Features

- 64-megabit (4M x 16) Flash Memory
- 2.7V - 3.6V Read/Write
- High Performance
  - Asynchronous Access Time – 70 ns
  - Page Mode Read Time – 20 ns
- Sector Erase Architecture
  - Eight 4K Word Sectors with Individual Write Lockout
  - One Hundred Twenty-seven 32K Word Main Sectors with Individual Write Lockout
- Typical Sector Erase Time: 32K Word Sectors – 700 ms; 4K Word Sectors – 200 ms
- Four Plane Organization, Permitting Concurrent Read in Any of the Three Planes not Being Programmed/Erased
  - Memory Plane A: 16M Memory Including Eight 4K Word Sectors
  - Memory Plane B: 16M Memory Consisting of 32K Word Sectors
  - Memory Plane C: 16M Memory Consisting of 32K Word Sectors
  - Memory Plane D: 16M Memory Consisting of 32K Word Sectors
- Suspend/Resume Feature for Erase and Program
  - Supports Reading and Programming Data from Any Sector by Suspending Erase of a Different Sector
  - Supports Reading Any Word by Suspending Programming of Any Other Word
- Low-power Operation
  - 30 mA Active
  - 35 µA Standby
- 2.2V I/O Option Reduces Overall System Power
- VPP Pin for Write Protection and Accelerated Program/Erase Operations
- $\overline{\text{Reset}}$ Input for Device Initialization
- CBGA Package
- Top or Bottom Boot Block Configuration Available
- 128-bit Protection Register
- Common Flash Interface (CFI)

64-megabit (4M x 16) Page Mode 2.7-volt Flash Memory

AT49BV6416C
AT49BV6416CT

1. Description

The AT49BV6416C(T) is a 2.7-volt 64-megabit Flash memory. The memory is divided into multiple sectors and planes for erase operations. The device can be read or reprogrammed off a single 2.7V power supply, making it ideally suited for In-System programming. The device can operate in the asynchronous or page read mode.

The AT49BV6416C(T) is divided into four memory planes. A read operation can occur in any of the three planes which is not being programmed or erased. This concurrent operation allows improved system performance by not requiring the system to wait for a program or erase operation to complete before a read is performed. To further increase the flexibility of the device, it contains an Erase Suspend and Program Suspend feature. This feature will put the erase or program on hold for any amount of time and let the user read data from or program data to any of the remaining sectors. There is no reason to suspend the erase or program operation if the data to be read is in another memory plane.

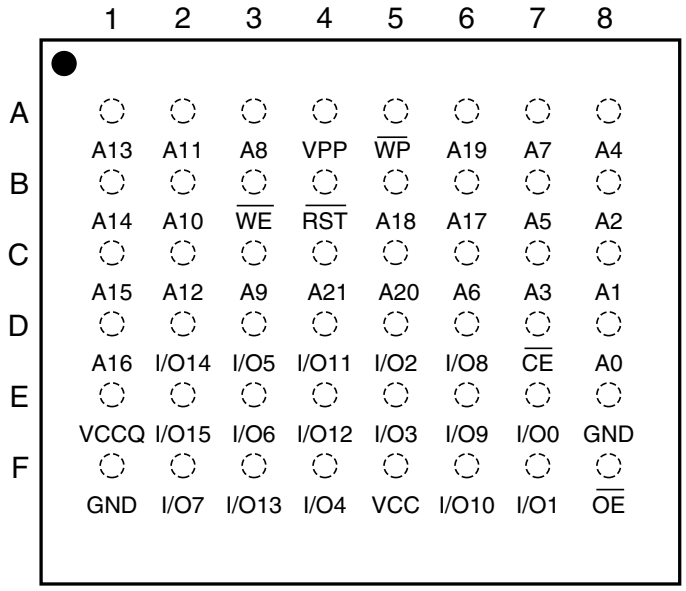
The VPP pin provides data protection and faster programming times. When the V_{PP} input is below 0.7V, the program and erase functions are inhibited. When V_{PP} is at 1.65V or above, normal program and erase operations can be performed. With V_{PP} at 10.0V, the program (Dual-word Program command) operation is accelerated.

3465C–FLASH–07/05

2. Pin Configurations

Pin Name	Pin Function
I/O0 - I/O15	Data Inputs/Outputs
A0 - A21	Addresses
$\overline{CE}$	Chip Enable
$\overline{OE}$	Output Enable
$\overline{WE}$	Write Enable
$\overline{Reset}$	Reset
$\overline{WP}$	Write Protect
VPP	Write Protection and Power Supply for Accelerated Program/Erase Operations
VCCQ	Output Power Supply

2.1 48-ball CBGA – Top View



3. Device Operation

3.1 Command Sequences

When the device is first powered on, it will be in the read mode. Command sequences are used to place the device in other operating modes such as program and erase. The command sequences are written by applying a low pulse on the $\overline{WE}$ input with $\overline{CE}$ low and $\overline{OE}$ high or by applying a low-going pulse on the $\overline{CE}$ input with $\overline{WE}$ low and $\overline{OE}$ high. The address is latched on the first rising edge of the $\overline{WE}$ or $\overline{CE}$. Valid data is latched on the rising edge of the $\overline{WE}$ or the $\overline{CE}$ pulse, whichever occurs first. The addresses used in the command sequences are not affected by entering the command sequences.

3.2 Asynchronous Read

The AT49BV6416C(T) is accessed like an EPROM. When $\overline{CE}$ and $\overline{OE}$ are low and $\overline{WE}$ is high, the data stored at the memory location determined by the address pins are asserted on the outputs. The outputs are put in the high impedance state whenever $\overline{CE}$ or $\overline{OE}$ is high. This dual-line control gives designers flexibility in preventing bus contention.

3.3 Page Read

The page read operation of the device is controlled by $\overline{CE}$ and $\overline{OE}$ inputs. The page size is four words. The first word access of the page read is the same as the asynchronous read. The first word is read at an asynchronous speed of 70 ns. Once the first word is read, toggling A0 and A1 will result in subsequent reads within the page being output at a speed of 20 ns. See the “Page Read Cycle Waveform” on page 24.

3.4 Reset

A $\overline{Reset}$ input pin is provided to ease some system applications. When $\overline{Reset}$ is at a logic high level, the device is in its standard operating mode. A low level on the $\overline{Reset}$ pin halts the present device operation and puts the outputs of the device in a high-impedance state. When a high level is reasserted on the $\overline{Reset}$ pin, the device returns to read mode.

3.5 Erase

Before a word can be reprogrammed it must be erased. The erased state of the memory bits is a logical “1”. The entire memory can be erased by using the Chip Erase command or individual planes can be erased by using the Plane Erase command or individual sectors can be erased by using the Sector Erase command.

3.5.1 Chip Erase

Chip Erase is a two-bus cycle operation. The automatic erase begins on the rising edge of the last $\overline{WE}$ pulse. Chip Erase does not alter the data of the protected sectors. The hardware reset during chip erase will stop the erase, but the data will be of an unknown state.

3.5.2 Plane Erase

As an alternative to a full Chip Erase, the device is organized into four planes that can be individually erased. The Plane Erase command is a two-bus cycle operation. The plane whose address is valid at the second rising edge of $\overline{WE}$ will be erased. The Plane Erase command does not alter the data in the protected sectors.

3.5.3 Sector Erase

The device is organized into multiple sectors that can be individually erased. The Sector Erase command is a two-bus cycle operation. The sector whose address is valid at the second rising edge of $\overline{WE}$ will be erased provided the given sector has not been protected.

3.6 Word Programming

The device is programmed on a word-by-word basis. Programming is accomplished via the internal device command register and is a two-bus cycle operation. The programming address and data are latched in the second cycle. The device will automatically generate the required internal programming pulses. Please note that a “0” cannot be programmed back to a “1”; only erase operations can convert “0”s to “1”s.

3.7 Flexible Sector Protection

The AT49BV6416C(T) offers two sector protection modes, the Softlock and the Hardlock. The Softlock mode is optimized as sector protection for sectors whose content changes frequently. The Hardlock protection mode is recommended for sectors whose content changes infrequently. Once either of these two modes is enabled, the contents of the selected sector is read-only and cannot be erased or programmed. Each sector can be independently programmed for either the Softlock or Hardlock sector protection mode. At power-up and reset, all sectors have their Softlock protection mode enabled.

3.7.1 Softlock And Unlock

The Softlock protection mode can be disabled by issuing a two-bus cycle Unlock command to the selected sector. Once a sector is unlocked, its contents can be erased or programmed. To enable the Softlock protection mode, a two-bus cycle Softlock command must be issued to the selected sector.

3.7.2 Hardlock And Write Protect ($\overline{WP}$)

The Hardlock sector protection mode operates in conjunction with the Write Protection ($\overline{WP}$) pin. The Hardlock sector protection mode can be enabled by issuing a two-bus cycle Hardlock software command to the selected sector. The state of the Write Protect pin affects whether the Hardlock protection mode can be overridden.

