64-Mbit (x16) Multi-Purpose Flash Plus

SST39VF6401B/SST39VF6402B

The SST39VF6401B/SST39VF6402B devices are 4-Mbit x16, CMOS Multi-Purpose Flash Plus (MPF+) manufactured with proprietary, high-performance CMOS SuperFlash technology. The split-gate cell design and thick-oxide tunneling injector attain better reliability and manufacturability compared with alternate approaches. The SST39VF6401B/SST39VF6402B write (Program or Erase) with a 2.7V-3.6V power supply. These devices conform to JEDEC® standard pinouts for x16 memories and are command set compatible with other Flash devices, enabling customers to save time and resources in implementation.

Features

- **Organized as 4-Mbit x16**
- **Single Voltage Read and Write Operations:**
  - 2.7V-3.6V
- **Superior Reliability:**
  - Endurance: 100,000 cycles (typical)
  - Greater than 100 years data retention
- **Low-Power Consumption (typical values at 5 MHz):**
  - Active current: 9 mA (typical)
  - Standby current: 3 µA (typical)
  - Auto Low Power mode: 3 µA (typical)
- **Hardware Block Protection/WP# Input Pin:**
  - Top Block Protection (top 32 KWord) for SST39VF6402B
  - Bottom Block Protection (bottom 32 KWord) for SST39VF6401B
- **Sector Erase Capability**
  - Uniform 2-KWord sectors
- **Block Erase Capability:**
  - Uniform 32-KWord blocks
- **Chip Erase Capability**
- **Erase Suspend/Erase Resume Capabilities**
- **Hardware Reset Pin (RST#)**
- **Security ID Feature:**
  - Microchip: 128 bits; User: 128 bits
- **Fast Read Access Time:**
  - 70 ns
- **Latched Address and Data**
- **Fast Erase and Word Program:**
  - Sector Erase time: 18 ms (typical)
  - Block Erase time: 18 ms (typical)
  - Chip Erase time: 40 ms (typical)
  - Word Program time: 7 µs (typical)
- **Automatic Write Timing:**
  - Internal V_{PP} generation
- **End-of-Write Detection**
  - Toggle Bits
  - Data# Polling
- **CMOS I/O Compatibility**
- **JEDEC Standard:**
  - Flash EEPROM pin assignments
  - Software command sequence compatibility
    - Address format is 11 bits, A_{10}-A_0
    - Block Erase 6th bus write cycle is 30H
    - Sector Erase 6th bus write cycle is 50H
- **Packages Available:**
  - 48-lead TSOP (12 mm x 20 mm)
- **All devices are RoHS compliant**

Product Description

The SST39VF640xB devices are 4-Mbit x16 CMOS Multi-Purpose Flash Plus (MPF+) manufactured with proprietary, high-performance CMOS SuperFlash technology. The split-gate cell design and thick-oxide tunneling injector attain better reliability and manufacturability compared with alternate approaches. The SST39VF640xB write (Program or Erase) with a 2.7V-3.6V power supply. These devices conform to JEDEC standard pin assignments for x16 memories.

Featuring high-performance Word Program, the SST39VF640xB devices provide a typical Word Program time of 7 µsec. These devices use Toggle Bit or Data# Polling to indicate the completion of Program operation. To protect against inadvertent write, they have on-chip hardware and software Data Protection schemes. Designed, manufactured and tested for a wide spectrum of applications, these devices are offered with a typical endurance of 100,000 cycles. Data retention is rated at greater than 100 years.

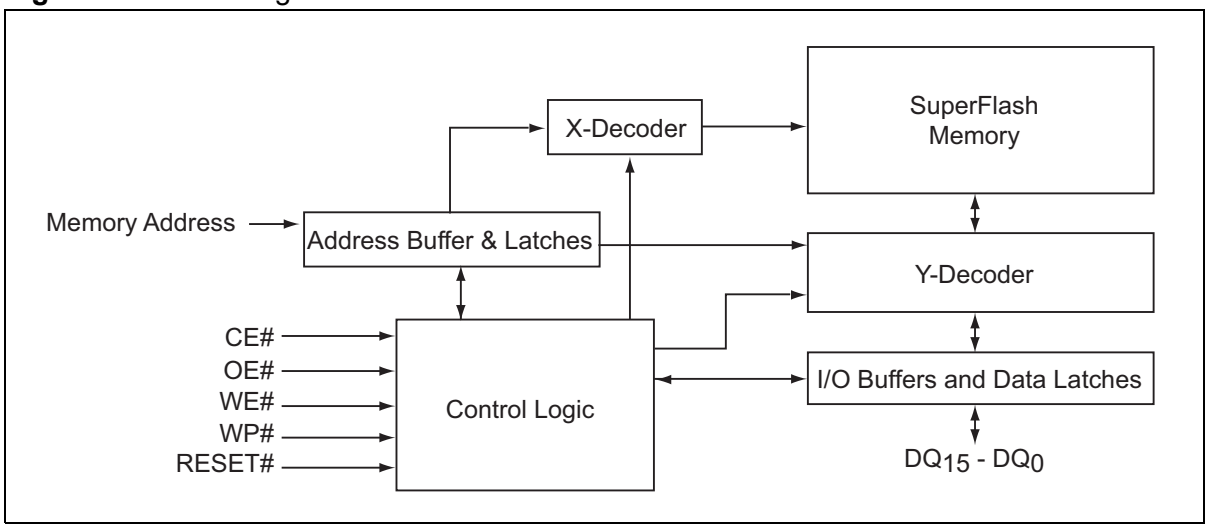
The SST39VF640xB devices are suited for applications that require convenient and economical updating of program, configuration or data memory. For all system applications, they significantly improve performance and reliability, while lowering power consumption. They inherently use less energy during Erase and Program than alternative Flash technologies. The total energy consumed is a function of the applied voltage, current and time of application. For any given voltage range, the SuperFlash technology uses less current to program and has a shorter erase time. As a result, the total energy consumed during any Erase or Program operation is less than alternative Flash technologies. These devices also improve flexibility while lowering the cost for program, data and configuration storage applications.

The SuperFlash technology provides fixed Erase and Program times, independent of the number of Erase/Program cycles that have occurred. Therefore the system software or hardware does not have to be modified or derated as is necessary with alternative Flash technologies, whose Erase and Program times increase with accumulated Erase/Program cycles.

To meet high-density, surface mount requirements, the SST39VF640xB devices are offered in 48-lead TSOP package. See Figure 2 for pin assignments.

Block Diagram

Figure 1: Block Diagram



Pin Assignments

Figure 2: Pin Assignments for 48-Lead TSOP

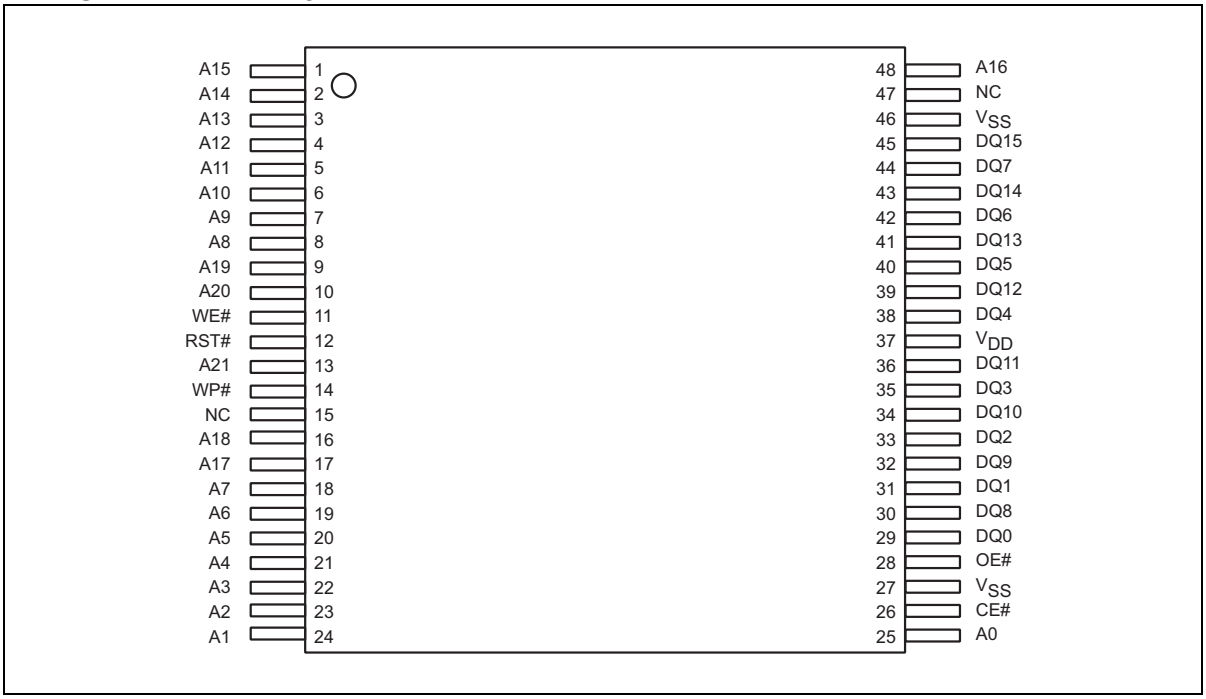


Table 1: Pin Description

Symbol	Pin Name	Functions
A_{MS}[1]-A_0	Address Inputs	To provide memory addresses. During Sector Erase, A_{MS}-A_{11} address lines will select the sector. During Block Erase, A_{MS}-A_{15} address lines will select the block.
DQ_{15}-DQ_0	Data Input/Output	To output data during Read cycles and receive input data during Write cycles. Data are internally latched during a Write cycle. The outputs are in tri-state when OE# or CE# is high.
WP#	Write Protect	To protect the top/bottom boot block from Erase/Program operation when grounded.
RST#	Reset	To reset and return the device to Read mode.
CE#	Chip Enable	To activate the device when CE# is low.
OE#	Output Enable	To gate the data output buffers.
WE#	Write Enable	To control the Write operations.
V_{DD}	Power Supply	To provide power supply voltage: 2.7V-3.6V
V_{SS}	Ground	
NC	No Connection	Unconnected pins.

1. A_{MS} = Most significant address; A_{MS} = A_{21} for SST39VF640xB

Device Operation

Commands are used to initiate the memory operation functions of the device. Commands are written to the device using standard microprocessor write sequences. A command is written by asserting WE# low while keeping CE# low. The address bus is latched on the falling edge of WE# or CE#, whichever occurs last. The data bus is latched on the rising edge of WE# or CE#, whichever occurs first.

The SST39VF640xB devices also have Auto Low Power mode which puts the device in a near standby mode after data have been accessed with a valid Read operation. This reduces the I_{DD} active read current from typically 9 mA to typically 3 µA. Auto Low Power mode reduces the typical I_{DD} active read current to the range of 2 mA/MHz of Read cycle time. The device exits Auto Low Power mode with any address transition or control signal transition used to initiate another Read cycle, with no access time penalty. Note that the device does not enter Auto Low Power mode after power-up with CE# held steadily low, until the first address transition or CE# is driven high.

Read

The Read operation of the SST39VF640xB is controlled by CE# and OE#, both of which have to be low for the system to obtain data from the outputs. CE# is used for device selection. When CE# is high, the chip is deselected and only standby power is consumed. OE# is the output control and is used to gate data from the output pins. The data bus is in high-impedance state when either CE# or OE# is high. Refer to Figure 3 for further details.

Word Program Operation

The SST39VF640xB are programmed on a word-by-word basis. Before programming, the sector where the word exists must be fully erased. The Program operation is accomplished in three steps. The first step is the 3-byte load sequence for Software Data Protection. The second step is to load word address and word data. During the Word Program operation, the addresses are latched on the falling edge of either CE# or WE#, whichever occurs last. The data are latched on the rising edge of either CE# or WE#, whichever occurs first. The third step is the internal Program operation which is initiated after the rising edge of the fourth WE# or CE#, whichever occurs first. The Program operation, once initiated, will be completed within 10 µs. See Figures 4 and 5 for WE# and CE# controlled Program operation timing diagrams and Figure 19 for a flowchart. During the Program operation, the only valid reads are Data# Polling and Toggle Bit. During the internal Program operation, the host is free to perform additional tasks. Any commands issued during the internal Program operation are ignored. During the command sequence, WP# should be statically held high or low.

