32 Mbit Concurrent SuperFlash + 16 Mbit PSRAM ComboMemory
SST34HF32A4

Preliminary Specifications

FEATURES:

- **Flash Organization: 2M x16 or 4M x8**
- **Dual-Bank Architecture for Concurrent Read/Write Operation**
  - 32 Mbit Top Sector Protection
  - 32 Mbit: 8 Mbit + 24Mbit
- **PSRAM Organization:**
  - 16 Mbit: 1024K x16
- **Single 2.7-3.3V Read and Write Operations**
- **Superior Reliability**
  - Endurance: 100,000 Cycles (typical)
  - Greater than 100 years Data Retention
- **Low Power Consumption:**
  - Active Current: 25 mA (typical)
  - Standby Current: 70 µA (typical)
- **Hardware Sector Protection (WP#)**
  - Protects 8 KWord in the smaller bank by holding WP# low and unprotects by holding WP# high
- **Hardware Reset Pin (RST#)**
  - Resets the internal state machine to reading data array
- **Byte Selection for Flash (CIOF pin)**
  - Selects 8-bit or 16-bit mode (56-ball package only)
- **Sector-Erase Capability**
  - Uniform 2 KWord sectors
- **Flash Chip-Erase Capability**
- **Block-Erase Capability**
  - Uniform 32 KWord blocks
- **Erase-Suspend / Erase-Resume Capabilities**
- **Read Access Time**
  - Flash: 70 ns
  - PSRAM: 70 ns
- **Security ID Feature**
  - SST: 128 bits
  - User: 256 Bytes
- **Latched Address and Data**
- **Fast Erase and Program (typical):**
  - Sector-Erase Time: 18 ms
  - Block-Erase Time: 18 ms
  - Chip-Erase Time: 35 ms
  - Word-Program Time: 7 µs
- **Automatic Write Timing**
  - Internal V_{PP} Generation
- **End-of-Write Detection**
  - Toggle Bit
  - Data# Polling
  - Ready/Busy# pin
- **CMOS I/O Compatibility**
- **JEDEC Standard Command Set**
- **Packages Available**
  - 56-ball LFBGA (8mm x 10mm)
  - 62-ball LFBGA (8mm x 10mm)
- **All non-Pb (lead-free) devices are RoHS compliant**

PRODUCT DESCRIPTION

The SST34HF32A4 ComboMemory integrates either a 2M x16 or 4M x8 CMOS flash memory bank with 1024K x16 CMOS pseudo SRAM (PSRAM) memory bank in a multi-chip package (MCP). This device is fabricated using SST proprietary, high-performance CMOS SuperFlash technology incorporating the split-gate cell design and thick-oxide tunneling injector to attain better reliability and manufacturability compared with alternate approaches. The SST34HF32A4 is ideal for applications such as cellular phones, GPS devices, PDAs, and other portable electronic devices in a low power and small form factor system.

The SST34HF32A4 features dual flash memory bank architecture allowing for concurrent operations between the two flash memory banks and the PSRAM. The device can read data from either bank while an Erase or Program operation is in progress in the opposite bank. The two flash memory banks are partitioned into 8 Mbit and 24 Mbit with top sector protection options for storing boot code, program code, configuration/parameter data and user data.

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 de-rated as is necessary with alternative flash technologies, whose Erase and Program times increase with accumulated Erase/Program cycles. The SST34HF32A4 offers a guaranteed endurance of 10,000 cycles. Data retention is rated at greater than 100 years. With high-performance Program operations, the flash memory banks provide a typical Word-Program time of 7 µsec. To protect against inadvertent flash write, the SST34HF32A4 contains on-chip hardware and software data protection schemes.

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The flash and PSRAM operate as two independent memory banks with respective bank enable signals. The memory bank selection is done by two bank enable signals. The PSRAM bank enable signals, BES1# and BES2, select the PSRAM bank. The flash memory bank enable signal, BEF#, has to be used with Software Data Protection (SDP) command sequence when controlling the Erase and Program operations in the flash memory bank. The memory banks are superimposed in the same memory address space where they share common address lines, data lines, WE# and OE# which minimize power consumption and area.

Designed, manufactured, and tested for applications requiring low power and small form factor, the SST34HF32A4 is offered in both commercial and extended temperatures and a small footprint package to meet board space constraint requirements. See Figure 3 for pin assignments.

Device Operation

The SST34HF32A4 uses BES1#, BES2 and BEF# to control operation of either the flash or the PSRAM memory bank. When BEF# is low, the flash bank is activated for Read, Program or Erase operation. When BES1# is low, and BES2 is high the PSRAM is activated for Read and Write operation. BEF# and BES1# cannot be at low level, and BES2 cannot be at high level at the same time. **If all bank enable signals are asserted, bus contention will result and the device may suffer permanent damage.** All address, data, and control lines are shared by flash and PSRAM memory banks which minimizes power consumption and loading. The device goes into standby when BEF# and BES1# bank enables are raised to V_{IHC} (Logic High) or when BEF# is high and BES2 is low.

Concurrent Read/Write Operation

Dual bank architecture of SST34HF32A4 devices allows the Concurrent Read/Write operation whereby the user can read from one bank while programming or erasing in the other bank. This operation can be used when the user needs to read system code in one bank while updating data in the other bank. See Table 3 for dual-bank memory organization.

Concurrent Read/Write States

Flash		
Bank 1	**Bank 2**	**PSRAM**
Read	Write	No Operation
Write	Read	No Operation
Write	No Operation	Read
No Operation	Write	Read
Write	No Operation	Write
No Operation	Write	Write

Note: For the purposes of this table, write means to perform Block-/Sector-Erase or Program operations as applicable to the appropriate bank.