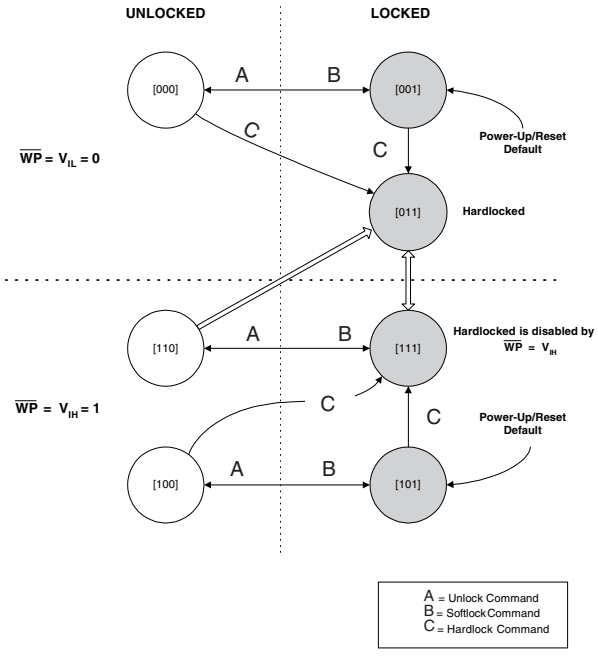
- When the $\overline{WP}$ pin is low and the Hardlock protection mode is enabled, the sector cannot be unlocked and the contents of the sector is read-only.
- When the $\overline{WP}$ pin is high, the Hardlock protection mode is overridden and the sector can be unlocked via the Unlock command.

To disable the Hardlock sector protection mode, the chip must be either reset or power cycled.

Table 3-1. Hardlock and Softlock Protection Configurations in Conjunction with $\overline{WP}$

V_{PP}	$\overline{WP}$	Hard-lock	Soft-lock	Erase/ Prog Allowed?	Comments
V_{CC}	0	0	0	Yes	No sector is locked
V_{CC}	0	0	1	No	Sector is Softlocked. The Unlock command can unlock the sector.
V_{CC}	0	1	1	No	Hardlock protection mode is enabled. The sector cannot be unlocked.
V_{CC}	1	0	0	Yes	No sector is locked.
V_{CC}	1	0	1	No	Sector is Softlocked. The Unlock command can unlock the sector.
V_{CC}	1	1	0	Yes	Hardlock protection mode is overridden and the sector is not locked.
V_{CC}	1	1	1	No	Hardlock protection mode is overridden and the sector can be unlocked via the Unlock command.
V_{IL}	x	x	x	No	Erase and Program Operations cannot be performed.

Figure 3-1. Sector Locking State Diagram



Note: 1. The notation [X, Y, Z] denotes the locking state of a sector. The current locking state of a sector is defined by the state of $\overline{WP}$ and the two bits of the sector-lock status D[1:0].

3.7.3 Sector Protection Detection

A software method is available to determine if the sector protection Softlock or Hardlock features are enabled. When the device is in the software product identification mode a read from the I/O0 and I/O1 at address location 00002H within a sector will show if the sector is unlocked, soft-locked, or hardlocked.

Table 3-2. Sector Protection Status

I/O1	I/O0	Sector Protection Status
0	0	Sector Not Locked
0	1	Softlock Enabled
1	0	Hardlock Enabled
1	1	Both Hardlock and Softlock Enabled

3.8 Read Status Register

The status register indicates the status of device operations and the success/failure of that operation. The Read Status Register command causes subsequent reads to output data from the status register until another command is issued. To return to reading from the memory, issue a Read command.

The status register bits are output on I/O7 - I/O0. The upper byte, I/O15 - I/O8, outputs 00H when a Read Status Register command is issued.

The contents of the status register [SR7:SR0] are latched on the falling edge of $\overline{OE}$ or $\overline{CE}$ (whichever occurs last), which prevents possible bus errors that might occur if status register contents change while being read. $\overline{CE}$ or $\overline{OE}$ must be toggled with each subsequent status read, or the status register will not indicate completion of a Program or Erase operation.

When the Write State Machine (WSM) is active, SR7 will indicate the status of the WSM; the remaining bits in the status register indicate whether the WSM was successful in performing the preferred operation (see Table 3-3 on page 7).

Table 3-3. Status Register Bit Definition

WSMS	ESS	ES	PRS	VPPS	PSS	SLS	PLS
7	6	5	4	3	2	1	0
				Notes			
SR7 WRITE STATE MACHINE STATUS (WSMS) 1 = Ready 0 = Busy				Check Write State Machine bit first to determine Word Program or Sector Erase completion, before checking program or erase status bits.			
SR6 = ERASE SUSPEND STATUS (ESS) 1 = Erase Suspended 0 = Erase In Progress/Completed				When Erase Suspend is issued, WSM halts execution and sets both WSMS and ESS bits to “1” – ESS bit remains set to “1” until an Erase Resume command is issued.			
SR5 = ERASE STATUS (ES) 1 = Error in Sector Erase 0 = Successful Sector Erase				When this bit is set to “1”, WSM has applied the max number of erase pulses to the sector and is still unable to verify successful sector erasure.			
SR4 = PROGRAM STATUS (PRS) 1 = Error in Programming 0 = Successful Programming				When this bit is set to “1”, WSM has attempted but failed to program a word			
SR3 = VPP STATUS (VPPS) 1 = VPP Low Detect, Operation Abort 0 = VPP OK				The V_{PP} status bit does not provide continuous indication of VPP level. The WSM interrogates V_{PP} level only after the Program or Erase command sequences have been entered and informs the system if V_{PP} has not been switched on. The V_{PP} is also checked before the operation is verified by the WSM.			
SR2 = PROGRAM SUSPEND STATUS (PSS) 1 = Program Suspended 0 = Program in Progress/Completed				When Program Suspend is issued, WSM halts execution and sets both WSMS and PSS bits to “1”. PSS bit remains set to “1” until a Program Resume command is issued.			
SR1 = SECTOR LOCK STATUS 1 = Prog/Erase attempted on a locked sector; Operation aborted. 0 = No operation to locked sectors				If a Program or Erase operation is attempted to one of the locked sectors, this bit is set by the WSM. The operation specified is aborted and the device is returned to read status mode.			
SR0 = Plane Status (PLS)				Indicates program or erase status of the addressed plane.			

Note: 1. A Command Sequence Error is indicated when SR1, SR3, SR4 and SR5 are set.

Table 3-4. Status Register Device WSMS and Write Status Definition

WSMS (SR7)	PLS (SR0)	Description
0	0	The addressed plane is performing a program/erase operation.
0	1	A plane other than the one currently addressed is performing a program/erase operation.
1	x	No program/erase operation is in progress in any plane. Erase and Program suspend bits (SR6, SR2) indicate whether other planes are suspended.

3.9 Erase Suspend/Erase Resume

The Erase Suspend command allows the system to interrupt a sector erase or plane erase operation. The erase suspend command does not work with the Chip Erase feature. Using the erase suspend command to suspend a sector erase operation, the system can program or read data from a different sector within the same plane. Since this device is organized into four planes, there is no need to use the erase suspend feature while erasing a sector when you want to read data from a sector in another plane. After the Erase Suspend command is given, the device requires a maximum time of 15 µs to suspend the erase operation. After the erase operation has been suspended, the plane that contains the suspended sector enters the erase-suspend-read mode. The system can then read data or program data to any other sector within the device. An address is not required during the Erase Suspend command. During a sector erase suspend, another sector cannot be erased. To resume the sector erase operation, the system must write the Erase Resume command. The Erase Resume command is a one-bus cycle command, which does require the plane address. Read, Read Status Register, Product ID Entry, Clear Status Register, Program, Program Suspend, Erase Resume, Sector Softlock/Hardlock, Sector Unlock are valid commands during an erase suspend.

3.10 Program Suspend/Program Resume

The Program Suspend command allows the system to interrupt a programming operation and then read data from a different word within the memory. After the Program Suspend command is given, the device requires a maximum of 10 µs to suspend the programming operation. After the programming operation has been suspended, the system can then read from any other word within the device. An address is not required during the program suspend operation. To resume the programming operation, the system must write the Program Resume command. The program suspend and resume are one-bus cycle commands. The command sequence for the erase suspend and program suspend are the same, and the command sequence for the erase resume and program resume are the same. Read, Read Status Register, Product ID Entry, Program Resume are valid commands during a Program Suspend.

3.11 128-bit Protection Register

The AT49BV6416C(T) contains a 128-bit register that can be used for security purposes in system design. The protection register is divided into two 64-bit blocks. The two blocks are designated as block A and block B. The data in block A is non-changeable and is programmed at the factory with a unique number. The data in block B is programmed by the user and can be locked out such that data in the block cannot be reprogrammed. To program block B in the protection register, the two-bus cycle Program Protection Register command must be used as shown in the “Command Definition Table” on page 15. To lock out block B, the two-bus cycle lock protection register command must be used as shown in the Command Definition table. Data bit D1 must be zero during the second bus cycle. All other data bits during the second bus cycle are don’t cares. To determine whether block B is locked out, the Status of Sector B Protection command is given. If data bit D1 is zero, block B is locked. If data bit D1 is one, block B can be reprogrammed. Please see the “Protection Register Addressing Table” on page 16 for the address locations in the protection register. To read the protection register, the Product ID Entry command is given followed by a normal read operation from an address within the protection register. After determining whether block B is protected or not or reading the protection register, the Read command must be given to return to the read mode.

3.12 Common Flash Interface (CFI)

CFI is a published, standardized data structure that may be read from a flash device. CFI allows system software to query the installed device to determine the configurations, various electrical and timing parameters, and functions supported by the device. CFI is used to allow the system to learn how to interface to the flash device most optimally. The two primary benefits of using CFI are ease of upgrading and second source availability. The command to enter the CFI Query mode is a one-bus cycle command which requires writing data 98h to any address. The CFI Query command can be written when the device is ready to read data or can also be written when the part is in the product ID mode. Once in the CFI Query mode, the system can read CFI data at the addresses given in the "Common Flash Interface Definition Table" on page 27. To return to the read mode, the read command should be issued.

