	VCC = 1.8V (I-Temp)
			32	—	ns	VCC = 3.0V (E-Temp)
			25	—	ns	VCC = 3.0V (I-Temp)
10	TLO	Clock Low Time	50	—	ns	VCC = 1.5V (I-Temp)
			32	—	ns	VCC = 1.8V (I-Temp)
			32	—	ns	VCC = 3.0V (E-Temp)
			25	—	ns	VCC = 3.0V (I-Temp)
11	TCLD	Clock Delay Time	50	—	ns	VCC = 1.5V (I-Temp)
			32	—	ns	VCC = 1.8V (I-Temp)
			32	—	ns	VCC = 3.0V (E-Temp)
			25	—	ns	VCC = 3.0V (I-Temp)

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

TABLE 1-2: AC CHARACTERISTICS (CONTINUED)

AC CHARACTERISTICS			Industrial (I): TA = -40°C to +85°C Extended (E): TA = -40°C to +125°C			
Param. No.	Symbol	Characteristic	Minimum	Maximum	Units	Test Conditions
12	TV	Output Valid from Clock Low	—	50	ns	VCC = 1.5V (I-Temp)
			—	32	ns	VCC = 1.8V (I-Temp)
			—	32	ns	VCC = 3.0V (E-Temp)
			—	25	ns	VCC = 3.0V (I-Temp)
13	THO	Output Hold Time	0	—	ns	Note 1
14	TDIS	Output Disable Time	—	20	ns	VCC = 1.5V (I-Temp)
			—	20	ns	VCC = 1.8V (I-Temp)
			—	20	ns	VCC = 3.0V (E-Temp)
			—	20	ns	VCC = 3.0V (I-Temp)
15	THS	$\overline{\text{HOLD}}$ Setup Time	10	—	ns	
16	THH	$\overline{\text{HOLD}}$ Hold Time	10	—	ns	
17	THZ	$\overline{\text{HOLD}}$ Low to Output High-Z	10	—	ns	
18	THV	$\overline{\text{HOLD}}$ 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
Operating temperature	-40°C to +125°C
CL = 100 pF	—
Timing Measurement Reference Level:	
Input	0.5 VCC
Output	0.5 VCC

FIGURE 1-1: HOLD TIMING

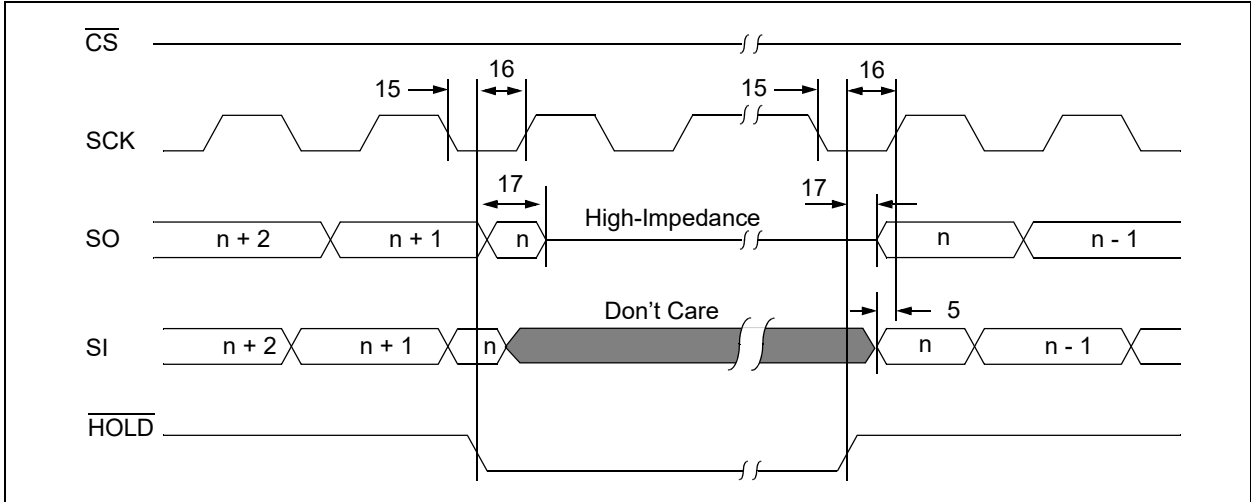


FIGURE 1-2: SERIAL INPUT TIMING

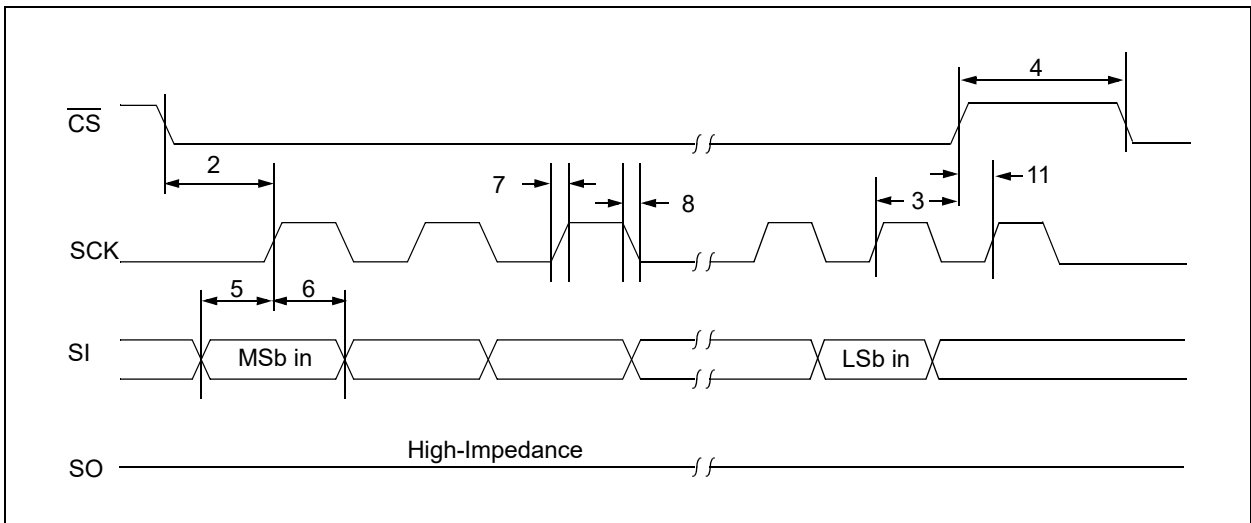
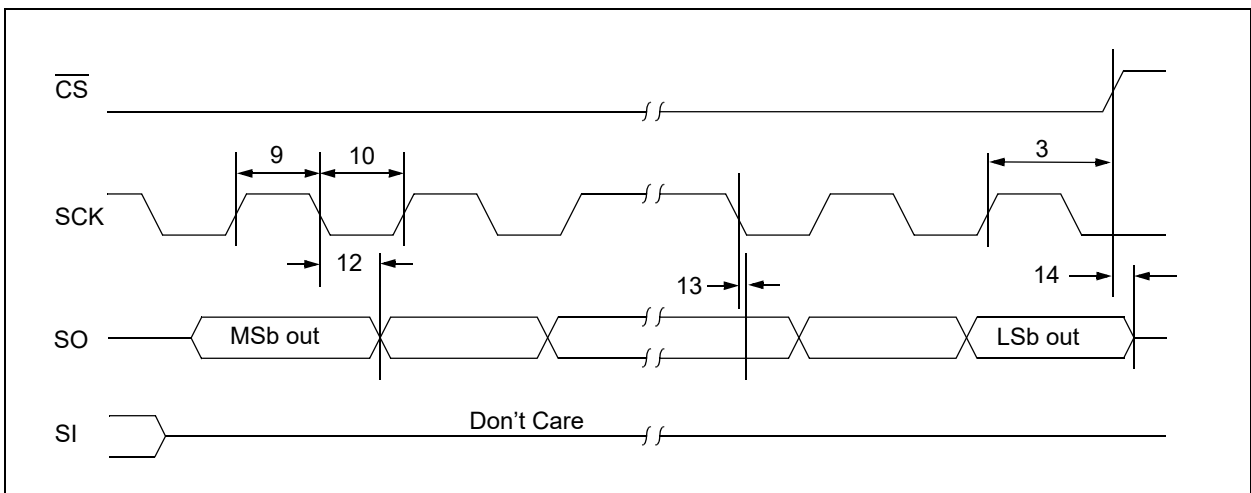