Sector/Block Erase Operation

The Sector (or Block) Erase operation allows the system to erase the device on a sector-by-sector (or block-by-block) basis. The SST39VF640xB offer both Sector Erase and Block Erase mode. The sector architecture is based on uniform sector size of 2 KWords. The Block Erase mode is based on uniform block size of 32 KWords. The Sector Erase operation is initiated by executing a 6-byte command sequence with Sector Erase command (50H) and sector address (SA) in the last bus cycle. The Block Erase operation is initiated by executing a 6-byte command sequence with Block Erase command (30H) and block address (BA) in the last bus cycle. The sector or block address is latched on the falling edge of the sixth WE# pulse, while the command (50H or 30H) is latched on the rising edge of the sixth WE# pulse. The internal Erase operation begins after the sixth WE# pulse.

The End-of-Erase operation can be determined using either Data# Polling or Toggle Bit methods. See Figures 9 and 10 for timing waveforms and Figure 23 for a flowchart. Any commands issued during the Sector or Block Erase operation are ignored. When WP# is low, any attempt to Sector (Block) Erase the protected block will be ignored. During the command sequence, WP# should be statically held high or low.

Erase Suspend/Erase Resume Commands

The Erase Suspend operation temporarily suspends a Sector or Block Erase operation thus allowing data to be read from any memory location or program data into any sector/block that is not suspended for an Erase operation. The operation is executed by issuing one byte command sequence with Erase Suspend command (B0H). The device automatically enters read mode typically within 20 µs after the Erase Suspend command had been issued. Valid data can be read from any sector or block that is not suspended from an Erase operation. Reading at address location within erase suspended sectors/blocks will output DQ_2 toggling and DQ_6 at '1'. While in Erase Suspend mode, a Word Program operation is allowed except for the sector or block selected for Erase Suspend.

To resume Sector Erase or Block Erase operation which has been suspended, the system must issue Erase Resume command. The operation is executed by issuing one byte command sequence with Erase Resume command (30H) at any address in the last Byte sequence.

Chip Erase Operation

The SST39VF640xB provide a Chip Erase operation, which allows the user to erase the entire memory array to the '1' state. This is useful when the entire device must be quickly erased.

The Chip Erase operation is initiated by executing a 6-byte command sequence with Chip Erase command (10H) at address 555H in the last byte sequence. The Erase operation begins with the rising edge of the sixth WE# or CE#, whichever occurs first. During the Erase operation, the only valid read is Toggle Bit or Data# Polling. See Table 6 for the command sequence, Figure 9 for timing diagram and Figure 23 for the flowchart. Any commands issued during the Chip Erase operation are ignored. When WP# is low, any attempt to Chip Erase will be ignored. During the command sequence, WP# should be statically held high or low.

Write Operation Status Detection

The SST39VF640xB provide two software means to detect the completion of a Write (Program or Erase) cycle to optimize the system write cycle time. The software detection includes two Status bits: Data# Polling (DQ_7) and Toggle Bit (DQ_6). The End-of-Write detection mode is enabled after the rising edge of WE#, which initiates the internal Program or Erase operation.

The actual completion of the nonvolatile write is asynchronous with the system; therefore, either a Data# Polling or Toggle Bit read may be simultaneous with the completion of the write cycle. If this occurs, the system may get an erroneous result, i.e., valid data may appear to conflict with either DQ_7 or DQ_6. To prevent spurious rejection, if an erroneous result occurs, the software routine should include a loop to read the accessed location an additional two (2) times. If both reads are valid, then the device has completed the Write cycle, otherwise the rejection is valid.

Data# Polling (DQ_7)

When the SST39VF640xB are in the internal Program operation, any attempt to read DQ_7 will produce the complement of the true data. Once the Program operation is completed, DQ_7 will produce true data. Note that even though DQ_7 may have valid data immediately following the completion of an internal Write operation, the remaining data outputs may still be invalid: valid data on the entire data bus will appear in subsequent successive Read cycles after an interval of 1 µs. During internal Erase operation, any attempt to read DQ_7 will produce a '0'. Once the internal Erase operation is completed, DQ_7 will produce a '1'. The Data# Polling is valid after the rising edge of fourth WE# (or CE#) pulse for Program operation. For Sector, Block or Chip Erase, the Data# Polling is valid after the rising edge of sixth WE# (or CE#) pulse. See Figure 6 for Data# Polling timing diagram and Figure 20 for a flowchart.

Toggle Bits (DQ6 and DQ2)

During the internal Program or Erase operation, any consecutive attempts to read DQ_6 will produce alternating '1's and '0's, i.e., toggling between 1 and 0. When the internal Program or Erase operation is completed, the DQ_6 bit will stop toggling. The device is then ready for the next operation. For Sector, Block or Chip Erase, the toggle bit (DQ_6) is valid after the rising edge of sixth WE# (or CE#) pulse. DQ_6 will be set to '1' if a Read operation is attempted on an Erase Suspended Sector/Block. If Program operation is initiated in a sector/block not selected in Erase Suspend mode, DQ_6 will toggle.

An additional Toggle Bit is available on DQ_2, which can be used in conjunction with DQ_6 to check whether a particular sector is being actively erased or erase-suspended. Table 2 shows detailed Status bits information. The Toggle Bit (DQ_2) is valid after the rising edge of the last WE# (or CE#) pulse of Write operation. See Figure 7 for Toggle Bit timing diagram and Figure 20 for a flowchart.

Table 2: Write Operation Status

Status		DQ_7	DQ_6	DQ_2
Normal Operation	Standard Program	DQ_7#	Toggle	No Toggle
	Standard Erase	0	Toggle	Toggle
Erase Suspend Mode	Read from Erase Suspended Sector/Block	1	1	Toggle
	Read from Non-Erase Suspended Sector/Block	Data	Data	Data
	Program	DQ_7#	Toggle	N/A

Note: DQ_7 and DQ_2 require a valid address when reading status information.

Data Protection

The SST39VF640xB provide both hardware and software features to protect nonvolatile data from inadvertent writes.

Hardware Data Protection

Noise/Glitch Protection: A WE# or CE# pulse of less than 5 ns will not initiate a write cycle.

V_{DD} Power Up/Down Detection: The Write operation is inhibited when V_{DD} is less than 1.5V.

Write Inhibit Mode: Forcing OE# low, CE# high or WE# high will inhibit the Write operation. This prevents inadvertent writes during power-up or power-down.

Hardware Block Protection

The SST39VF6402B supports top hardware block protection, which protects the top 32 KWord blocks of the device. The SST39VF6401B supports bottom hardware block protection, which protects the bottom 32 KWord blocks of the device. The Boot Block address ranges are described in Table 3. Program and Erase operations are prevented on the 32 KWord blocks when WP# is low. If WP# is left floating, it is internally held high via a pull-up resistor, and the Boot Block is unprotected, enabling Program and Erase operations on that block.

Table 3: Boot Block Address Ranges

Product	Address Range
Bottom Boot Block	
SST39VF6401B	000000H-007FFFH
Top Boot Block	
SST39VF6402B	3F8000H-3FFFFFH

Hardware Reset (RST#)

The RST# pin provides a hardware method of resetting the device to read array data. When the RST# pin is held low for at least T_{RP}, any in-progress operation will terminate and return to Read mode. When no internal Program/Erase operation is in progress, a minimum period of T_{RHR} is required after RST# is driven high before a valid Read can take place (see Figure 15).

The Erase or Program operation that has been interrupted needs to be reinitiated after the device resumes normal operation mode to ensure data integrity.

Software Data Protection (SDP)

The SST39VF640xB provide the JEDEC approved Software Data Protection scheme for all data alteration operations, i.e., Program and Erase. Any Program operation requires the inclusion of the 3-byte sequence. The 3-byte load sequence is used to initiate the Program operation, providing optimal protection from inadvertent Write operations, e.g., during the system power-up or power-down. Any Erase operation requires the inclusion of 6-byte sequence. These devices are shipped with the Software Data Protection permanently enabled. See Table 6 for the specific software command codes. During the SDP command sequence, invalid commands will abort the device to read mode within T_{RC}. The contents of DQ_{15}-DQ_8 can be V_{IL} or V_{IH}, but no other value, during any SDP command sequence.

Common Flash Memory Interface (CFI)

The SST39VF640xB also contain the CFI information to describe the characteristics of the device. To enter CFI Query mode, the system must write the 3-byte sequence, same as product ID entry command with 98H (CFI Query command) to address 555H in the last byte sequence. Once the device enters CFI Query mode, the system can read CFI data at the addresses given in Tables 7 through 9. The system must write the CFI Exit command to return to Read mode from the CFI Query mode.

Product Identification

The Product Identification mode identifies the devices as the SST39VF6401B and SST39VF6402B, and the manufacturer as Microchip. This mode may be accessed through software operations. Users may use the Software Product Identification operation to identify the part (i.e., using the device ID) when using multiple manufacturers in the same socket. For details, see Table 6 for software operation, Figure 11 for the Software ID Entry and Read timing diagram and Figure 21 for the Software ID Entry command sequence flowchart.

Table 4: Product Identification

	Address	Data
Manufacturer's ID	0000H	BFH
Device ID		
SST39VF6401B	0001H	236DH
SST39VF6402B	0001H	236CH

Product Identification Mode Exit/CFI Mode Exit

To return to the standard Read mode, the Software Product Identification mode must be exited. Exit is accomplished by issuing the Software ID Exit command sequence, which returns the device to Read mode. This command may also be used to reset the device to Read mode after any inadvertent transient condition that causes the device to behave abnormally, e.g., not read correctly. Please note that the Software ID Exit/CFI Exit command is ignored during an internal Program or Erase operation. See Table 6 for software command codes, Figure 13 for timing waveform and Figures 21 and 22 for flowcharts.

Security ID

The SST39VF640xB devices offer a 256-bit Security ID space. The Secure ID space is divided into two 128-bit segments: one factory-programmed segment and one user-programmed segment. The first segment is programmed and locked at Microchip with a random 128-bit number. The user segment is left unprogrammed for the customer to program as desired.

To program the user segment of the Security ID, the user must use the Security ID Word-Program command. To detect end-of-write for the SEC ID, read the toggle bits. Do not use Data# Polling. Once this is complete, the Sec ID should be locked using the User Sec ID Program Lock-Out. This disables any future corruption of this space. Note that regardless of whether or not the Sec ID is locked, neither Sec ID segment can be erased.

The Secure ID space can be queried by executing a 3-byte command sequence with Enter Sec ID command (88H) at address 555H in the last byte sequence. To exit this mode, the Exit Sec ID command should be executed. Refer to Table 6 for more details.

Operations

Table 5: Operation Modes Selection

Mode	CE#	OE#	WE#	DQ	Address
Read	V_{IL}	V_{IL}	V_{IH}	D_{OUT}	A_{IN}
Program	V_{IL}	V_{IH}	V_{IL}	D_{IN}	A_{IN}
Erase	V_{IL}	V_{IH}	V_{IL}	X[1]	Sector or block address, XXH for Chip Erase
Standby	V_{IH}	X	X	High-Z	X
Write Inhibit	X	V_{IL}	X	High-Z/ D_{OUT}	X
	X	X	V_{IH}	High-Z/ D_{OUT}	X
Product Identification					
Software Mode	V_{IL}	V_{IL}	V_{IH}		See Table 6

1. X can be V_{IL} or V_{IH}, but no other value

Table 6: Software Command Sequence

Command Sequence	1st Bus Write Cycle		2nd Bus Write Cycle		3rd Bus Write Cycle		4th Bus Write Cycle		5th Bus Write Cycle		6th Bus Write Cycle	
	Addr[1]	Data[2]	Addr[1]	Data[2]	Addr[1]	Data[2]	Addr[1]	Data[2]	Addr[1]	Data[2]	Addr[1]	Data[2]
Word Program	555H	AAH	2AAH	55H	555H	A0H	WA[3]	Data				
Sector Erase	555H	AAH	2AAH	55H	555H	80H	555H	AAH	2AAH	55H	SA_X[4]	50H
Block Erase	555H	AAH	2AAH	55H	555H	80H	555H	AAH	2AAH	55H	BA_X[4]	30H
Chip Erase	555H	AAH	2AAH	55H	555H	80H	555H	AAH	2AAH	55H	555H	10H
Erase Suspend	XXXXH	B0H										
Erase Resume	XXXXH	30H										
Query Sec ID[5]	555H	AAH	2AAH	55H	555H	88H						
User Security ID Word Program	555H	AAH	2AAH	55H	555H	A5H	WA[6]	Data				
User Security ID Program Lock-Out	555H	AAH	2AAH	55H	555H	85H	XXH[6]	0000H				
Software ID Entry[7,,8]	555H	AAH	2AAH	55H	555H	90H						