3.13 Hardware Data Protection

Hardware features protect against inadvertent programs to the AT49BV6416C(T) in the following ways: (a) V_{CC} sense: if V_{CC} is below 1.8V (typical), the device is reset and the program and erase functions are inhibited. (b) V_{CC} power-on delay: once V_{CC} has reached the V_{CC} sense level, the device will automatically time-out 10 ms (typical) before programming. (c) Program inhibit: holding any one of $\overline{OE}$ low, $\overline{CE}$ high or $\overline{WE}$ high inhibits program cycles. (d) Noise filter: pulses of less than 15 ns (typical) on the $\overline{WE}$ or $\overline{CE}$ inputs will not initiate a program cycle. (e) V_{PP} is less than V_{ILPP}.

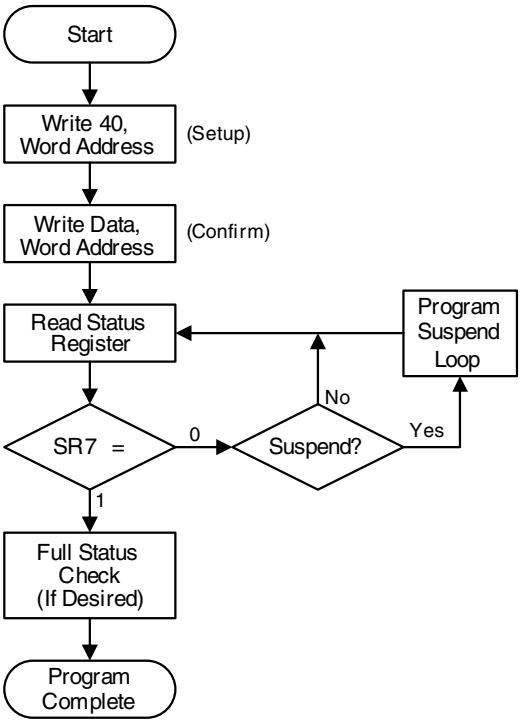
3.14 Input Levels

While operating with a 2.7V to 3.6V power supply, the address inputs and control inputs ($\overline{OE}$, $\overline{CE}$ and $\overline{WE}$) may be driven from 0 to 5.5V without adversely affecting the operation of the device. The I/O lines can be driven from 0 to V_{CCQ} + 0.6V.

3.15 Output Levels

For the AT49BV6416C(T), output high levels are equal to V_{CCQ} - 0.1V (not V_{CC}). For 2.7V to 3.6V output levels, V_{CCQ} must be tied to V_{CC}.

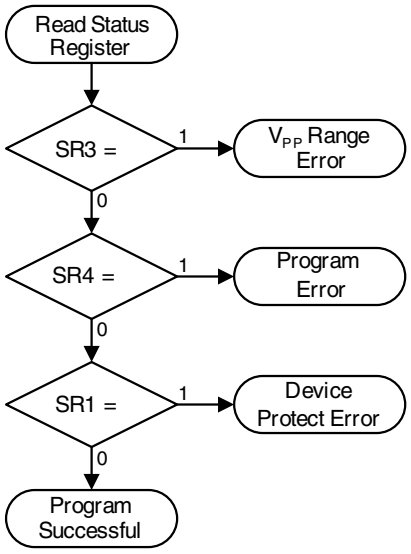
3.16 Word Program Flowchart



3.17 Word Program Procedure

Bus Operation	Command	Comments
Write	Program Setup	Data = 40 Addr = Location to program
Write	Data	Data = Data to program Addr = Location to program
Read	None	Status register data: Toggle $\overline{CE}$ or $\overline{OE}$ to update status register
Idle	None	Check SR7 1 = WSM Ready 0 = WSM Busy
Repeat for subsequent Word Program operations. Full status register check can be done after each program, or after a sequence of program operations. Write FF after the last operation to set to the Read state.		

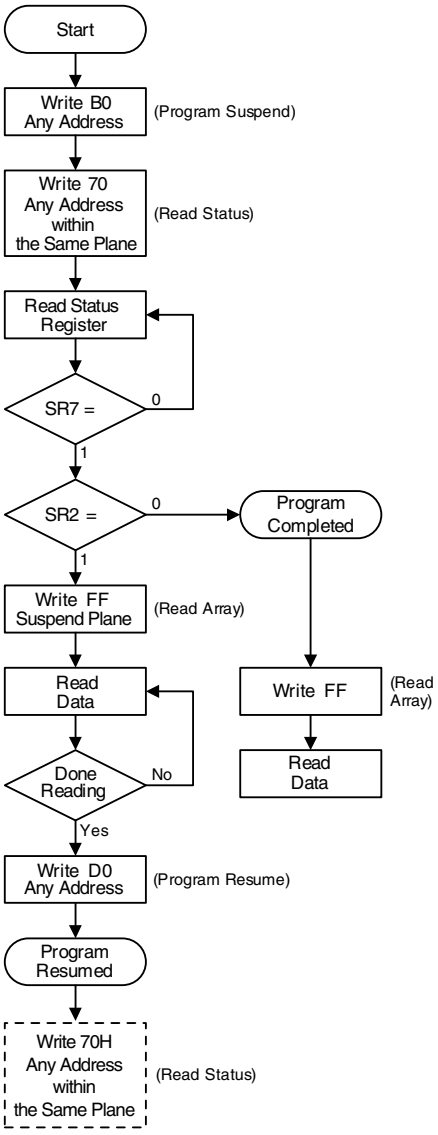
3.18 Full Status Check Flowchart



3.19 Full Status Check Procedure

Bus Operation	Command	Comments
Idle	None	Check SR3: 1 = V_{PP} Error
Idle	None	Check SR4: 1 = Data Program Error
Idle	None	Check SR1: 1 = Sector locked; operation aborted
SR3 MUST be cleared before the Write State Machine allows further program attempts. If an error is detected, clear the status register before continuing operations – only the Clear Status Register command clears the status register error bits.		

3.20 Program Suspend/Resume Flowchart



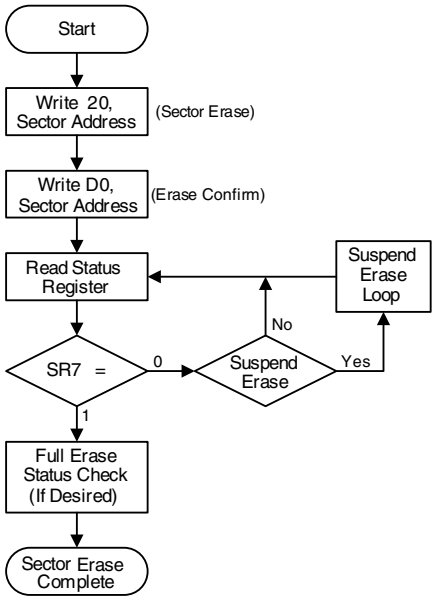
3.21 Program Suspend/Resume Procedure

Bus Operation	Command	Comments
Write	Program Suspend	Data = B0 Addr = Sector address to Suspend (SA)
Write	Read Status	Data = 70 Addr = Any address within the Same Plane
Read	None	Status register data: Toggle $\overline{CE}$ or $\overline{OE}$ to update status register Addr = Any address
Idle	None	Check SR7 1 = WSM Ready 0 = WSM Busy
Idle	None	Check SR2 1 = Program suspended 0 = Program completed
Write	Read Array	Data = FF Addr = Any address within the Suspended Plane
Read	None	Read data from any sector in the memory other than the one being programmed
Write	Program Resume	Data = D0 Addr = Any address

If the Suspend Plane was placed in Read mode:

Write	Read Status	Return Plane to Status mode: Data = 70 Addr = Any address within the Same Plane

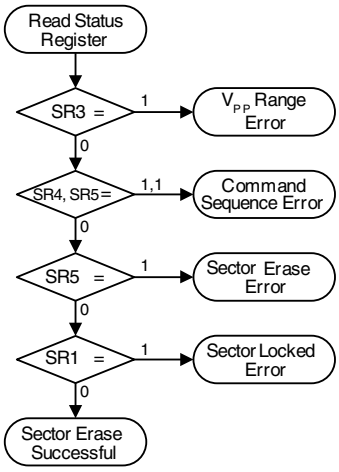
3.22 Sector Erase Flowchart



3.23 Sector Erase Procedure

Bus Operation	Command	Comments
Write	Sector Erase Setup	Data = 20 Addr = Sector to be erased (SA)
Write	Erase Confirm	Data = D0 Addr = Sector to be erased (SA)
Read	None	Status register data: Toggle $\overline{CE}$ or $\overline{OE}$ to update status register data
Idle	None	Check SR7 1 = WSMS Ready 0 = WSMS Busy
Repeat for subsequent sector erasures. Full status register check can be done after each sector erase, or after a sequence of sector erasures. Write FF after the last operation to enter read mode.		