FIGURE 1-3: SERIAL OUTPUT TIMING



2.0 FUNCTIONAL DESCRIPTION

2.1 Principles of Operation

The 23X256 is a 32,768-byte 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.

The 23X256 contains an 8-bit instruction register. The device is accessed via the SI pin, with data being clocked in on the rising edge of SCK. The \overline{CS} pin must be low and the HOLD pin must be high for the entire operation.

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

Data (SI) is sampled on the first rising edge of SCK after \overline{CS} goes low. If the clock line is shared with other peripheral devices on the SPI bus, the user can assert the HOLD input and place the 23X256 in 'HOLD' mode. After releasing the HOLD pin, operation will resume from the point when the HOLD was asserted.

2.2 Modes of Operation

The 23A256/23K256 has three modes of operation that are selected by setting bits 7 and 6 in the STATUS register. The modes of operation are Byte, Page and Burst.

Byte Operation – is selected when bits 7 and 6 in the STATUS register are set to 00. In this mode, the read/write operations are limited to only one byte. The Command followed by the 16-bit address is clocked into the device and the data to/from the device is transferred on the next 8 clocks (see Figure 2-1, Figure 2-2).

Page Operation – is selected when bits 7 and 6 in the STATUS register are set to 10. The 23A256/23K256 has 1024 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, Figure 2-4).

Sequential Operation – is selected when bits 7 and 6 in the STATUS 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 0x0000 (see 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 23X256 followed by the 16-bit address, with the first MSb 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 Page mode, after the first byte of data is shifted out, the next memory location on the page can be read out by continuing to provide clock pulses. This allows for 32 consecutive address reads. After the 32nd address read the internal address counter wraps back to the byte 0 address in that page.

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 (7FFFh), the address counter rolls over to address 0000h, allowing the read cycle to be continued indefinitely. The read operation is terminated by raising the \overline{CS} pin (see Figure 2-1).

2.4 Write Sequence

Prior to any attempt to write data to the 23X256, 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 16-bit address, with the first MSb of the address being a "don't care" bit 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 (7FFFh), the address counter rolls over to (0000h). This allows the operation to continue indefinitely, however, previous data will be overwritten.

TABLE 2-1: INSTRUCTION SET

Instruction Name	Instruction Format	Description
READ	0000 0011	Read data from memory array beginning at selected address
WRITE	0000 0010	Write data to memory array beginning at selected address
RDSR	0000 0101	Read STATUS register
WRSR	0000 0001	Write STATUS register