1. Address format A_{10}-A_0 (Hex).
Addresses A_{11}- A_{21} can be V_{IL} or $V_{IH,}$ but no other value, for Command sequence for SST39VF640xB.
2. DQ_{15}-DQ_8 can be V_{IL} or V_{IH}, but no other value for Command sequence.
3. WA = Program Word address
4. SA_X for Sector Erase; uses A_{MS}-A_{11} address lines
   BA_X, for Block Erase; uses A_{MS}-A_{15} address lines
   A_{MS} = Most significant address
   A_{MS} = A_{21} for SST39VF640xB
5. With A_{MS}-A_4 = 0;Sec ID is read with A_3-A_0,
   SST ID is read with A_3 = 0 (Address range = 000000H to 000007H),
   User ID is read with A_3 = 1 (Address range = 000010H to 000017H).
   Lock Status is read with A_7-A_0 = 0000FFH. Unlocked: DQ_3 = 1 / Locked: DQ_3 = 0.
6. Valid Word-Addresses for Sec ID are from 000000H-000007H and 000010H-000017H.
7. The device does not remain in Software Product ID Mode if powered down.
8. With A_{MS}-A_1 =0; Manufacturer ID = 00BFH, is read with A_0 = 0,
   SST39VF6401B Device ID = 236DH, is read with A_0 = 1,
   SST39VF6402B Device ID = 236CH, is read with A_0 = 1.
   A_{MS} = Most significant address
   A_{MS} = A_{21} for SST39VF640xB
9. Both Software ID Exit operations are equivalent.
10. If users never lock after programming, Sec ID can be programmed over the previously unprogrammed bits (data=1) using the Sec ID mode again (the programmed '0' bits cannot be reversed to '1'). Valid Word-Addresses for Sec ID are from 000000H-000007H and 000010H-000017H.

Table 6: Software Command Sequence

Command Sequence	1st Bus Write Cycle		2nd Bus Write Cycle		3rd Bus Write Cycle		4th Bus Write Cycle		5th Bus Write Cycle		6th Bus Write Cycle	
CFI Query Entry	555H	AAH	2AAH	55H	555H	98H						
Software ID Exit[9,10] /CFI Exit/Sec ID Exit	555H	AAH	2AAH	55H	555H	F0H						
Software ID Exit[9,10,] /CFI Exit/Sec ID Exit	XXH	F0H										

1. Address format A_{10}-A_0 (Hex).
Addresses A_{11}- A_{21} can be V_{IL} or $V_{IH,}$ but no other value, for Command sequence for SST39VF640xB.
2. DQ_{15}-DQ_8 can be V_{IL} or V_{IH}, but no other value for Command sequence.
3. WA = Program Word address
4. SA_X for Sector Erase; uses A_{MS}-A_{11} address lines
   BA_X, for Block Erase; uses A_{MS}-A_{15} address lines
   A_{MS} = Most significant address
   A_{MS} = A_{21} for SST39VF640xB
5. With A_{MS}-A_4 = 0;Sec ID is read with A_3-A_0,
   SST ID is read with A_3 = 0 (Address range = 000000H to 000007H),
   User ID is read with A_3 = 1 (Address range = 000010H to 000017H).
   Lock Status is read with A_7-A_0 = 0000FFH. Unlocked: DQ_3 = 1 / Locked: DQ_3 = 0.
6. Valid Word-Addresses for Sec ID are from 000000H-000007H and 000010H-000017H.
7. The device does not remain in Software Product ID Mode if powered down.
8. With A_{MS}-A_1 =0; Manufacturer ID = 00BFH, is read with A_0 = 0,
   SST39VF6401B Device ID = 236DH, is read with A_0 = 1,
   SST39VF6402B Device ID = 236CH, is read with A_0 = 1.
   A_{MS} = Most significant address
   A_{MS} = A_{21} for SST39VF640xB
9. Both Software ID Exit operations are equivalent.
10. If users never lock after programming, Sec ID can be programmed over the previously unprogrammed bits (data=1) using the Sec ID mode again (the programmed '0' bits cannot be reversed to '1'). Valid Word-Addresses for Sec ID are from 000000H-000007H and 000010H-000017H.

Table 7: CFI Query Identification String[1] for SST39VF640xB

Address	Data	Data
10H	0051H	Query Unique ASCII string "QRY"
11H	0052H	
12H	0059H	
13H	0002H	Primary OEM command set
14H	0000H	
15H	0000H	Address for Primary Extended Table
16H	0000H	
17H	0000H	Alternate OEM command set (00H = none exists)
18H	0000H	
19H	0000H	Address for Alternate OEM extended Table (00H = none exits)
1AH	0000H	

1. Refer to CFI publication 100 for more details.

Table 8: System Interface Information for SST39VF640xB

Address	Data	Data
1BH	0027H	V_{DD} Min (Program/Erase) DQ_7-DQ_4: Volts, DQ_3-DQ_0: 100 millivolts
1CH	0036H	V_{DD} Max (Program/Erase) DQ_7-DQ_4: Volts, DQ_3-DQ_0: 100 millivolts
1DH	0000H	V_{PP} min. (00H = no V_{PP} pin)
1EH	0000H	V_{PP} max. (00H = no V_{PP} pin)
1FH	0003H	Typical time out for Word-Program 2^N µs (2^3 = 8 µs)
20H	0000H	Typical time out for min. size buffer program 2^N µs (00H = not supported)
21H	0004H	Typical time out for individual Sector/Block-Erase 2^N ms (2^4 = 16 ms)
22H	0005H	Typical time out for Chip-Erase 2^N ms (2^5 = 32 ms)
23H	0001H	Maximum time out for Word-Program 2^N times typical (2^1 x 2^3 = 16 µs)
24H	0000H	Maximum time out for buffer program 2^N times typical
25H	0001H	Maximum time out for individual Sector/Block-Erase 2^N times typical (2^1 x 2^4 = 32 ms)
26H	0001H	Maximum time out for Chip-Erase 2^N times typical (2^1 x 2^5 = 64 ms)

Table 9: Device Geometry Information for SST39VF640xB

Address	Data	Data
27H	0017H	Device size = 2^N Bytes (17H = 23; 2^{23} = 8 MByte)
28H	0001H	Flash Device Interface description; 0001H = x16-only asynchronous interface
29H	0000H	
2AH	0000H	Maximum number of bytes in multi-byte write = 2^N (00H = not supported)
2BH	0000H	
2CH	0002H	Number of Erase Sector/Block sizes supported by device
2DH	00FFH	Sector Information (y + 1 = Number of sectors; z x 256B = sector size)
2EH	0007H	y = 2047 + 1 = 2048 sectors (07FFH = 2047)
2FH	0010H	
30H	0000H	z = 16 x 256 Bytes = 4 KBytes/sector (0010H = 16)
31H	007FH	Block Information (y + 1 = Number of blocks; z x 256B = block size)
32H	0000H	y =127 + 1 = 128 blocks (007FH = 127)
33H	0000H	
34H	0001H	z = 256 x 256 Bytes = 64 KBytes/block (0100H = 256)

Absolute Maximum Stress Ratings: (Applied conditions greater than those listed under "Absolute Maximum Stress Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these conditions or conditions greater than those defined in the operational sections of this data sheet is not implied. Exposure to absolute maximum stress rating conditions may affect device reliability.)

Temperature Under Bias . . . . . -55°C to +125°C
Storage Temperature . . . . . -65°C to +150°C
D. C. Voltage on Any Pin to Ground Potential . . . . . -0.5V to V_{DD}+0.5V
Transient Voltage (<20 ns) on Any Pin to Ground Potential . . . . . -2.0V to V_{DD}+2.0V
Voltage on A_9 Pin to Ground Potential . . . . . -0.5V to 13.2V
Package Power Dissipation Capability (T_A = 25°C) 1.0W
Surface Mount Solder Reflow Temperature[1] . . . . . 260°C for 10 seconds
Output Short Circuit Current[2] . . . . . 50 mA

1. Excluding certain with-Pb 32-PLCC units, all packages are 260°C capable in both non-Pb and with-Pb solder versions. Certain with-Pb 32-PLCC package types are capable of 240°C for 10 seconds; please consult the factory for the latest information.
2. Outputs shorted for no more than one second. No more than one output shorted at a time.

Table 10: Operating Range

Range	Ambient Temp	V_{DD}
Commercial	0°C to +70°C	2.7V-3.6V
Industrial	-40°C to +85°C	2.7V-3.6V

Table 11: AC Conditions of Test[1]

Input Rise/Fall Time	Output Load
5ns	C_L = 30 pF

1. See Figures 17 and 18.

Table 12: DC Operating Characteristics V_{DD} = 2.7V-3.6V[1]

Symbol	Parameter	Limits			Test Conditions
		Min	Max	Units	
I_{DD}	Power Supply Current				Address input = V_{ILT}/V_{IHT}[2], at f = 5 MHz, V_{DD} = V_{DD} Max
	Read[3]		18	mA	CE#=V_{IL}, OE#=WE#=V_{IH}, all I/Os open
	Program and Erase		35	mA	CE#=WE#=V_{IL}, OE#=V_{IH}
I_{SB}	Standby V_{DD} Current		20	µA	CE#=V_{IHC}, V_{DD}=V_{DD} Max
I_{ALP}	Auto Low Power		20	µA	CE#=V_{ILC}, V_{DD}=V_{DD} Max All inputs=V_{SS} or V_{DD}, WE#=V_{IHC}
I_{LI}	Input Leakage Current		1	µA	V_{IN}=GND to V_{DD}, V_{DD}=V_{DD} Max
I_{LIW}	Input Leakage Current on WP# pin and RST#		10	µA	WP#=GND to V_{DD} or RST#=GND to V_{DD}
I_{LO}	Output Leakage Current		10	µA	V_{OUT}=GND to V_{DD}, V_{DD}=V_{DD} Max
V_{IL}	Input Low Voltage		0.8	V	V_{DD}=V_{DD} Min
V_{ILC}	Input Low Voltage (CMOS)		0.3	V	V_{DD}=V_{DD} Max

Table 12: DC Operating Characteristics V_{DD} = 2.7V-3.6V[1]

Symbol	Parameter	Limits			Test Conditions
		Min	Max	Units	
V_{IH}	Input High Voltage	$0.7V_{DD}$		V	$V_{DD}=V_{DD}$ Max
V_{IHC}	Input High Voltage (CMOS)	V_{DD}-0.3		V	$V_{DD}=V_{DD}$ Max
V_{OL}	Output Low Voltage		0.2	V	I_{OL}=100 µA, $V_{DD}=V_{DD}$ Min
V_{OH}	Output High Voltage	V_{DD}-0.2		V	I_{OH}=-100 µA, $V_{DD}=V_{DD}$ Min

1. Typical conditions for the Active Current shown on the front page of the data sheet are average values at +25°C (room temperature), and V_{DD} = 3V. Not 100% tested.
2. See Figure 17 .
3. The I_{DD} current listed is typically less than 2mA/MHz, with OE# at V_{IH}. Typical V_{DD} is 3V.

Table 13: Recommended System Power-up Timings

Symbol	Parameter	Minimum	Units
$T_{PU-READ}$[1]	Power-up to Read Operation	100	µs
$T_{PU-WRITE}$[1]	Power-up to Program/Erase Operation	100	µs

1. This parameter is measured only for initial qualification and after a design or process change that could affect this parameter.

Table 14: Capacitance (T_A = +25°C, f=1 Mhz, other pins open)

Parameter	Description	Test Condition	Maximum
$C_{I/O}$[1]	I/O Pin Capacitance	$V_{I/O}$ = 0V	12 pF
C_{IN}[1]	Input Capacitance	V_{IN} = 0V	6 pF

1. This parameter is measured only for initial qualification and after a design or process change that could affect this parameter.

Table 15: Reliability Characteristics

Symbol	Parameter	Minimum Specification	Units	Test Method
N_{END}[1,2]	Endurance	10,000	Cycles	JEDEC Standard A117
T_{DR}[1]	Data Retention	100	Years	JEDEC Standard A103
I_{LTH}[1]	Latch Up	100 + I_{DD}	mA	JEDEC Standard 78

1. This parameter is measured only for initial qualification and after a design or process change that could affect this parameter.
2. N_{END} endurance rating is qualified as a 10,000 cycle minimum for the whole device. A sector- or block-level rating would result in a higher minimum specification.