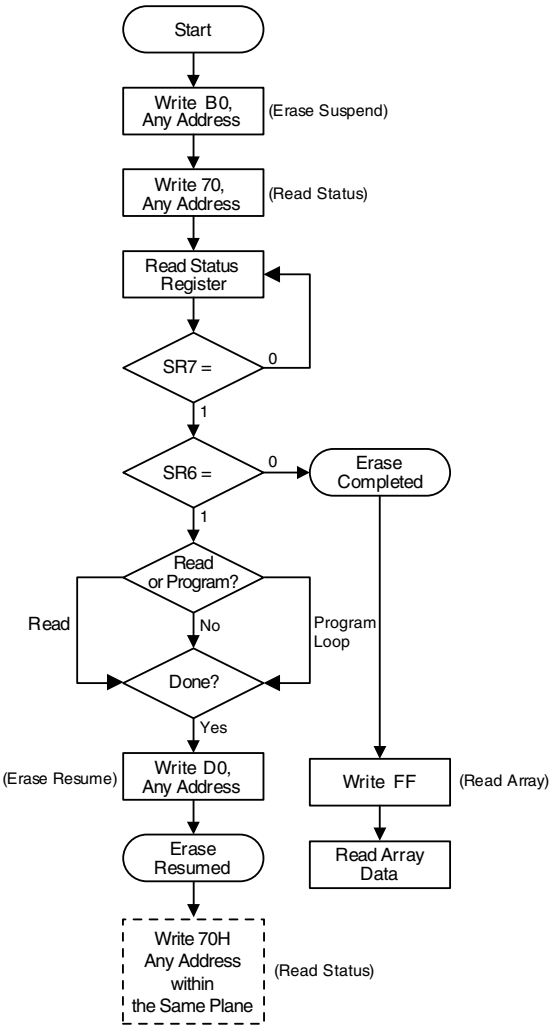
3.24 Full Erase Status Check Flowchart



3.25 Full Erase Status Check Procedure

Bus Operation	Command	Comments
Idle	None	Check SR3: 1 = V_{PP} Range Error
Idle	None	Check SR4, SR5: Both 1 = Command Sequence Error
Idle	None	Check SR5: 1 = Sector Erase Error
Idle	None	Check SR1: 1 = Attempted erase of locked sector; erase aborted.
SR1, SR3 must be cleared before the Write State Machine allows further erase attempts. Only the Clear Status Register command clears SR1, SR3, SR4, SR5. If an error is detected, clear the status register before attempting an erase retry or other error recovery.		

3.26 Erase Suspend/Resume Flowchart



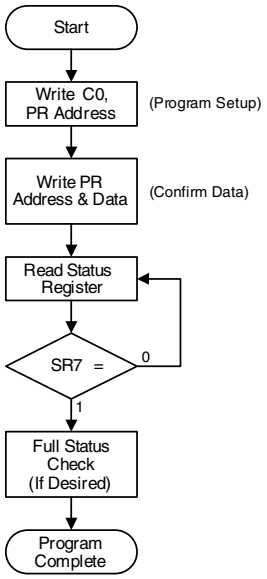
3.27 Erase Suspend/Resume Procedure

Bus Operation	Command	Comments
Write	Erase Suspend	Data = B0 Addr = Any address within the Same Plane
Write	Read Status	Data = 70 Addr = Any address
Read	None	Status register data: Toggle $\overline{CE}$ or $\overline{OE}$ to update status register Addr = Any address within the Same Plane
Idle	None	Check SR7 1 = WSM Ready 0 = WSM Busy
Idle	None	Check SR6 1 = Erase suspended 0 = Erase completed
Write	Read or Program	Data = FF or 40 Addr = Any address
Read or Write	None	Read or program data from/to sector other than the one being erased
Write	Program Resume	Data = D0 Addr = Any address

If the Suspended Plane was placed in Read mode or a Program loop:

Write	Read Status	Return Plane to Status mode: Data = 70 Addr = Any address within the Same Plane

3.28 Protection Register Programming Flowchart



3.29 Protection Register Programming Procedure

Bus Operation	Command	Comments
Write	Program PR Setup	Data = C0 Addr = First Location to Program
Write	Protection Program	Data = Data to Program Addr = Location to Program
Read	None	Status register data: Toggle $\overline{CE}$ or $\overline{OE}$ to update status register data
Idle	None	Check SR7 1 = WSMS Ready 0 = WSMS Busy

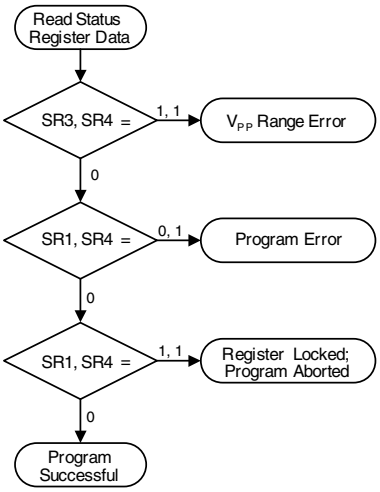
Program Protection Register operation addresses must be within the protection register address space. Addresses outside this space will return an error.

Repeat for subsequent programming operations.

Full status register check can be done after each program, or after a sequence of program operations.

Write FF after the last operation to return to the Read mode.

3.30 Full Status Check Flowchart



3.31 Full Status Check Procedure

Bus Operation	Command	Comments
Idle	None	Check SR1, SR3, SR4: 0,1,1 = V_{PP} Range Error
Idle	None	Check SR1, SR3, SR4: 0,0,1 = Programming Error
Idle	None	Check SR1, SR3, SR4: 1, 0,1 = Sector locked; operation aborted

SR3 must be cleared before the Write State Machine allows further program attempts.

Only the Clear Status Register command clears SR1, SR3, SR4.

If an error is detected, clear the status register before attempting a program retry or other error recovery.

4. Command Definition Table

Command Sequence	Bus Cycles	1st Bus Cycle		2nd Bus Cycle		3rd Bus Cycle	
		Addr	Data	Addr	Data	Addr	Data
Read	1	PA[2]	FF				
Chip Erase	2	xx	21	Addr	D0		
Plane Erase	2	xx	22	Addr	D0		
Sector Erase	2	SA[3]	20	SA[3]	D0		
Word Program	2	Addr[4]	40/10	Addr[4]	D_{IN}		
Dual Word Program[5]	3	Addr0	E0	Addr0	D_{IN0}	Addr1	D_{IN1}
Erase/Program Suspend	1	xx	B0				
Erase/Program Resume	1	PA[2]	D0				
Product ID Entry[6][7]	1	PA[2]	90				
Sector Softlock	2	SA[3]	60	SA[3]	01		
Sector Hardlock	2	SA[3]	60	SA[3]	2F		
Sector Unlock	2	SA[3]	60	SA[3]	D0		
Read Status Register	2	PA[2]	70	PA[7]	D_{OUT}[8]		
Clear Status Register	1	xx	50				
Program Protection Register– Block B	2	xxxx[10]8x[9]	C0	xxxx[10]8x[9]	D_{IN}		
Lock Protection Register – Sector B	2	xxxx80[10]	C0	xxxx80[10]	FFFD		
Status of Sector B Protection	2	xxxx80[10]	90	xxxx80[10]	D_{OUT}[11]		
CFI Query	1	xx	98				

Notes:
1. The DATA FORMAT shown for each bus cycle is as follows; I/O7 - I/O0 (Hex). I/O15 - I/O8 are don't care. The ADDRESS FORMAT shown for each bus cycle is as follows: A7 - A0 (Hex). Address A21 through A8 are don't care.
2. PA is the plane address (A21 - A20). Any address within a plane can be used.
3. SA = sector address. Any word address within a sector can be used to designate the sector address (see pages 17 - 20 for details).
4. The first bus cycle address should be the same as the word address to be programmed.
5. This fast programming option enables the user to program two words in parallel only when V_{PP} = 10V. The addresses, Addr0 and Addr1, of the two words, D_{IN0} and D_{IN1}, must only differ in address A0. This command should be used during manufacturing purposes only.
6. During the second bus cycle, the manufacturer code is read from address PA+00000H, the device code is read from address PA+00001H, and the data in the protection register is read from addresses 000081H - 000088H.
7. The plane address should be the same during the first and second bus cycle.
8. The status register bits are output on I/O7 - I/O0.
9. Any address within the user programmable protection register region. Please see "Protection Register Addressing Table" on page 16
10. For the AT49BV6416C, xxxx = 0000H. For the AT49BV6416CT, xxxx = 3F80H.
11. If data bit D1 is "0", sector B is locked. If data bit D1 is "1", sector B can be reprogrammed.

5. Absolute Maximum Ratings*

Temperature under Bias	-55°C to +125°C
Storage Temperature	-65°C to +150°C
All Input Voltages Except V_{PP} (Including NC Pins) with Respect to Ground	-0.6V to +6.25V
V_{PP} Input Voltage with Respect to Ground	0V to 10V
All Output Voltages with Respect to Ground	-0.6V to V_{CCQ} + 0.6V

*NOTICE: Stresses beyond 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 these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

6. Protection Register Addressing Table

Word	Use	Block	A7	A6	A5	A4	A3	A2	A1	A0
0	Factory	A	1	0	0	0	0	0	0	1
1	Factory	A	1	0	0	0	0	0	1	0
2	Factory	A	1	0	0	0	0	0	1	1
3	Factory	A	1	0	0	0	0	1	0	0
4	User	B	1	0	0	0	0	1	0	1
5	User	B	1	0	0	0	0	1	1	0
6	User	B	1	0	0	0	0	1	1	1
7	User	B	1	0	0	0	1	0	0	0

Notes: 1. For the AT49BV6416C, all address lines not specified in the above table, A21 - A8, must be 0 when accessing the Protection Register.

2. For the AT49BV6416CT, all address lines not specified in the table, A21 - A8, must be 3F80H when accessing the Protection Register.