FIGURE 2-1: BYTE READ SEQUENCE

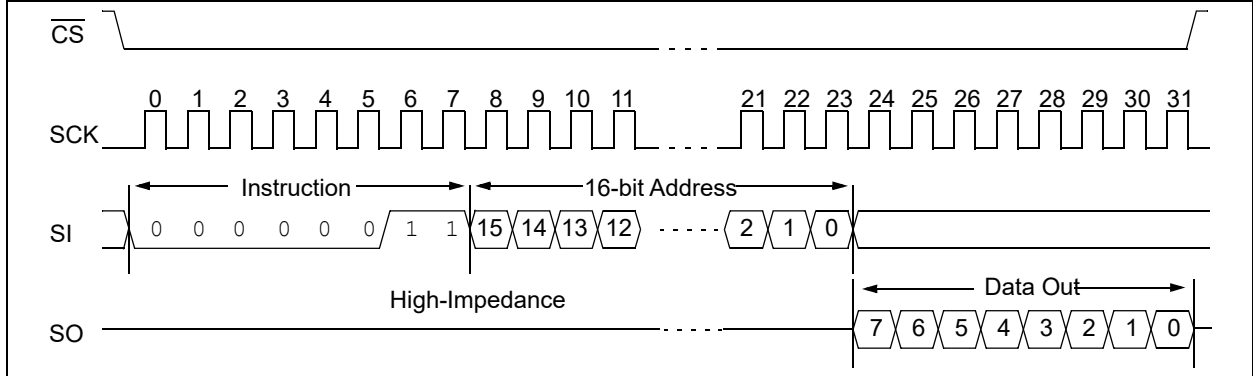


FIGURE 2-2: BYTE WRITE SEQUENCE

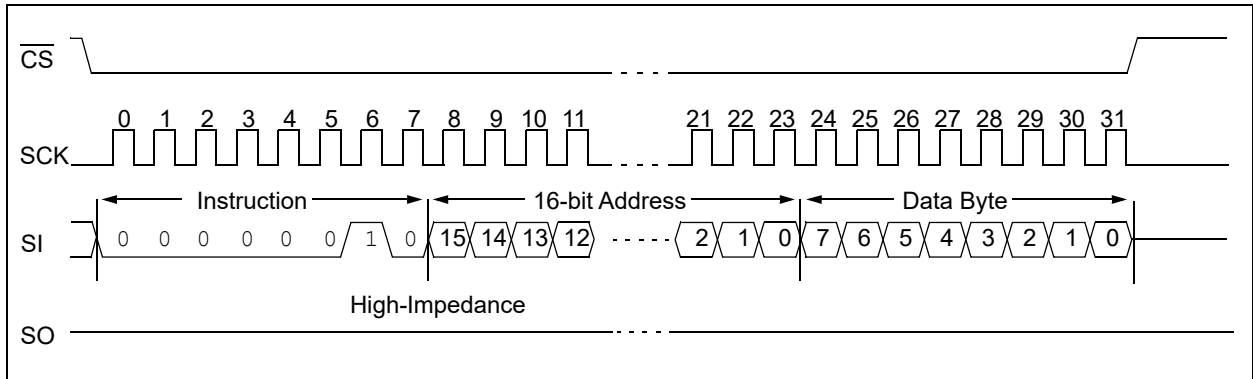


FIGURE 2-3: PAGE READ SEQUENCE

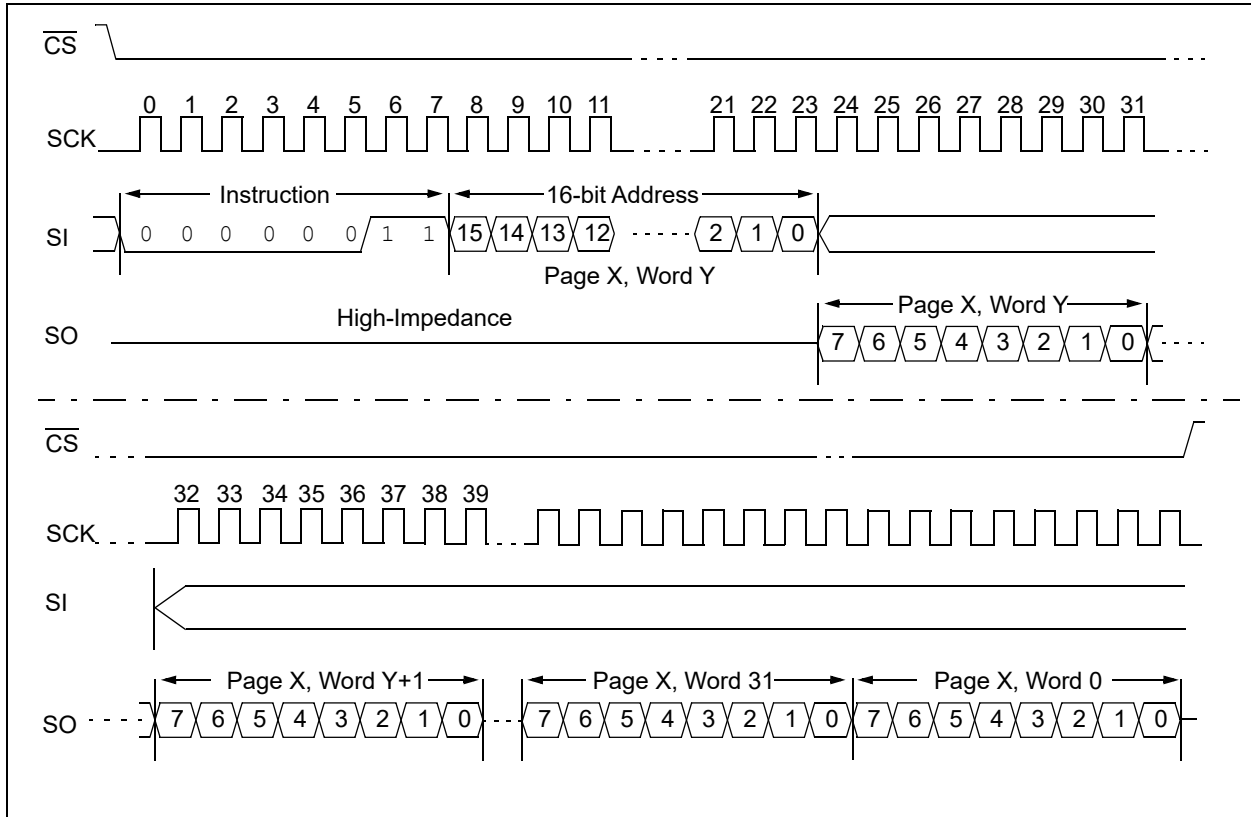


FIGURE 2-4: PAGE WRITE SEQUENCE

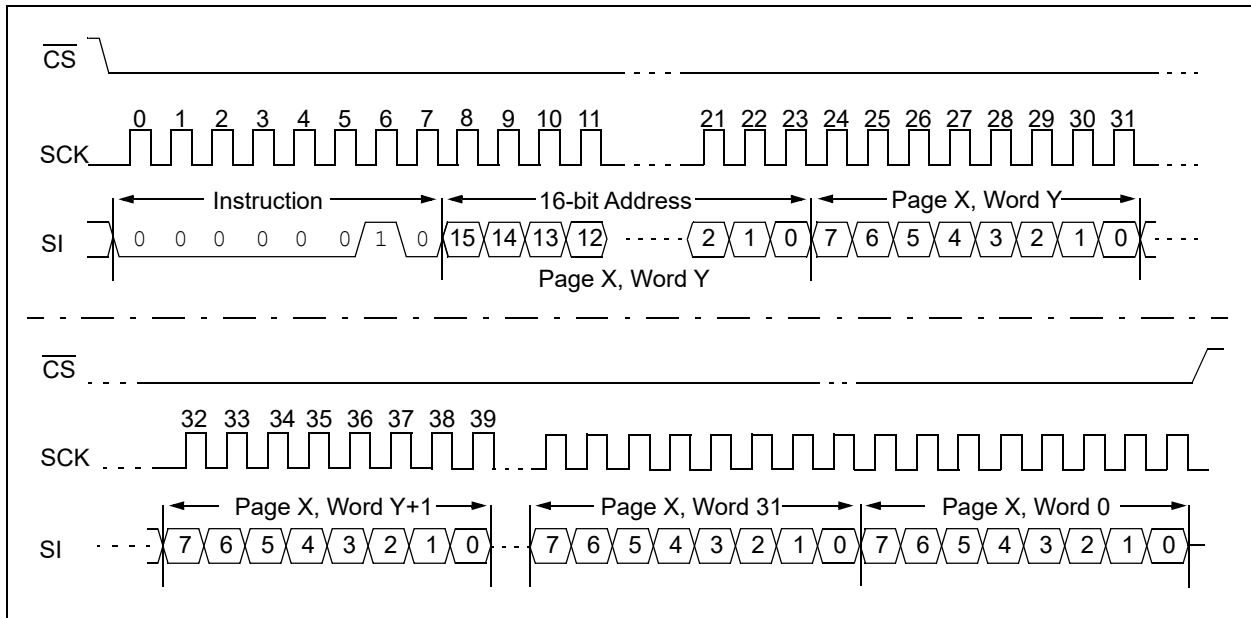


FIGURE 2-5: SEQUENTIAL READ SEQUENCE

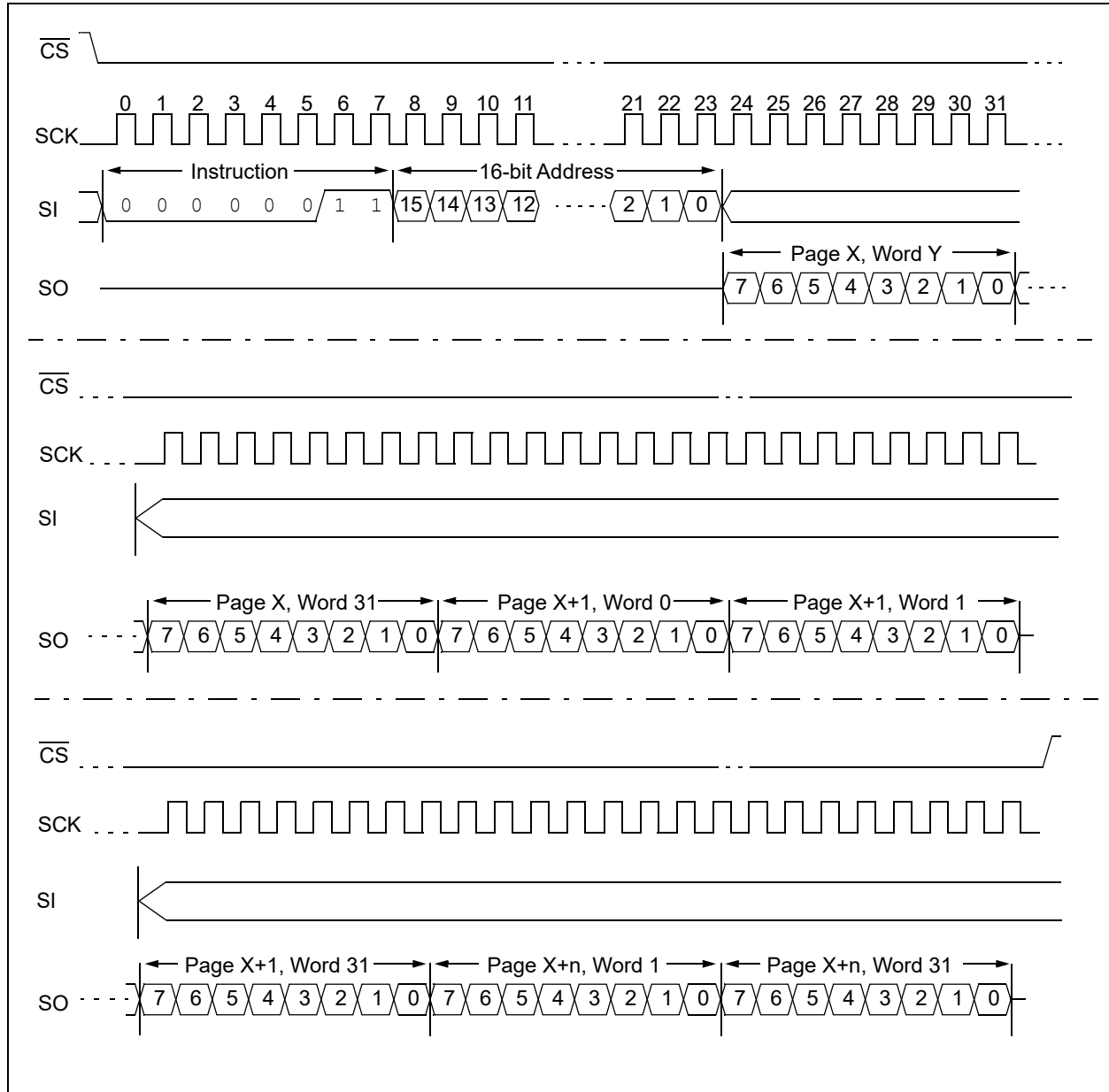
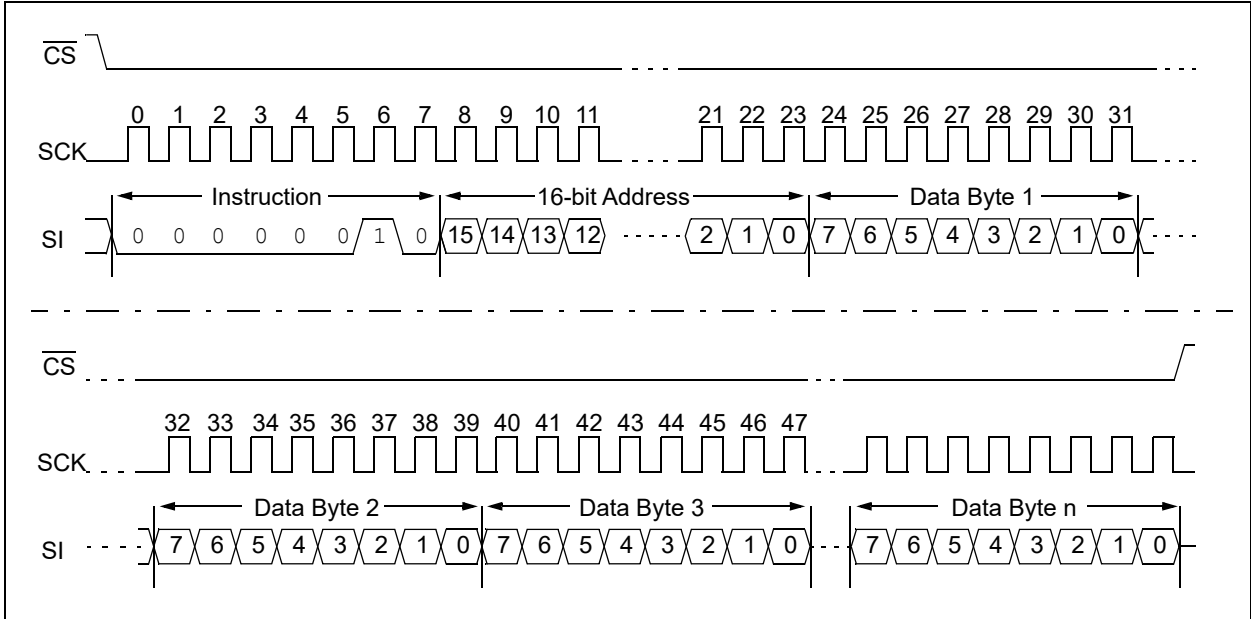


FIGURE 2-6: SEQUENTIAL WRITE SEQUENCE



2.5 Read Status Register Instruction (RDSR)

The Read Status Register instruction (RDSR) provides access to the STATUS register. The STATUS register may be read at any time. The STATUS register is formatted as follows:

TABLE 2-2: STATUS REGISTER

7	6	5	4	3	2	1	0
W/R	W/R	-	-	-	-	-	W/R
MODE	MODE	0	0	0	0	0	HOLD

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 (default operation)
- 1 0 = Page mode
- 0 1 = Sequential mode
- 1 1 = Reserved