Flash Read Operation

The Read operation of the SST34HF32A4 is controlled by BEF# and OE#, both have to be low for the system to obtain data from the outputs. BEF# is used for device selection. When BEF# 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 BEF# or OE# is high. Refer to the Read cycle timing diagram in Figure 8 for details.

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Flash Program Operation

These devices are programmed on a word-by-word or byte-by-byte basis depending on the state of the CIOF pin. Before programming, one must ensure that the sector being programmed is fully erased.

The Program operation is accomplished in three steps:

1. Software Data Protection is initiated using the three-byte load sequence.
2. Address and data are loaded.

   During the Program operation, the addresses are latched on the falling edge of either BEF# or WE#, whichever occurs last. The data is latched on the rising edge of either BEF# or WE#, whichever occurs first.
3. The internal Program operation is initiated after the rising edge of the fourth WE# or BEF#, whichever occurs first. The Program operation, once initiated, will be completed typically within 7 µs.

See Figures 9 and 10 for WE# and BEF# controlled Program operation timing diagrams and Figure 23 for flowcharts. 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 an internal Program operation are ignored.

Flash Sector- /Block-Erase Operation

These devices offer both Sector-Erase and Block-Erase operations. These operations allow the system to erase the devices on a sector-by-sector (or block-by-block) basis. The sector architecture is based on a uniform sector size of 2 KWord. The Block-Erase mode is based on a uniform block size of 32 KWord. The Sector-Erase operation is initiated by executing a six-byte command sequence with a Sector-Erase command (50H) and sector address (SA) in the last bus cycle. The Block-Erase operation is initiated by executing a six-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 (30H or 50H) is latched on the rising edge of the sixth WE# pulse. The internal Erase operation begins after the sixth WE# pulse. Any commands issued during the Block- or Sector-Erase operation are ignored except Erase-Suspend and Erase-Resume. See Figures 14 and 15 for timing waveforms.

Flash Chip-Erase Operation

The SST34HF32A4 provide a Chip-Erase operation, which allows the user to erase all flash sectors/blocks to the “1” state. This is useful when the device must be quickly erased.

The Chip-Erase operation is initiated by executing a six-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 BEF#, whichever occurs first. During the Erase operation, the only valid read is Toggle Bits or Data# Polling. See Table 6 for the command sequence, Figure 13 for timing diagram, and Figure 27 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.

Flash Erase-Suspend/-Resume Operations

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 a one-byte command sequence with Erase-Suspend command (B0H). The device automatically enters read mode 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 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 an Erase-Resume command. The operation is executed by issuing a one-byte command sequence with Erase Resume command (30H) at any address in the one-byte sequence.

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Flash Write Operation Status Detection

The SST34HF32A4 provide one hardware and two software means to detect the completion of a Write (Program or Erase) cycle, in order to optimize the system Write cycle time. The hardware detection uses the Ready/Busy# (RY/BY#) pin. 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 Ready/Busy# (RY/BY#), Data# Polling (DQ_7) or Toggle Bit (DQ_6) read may be simultaneous with the completion of the Write cycle. If this occurs, the system may possibly get an erroneous result, i.e., valid data may appear to conflict with either DQ_7 or DQ_6. In order 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.

Ready/Busy# (RY/BY#)

The SST34HF32A4 include a Ready/Busy# (RY/BY#) output signal. RY/BY# is an open drain output pin that indicates whether an Erase or Program operation is in progress. Since RY/BY# is an open drain output, it allows several devices to be tied in parallel to V_{DD} via an external pull-up resistor. After the rising edge of the final WE# pulse in the command sequence, the RY/BY# status is valid. When RY/BY# is actively pulled low, it indicates that an Erase or Program operation is in progress. When RY/BY# is high (Ready), the devices may be read or left in standby mode.

Byte/Word (CIOF)

This function, found only on the 56-ball package, includes a CIOF pin to control whether the device data I/O pins operate x8 or x16. If the CIOF pin is at logic “1” (V_{IH}) the device is in x16 data configuration: all data I/0 pins DQ_0-DQ_{15} are active and controlled by BEF# and OE#.

If the CIOF pin is at logic “0”, the device is in x8 data configuration: only data I/O pins DQ_0-DQ_7 are active and controlled by BEF# and OE#. The remaining data pins DQ_8-DQ_{14} are at Hi-Z, while pin DQ_{15} is used as the address input A_{-1} for the Least Significant Bit of the address bus.

Flash Data# Polling (DQ_7)

When the devices are in an 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. 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 BEF#) pulse for Program operation. For Sector-, Block-, or Chip-Erase, the Data# Polling is valid after the rising edge of sixth WE# (or BEF#) pulse. See Figure 11 for Data# Polling (DQ_7) timing diagram and Figure 24 for a flowchart.

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Toggle Bits (DQ_6 and DQ_2)

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. The toggle bit is valid after the rising edge of the fourth WE# (or BEF#) pulse for Program operations. For Sector-, Block-, or Chip-Erase, the toggle bit (DQ_6) is valid after the rising edge of sixth WE# (or BEF#) 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 1 shows detailed status bit information. The Toggle Bit (DQ_2) is valid after the rising edge of the last WE# (or BEF#) pulse of a Write operation. See Figure 12 for Toggle Bit timing diagram and Figure 24 for a flowchart.