AC Characteristics

Table 16: Read Cycle Timing Parameters V_{DD} = 2.7V-3.6V

Symbol	Parameter	SST39VF640xB-70		Units
		Min	Max	
T_{RC}	Read Cycle Time	70		ns
T_{CE}	Chip Enable Access Time		70	ns
T_{AA}	Address Access Time		70	ns
T_{OE}	Output Enable Access Time		35	ns
T_{CLZ}[1]	CE# Low to Active Output	0		ns
T_{OLZ}[1]	OE# Low to Active Output	0		ns
T_{CHZ}[1]	CE# High to High-Z Output		20	ns
T_{OHZ}[1]	OE# High to High-Z Output		20	ns
T_{OH}[1]	Output Hold from Address Change	0		ns
T_{RP}[1]	RST# Pulse Width	500		ns
T_{RHR}[1]	RST# High before Read	50		ns
T_{RY}[1,2]	RST# Pin Low to Read Mode		20	µs

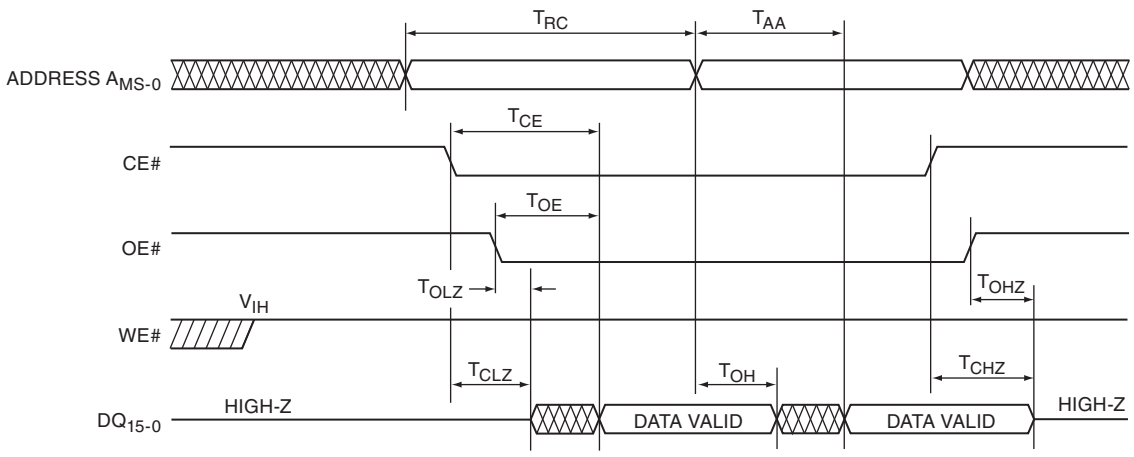
1. This parameter is measured only for initial qualification and after a design or process change that could affect this parameter.
2. This parameter applies to Sector-Erase, Block-Erase, and Program operations. This parameter does not apply to Chip-Erase operations.

Table 17: Program/Erase Cycle Timing Parameters

Symbol	Parameter	Min	Max	Units
T_{BP}	Word Program Time		10	µs
T_{AS}	Address Setup Time	0		ns
T_{AH}	Address Hold Time	30		ns
T_{CS}	WE# and CE# Setup Time	0		ns
T_{CH}	WE# and CE# Hold Time	0		ns
T_{OES}	OE# High Setup Time	0		ns
T_{OEH}	OE# High Hold Time	10		ns
T_{CP}	CE# Pulse Width	40		ns
T_{WP}	WE# Pulse Width	40		ns
T_{WPH}[1]	WE# Pulse Width High	30		ns
T_{CPH}[1]	CE# Pulse Width High	30		ns
T_{DS}	Data Setup Time	30		ns
T_{DH}[1]	Data Hold Time	0		ns
T_{IDA}[1]	Software ID Access and Exit Time		150	ns
T_{SE}	Sector Erase		25	ms
T_{BE}	Block Erase		25	ms
T_{SCE}	Chip Erase		50	ms

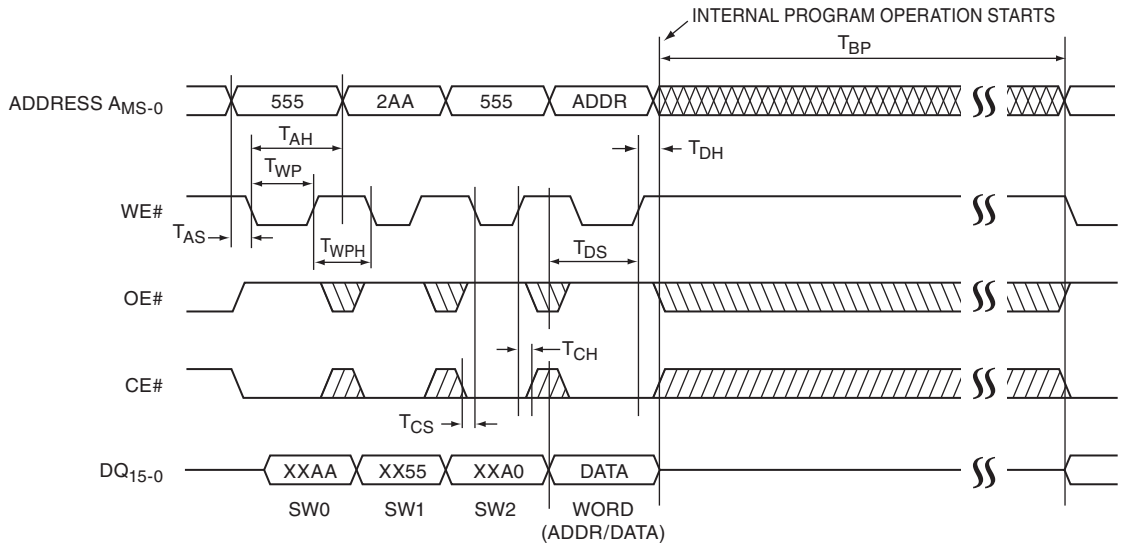
1. This parameter is measured only for initial qualification and after a design or process change that could affect this parameter.

Figure 3: Read Cycle Timing Diagram



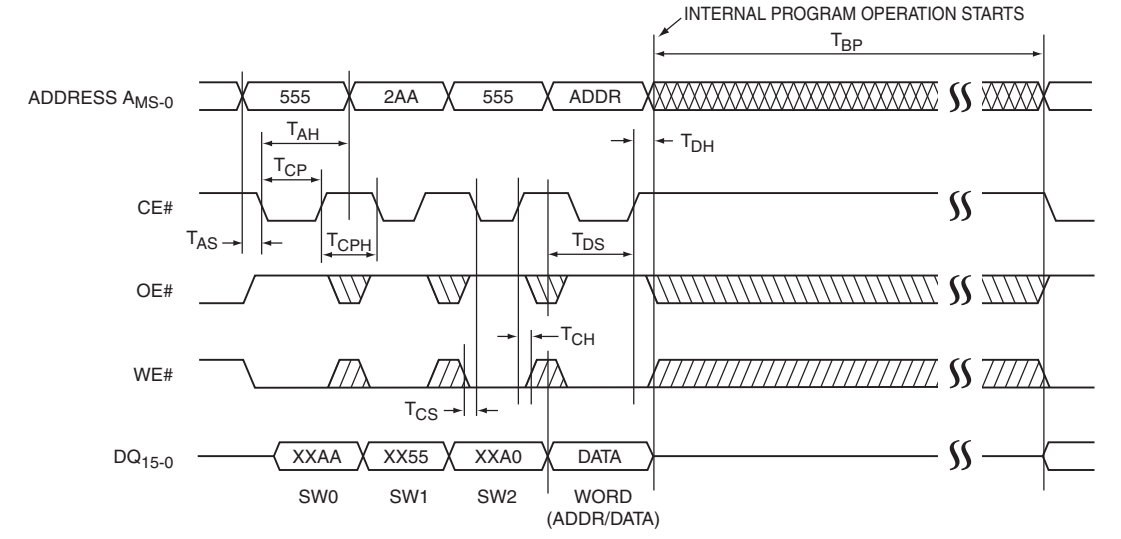
Note: A_{MS} = Most significant address
$A_{MS} = A_{21}$ for SST39VF640xB

Figure 4: WE# Controlled Program Cycle Timing Diagram



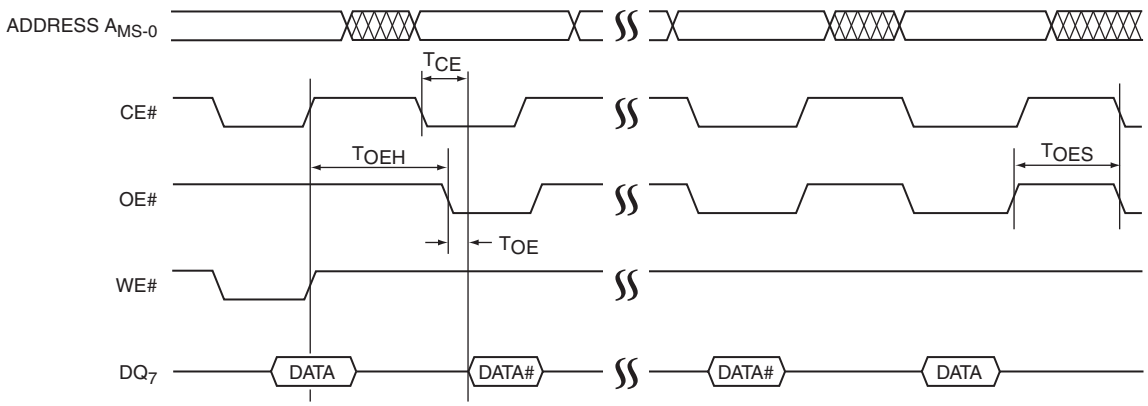
Note: A_{MS} = Most significant address
$A_{MS} = A_{21}$ for SST39VF640xB
WP# must be held in proper logic state (V_{IL} or V_{IH}) 1 µs prior to and 1 µs after the command sequence.
X can be V_{IL} or V_{IH}, but no other value.

Figure 5: CE# Controlled Program Cycle Timing Diagram



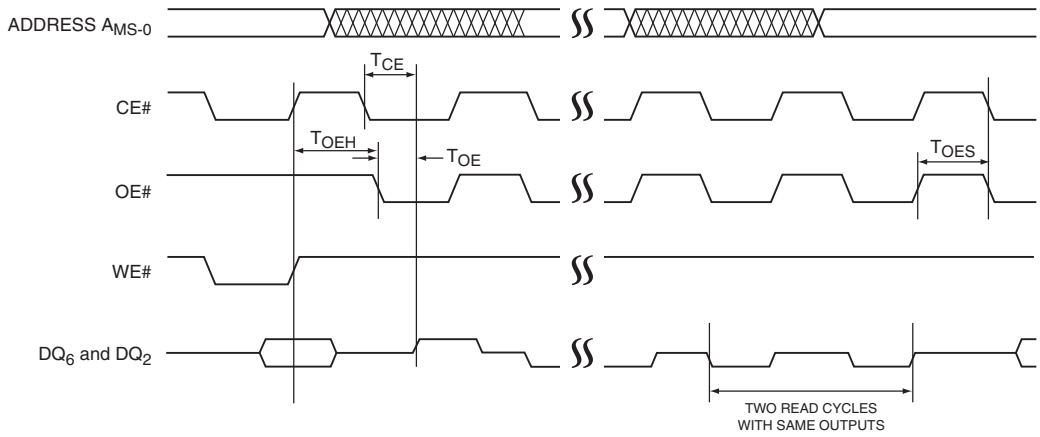
Note: A_{MS} = Most significant address
$A_{MS} = A_{21}$ for SST39VF640xB
WP# must be held in proper logic state (V_{IL} or V_{IH}) 1 µs prior to and 1 µs after the command sequence.
X can be V_{IL} or V_{IH}, but no other value.