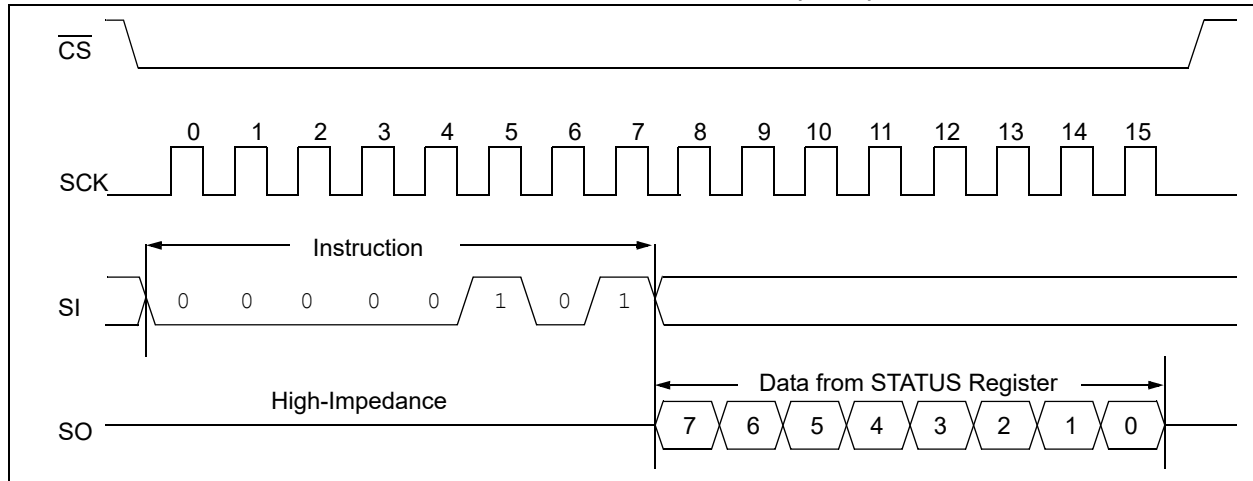
Write and read commands are shown in [Figure 2-7](#) and [Figure 2-8](#).

The HOLD bit enables the Hold pin functionality. It must be set to a '0' before HOLD pin is brought low for HOLD function to work properly. Setting HOLD to '1' disables the feature.

Bits 1 through 5 are reserved and should always be set to '0'.

See [Figure 2-7](#) for the RDSR timing sequence.

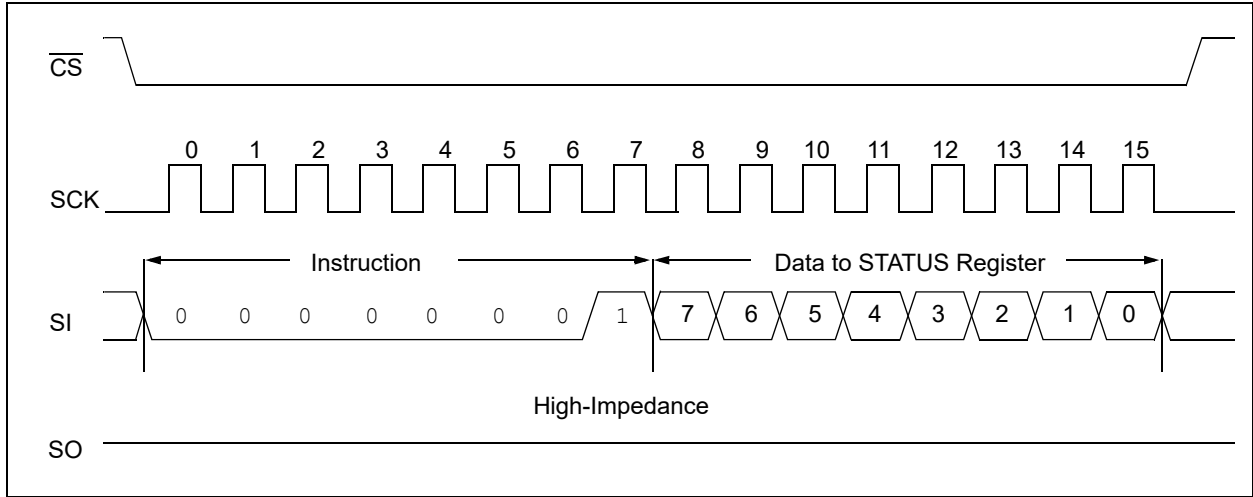
FIGURE 2-7: READ STATUS REGISTER TIMING SEQUENCE (RDSR)



2.6 Write Status Register Instruction (WRSR)

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

FIGURE 2-8: WRITE STATUS REGISTER TIMING SEQUENCE (WRSR)



2.7 Power-On State

The 23X256 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

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	1	1	Chip Select Input
SO	2	2	2	Serial Data Output
Vss	4	4	4	Ground
SI	5	5	5	Serial Data Input
SCK	6	6	6	Serial Clock Input
$\overline{\text{HOLD}}$	7	7	7	Hold Input
Vcc	8	8	8	Supply Voltage

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

A low level on this pin selects the device. A high level deselects the device and forces it into Standby mode. 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 23X256. During a read cycle, data is 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 is latched on the rising edge of the serial clock.

3.4 Serial Clock (SCK)

The SCK is used to synchronize the communication between a host and the 23X256. 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.

3.5 Hold ($\overline{\text{HOLD}}$)

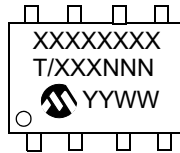
The $\overline{\text{HOLD}}$ pin is used to suspend transmission to the 23X256 while in the middle of a serial sequence without having to retransmit the entire sequence again. It must be held high any time this function is not being used. Once the device is selected and a serial sequence is underway, the $\overline{\text{HOLD}}$ pin may be pulled low to pause further serial communication without resetting the serial sequence. The $\overline{\text{HOLD}}$ pin must be brought low while SCK is low, otherwise the HOLD function will not be invoked until the next SCK high-to-low transition. The 23X256 must remain selected during this sequence. The SI, SCK and SO pins are in a high-impedance state during the time the device is paused and transitions on these pins will be ignored. To resume serial communication, $\overline{\text{HOLD}}$ must be brought high while the SCK pin is low, otherwise serial communication will not resume. Lowering the HOLD line at any time will tri-state the SO line.

Hold functionality is disabled by the STATUS register bit.