7. Memory Organization – AT49BV6416C

Plane	Sector	Size (Words)	x16 Address Range (A21 - A0)
A	SA0	4K	00000 - 00FFF
A	SA1	4K	01000 - 01FFF
A	SA2	4K	02000 - 02FFF
A	SA3	4K	03000 - 03FFF
A	SA4	4K	04000 - 04FFF
A	SA5	4K	05000 - 05FFF
A	SA6	4K	06000 - 06FFF
A	SA7	4K	07000 - 07FFF
A	SA8	32K	08000 - 0FFFF
A	SA9	32K	10000 - 17FFF
A	SA10	32K	18000 - 1FFFF
A	SA11	32K	20000 - 27FFF
A	SA12	32K	28000 - 2FFFF
A	SA13	32K	30000 - 37FFF
A	SA14	32K	38000 - 3FFFF
A	SA15	32K	40000 - 47FFF
A	SA16	32K	48000 - 4FFFF
A	SA17	32K	50000 - 57FFF
A	SA18	32K	58000 - 5FFFF
A	SA19	32K	60000 - 67FFF
A	SA20	32K	68000 - 6FFFF
A	SA21	32K	70000 - 77FFF
A	SA22	32K	78000 - 7FFFF
A	SA23	32K	80000 - 87FFF
A	SA24	32K	88000 - 8FFFF
A	SA25	32K	90000 - 97FFF
A	SA26	32K	98000 - 9FFFF
A	SA27	32K	A0000 - A7FFF
A	SA28	32K	A8000 - AFFFF
A	SA29	32K	B0000 - B7FFF
A	SA30	32K	B8000 - BFFFF
A	SA31	32K	C0000 - C7FFF
A	SA32	32K	C8000 - CFFFF
A	SA33	32K	D0000 - D7FFF
A	SA34	32K	D8000 - DFFFF
A	SA35	32K	E0000 - E7FFF

7. Memory Organization – AT49BV6416C (Continued)

Plane	Sector	Size (Words)	x16 Address Range (A21 - A0)
A	SA36	32K	E8000 - EFFFF
A	SA37	32K	F0000 - F7FFF
A	SA38	32K	F8000 - FFFFF
B	SA39	32K	100000 - 107FFF
B	SA40	32K	108000 - 10FFFF
B	SA41	32K	110000 - 117FFF
B	SA42	32K	118000 - 11FFFF
B	SA43	32K	120000 - 127FFF
B	SA44	32K	128000 - 12FFFF
B	SA45	32K	130000 - 137FFF
B	SA46	32K	138000 - 13FFFF
B	SA47	32K	140000 - 147FFF
B	SA48	32K	148000 - 14FFFF
B	SA49	32K	150000 - 157FFF
B	SA50	32K	158000 - 15FFFF
B	SA51	32K	160000 - 167FFF
B	SA52	32K	168000 - 16FFFF
B	SA53	32K	170000 - 177FFF
B	SA54	32K	178000 - 17FFFF
B	SA55	32K	180000 - 187FFF
B	SA56	32K	188000 - 18FFFF
B	SA57	32K	190000 - 197FFF
B	SA58	32K	198000 - 19FFFF
B	SA59	32K	1A0000 - 1A7FFF
B	SA60	32K	1A8000 - 1AFFFF
B	SA61	32K	1B0000 - 1B7FFF
B	SA62	32K	1B8000 - 1BFFFF
B	SA63	32K	1C0000 - 1C7FFF
B	SA64	32K	1C8000 - 1CFFFF
B	SA65	32K	1D0000 - 1D7FFF
B	SA66	32K	1D8000 - 1DFFFF
B	SA67	32K	1E0000 - 1E7FFF
B	SA68	32K	1E8000 - 1EFFFF
B	SA69	32K	1F0000 - 1F7FFF
B	SA70	32K	1F8000 - 1FFFFF
C	SA71	32K	200000 - 207FFF

7. Memory Organization – AT49BV6416C (Continued)

Plane	Sector	Size (Words)	x16 Address Range (A21 - A0)
C	SA72	32K	208000 - 20FFFF
C	SA73	32K	210000 - 217FFF
C	SA74	32K	218000 - 21FFFF
C	SA75	32K	220000 - 227FFF
C	SA76	32K	228000 - 22FFFF
C	SA77	32K	230000 - 237FFF
C	SA78	32K	238000 - 23FFFF
C	SA79	32K	240000 - 247FFF
C	SA80	32K	248000 - 24FFFF
C	SA81	32K	250000 - 257FFF
C	SA82	32K	258000 - 25FFFF
C	SA83	32K	260000 - 267FFF
C	SA84	32K	268000 - 26FFFF
C	SA85	32K	270000 - 277FFF
C	SA86	32K	278000 - 27FFFF
C	SA87	32K	280000 - 287FFF
C	SA88	32K	288000 - 28FFFF
C	SA89	32K	290000 - 297FFF
C	SA90	32K	298000 - 29FFFF
C	SA91	32K	2A0000 - 2A7FFF
C	SA92	32K	2A8000 - 2AFFFF
C	SA93	32K	2B0000 - 2B7FFF
C	SA94	32K	2B8000 - 2BFFFF
C	SA95	32K	2C0000 - 2C7FFF
C	SA96	32K	2C8000 - 2CFFFF
C	SA97	32K	2D0000 - 2D7FFF
C	SA98	32K	2D8000 - 2DFFFF
C	SA99	32K	2E0000 - 2E7FFF
C	SA100	32K	2E8000 - 2EFFFF
C	SA101	32K	2F0000 - 2F7FFF
C	SA102	32K	2F8000 - 2FFFFF
D	SA103	32K	300000 - 307FFF
D	SA104	32K	308000 - 30FFFF
D	SA105	32K	310000 - 317FFF
D	SA106	32K	318000 - 31FFFF
D	SA107	32K	320000 - 327FFF

7. Memory Organization – AT49BV6416C (Continued)

Plane	Sector	Size (Words)	x16 Address Range (A21 - A0)
D	SA108	32K	328000 - 32FFFF
D	SA109	32K	330000 - 337FFF
D	SA110	32K	338000 - 33FFFF
D	SA111	32K	340000 - 347FFF
D	SA112	32K	348000 - 34FFFF
D	SA113	32K	350000 - 357FFF
D	SA114	32K	358000 - 35FFFF
D	SA115	32K	360000 - 367FFF
D	SA116	32K	368000 - 36FFFF
D	SA117	32K	370000 - 377FFF
D	SA118	32K	378000 - 37FFFF
D	SA119	32K	380000 - 387FFF
D	SA120	32K	388000 - 38FFFF
D	SA121	32K	390000 - 397FFF
D	SA122	32K	398000 - 39FFFF
D	SA123	32K	3A0000 - 3A7FFF
D	SA124	32K	3A8000 - 3AFFFF
D	SA125	32K	3B0000 - 3B7FFF
D	SA126	32K	3B8000 - 3BFFFF
D	SA127	32K	3C0000 - 3C7FFF
D	SA128	32K	3C8000 - 3CFFFF
D	SA129	32K	3D0000 - 3D7FFF
D	SA130	32K	3D8000 - 3DFFFF
D	SA131	32K	3E0000 - 3E7FFF
D	SA132	32K	3E8000 - 3EFFFF
D	SA133	32K	3F0000 - 3F7FFF
D	SA134	32K	3F8000 - 3FFFFF

8. Memory Organization – AT49BV6416CT

Plane	Sector	Size (Words)	x16 Address Range (A21 - A0)
D	SA0	32K	00000 - 07FFF
D	SA1	32K	08000 - 0FFFF
D	SA2	32K	10000 - 17FFF
D	SA3	32K	18000 - 1FFFF
D	SA4	32K	20000 - 27FFF
D	SA5	32K	28000 - 2FFFF
D	SA6	32K	30000 - 37FFF
D	SA7	32K	38000 - 3FFFF
D	SA8	32K	40000 - 47FFF
D	SA9	32K	48000 - 4FFFF
D	SA10	32K	50000 - 57FFF
D	SA11	32K	58000 - 5FFFF
D	SA12	32K	60000 - 67FFF
D	SA13	32K	68000 - 6FFFF
D	SA14	32K	70000 - 77FFF
D	SA15	32K	78000 - 7FFFF
D	SA16	32K	80000 - 87FFF
D	SA17	32K	88000 - 8FFFF
D	SA18	32K	90000 - 97FFF
D	SA19	32K	98000 - 9FFFF
D	SA20	32K	A0000 - A7FFF
D	SA21	32K	A8000 - AFFFF
D	SA22	32K	B0000 - B7FFF
D	SA23	32K	B8000 - BFFFF
D	SA24	32K	C0000 - C7FFF
D	SA25	32K	C8000 - CFFFF
D	SA26	32K	D0000 - D7FFF
D	SA27	32K	D8000 - DFFFF
D	SA28	32K	E0000 - E7FFF
D	SA29	32K	E8000 - EFFFF
D	SA30	32K	F0000 - F7FFF
D	SA31	32K	F8000 - FFFFF
C	SA32	32K	100000 - 107FFF
C	SA33	32K	108000 - 10FFFF
C	SA34	32K	110000 - 117FFF
C	SA35	32K	118000 - 11FFFF

8. Memory Organization – AT49BV6416CT (Continued)

Plane	Sector	Size (Words)	x16 Address Range (A21 - A0)
C	SA36	32K	120000 - 127FFF
C	SA37	32K	128000 - 12FFFF
C	SA38	32K	130000 - 137FFF
C	SA39	32K	138000 - 13FFFF
C	SA40	32K	140000 - 147FFF
C	SA41	32K	148000 - 14FFFF
C	SA42	32K	150000 - 157FFF
C	SA43	32K	158000 - 15FFFF
C	SA44	32K	160000 - 167FFF
C	SA45	32K	168000 - 16FFFF
C	SA46	32K	170000 - 177FFF
C	SA47	32K	178000 - 17FFFF
C	SA48	32K	180000 - 187FFF
C	SA49	32K	188000 - 18FFFF
C	SA50	32K	190000 - 197FFF
C	SA51	32K	198000 - 19FFFF
C	SA52	32K	1A0000 - 1A7FFF
C	SA53	32K	1A8000 - 1AFFFF
C	SA54	32K	1B0000 - 1B7FFF
C	SA55	32K	1B8000 - 1BFFFF
C	SA56	32K	1C0000 - 1C7FFF
C	SA57	32K	1C8000 - 1CFFFF
C	SA58	32K	1D0000 - 1D7FFF
C	SA59	32K	1D8000 - 1DFFFF
C	SA60	32K	1E0000 - 1E7FFF
C	SA61	32K	1E8000 - 1EFFFF
C	SA62	32K	1F0000 - 1F7FFF
C	SA63	32K	1F8000 - 1FFFFF
B	SA64	32K	200000 - 207FFF
B	SA65	32K	208000 - 20FFFF
B	SA66	32K	210000 - 217FFF
B	SA67	32K	218000 - 21FFFF
B	SA68	32K	220000 - 227FFF
B	SA69	32K	228000 - 22FFFF
B	SA70	32K	230000 - 237FFF
B	SA71	32K	238000 - 23FFFF