Figure 6: Data# Polling Timing Diagram



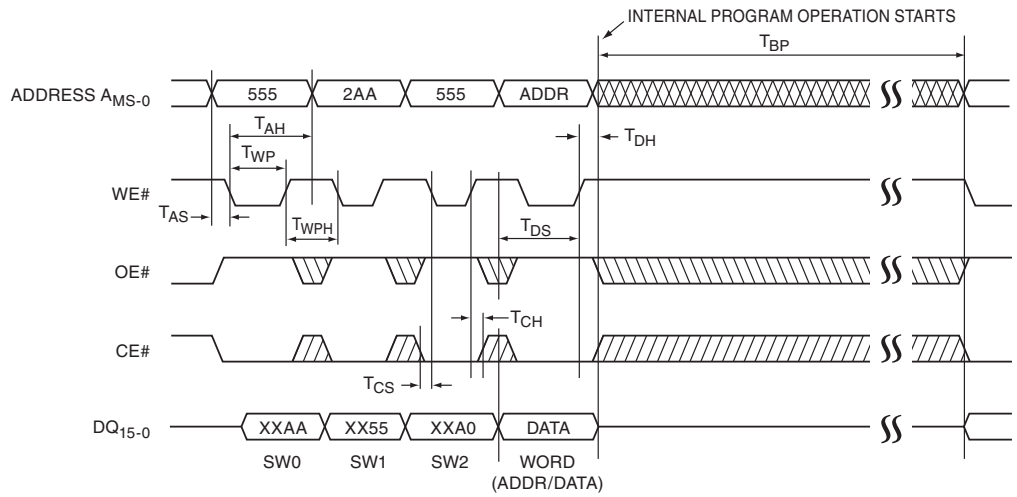
Note: A_{MS} = Most significant address
$A_{MS} = A_{21}$ for SST39VF640xB

Figure 7: Toggle Bits Timing Diagram



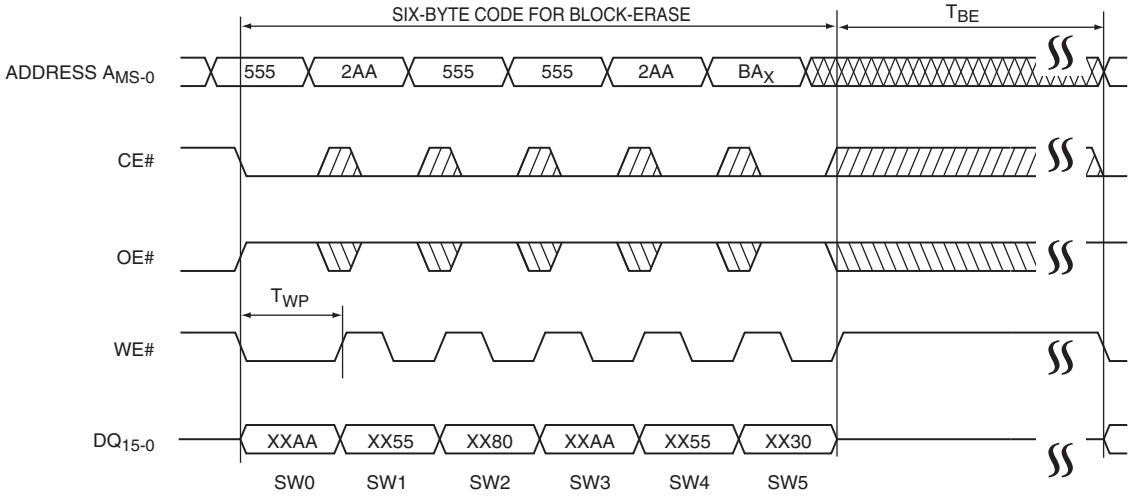
Note: A_{MS} = Most significant address
$A_{MS} = A_{21}$ for SST39VF640xB

Figure 8: WE# Controlled Chip Erase Timing Diagram



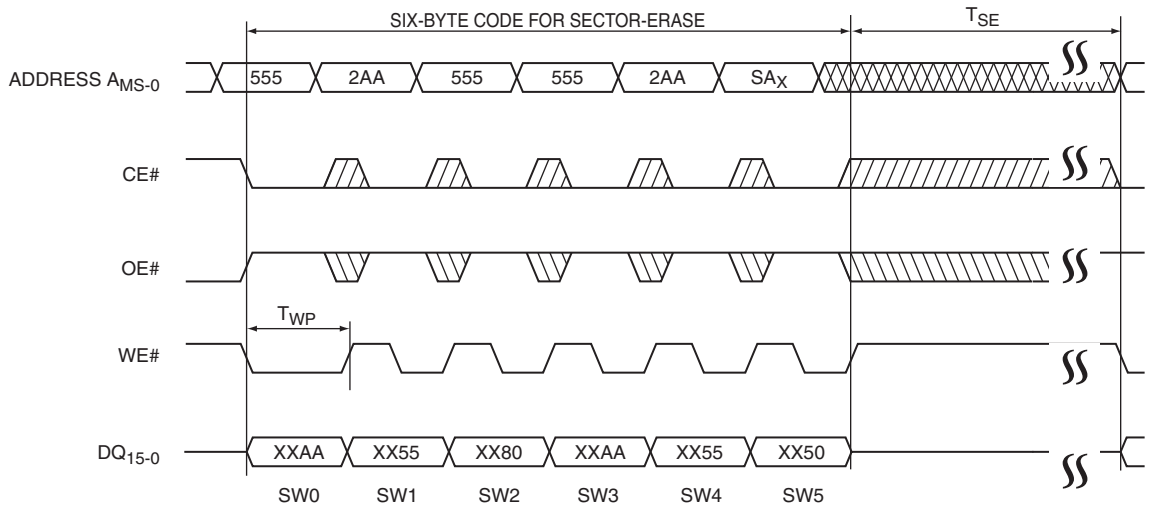
Note: This device also supports CE# controlled Chip-Erase operation The WE# and CE# signals are interchangeable as long as minimum timings are met (see Table 17).
A_{MS} = Most significant address
$A_{MS} = A_{21}$ for SST39VF640xB
WP# must be held in proper logic state (V_{IL} or V_{IH}) 1 µs prior to and 1 µs after the command sequence.
X can be V_{IL} or $V_{IH,}$ but no other value.

Figure 9: WE# Controlled Block Erase Timing Diagram



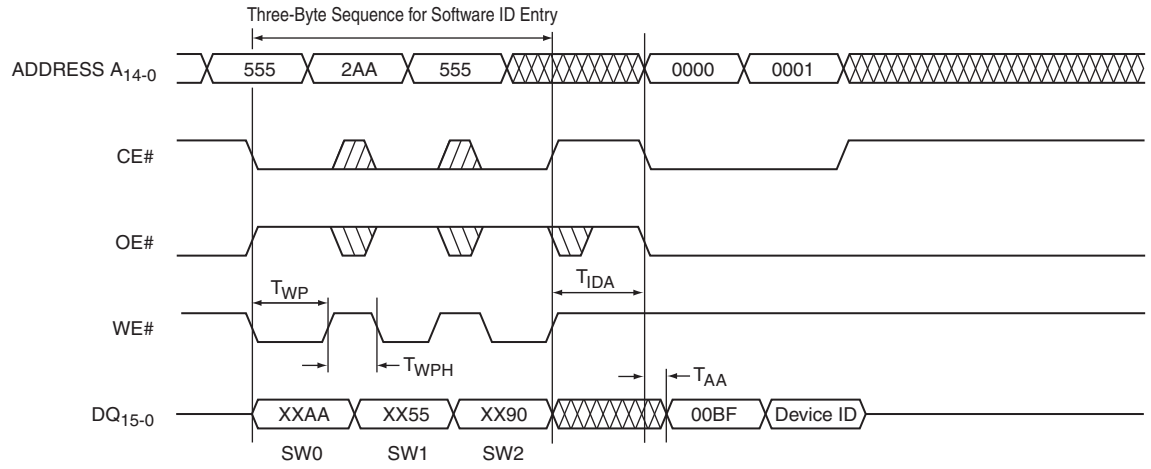
Note: This device also supports CE# controlled Block-Erase operation The WE# and CE# signals are interchangeable as long as minimum timings are met (see Table 17).
BA_X = Block Address
A_{MS} = Most significant address
$A_{MS} = A_{21}$ for SST39VF640xB
WP# must be held in proper logic state (V_{IL} or V_{IH}) 1 µs prior to and 1 µs after the command sequence.
X can be V_{IL} or $V_{IH,}$ but no other value.

Figure 10: WE# Controlled Sector Erase Timing Diagram



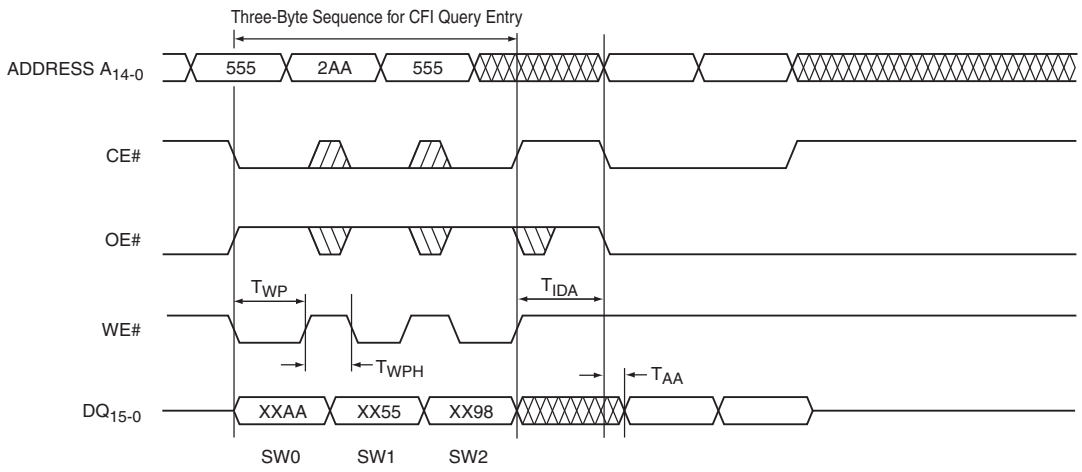
Note: This device also supports CE# controlled Sector-Erase operation The WE# and CE# signals are interchangeable as long as minimum timings are met (see Table 17).
SA_X = Sector Address
A_{MS} = Most significant address
A_{MS} = A_{21} for SST39VF640xB
WP# must be held in proper logic state (V_{IL} or V_{IH}) 1 µs prior to and 1 µs after the command sequence.
X can be V_{IL} or $V_{IH,}$ but no other value.

Figure 11: Software ID Entry and Read



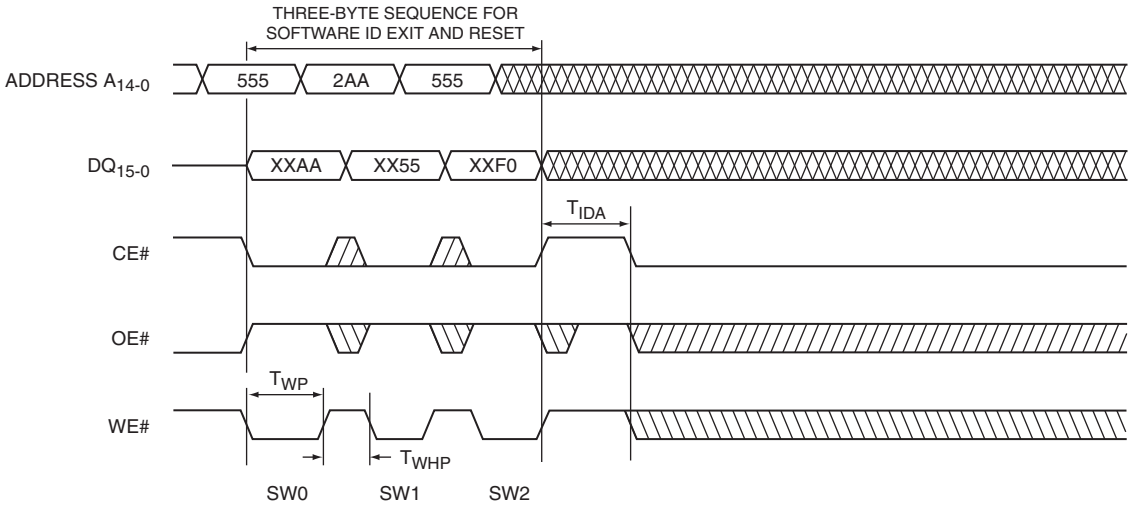
Note: Device ID = 236DH for SST39VF6401B and 236CH for SST39VF6402B
WP# must be held in proper logic state (V_{IL} or V_{IH}) 1 µs prior to and 1 µs after the command sequence.
X can be V_{IL} or $V_{IH,}$ but no other value.