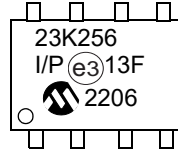
4.0 PACKAGING INFORMATION

4.1 Package Marking Information

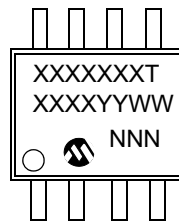
8-Lead PDIP



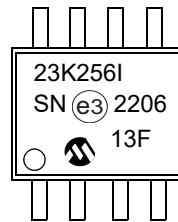
Example



8-Lead SOIC (3.90 mm)



Example



8-Lead TSSOP



Example



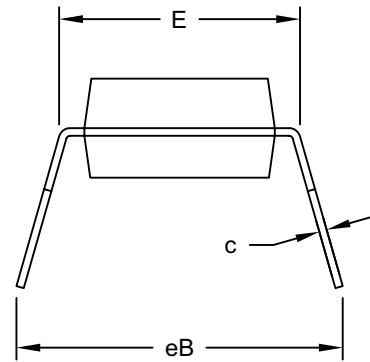
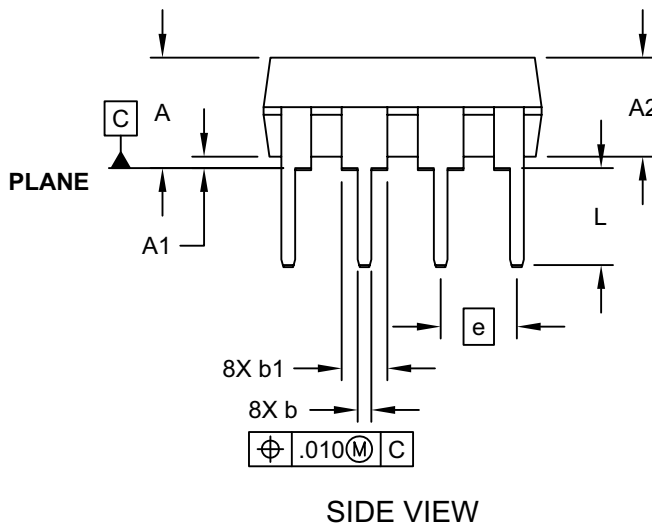
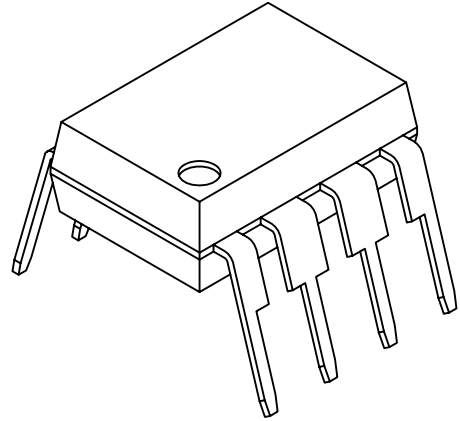
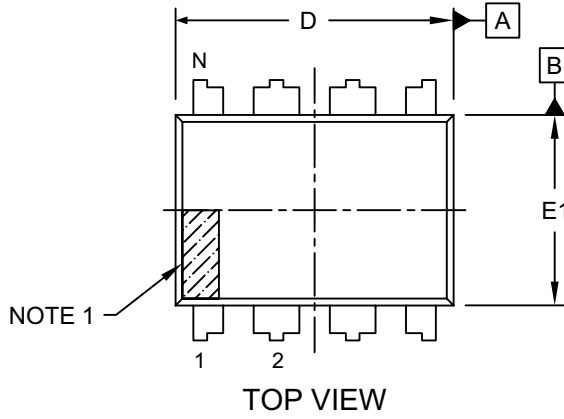
Legend:	XX...X	Part number or part number code
	T	Temperature (I, E)
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code (2 characters for small packages)
	(e3)	Pb-free JEDEC designator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

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/packageing>

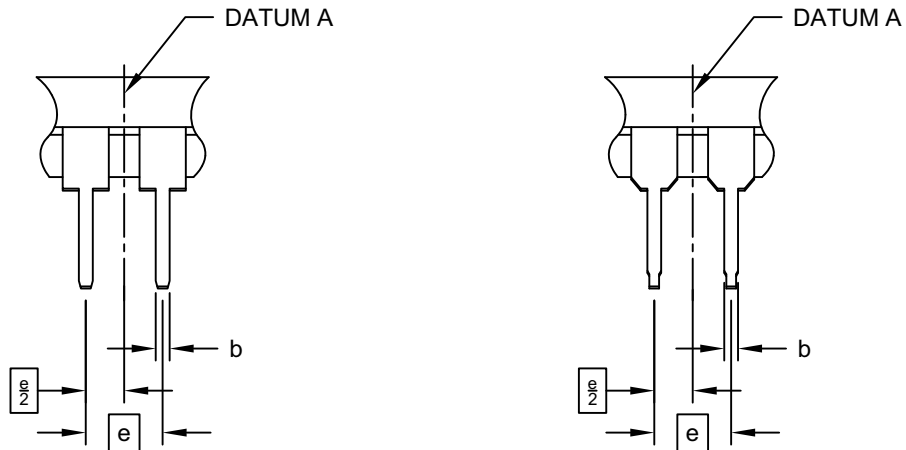


Microchip Technology Drawing No. C04-018-P Rev E Sheet 1 of 2

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

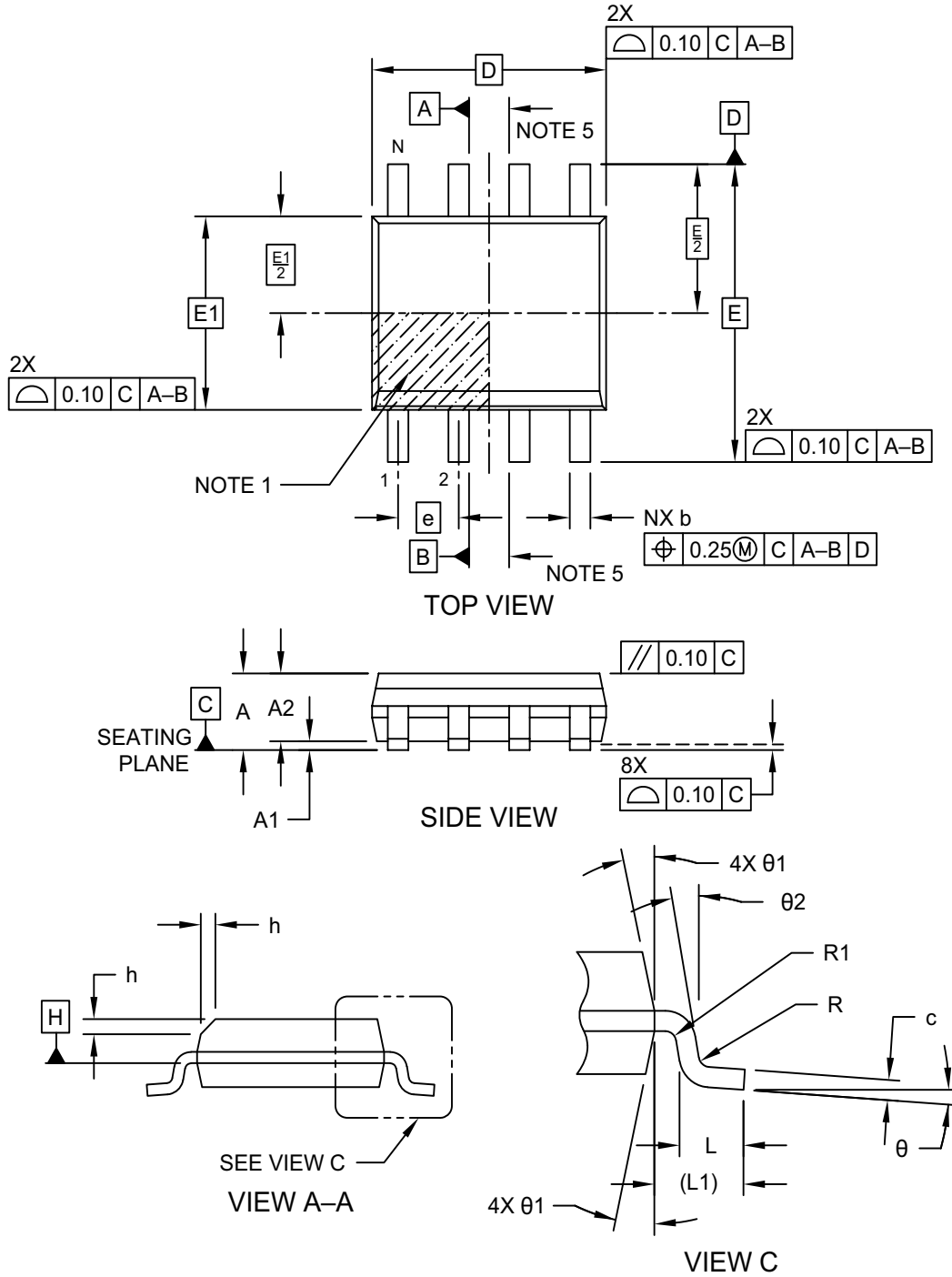
Notes:

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 .010" per side.
4. Dimensioning and tolerancing per ASME Y14.5M
BSC: Basic Dimension. Theoretically exact value shown without tolerances.
5. 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]

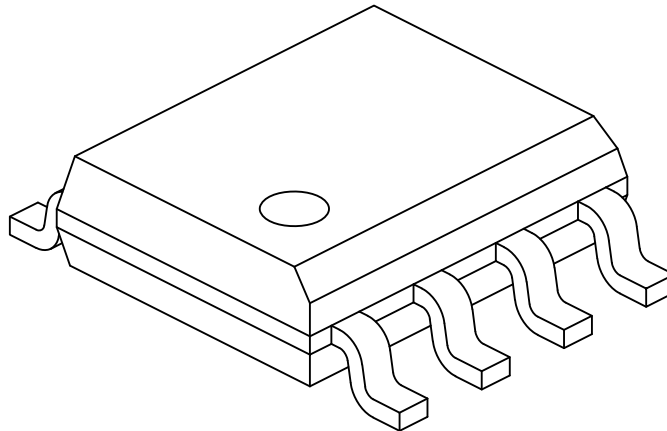
Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Microchip Technology Drawing No. C04-057-SN Rev H Sheet 1 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>



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		
Lead Thickness	c	0.17	–	0.25
Lead Width	b	0.31	–	0.51
Lead Bend Radius	R	0.07	–	–
Lead Bend Radius	R1	0.07	–	–
Foot Angle	θ	0°	–	8°
Mold Draft Angle	θ1	5°	–	15°
Lead Angle	θ2	0°	–	8°

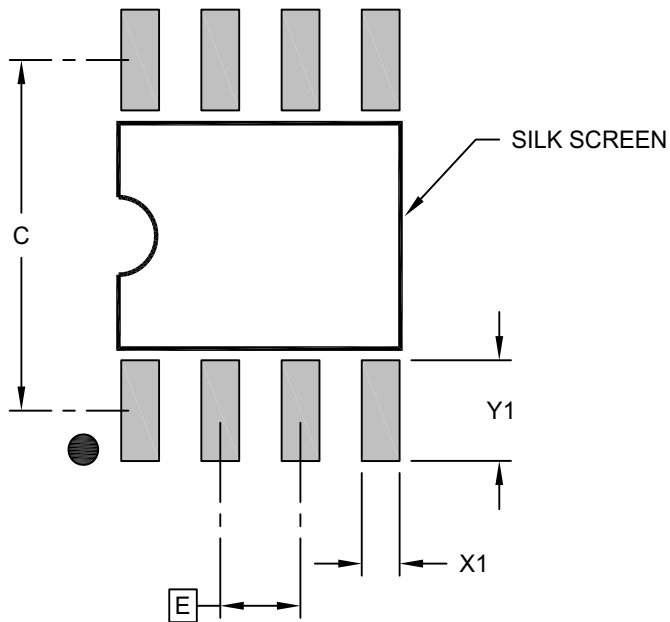
Notes:

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 H 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

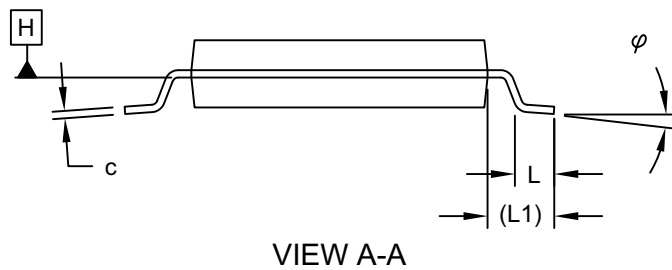
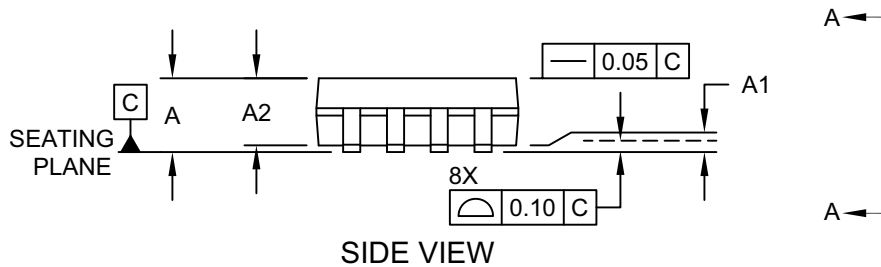
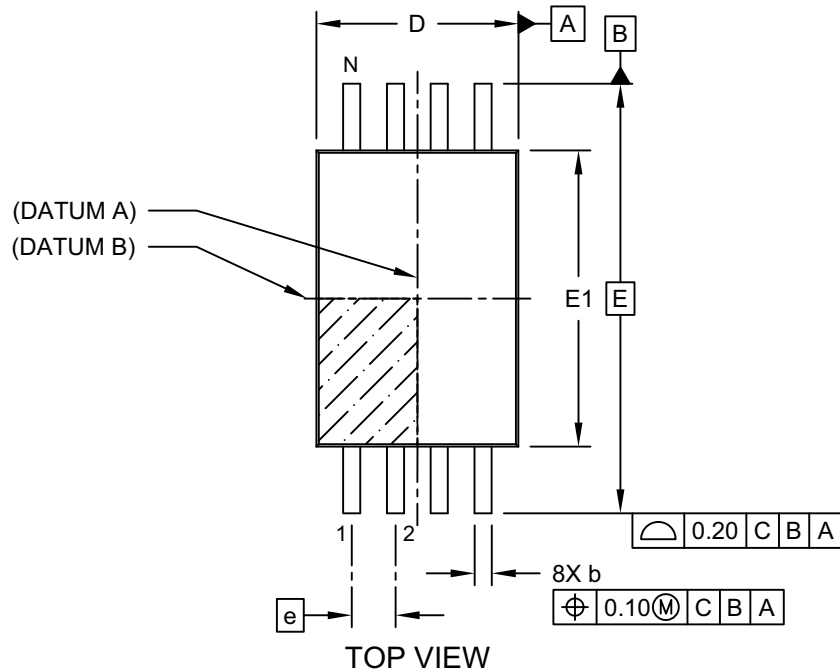
Notes:

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

Microchip Technology Drawing C04-2057-SN Rev H

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

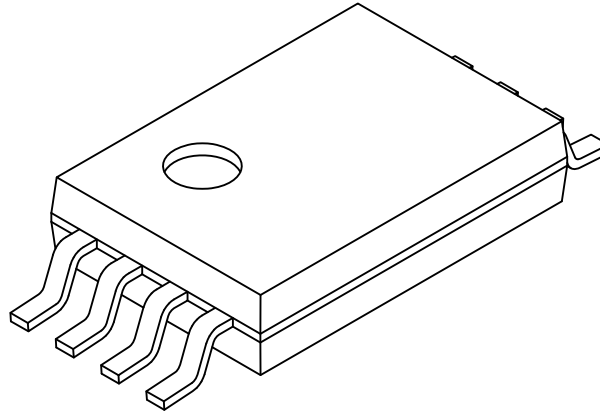
Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



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>



		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	-	-	
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	ϕ	0°	4°	8°	
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 0.20mm per side.
3. Dimensioning and tolerancing per ASME Y14.5M

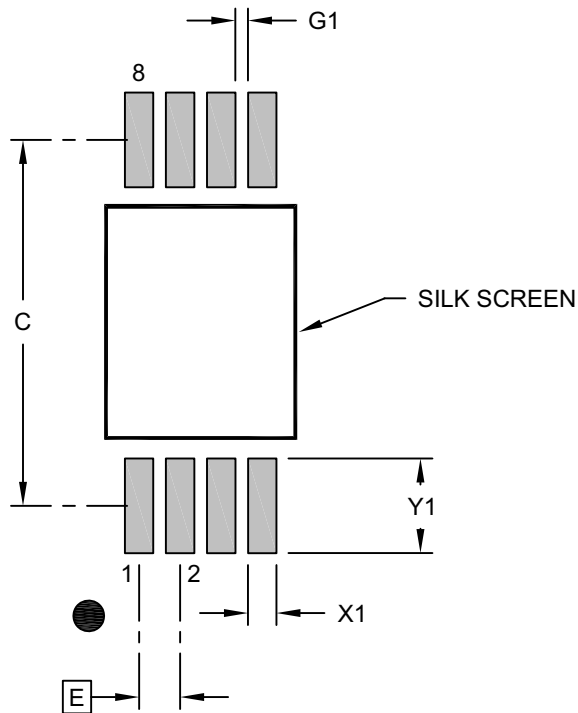
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

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

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

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:

- Dimensioning and tolerancing per ASME Y14.5M
BSC: Basic Dimension. Theoretically exact value shown without tolerances.
- 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 G (04/2022)

Replaced Automotive with Extended; Replaced terminology “Master” with “Host”; Updated PDIP, SOIC and TSSOP package drawings.

Revision F (10/2011)

Revised Parameter D003 in Table 1-1: DC Characteristics.

Revision E (08/2010)

Revised Table 1-1, Param. No. D009; Revised Package Drawings.

Revision D (04/2009)

Removed Preliminary status; Revised Standby Current; Revised Table 1-1, Param. No. D009; Revised TSSOP Package marking; Revised Product ID.

Revision C (01/2009)

Revised Section 2.5: Added a paragraph.

Revision B (12/2008)

Updates; Table 1-1, add Param. D011.

Revision A (11/2008)

Original Release.

THE MICROCHIP WEBSITE

Microchip provides online support via our website at 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. 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>X⁽¹⁾</u>	<u>-X</u>	<u>/XX</u>
Device		Tape and Reel Option	Temperature Range	Package
Device:		23A256 =	256-Kbit, 1.8V, SPI Serial SRAM	
		23K256 =	256-Kbit, 3.6V, SPI Serial SRAM	
Tape and Reel Option⁽¹⁾:	Reel	Blank =	Standard packaging (tube)	
		T =	Tape & Reel	
Temperature Range:		I =	-40°C to+85°C	
		E =	-40°C to+125°C	
Package:		P =	Plastic PDIP (300 mil body), 8-lead	
		SN =	Plastic SOIC (3.90 mml body), 8-lead	
		ST =	TSSOP, 8-lead	

Examples:

- a) 23K256-I/ST: 256-Kbit, 3.6V Serial SRAM, Industrial temperature, TSSOP package
- b) 23A256T-I/SN: 256-Kbit, 1.8V Serial SRAM, Industrial temperature, Tape and Reel, SOIC package
- c) 23K256-E/ST: 256-Kbit, 3.6V Serial SRAM, Extended temperature, TSSOP package

Note 1: 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.

Note the following details of the code protection feature on Microchip products:

- 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, within operating specifications, and under normal conditions.
- Microchip values and aggressively protects its intellectual property rights. Attempts to breach the code protection features of Microchip product is strictly prohibited and may violate the Digital Millennium Copyright Act.
- 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. Microchip is committed to continuously improving the code protection features of our products.

This publication and the information herein may be used only with Microchip products, including to design, test, and integrate Microchip products with your application. Use of this information in any other manner violates these terms. Information regarding device applications 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. Contact your local Microchip sales office for additional support or, obtain additional support at <https://www.microchip.com/en-us/support/design-help/client-support-services>.

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.

Trademarks

The Microchip name and logo, the Microchip logo, Adaptec, AnyRate, AVR, AVR logo, AVR Freaks, BesTime, BitCloud, CryptoMemory, CryptoRF, dsPIC, flexPWR, HELDO, IGLOO, JukeBlox, KeeLoq, Kleer, LANCheck, LinkMD, maXStylus, maXTouch, MediaLB, megaAVR, Microsemi, Microsemi logo, MOST, MOST logo, MPLAB, OptoLyzer, 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, QuietWire, SmartFusion, SyncWorld, Temux, TimeCesium, TimeHub, TimePictra, TimeProvider, TrueTime, 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, GridTime, IdealBridge, In-Circuit Serial Programming, ICSP, INICnet, Intelligent Paralleling, Inter-Chip Connectivity, JitterBlocker, Knob-on-Display, maxCrypto, maxView, memBrain, Mindi, MiWi, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, NVM Express, NVMe, 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, SmartHLS, SMART-I.S., storClad, SQL, 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, Symmcom, and Trusted Time 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.

© 2008-2022, Microchip Technology Incorporated and its subsidiaries.

All Rights Reserved.

ISBN: 978-1-6683-0265-1



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

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