8. Memory Organization – AT49BV6416CT (Continued)

Plane	Sector	Size (Words)	x16 Address Range (A21 - A0)
B	SA72	32K	240000 - 247FFF
B	SA73	32K	248000 - 24FFFF
B	SA74	32K	250000 - 257FFF
B	SA75	32K	258000 - 25FFFF
B	SA76	32K	260000 - 267FFF
B	SA77	32K	268000 - 26FFFF
B	SA78	32K	270000 - 277FFF
B	SA79	32K	278000 - 27FFFF
B	SA80	32K	280000 - 287FFF
B	SA81	32K	288000 - 28FFFF
B	SA82	32K	290000 - 297FFF
B	SA83	32K	298000 -29FFFF
B	SA84	32K	2A0000 - 2A7FFF
B	SA85	32K	2A8000 - 2AFFFF
B	SA86	32K	2B0000 - 2B7FFF
B	SA87	32K	2B8000 - 2BFFFF
B	SA88	32K	2C0000 - 2C7FFF
B	SA89	32K	2C8000 - 2CFFFF
B	SA90	32K	2D0000 - 2D7FFF
B	SA91	32K	2D8000 - 2DFFFF
B	SA92	32K	2E0000 - 2E7FFF
B	SA93	32K	2E8000 - 2EFFFF
B	SA94	32K	2F0000 - 2F7FFF
B	SA95	32K	2F8000 - 2FFFFF
A	SA96	32K	300000 - 307FFF
A	SA97	32K	308000 - 30FFFF
A	SA98	32K	310000 - 317FFF
A	SA99	32K	318000 - 31FFFF
A	SA100	32K	320000 - 327FFF
A	SA101	32K	328000 - 32FFFF
A	SA102	32K	330000 - 337FFF
A	SA103	32K	338000 - 33FFFF
A	SA104	32K	340000 - 347FFF
A	SA105	32K	348000 - 34FFFF
A	SA106	32K	350000 - 357FFF
A	SA107	32K	358000 - 35FFFF

8. Memory Organization – AT49BV6416CT (Continued)

Plane	Sector	Size (Words)	x16 Address Range (A21 - A0)
A	SA108	32K	360000 - 367FFF
A	SA109	32K	368000 - 36FFFF
A	SA110	32K	370000 - 377FFF
A	SA111	32K	378000 - 37FFFF
A	SA112	32K	380000 - 387FFF
A	SA113	32K	388000 - 38FFFF
A	SA114	32K	390000 - 397FFF
A	SA115	32K	398000 - 39FFFF
A	SA116	32K	3A0000 - 3A7FFF
A	SA117	32K	3A8000 - 3AFFFF
A	SA118	32K	3B0000 - 3B7FFF
A	SA119	32K	3B8000 - 3BFFFF
A	SA120	32K	3C0000 - 3C7FFF
A	SA121	32K	3C8000 - 3CFFFF
A	SA122	32K	3D0000 - 3D7FFF
A	SA123	32K	3D8000 - 3DFFFF
A	SA124	32K	3E0000 - 3E7FFF
A	SA125	32K	3E8000 - 3EFFFF
A	SA126	32K	3F0000 - 3F7FFF
A	SA127	4K	3F8000 - 3F8FFF
A	SA128	4K	3F9000 - 3F9FFF
A	SA129	4K	3FA000 - 3FAFFF
A	SA130	4K	3FB000 - 3FBFFF
A	SA131	4K	3FC000 - 3FCFFF
A	SA132	4K	3FD000 - 3FDFFF
A	SA133	4K	3FE000 - 3FEFFF
A	SA134	4K	3FF000 - 3FFFFF

9. DC and AC Operating Range

		AT49BV6416C(T)-70
Operating Temperature (Case)	Industrial	-40°C - 85°C
V_{CC} Power Supply		2.7V - 3.6V

10. Operating Modes

Mode	$\overline{CE}$	$\overline{OE}$	$\overline{WE}$	$\overline{Reset}$	V_{PP}[4]	Ai	I/O
Read	V_{IL}	V_{IL}	V_{IH}	V_{IH}	X	Ai	D_{OUT}
Program/Erase[3]	V_{IL}	V_{IH}	V_{IL}	V_{IH}	V_{IHPP}[5]	Ai	D_{IN}
Standby/Program Inhibit	V_{IH}	X[1]	X	V_{IH}	X	X	High Z
Program Inhibit	X	X	V_{IH}	V_{IH}	X		
	X	V_{IL}	X	V_{IH}	X		
	X	X	X	X	V_{ILPP}[6]		
Output Disable	X	V_{IH}	X	V_{IH}	X		High Z
Reset	X	X	X	V_{IL}	X	X	High Z
Product Identification							
Software				V_{IH}		A0 = V_{IL}, A1 - A21 = V_{IL}	Manufacturer Code[3]
						A0 = V_{IH}, A1 - A21 = V_{IL}	Device Code[3]

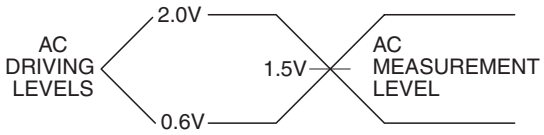
Notes:
1. X can be V_{IL} or V_{IH}.
2. Refer to AC programming waveforms.
3. Manufacturer Code: 001FH; Device Code: 00C5H – AT49BV6416C; 00DFH – AT49BV6416CT
4. The VPP pin can be tied to V_{CC}. For faster program/erase operations, V_{PP} can be set to 9.5V ± 0.5V.
5. V_{IHPP} (min) = 1.65V.
6. V_{ILPP} (max) = 0.7V.

11. DC Characteristics

Symbol	Parameter	Condition	Min	Max	Units
I_{LI}	Input Load Current	V_{IN} = 0V to V_{CC}		1	µA
I_{LO}	Output Leakage Current	$V_{I/O}$ = 0V to V_{CC}		1	µA
I_{SB1}	V_{CC} Standby Current CMOS	$\overline{CE}$ = V_{CCQ} - 0.3V to V_{CC}		35	µA
I_{CC}[1]	V_{CC} Active Current	f = 5 MHz; I_{OUT} = 0 mA		30	mA
I_{CCRE}	V_{CC} Read While Erase Current	f = 5 MHz; I_{OUT} = 0 mA		60	mA
I_{CCRW}	V_{CC} Read While Write Current	f = 5 MHz; I_{OUT} = 0 mA		60	mA
V_{IL}	Input Low Voltage			0.6	V
V_{IH}	Input High Voltage		V_{CCQ} - 0.6		V
V_{OL}	Output Low Voltage	I_{OL} = 2.1 mA		0.45	V
V_{OH}	Output High Voltage	I_{OH} = -100 µA; V_{CCQ} = 2.2V - 3.6V	V_{CCQ} - 0.1		V

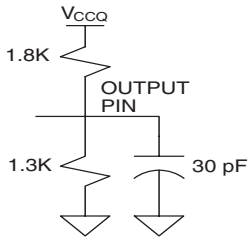
Note: 1. In the erase mode, I_{CC} is 35 mA.

12. Input Test Waveforms and Measurement Level



t_R, t_F < 5 ns

13. Output Test Load



14. Pin Capacitance

f = 1 MHz, T = 25°C[1]

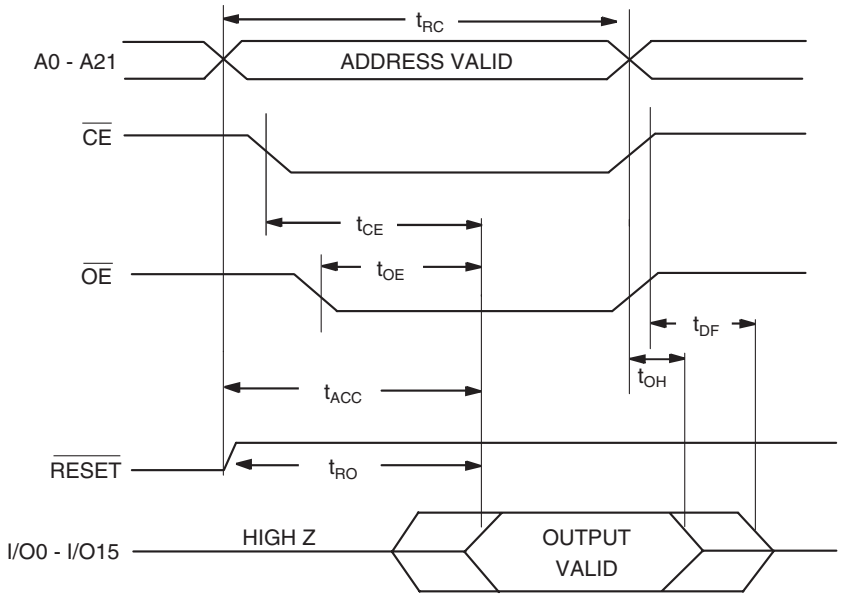
	Typ	Max	Units	Conditions
C_{IN}	4	6	pF	V_{IN} = 0V
C_{OUT}	8	12	pF	V_{OUT} = 0V