Figure 12: CFI Query Entry and Read



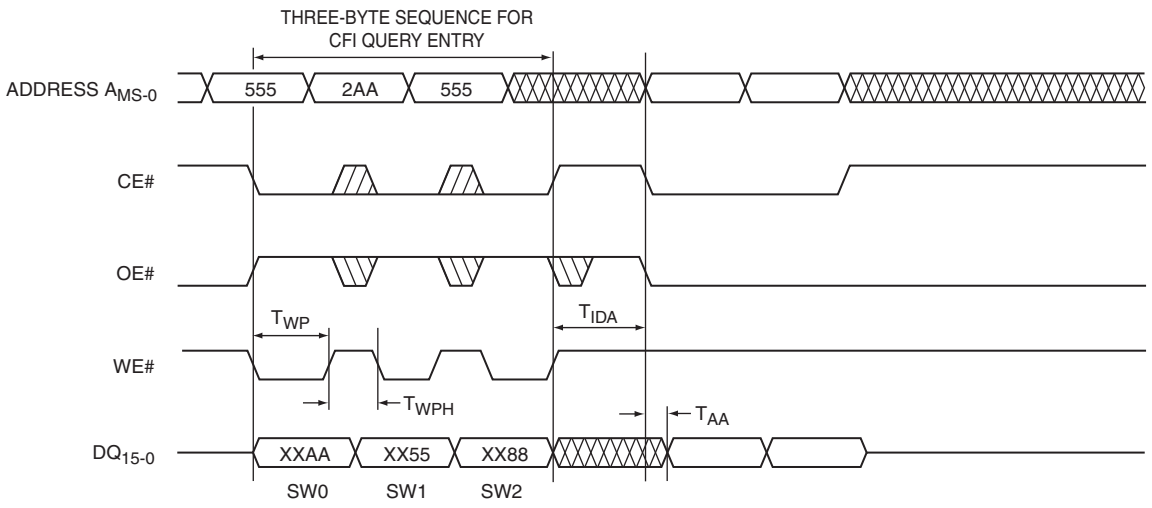
Note: WP# must be held in proper logic state (V_{IL} or V_{IH}) 1 µs prior to and 1 µs after the command sequence. X can be V_{IL} or V_{IH}, but no other value.

Figure 13: Software ID Exit/CFI Exit



Note: WP# must be held in proper logic state (V_{IL} or V_{IH}) 1 µs prior to and 1 µs after the command sequence. X can be V_{IL} or V_{IH}, but no other value.

Figure 14: Sec ID Entry



Note: A_{MS} = Most significant address
$A_{MS} = A_{21}$ for SST39VF640xB
WP# must be held in proper logic state (V_{IL} or V_{IH}) 1 µs prior to and 1 µs after the command sequence.
X can be V_{IL} or $V_{IH,}$ but no other value.

Figure 15: RST# Timing Diagram (When no internal operation is in progress)

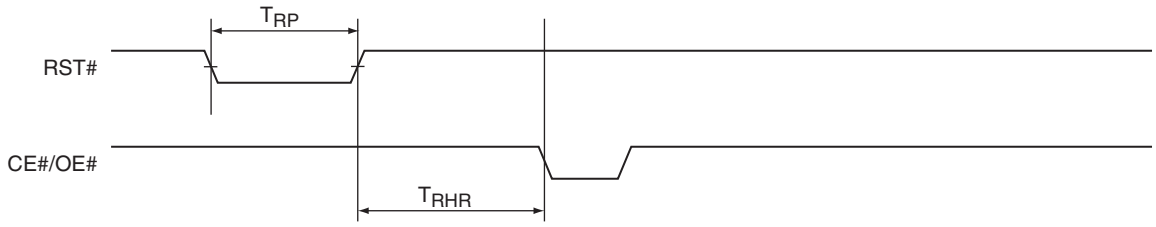


Figure 16: RST# Timing Diagram (During Program or Erase operation)

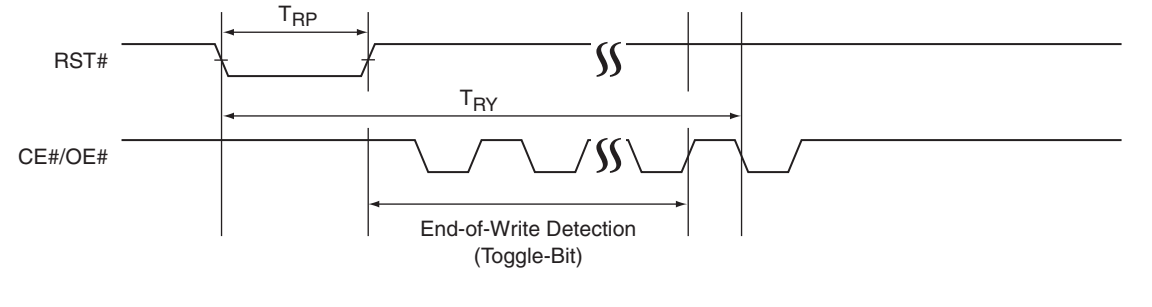
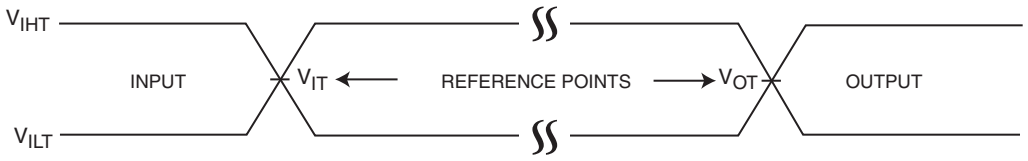


Figure 17: AC Input/Output Reference Waveforms



AC test inputs are driven at V_{IHT} (0.9 V_{DD}) for a logic "1" and V_{ILT} (0.1 V_{DD}) for a logic "0". Measurement reference points for inputs and outputs are V_{IT} (0.5 V_{DD}) and V_{OT} (0.5 V_{DD}). Input rise and fall times (10% ↔ 90%) are <5 ns.

Note: V_{IT} - V_{INPUT} Test
V_{OT} - V_{OUTPUT} Test
V_{IHT} - V_{INPUT} HIGH Test
V_{ILT} - V_{INPUT} LOW Test