TABLE 1: Write Operation Status

Status		DQ_7	DQ_6	DQ_2	RY/BY#
Normal Operation	Standard Program	DQ7#	Toggle	No Toggle	0
	Standard Erase	0	Toggle	Toggle	0
Erase-Suspend Mode	Read From Erase Suspended Sector/Block	1	1	Toggle	1
	Read From Non-Erase Suspended Sector/Block	Data	Data	Data	1
	Program	DQ7#	Toggle	No Toggle	0

T1.1 1313

Note: DQ_7, DQ_6, and DQ_2 require a valid address when reading status information. The address must be in the bank where the operation is in progress in order to read the operation status. If the address is pointing to a different bank (not busy), the device will output array data.

Data Protection

The SST34HF32A4 provide both hardware and software features to protect nonvolatile data from inadvertent writes.

Hardware Data Protection

Noise/Glitch Protection: A WE# or BEF# 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, BEF# high, or WE# high will inhibit the Write operation. This prevents inadvertent writes during power-up or power-down.

Hardware Block Protection

The SST34HF32A4 provide a hardware block protection which protects the outermost 8 KWord in Bank 1. The block is protected when WP# is held low.

A user can disable block protection by driving WP# high thus allowing erase or program of data into the protected sectors. WP# must be held high prior to issuing the write command and remain stable until after the entire Write operation has completed.

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 (see Figure 20). 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 19).

The Erase operation that has been interrupted needs to be reinitiated after the device resumes normal operation mode to ensure data integrity. See Figures 19 and 20 for timing diagrams.

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Software Data Protection (SDP)

The SST34HF32A4 provide the JEDEC standard Software Data Protection scheme for all data alteration operations, i.e., Program and Erase. Any Program operation requires the inclusion of the three-byte sequence. The three-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 six-byte sequence. The SST34HF32A4 are shipped with the Software Data Protection permanently enabled. See Table 6 for the specific software command codes. During SDP command sequence, invalid commands will abort the device to Read mode within $T_{RC.}$ The contents of DQ_{15}-DQ_8 are "Don't Care" during any SDP command sequence.

Common Flash Memory Interface (CFI)

These devices also contain the CFI information to describe the characteristics of the devices. In order to enter the CFI Query mode, the system must write the three-byte sequence, same as the Software ID Entry command with 98H (CFI Query command) to address BK_X555H in the last byte sequence. In order to enter the CFI Query mode, the system can also use the one-byte sequence with BK_X55H on Address and 98H on Data Bus. See Figure 17 for CFI Entry and Read timing diagram. Once the device enters the 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.

Security ID

The SST34HF32A4 devices offer a 136-word Security ID space. The Secure ID space is divided into two segments—one 128-bit factory programmed segment and one 128-word (256-byte) user-programmed segment. The first segment is programmed and locked at SST with a unique, 128-bit number. The user segment is left un-programmed for the customer to program as desired.

To program the user segment of the Security ID, the user must use the Security ID Program command. End-of-Write status is checked by reading the toggle bits. Data# Polling is not used for Security ID End-of-Write detection. Once programming 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 three-byte command sequence with Query-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.

Product Identification

The Product Identification mode identifies the device as the SST34HF32A4 and manufacturer as SST. This mode may be accessed by software operations only. The hardware device ID Read operation, which is typically used by programmers cannot be used on this device because of the shared lines between flash and PSRAM in the multi-chip package. Therefore, application of high voltage to pin A_9 may damage this device. 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 Tables 5 and 6 for software operation, Figure 16 for the Software ID Entry and Read timing diagram and Figure 25 for the ID Entry command sequence flowchart.

TABLE 2: Product Identification

	ADDRESS	DATA
Manufacturer's ID	BK0000H	00BFH
Device ID SST34HF32A4	BK0001H	7353H

T2.0 1313

Note: BK = Bank Address (A_{20}-A_{18})

Product Identification Mode Exit/CFI Mode Exit

In order 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 the Read mode. This command may also be used to reset the device to the Read mode after any inadvertent transient condition that apparently 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 16 for timing waveform and Figure 25 for a flowchart.

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PSRAM Operation

With BES1# low, BES2 and BEF# high, the SST34HF32A4 operate as 1024K x16 CMOS PSRAM, with fully static operation requiring no external clocks or timing strobes. The SST34HF32A4 PSRAM is mapped into the first 1024 KWord address space. When BES1#, BEF# are high and BES2 is low, all memory banks are deselected and the device enters standby. Read and Write cycle times are equal. The control signals UBS# and LBS# provide access to the upper data byte and lower data byte. See Table 5 for Read and Write data byte control modes of operation.

PSRAM Deep Power-Down Mode

This mode can be used to lower the power consumption of the PSRAM in the SST34HF32A4 device only. Deep power-down occurs 1µs after being enabled by driving BES2 low. Normal operation occurs 500µs after BES2 is driven high. In deep power-down mode, PSRAM data is lost.For details, see Figure 1.

PSRAM Read

The PSRAM Read operation of the SST34HF32A4 is controlled by OE# and BES1#, both have to be low with WE# and BES2 high for the system to obtain data from the outputs. BES1# and BES2 are used for PSRAM bank selection. OE# is the output control and is used to gate data from the output pins. The data bus is in high impedance state when OE# is high. Refer to the Read cycle timing diagram, Figure 5, for further details.

PSRAM Write

The PSRAM Write operation of the SST34HF32A4 is controlled by WE# and BES1#, both have to be low, BES2 must be high for the system to write to the PSRAM. During the Word-Write operation, the addresses and data are referenced to the rising edge of either BES1#, WE#, or the falling edge of BES2 whichever occurs first. The write time is measured from the last falling edge of BES#1 or WE# or the rising edge of BES2 to the first rising edge of BES1#, or WE# or the falling edge of BES2. Refer to the Write cycle timing diagrams, Figures 6 and 7, for further details.