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

15. AC Asynchronous Read Timing Characteristics

Symbol	Parameter	Min	Max	Units
t_{RC}	Read Cycle Time	70		ns
t_{ACC}	Access, Address to Data Valid		70	ns
t_{CE}	Access, $\overline{CE}$ to Data Valid		70	ns
t_{OE}	$\overline{OE}$ to Data Valid		20	ns
t_{DF}	$\overline{CE}$, $\overline{OE}$ High to Data Float		25	ns
t_{OH}	Output Hold from $\overline{OE}$, $\overline{CE}$ or Address, whichever Occurs First	0		ns
t_{RO}	$\overline{Reset}$ to Output Delay		150	ns

16. Asynchronous Read Cycle Waveform[(1)(2)(3)]

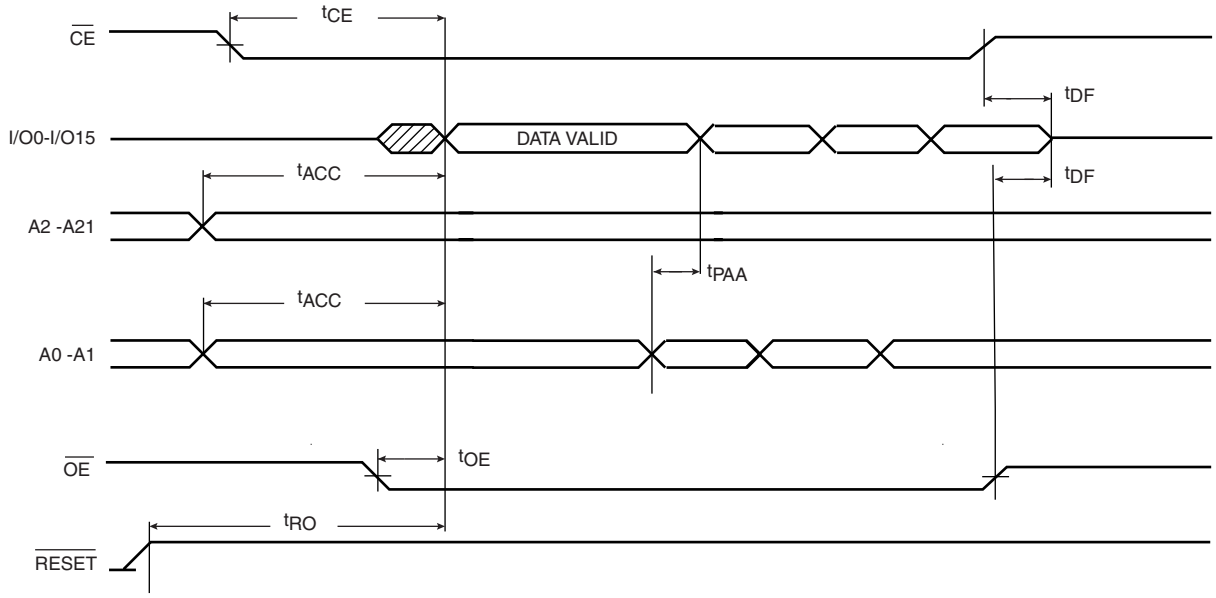


Notes:
1. $\overline{CE}$ may be delayed up to $t_{ACC} - t_{CE}$ after the address transition without impact on t_{ACC}.
2. $\overline{OE}$ may be delayed up to $t_{CE} - t_{OE}$ after the falling edge of $\overline{CE}$ without impact on t_{CE} or by $t_{ACC} - t_{OE}$ after an address change without impact on t_{ACC}.
3. t_{DF} is specified from $\overline{OE}$ or $\overline{CE}$, whichever occurs first (CL = 5 pF).

17. AC Asynchronous Read Timing Characteristics

Symbol	Parameter	Min	Max	Units
t_{ACC}	Access, Address to Data Valid		70	ns
t_{CE}	Access, $\overline{CE}$ to Data Valid		70	ns
t_{OE}	$\overline{OE}$ to Data Valid		20	ns
t_{DF}	$\overline{CE}$, $\overline{OE}$ High to Data Float		25	ns
t_{RO}	$\overline{Reset}$ to Output Delay		150	ns
t_{PAA}	Page Address Access Time		20	ns

18. Page Read Cycle Waveform

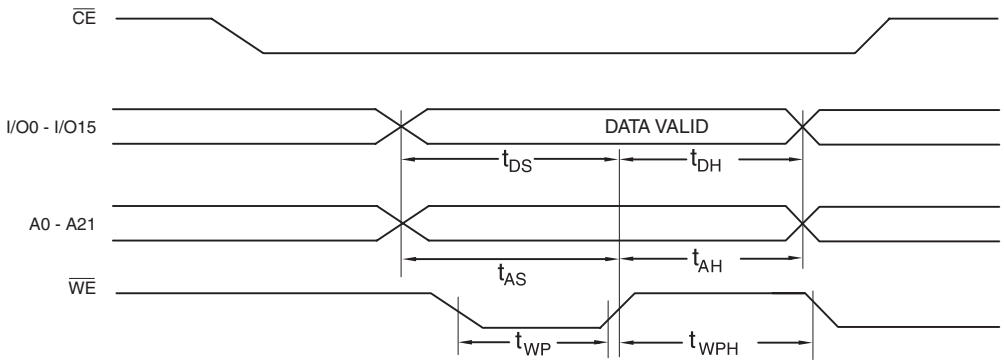


19. AC Word Load Characteristics

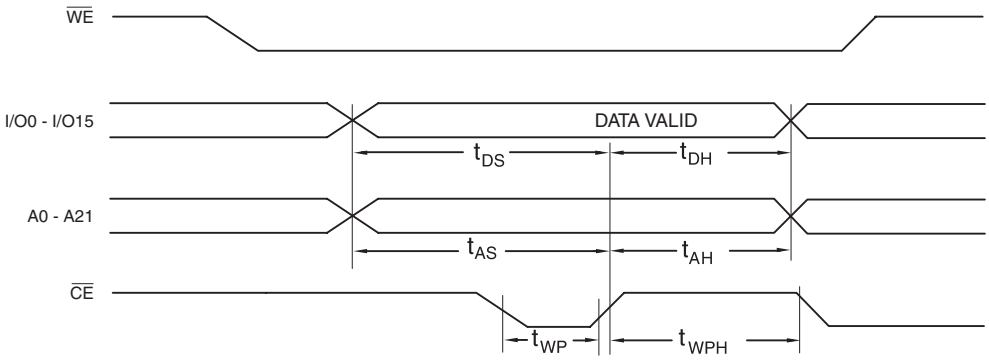
Symbol	Parameter	Min	Max	Units
t_{AS}	Address Setup Time to $\overline{WE}$ and $\overline{CE}$ High	50		ns
t_{AH}	Address Hold Time	0		ns
t_{DS}	Data Setup Time	50		ns
t_{DH}	Data Hold Time	0		ns
t_{WP}	$\overline{CE}$ or $\overline{WE}$ Low Pulse Width	35		ns
t_{WPH}	$\overline{CE}$ or $\overline{WE}$ High Pulse Width	25		ns

20. AC Word Load Waveforms

20.1 $\overline{WE}$ Controlled



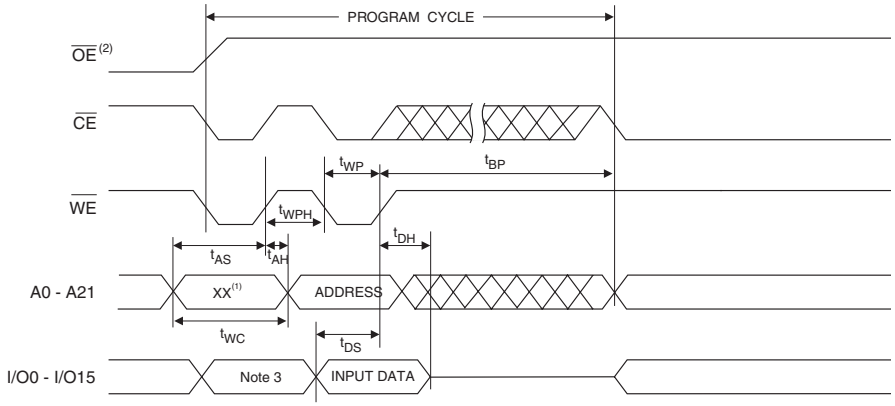
20.2 $\overline{CE}$ Controlled



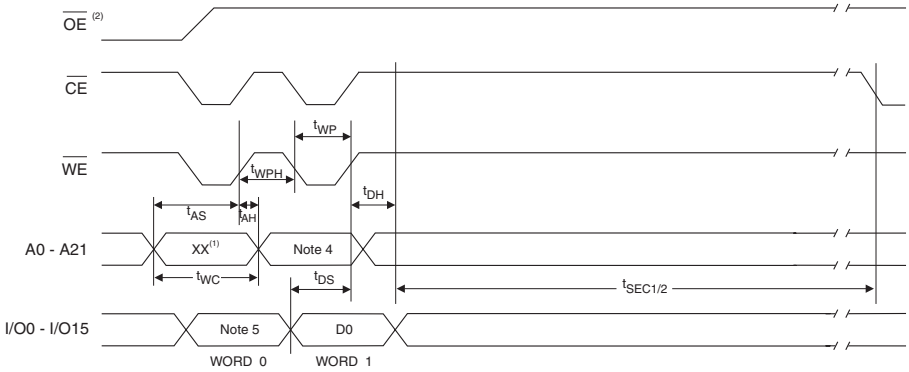
21. Program Cycle Characteristics

Symbol	Parameter	Min	Typ	Max	Units
t_{BP}	Word Programming Time		15		µs
t_{SEC1}	Sector Erase Cycle Time (4K word sectors)		200		ms
t_{SEC2}	Sector Erase Cycle Time (32K word sectors)		700		ms
t_{ES}	Erase Suspend Time			15	µs
t_{PS}	Program Suspend Time			10	µs
t_{ERES}	Delay between Erase Resume and Erase Suspend	500			µs

22. Program Cycle Waveforms



23. Sector, Plane or Chip Erase Cycle Waveforms



Notes:
1. Any address can be used to load data.
2. $\overline{OE}$ must be high only when $\overline{WE}$ and $\overline{CE}$ are both low.
3. The data can be 40H or 10H.
4. For chip erase, any address can be used. For plane erase or sector erase, the address depends on what plane or sector is to be erased.
5. For chip erase, the data should be 21H, for plane erase, the data should be 22H, and for sector erase, the data should be 20H.