Figure 18: A Test Load Example

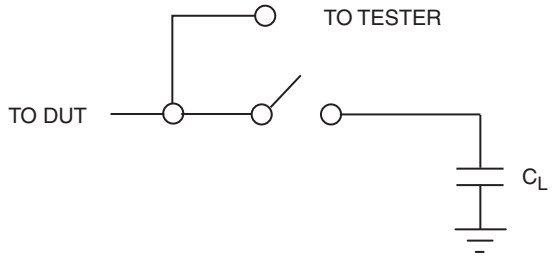


Figure 19: Word Program Algorithm

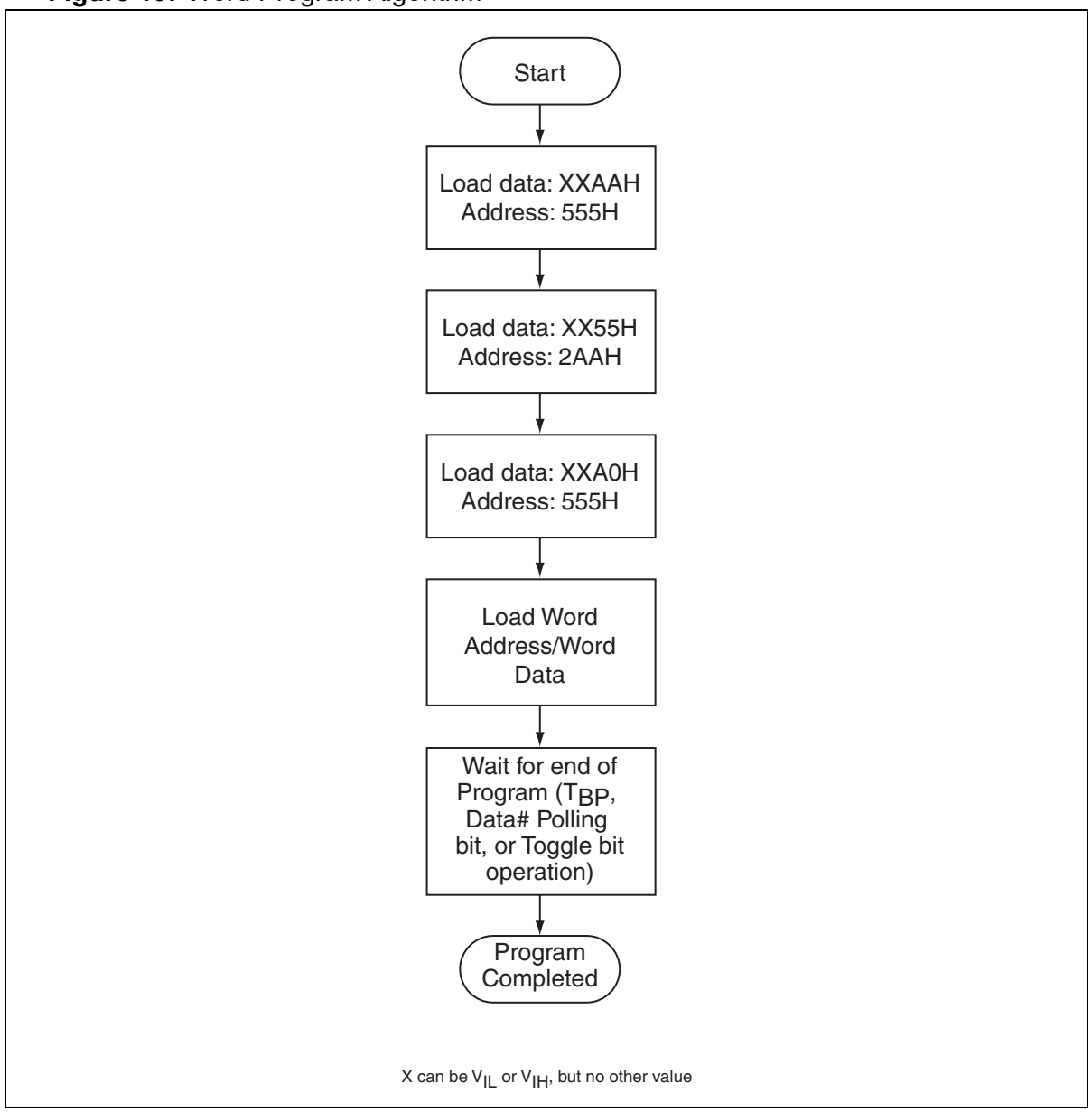


Figure 20: Wait Options

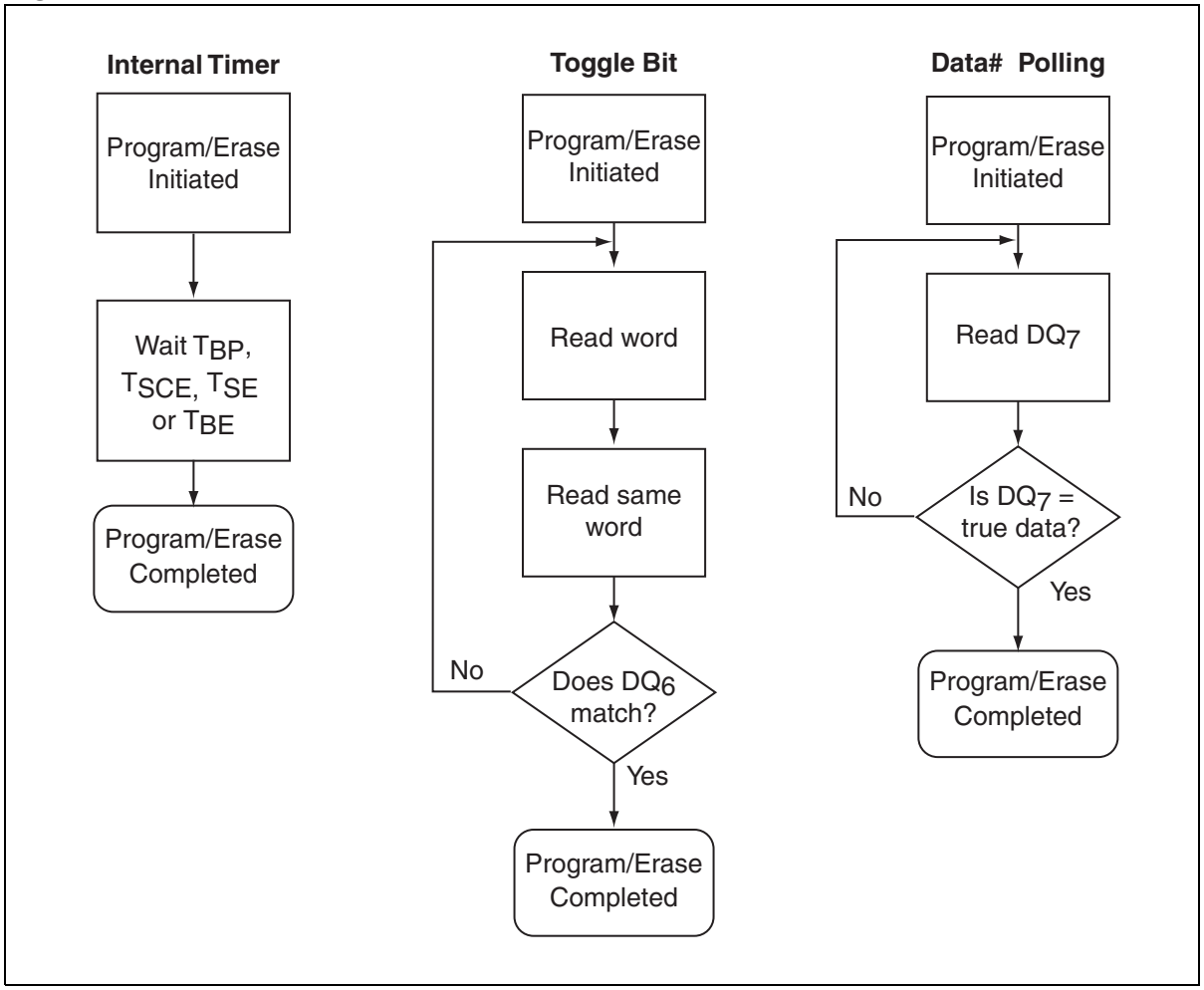


Figure 21: Software ID/CFI Entry Command Flowcharts

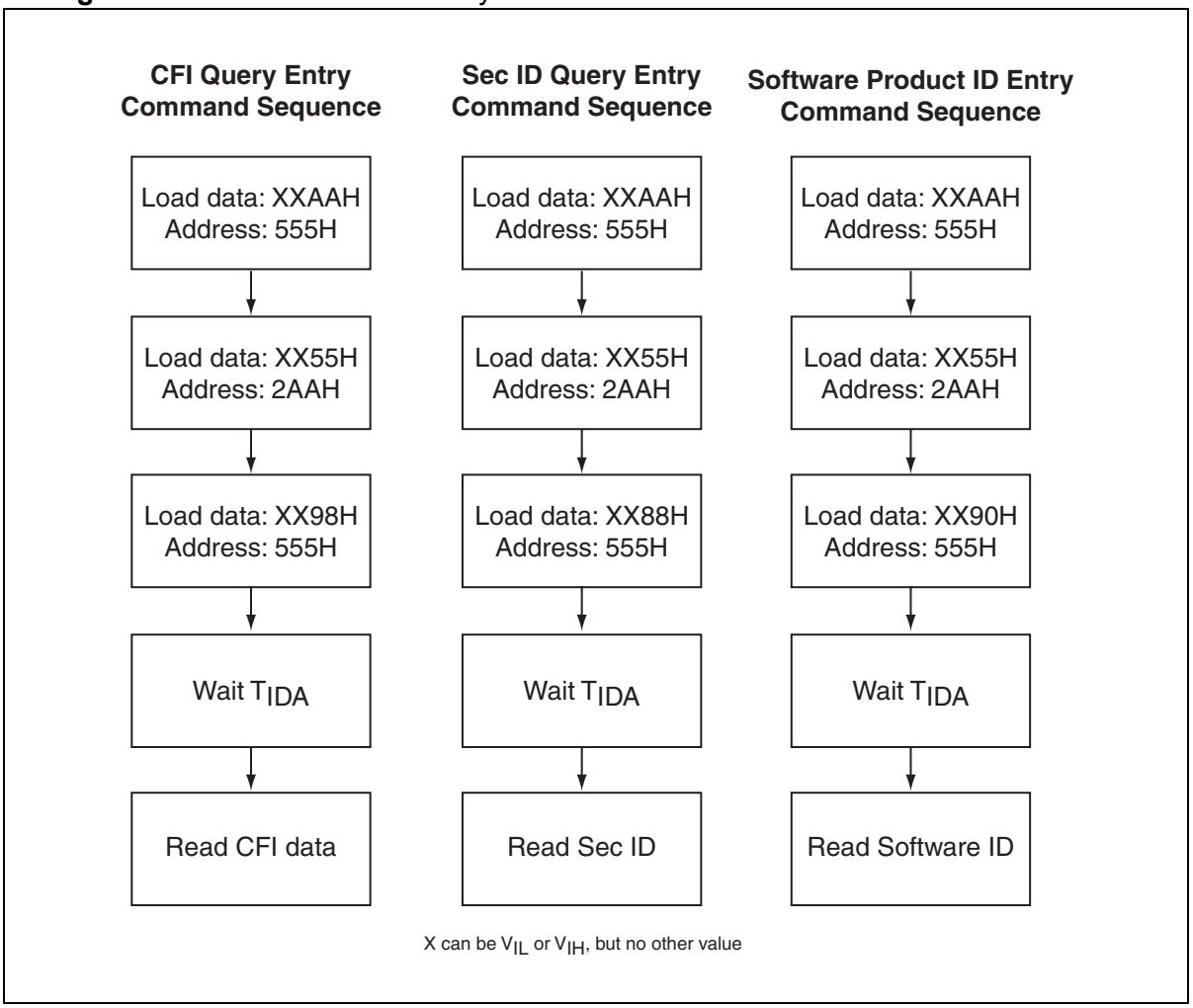


Figure 22: Software ID/CFI Exit Command Flowcharts

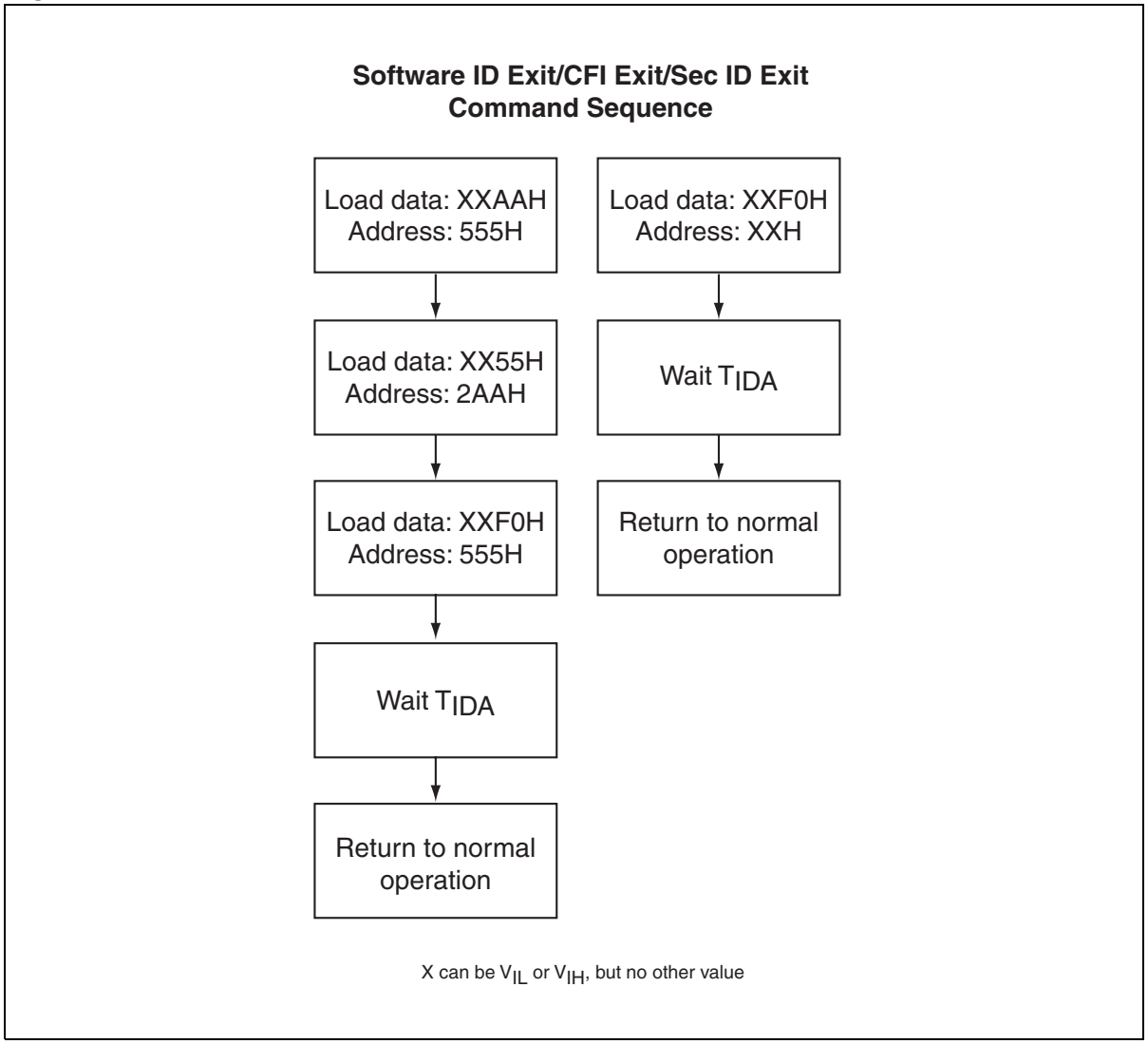
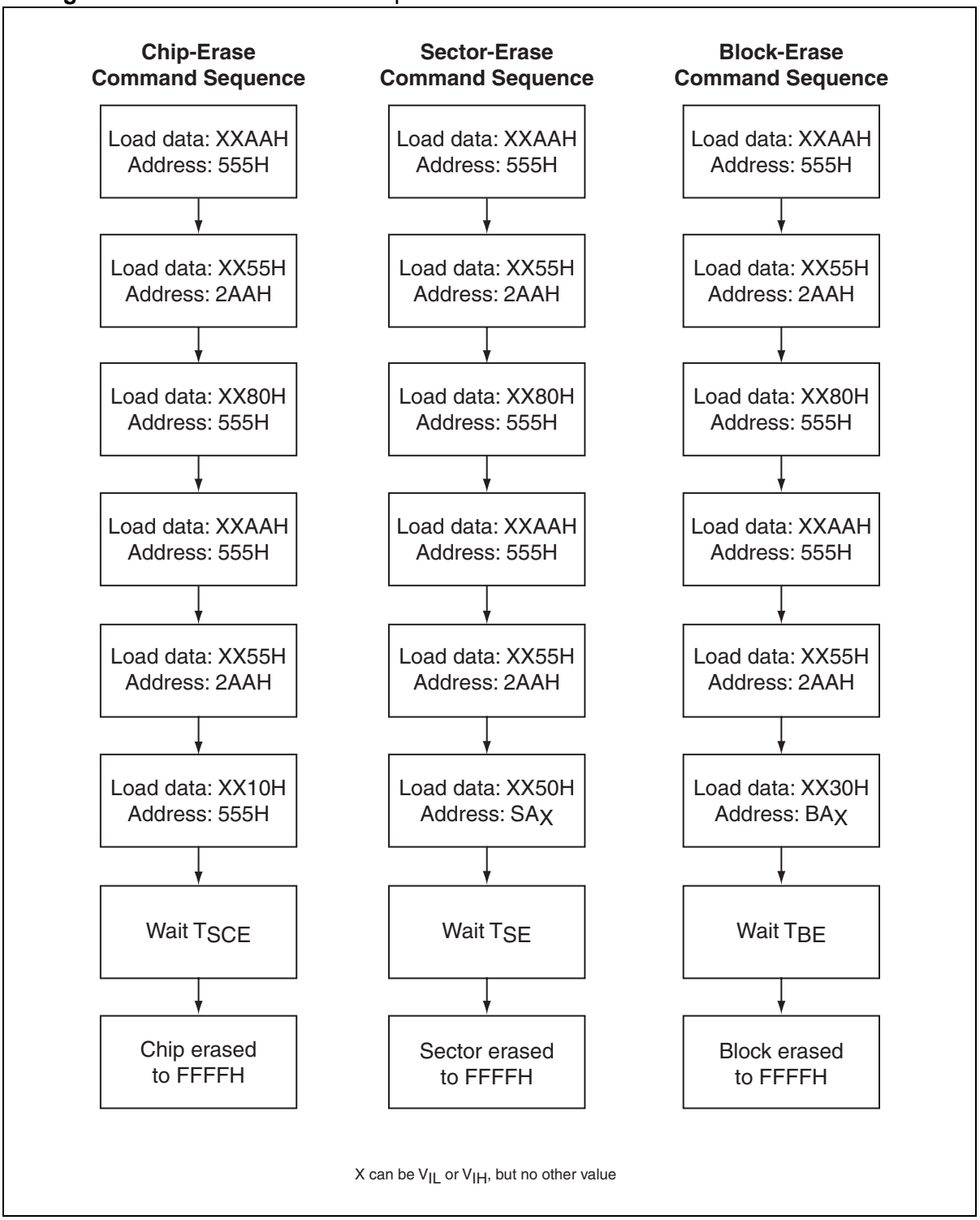
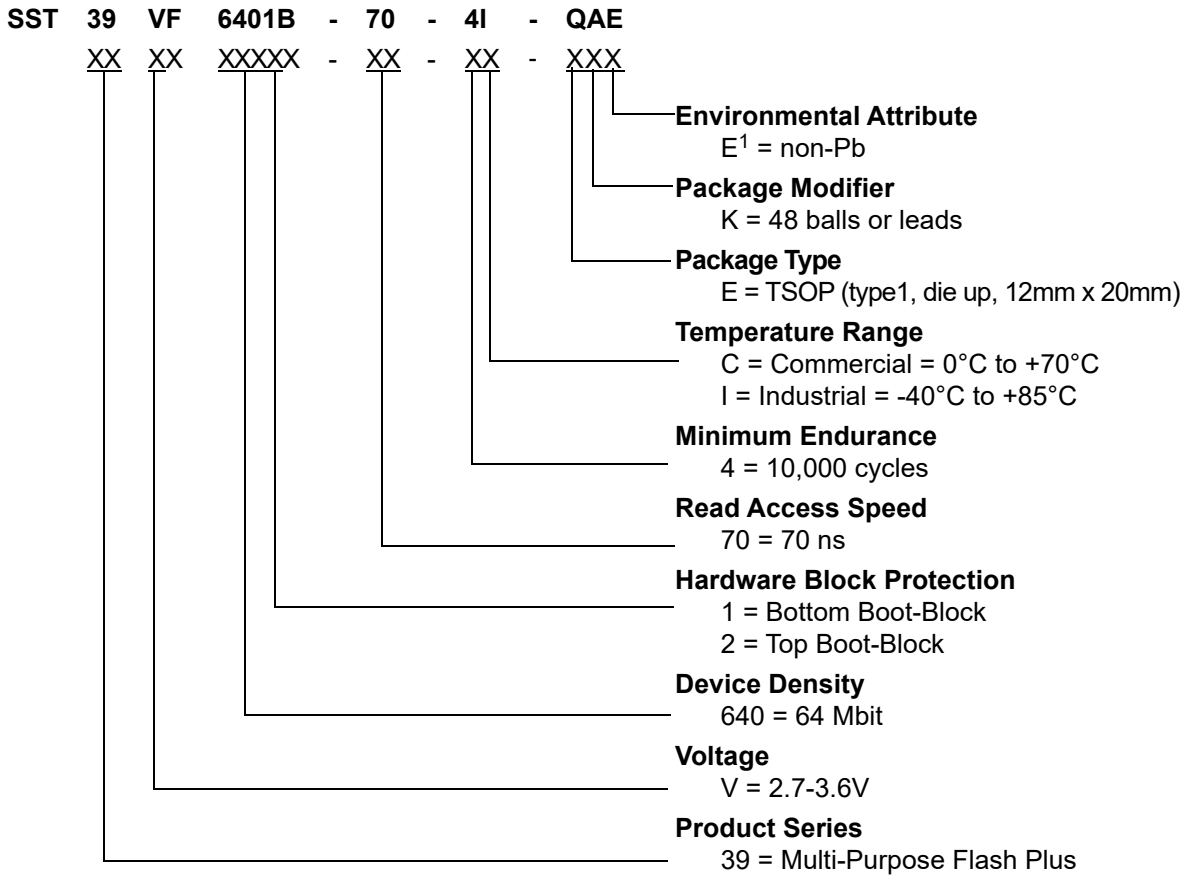