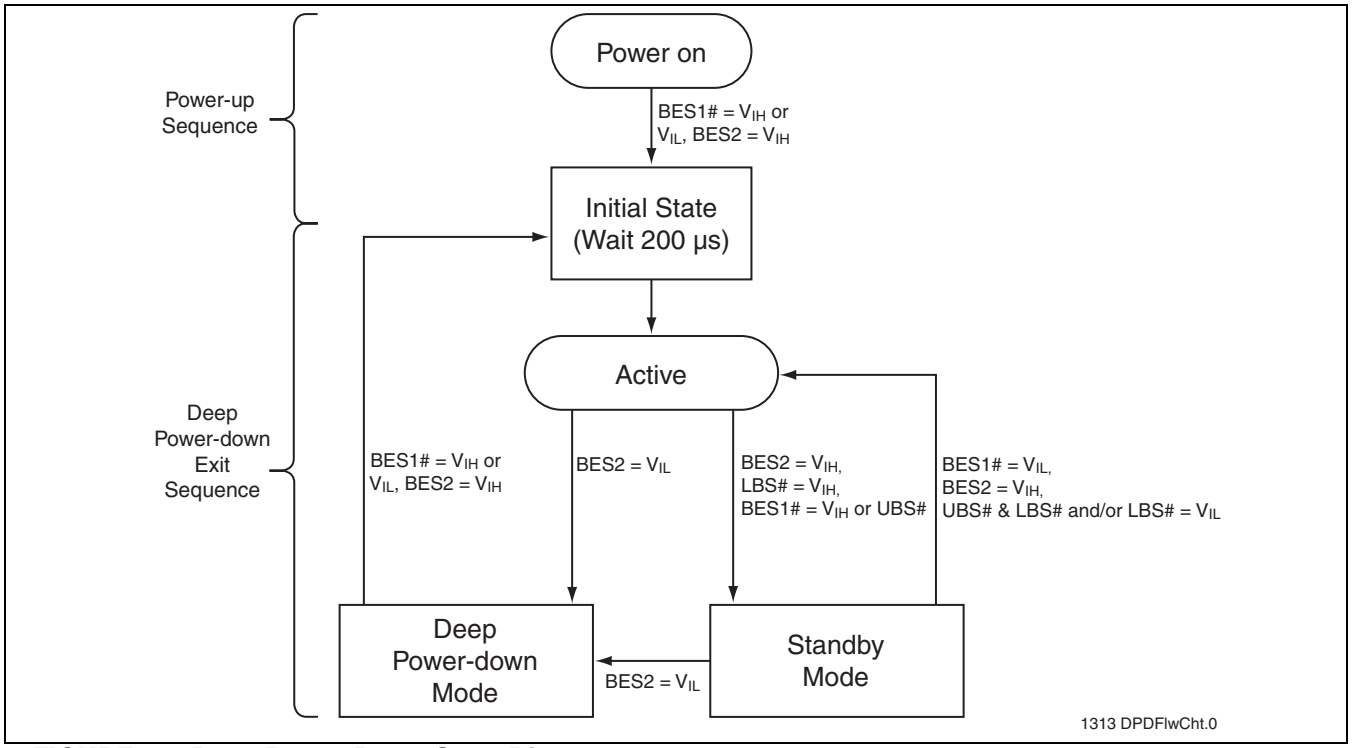

FIGURE 1: Deep Power-Down State Diagram

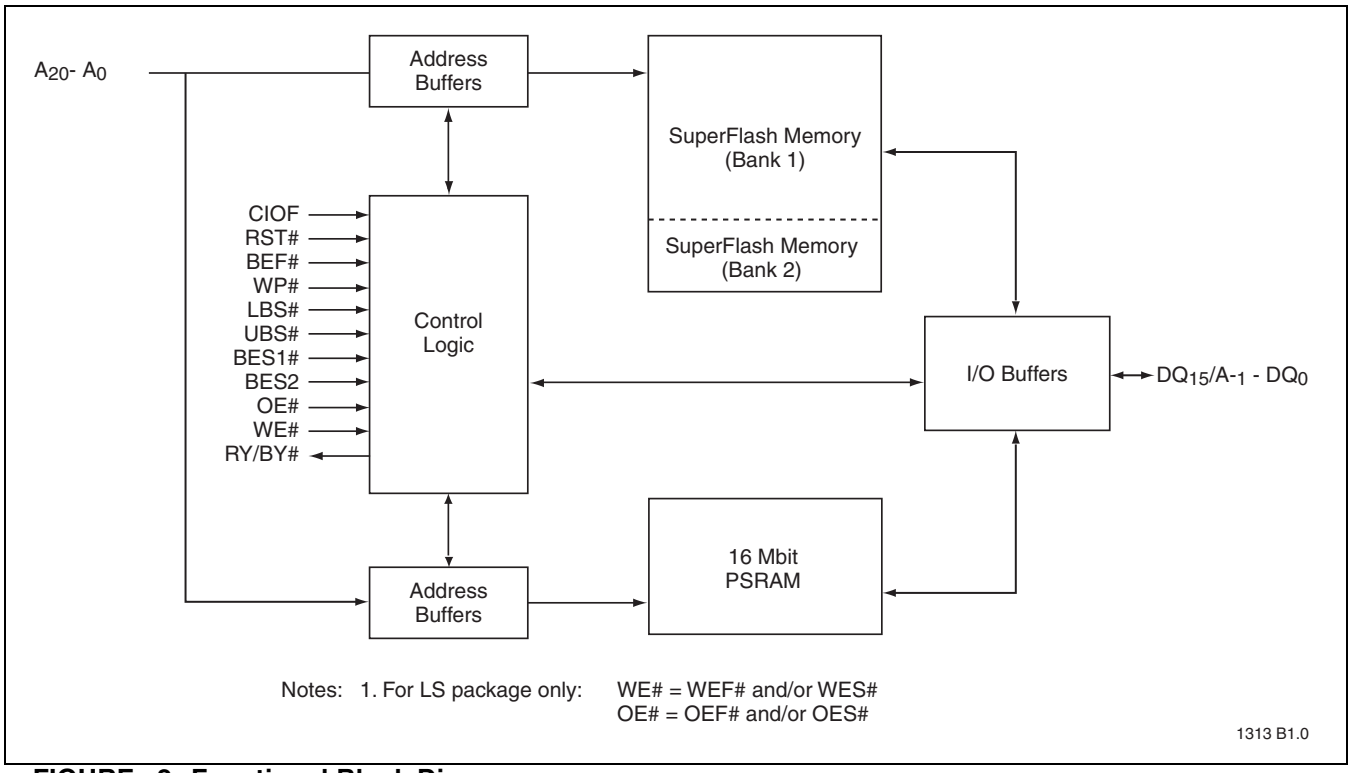

FIGURE 2: Functional Block Diagram

TABLE 3: Dual-Bank Memory Organization (1 of 2)

SST34HF32A4	Block	Block Size	Address Range x8	Address Range x16
Bank 1	BA63	8 KW / 16 KB	3FC000H–3FFFFFH	1FE000H–1FFFFFH
		24 KW / 48 KB	3F0000H–3FBFFFH	1F8000H–1FDFFFH
	BA62	32 KW / 64 KB	3E0000H–3EFFFFH	1F0000H–1F7FFFH
	BA61	32 KW / 64 KB	3D0000H–3DFFFFH	1E8000H–1EFFFFH
	BA60	32 KW / 64 KB	3C0000H–3CFFFFH	1E0000H–1E7FFFH
	BA59	32 KW / 64 KB	3B0000H–3BFFFFH	1D8000H–1DFFFFH
	BA58	32 KW / 64 KB	3A0000H–3AFFFFH	1D0000H–1D7FFFH
	BA57	32 KW / 64 KB	390000H–39FFFFH	1C8000H–1CFFFFH
	BA56	32 KW / 64 KB	380000H–38FFFFH	1C0000H–1C7FFFH
	BA55	32 KW / 64 KB	370000H–37FFFFH	1B8000H–1BFFFFH
	BA54	32 KW / 64 KB	360000H–36FFFFH	1B0000H–1B7FFFH
	BA53	32 KW / 64 KB	350000H–35FFFFH	1A8000H–1AFFFFH
	BA52	32 KW / 64 KB	340000H–34FFFFH	1A0000H–1A7FFFH
	BA51	32 KW / 64 KB	330000H–33FFFFH	198000H–19FFFFH
	BA50	32 KW / 64 KB	320000H–32FFFFH	190000H–197FFFH
	BA49	32 KW / 64 KB	310000H–31FFFFH	188000H–18FFFFH
	BA48	32 KW / 64 KB	300000H–30FFFFH	180000H–187FFFH
Bank 2	BA47	32 KW / 64 KB	2F0000H–2FFFFFH	178000H–17FFFFH
	BA46	32 KW / 64 KB	2E0000H–2EFFFFH	170000H–177FFFH