24. Common Flash Interface Definition Table

Address	AT49BV6416CT	AT49BV6416C	Comments
10h	0051h	0051h	“Q”
11h	0052h	0052h	“R”
12h	0059h	0059h	“Y”
13h	0003h	0003h	
14h	0000h	0000h	
15h	0041h	0041h	
16h	0000h	0000h	
17h	0000h	0000h	
18h	0000h	0000h	
19h	0000h	0000h	
1Ah	0000h	0000h	
1Bh	0027h	0027h	VCC min write/erase
1Ch	0036h	0036h	VCC max write/erase
1Dh	0009h	0009h	VPP min voltage
1Eh	000Ah	000Ah	VPP max voltage
1Fh	0004h	0004h	Typ word write – 15 µs
20h	0000h	0000h	
21h	0009h	0009h	Typ block erase – 500 ms
22h	0010h	0010h	Typ chip erase – 64,300 ms
23h	0004h	0004h	Max word write/typ time
24h	0000h	0000h	n/a
25h	0003h	0003h	Max block erase/typ block erase
26h	0003h	0003h	Max chip erase/ typ chip erase
27h	0017h	0017h	Device size
28h	0001h	0001h	x16 device
29h	0000h	0000h	x16 device
2Ah	0000h	0000h	Multiple byte write not supported
2Bh	0000h	0000h	Multiple byte write not supported
2Ch	0002h	0002h	2 regions, x = 2
2Dh	007Eh	0007h	64K bytes, Y = 126 (Top); 8K bytes, Y = 7 (Bottom)
2Eh	0000h	0000h	64K bytes, Y = 126 (Top); 8K bytes, Y = 7 (Bottom)
2Fh	0000h	0020h	64K bytes, Z = 256 (Top); 8K bytes, Z = 32 (Bottom)
30h	0001h	0000h	64K bytes, Z = 256 (Top); 8K bytes, Z = 32 (Bottom)
31h	0007h	007Eh	8K bytes, Y = 7 (Top); 64K bytes, Y = 126 (Bottom)
32h	0000h	0000h	8K bytes, Y = 7 (Top); 64K bytes, Y = 126 (Bottom)
33h	0020h	0000h	8K bytes, Z = 32 (Top);64K bytes, Z = 256 (Bottom)
34h	0000h	0001h	8K bytes, Z = 32 (Top);64K bytes, Z = 256 (Bottom)

24. Common Flash Interface Definition Table

Address	AT49BV6416CT	AT49BV6416C	Comments
VENDOR SPECIFIC EXTENDED QUERY			
41h	0050h	0050h	“P”
42h	0052h	0052h	“R”
43h	0049h	0049h	“I”
44h	0031h	0031h	Major version number, ASCII
45h	0030h	0030h	Minor version number, ASCII
46h	00AFh	00AFh	Bit 0 – chip erase supported, 0 – no, 1 – yes Bit 1 – erase suspend supported, 0 – no, 1 – yes Bit 2 – program suspend supported, 0 – no, 1 – yes Bit 3 – simultaneous operations supported, 0 – no, 1 – yes Bit 4 – burst mode read supported, 0 – no, 1 – yes Bit 5 – page mode read supported, 0 – no, 1 – yes Bit 6 – queued erase supported, 0 – no, 1 – yes Bit 7 – protection bits supported, 0 – no, 1 – yes
47h	0000h	0001h	Bit 0 – top (“0”) or bottom (“1”) boot block device Undefined bits are “0”
48h	0000h	0000h	Bit 0 – 4 word linear burst with wrap around, 0 – no, 1 – yes Bit 1 – 8 word linear burst with wrap around, 0 – no, 1 – yes Bit 2 – 16 word linear burst with wrap around, 0 – no, 1 – yes Bit 3 – continuous burst, 0 – no, 1 – yes Undefined bits are “0”
49h	0001h	0001h	Bit 0 – 4 word page, 0 – no, 1 – yes Bit 1 – 8 word page, 0 – no, 1 – yes Undefined bits are “0”
4Ah	0080h	0080h	Location of protection register lock byte, the section’s first byte
4Bh	0003h	0003h	# of bytes in the factory prog section of prot register – 2*n
4Ch	0003h	0003h	# of bytes in the user prog section of prot register – 2*n

25. Ordering Information

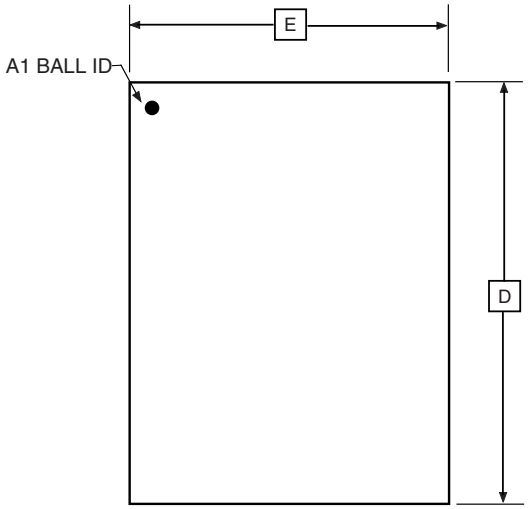
25.1 Standard Packaging

t_{ACC} (ns)	I_{CC} (mA)		Ordering Code	Package	Operation Range
	Active	Standby			
70	30	0.035	AT49BV6416C-70CI	48C20	Industrial (-40° to 85°C)
70	30	0.035	AT49BV6416CT-70CI	48C20	Industrial (-40° to 85°C)

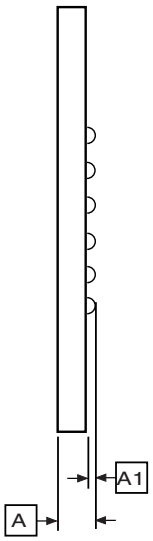
Package Type	
48C20	48-ball, Plastic Chip-size Ball Grid Array Package (CBGA)

26. Packaging Information

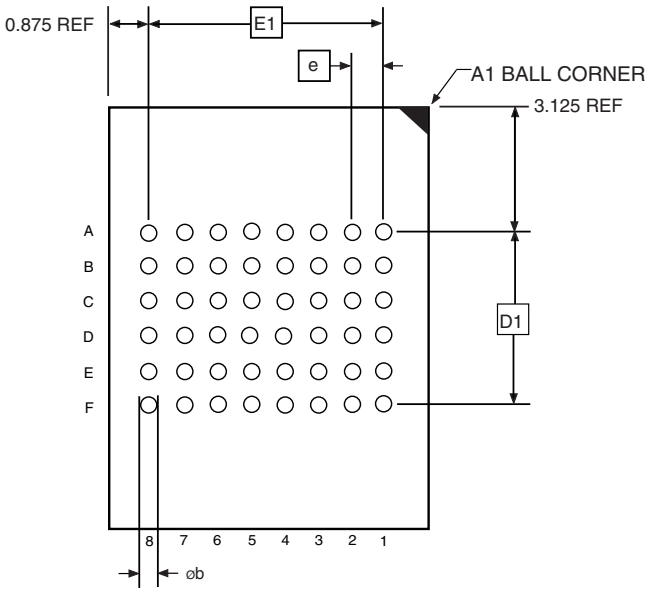
26.1 48C20 – CBGA



Top View



Side View



Bottom View

COMMON DIMENSIONS
(Unit of Measure = mm)

SYMBOL	MIN	NOM	MAX	NOTE
E	6.90	7.00	7.10	
E1		5.25 TYP		
D	9.90	10.00	10.10	
D1		3.75 TYP		
A	–	–	1.0	
A1	0.21	–	–	
e		0.75 BSC		
øb		0.35 TYP		

01/8/04

	TITLE	DRAWING NO.	REV.
2325 Orchard Parkway San Jose, CA 95131	**48C20**, 48-ball (8 x 6 Array),0.75 mm Pitch, 7.0 x 10.0 x 1.0 mm Chip-scale Ball Grid Array Package (CBGA)	48C20	A

27. Revision History

Revision No.	History
Revision A – April 2004	• Initial Release
Revision B – November 2004	• Removed “Preliminary” from the datasheet. • Modified note 6 and added notes 7 and 10 on page 13. • Modified note 1 and added note 2 on page 14. • Changed the I_{SB1} spec to 35 µA.
Revision C – July 2005	• Converted datasheet to new template. • Changed the V_{PP} value to 9.5 ± 0.5V in the text, tables on pages 15, 16, 21 and CFI table on page 27. V_{PP} text also changed to show that a high voltage on V_{PP} improves only the programming time. • Changed the maximum voltage that can be applied on the address inputs and control inputs to 5.5V on page 9. • Changed the maximum input voltage under absolute maximum ratings to 6.25V on page 16.

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