Figure 23: Erase Command Sequence



Product Ordering Information



1. Environmental suffix “E” denotes non-Pb solder. Non-Pb solder devices are “RoHS Compliant”.

Valid Combinations for SST39VF6401B

SST39VF6401B-70-4C-EKE
SST39VF6401B-70-4I-EKE

Valid Combinations for SST39VF6402B

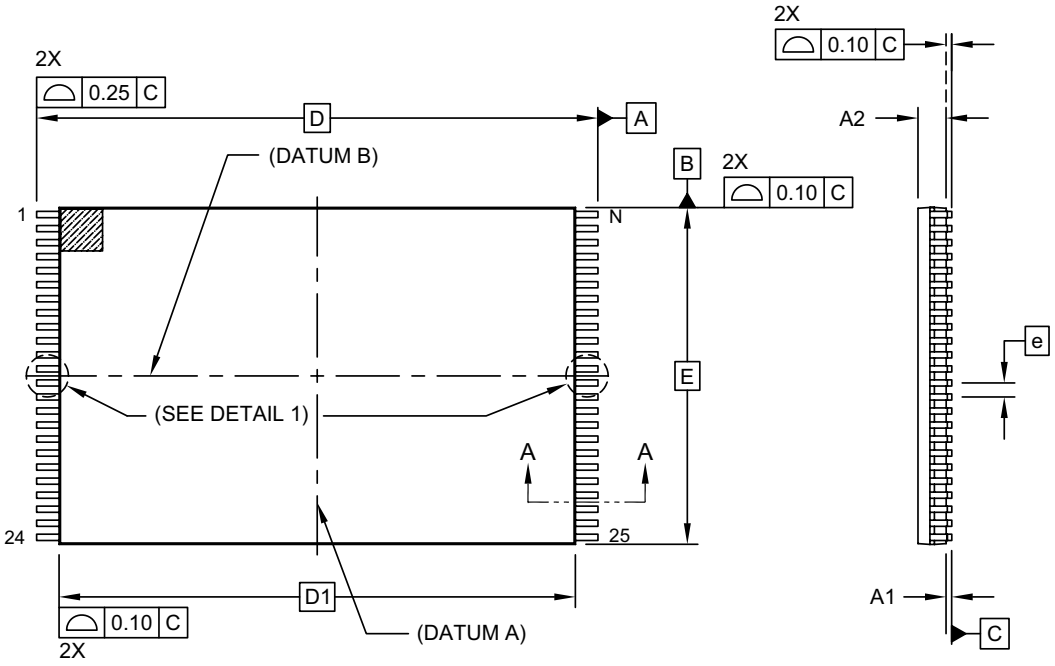
SST39VF6402B-70-4C-EKE
SST39VF6402B-70-4I-EKE

Note: Valid combinations are those products in mass production or will be in mass production. Consult your Microchip sales representative to confirm availability of valid combinations and to determine availability of new combinations.

Packaging Diagrams

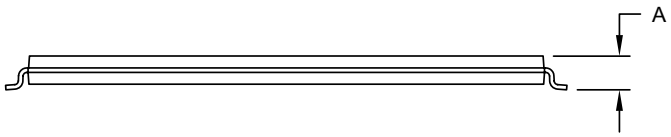
48-LEAD THIN SMALL OUTLINE PACKAGE (TV) - 12x20 mm Body [TSOP]

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



TOP VIEW

END VIEW

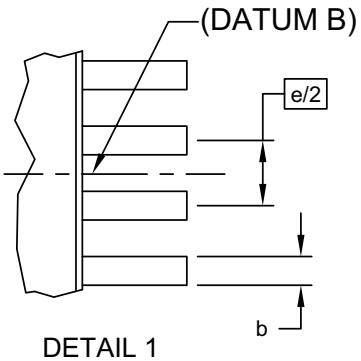


SIDE VIEW

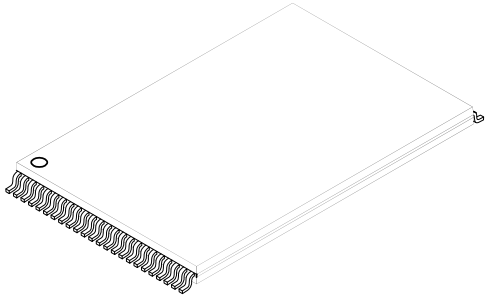
Microchip Technology Drawing C04-177 Rev B Sheet 1 of 2

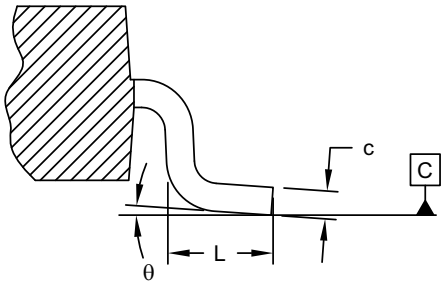
48-LEAD THIN SMALL OUTLINE PACKAGE (TV) - 12x20 mm Body [TSOP]

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



DETAIL 1





SECTION A-A

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		48	
Pitch	e		0.50 BSC	
Overall Height	A	-	-	1.20
Standoff	A1	0.05	-	0.15
Molded Package Height	A2	0.95	1.00	1.05
Overall Width	E		12.00 BSC	
Overall Length	D		20.00 BSC	
Molded Package Length	D1		18.40 BSC	
Lead Width	b	0.17	0.22	0.27
Lead Thickness	c	0.10	-	0.21
Lead Length	L	0.50	0.60	0.70
Lead Foot Angle	θ	0°	5°	8°

Notes:

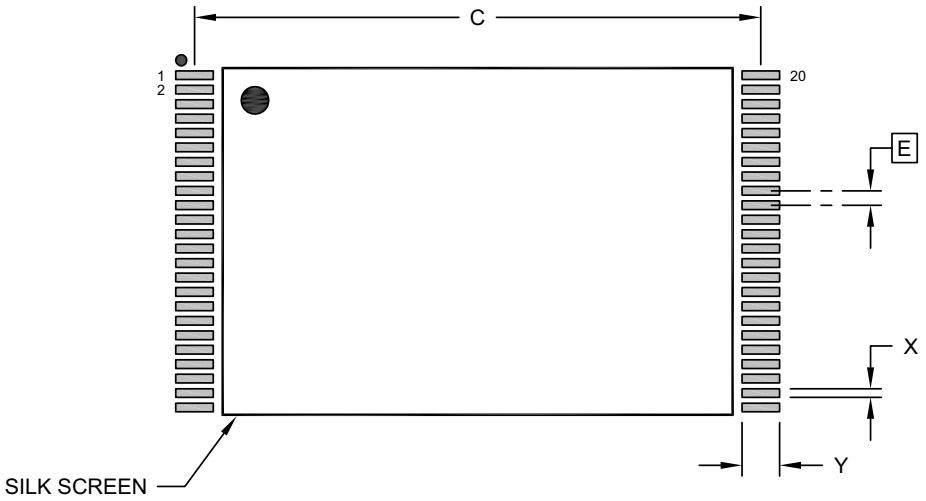
1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.
REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-177 Rev B Sheet 2 of 2

48-LEAD THIN SMALL OUTLINE PACKAGE (TV) - 12x20 mm Body [TSOP]

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		0.50 BSC	
Contact Pad Spacing	C		19.60	
Contact Pad Width (Xnn)	X			0.30
Contact Pad Length (Xnn)	Y			1.30

Notes:

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

Microchip Technology Drawing C04-2177 Rev B

Table 18: Revision History

Revision	Description	Date
D	• Removed “Not recommended for new design”. • Removed B1KE package from the data sheet due to EOL.	May 2023
C	• Corrected part number included with “Not Recommended for New Designs statement” at the top of page 1. • Updated Microchip trademark and sales and service information.	May 2018
B	• Updated “Not Recommended for New Designs” statement on page 1.	Aug 2015
A	• Removed Pb and 90ns parts • Marked the document “Not Recommended for New Designs” • Applied new document format • Released document under letter revision system • Updated Spec number from S71288 to DS25008	Aug 2011
02	• Changed document phase from Preliminary Information to Data Sheet	Jul 2006
01	• Clarified JEDEC software command compatibility on page 1	May 2005
00	• Initial release	Mar 2005

NOTES:

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.

For information regarding Microchip's Quality Management Systems, please visit www.microchip.com/quality.

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