	BA45	32 KW / 64 KB	2D0000H–2DFFFFH	168000H–16FFFFH
	BA44	32 KW / 64 KB	2C0000H–2CFFFFH	160000H–167FFFH
	BA43	32 KW / 64 KB	2B0000H–2BFFFFH	158000H–15FFFFH
	BA42	32 KW / 64 KB	2A0000H—2AFFFFH	150000H–157FFFH
	BA41	32 KW / 64 KB	290000H—29FFFFH	148000H–14FFFFH
	BA40	32 KW / 64 KB	280000H—28FFFFH	140000H–147FFFH
	BA39	32 KW / 64 KB	270000H—27FFFFH	138000H–13FFFFH
	BA38	32 KW / 64 KB	260000H—26FFFFH	130000H–137FFFH
	BA37	32 KW / 64 KB	250000H—25FFFFH	128000H–12FFFFH
	BA36	32 KW / 64 KB	240000H—24FFFFH	120000H–127FFFH
	BA35	32 KW / 64 KB	230000H—23FFFFH	118000H–11FFFFH
	BA34	32 KW / 64 KB	220000H—22FFFFH	110000H–117FFFH
	BA33	32 KW / 64 KB	210000H—21FFFFH	108000H–10FFFFH
	BA32	32 KW / 64 KB	200000H—20FFFFH	100000H–107FFFH
	BA31	32 KW / 64 KB	1F0000H—1FFFFFH	0F8000H–0FFFFFH
	BA30	32 KW / 64 KB	1E0000H—1EFFFFH	0F0000H–0F7FFFH
	BA29	32 KW / 64 KB	1D0000H—1DFFFFH	0E8000H–0EFFFFH
	BA28	32 KW / 64 KB	1C0000H—1CFFFFH	0E0000H–0E7FFFH
	BA27	32 KW / 64 KB	1B0000H—1BFFFFH	0D8000H–0DFFFFH
	BA26	32 KW / 64 KB	1A0000H—1AFFFFH	0D0000H–0D7FFFH
	BA25	32 KW / 64 KB	190000H—19FFFFH	0C8000H–0CFFFFH
	BA24	32 KW / 64 KB	180000H—18FFFFH	0C0000H–0C7FFFH
	BA23	32 KW / 64 KB	170000H—17FFFFH	0B8000H–0BFFFFH
	BA22	32 KW / 64 KB	160000H—16FFFFH	0B0000H–0B7FFFH

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TABLE 3: Dual-Bank Memory Organization (Continued) (2 of 2)

SST34HF32A4	Block	Block Size	Address Range x8	Address Range x16
Bank 2	BA21	32 KW / 64 KB	150000H—15FFFFH	0A8000H–0AFFFFH
	BA20	32 KW / 64 KB	140000H—14FFFFH	0A0000H–0A7FFFH
	BA19	32 KW / 64 KB	130000H—13FFFFH	098000H–09FFFFH
	BA18	32 KW / 64 KB	120000H—12FFFFH	090000H–097FFFH
	BA17	32 KW / 64 KB	110000H—11FFFFH	088000H–08FFFFH
	BA16	32 KW / 64 KB	100000H—10FFFFH	080000H–087FFFH
	BA15	32 KW / 64 KB	0F0000H—0FFFFFH	078000H–07FFFFH
	BA14	32 KW / 64 KB	0E0000H—0EFFFFH	070000H–077FFFH
	BA13	32 KW / 64 KB	0D0000H—0DFFFFH	068000H–06FFFFH
	BA12	32 KW / 64 KB	0C0000H—0CFFFFH	060000H–067FFFH
	BA11	32 KW / 64 KB	0B0000H—0BFFFFH	058000H–05FFFFH
	BA10	32 KW / 64 KB	0A0000H—0AFFFFH	050000H–057FFFH
	BA9	32 KW / 64 KB	090000H—09FFFFH	048000H–04FFFFH
	BA8	32 KW / 64 KB	080000H—08FFFFH	040000H–047FFFH
	BA7	32 KW / 64 KB	070000H—07FFFFH	038000H–03FFFFH
	BA6	32 KW / 64 KB	060000H—06FFFFH	030000H–037FFFH
	BA5	32 KW / 64 KB	050000H–05FFFFH	028000H–02FFFFH
	BA4	32 KW / 64 KB	040000H–04FFFFH	020000H–027FFFH
	BA3	32 KW / 64 KB	030000H–03FFFFH	018000H–01FFFFH
	BA2	32 KW / 64 KB	020000H–02FFFFH	010000H–017FFFH
	BA1	32 KW / 64 KB	010000H–01FFFFH	008000H–00FFFFH
	BA0	32 KW / 64 KB	000000H–00FFFFH	000000H–007FFFH

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PIN DESCRIPTION

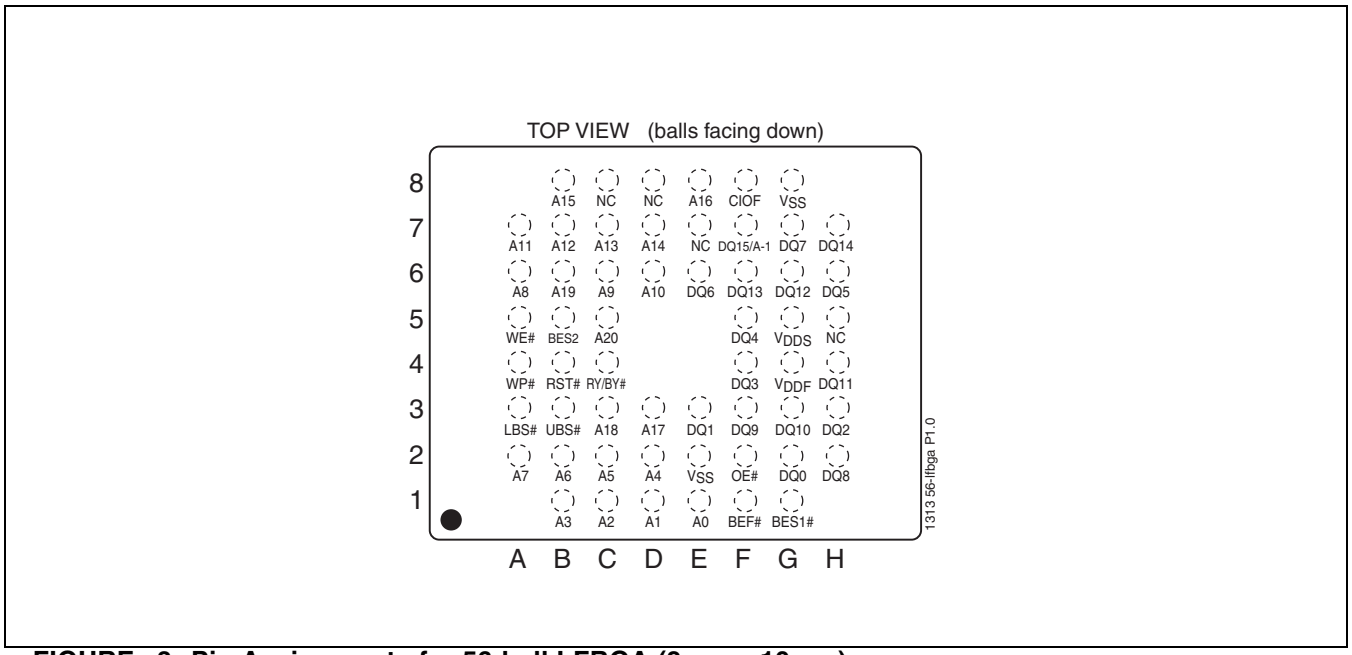

FIGURE 3: Pin Assignments for 56-ball LFBGA (8mm x 10mm)

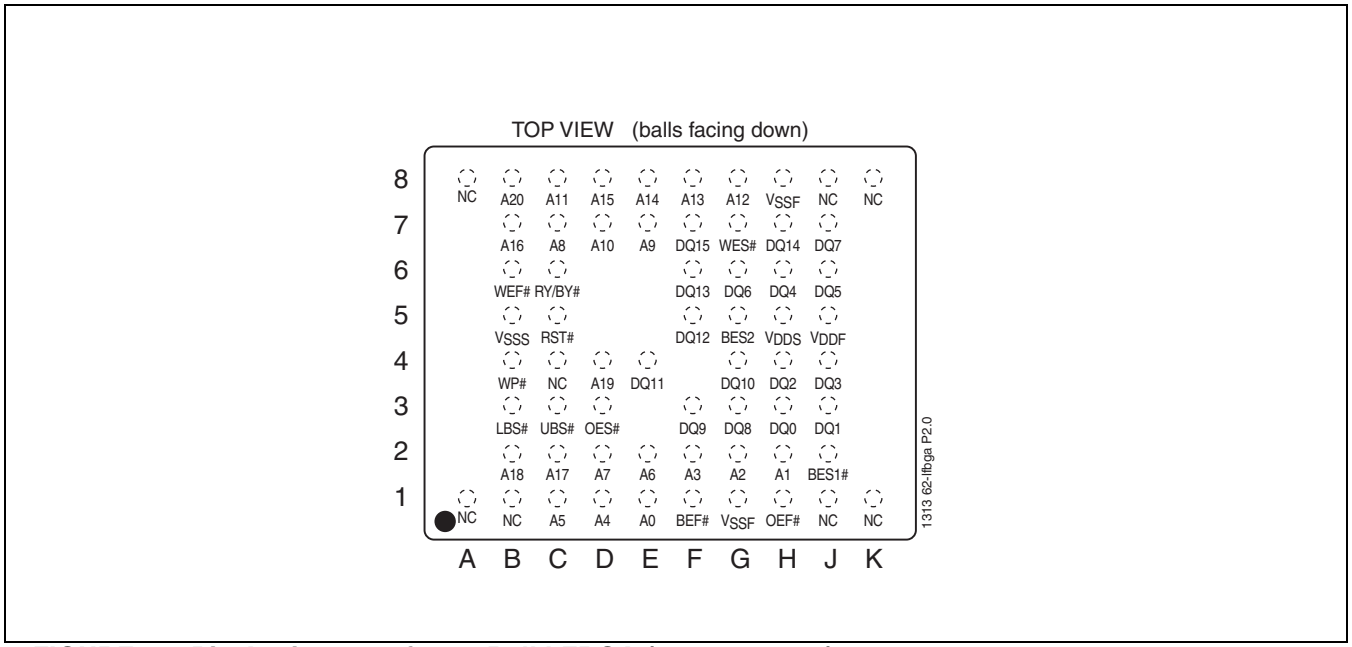

FIGURE 4: Pin Assignment for 62-Ball LFBGA (8mm x 10mm)

Preliminary Specifications

TABLE 4: Pin Description

Symbol	Pin Name	Functions
A_{MS} to A_0	Address Inputs	To provide flash address, A_{20}-A_0. To provide PSRAM address, A_{19}-A_0
DQ_{14}-DQ_0	Data Inputs/Outputs	To output data during Read cycles and receive input data during Write cycles. Data is internally latched during a flash Erase/Program cycle. The outputs are in tri-state when OE# is high or BES1# is high or BES2 is low and BEF# is high.
DQ_{15}/A_{-1}	Data Input/Output and LBS Address	DQ_{15} is used as data I/O pin when in x16 mode (CIOF = "1") A_{-1} is used as the LBS address pin when in x8 mode (CIOF = "0")
BEF#	Flash Memory Bank Enable	To activate the Flash memory bank when BEF# is low
BES1#	PSRAM Memory Bank Enable	To activate the PSRAM memory bank when BES1# is low
BES2	PSRAM Deep Power-down Enable	To activate the PSRAM memory deep power-down mode when BES2 is low.
OE#	Output Enable	To gate the data output buffers
WE#	Write Enable	To control the Write operations
CIOF	Byte Selection for Flash	When low, select Byte mode. When high, select Word mode.
UBS#	Upper Byte Control (PSRAM)	To enable DQ_{15}-DQ_8
LBS#	Lower Byte Control (PSRAM)	To enable DQ_7-DQ_0
WP#	Write Protect	To protect and unprotect the bottom 8 KWord (4 sectors) from Erase or Program operation
RST#	Reset	To Reset and return the device to Read mode
RY/BY#	Ready/Busy#	To output the status of a Program or Erase Operation RY/BY# is a open drain output, so a 10KΩ - 100KΩ pull-up resistor is required to allow RY/BY# to transition high indicating the device is ready to read.
V_{SSF}[1]	Ground	Flash only
V_{SSS}[1]	Ground	PSRAM only
V_{SS}	Ground	
V_{DDF}	Power Supply (Flash)	2.7-3.3V Power Supply to Flash only
V_{DDS}	Power Supply (PSRAM)	2.7-3.3V Power Supply to PSRAM only
NC	No Connection	Unconnected pins

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1. LS package only

TABLE 5: OPERATIONAL MODES SELECTION

Mode	BEF#[,1]	BES1#[1,1]	BES2[1]	OE#[2,3]	WE#[2]	LBS#[2]	UBS#[2]	DQ_{7-0}	DQ_{15-8}
Full Standby	V_{IH}	V_{IH}	V_{IH}	X	X	X	X	HIGH-Z	HIGH-Z
PSRAM Deep Power-down[4]	V_{IH}	V_{IL}	V_{IL}	X	X	X	X	HIGH-Z	HIGH-Z
Output Disable	V_{IH}	V_{IL}	V_{IH}	V_{IH}	V_{IH}	X	X	HIGH-Z	HIGH-Z
	V_{IL}	V_{IH}	V_{IH}	V_{IH}	V_{IH}	X	X	HIGH-Z	HIGH-Z
Flash Read	V_{IL}	V_{IH}	V_{IH}	V_{IL}	V_{IH}	X	X	D_{OUT}	D_{OUT}
Flash Write	V_{IL}	V_{IH}	V_{IH}	V_{IH}	V_{IL}	X	X	D_{IN}	D_{IN}
Flash Erase	V_{IL}	V_{IH}	V_{IH}	V_{IH}	V_{IL}	X	X	X	X
PSRAM Read	V_{IH}	V_{IL}	V_{IH}	V_{IL}	V_{IH}	V_{IL}	V_{IL}	D_{OUT}	D_{OUT}
						V_{IH}	V_{IL}	HIGH-Z	D_{OUT}
						V_{IL}	V_{IH}	D_{OUT}	HIGH-Z
PSRAM Write	V_{IH}	V_{IL}	V_{IH}	X	V_{IL}	V_{IL}	V_{IL}	D_{IN}	D_{IN}
						V_{IH}	V_{IL}	HIGH-Z	D_{IN}
						V_{IL}	V_{IH}	D_{IN}	HIGH-Z
Product Identification[5]	V_{IL}	V_{IH}	V_{IH}	V_{IL}	V_{IH}	X	X	Manufacturer's ID[6] Device ID[6]	

T5.0 1313

1. Do not apply BEF# = V_{IL}, BES1# - V_{IL} and BES2 = V_{IL} at the same time.
2. X can be V_{IL} or V_{IH}, but no other value.
3. OE# = OEF# and OES#
   WE# = WEF# and WES# for LS package only
4. In PSRAM Deep power-down, PSRAM data is lost.
5. Software mode only
6. With A_{19}-A_{18} = V_{IL};SST Manufacturer's ID = BFH, is read with A_0=0,
   SST32HF32A4 Device ID =7353H, is read with A_0=1,

Preliminary Specifications

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]
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 Program	555H	AAH	2AAH	55H	555H	A5H	SIWA[6]	Data				
User Security ID Program Lock-out[7]	555H	AAH	2AAH	55H	555H	85H	XXH	0000H				
Software ID Entry[8]	555H	AAH	2AAH	55H	BK_X[4] 555H	90H						
CFI Query Entry[9]	555H	AAH	2AAH	55H	BK_X[4] 555H	98H						
CFI Query Entry[9]	BK_X[4] 55H	98H										
Software ID Exit/ CFI Exit/ Sec ID Exit[10,11]	555H	AAH	2AAH	55H	555H	F0H						
Software ID Exit/ CFI Exit/ Sec ID Exit[10,11]	XXH	F0H										

T6.0 1313

1. Address format A_{10}-A_0 (Hex), Addresses A_{20}-A_{11} can be V_{IL} or V_{IH}, but no other value, for the command sequence when in x16 mode. When in x8 mode, Addresses A_{20}-A_{12}, Address A_{-1} and DQ_{14}-DQ_8 can be V_{IL} or V_{IH}, but no other value, for the command sequence.
2. DQ_{15}-DQ_8 can be V_{IL} or V_{IH}, but no other value, for the command sequence
3. WA = Program Word/Byte address
4. SA_X for Sector-Erase; uses A_{20}-A_{11} address lines
   BA_X for Block-Erase; uses A_{20}-A_{15} address lines
   BK_X for Bank Address; uses A_{20}-A_{18} address lines
5. For SST34HF32A4 the Security ID Address Range is:
   (x16 mode) = 0FF000H to 0FF087H, (x8 mode) = 000000H to 00010FH
   SST ID is read at Address Range (x16 mode) = 000000H to 000007H (x8 mode) = 000000H to 0000FFH
   User ID is read at Address Range (x16 mode) = 000008H to 000087H (x8 mode) = 000100H to 00010FH
   Lock Status is read at Address 0000FFH (x16) or 0001FFH (x8). Unlocked: DQ_3 = 1 / Locked: DQ_3 = 0.
6. SIWA = User Security ID Program Word/Byte address
   For SST34HF32A4, valid Address Range is
   (x16 mode) = 000008H-000087H (x8 mode) = 000010H-00010FH.
   All 4 cycles of User Security ID Program and Program Lock-out must be completed before going back to Read-Array mode.
7. The User Security ID Program Lock-out command must be executed in x16 mode (BYTE#=V_{IH}).
8. The device does not remain in Software Product Identification mode if powered down.
9. A_{19} and A_{18} = V_{IL}
10. Both Software ID Exit operations are equivalent
11. If users never lock after programming, User Sec ID can be programmed over the previously unprogrammed bits (data=1) using the User Sec ID mode again (the programmed “0” bits cannot be reversed to “1”).

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TABLE 7: CFI QUERY IDENTIFICATION STRING[1]

Address x16 Mode	Address x8 Mode	Data[2]	Description
10H	20H	0051H	Query Unique ASCII string “QRY”
11H	22H	0052H	
12H	24H	0059H	
13H	26H	0002H	Primary OEM command set
14H	28H	0000H	
15H	2AH	0000H	Address for Primary Extended Table
16H	2CH	0000H	
17H	2EH	0000H	Alternate OEM command set (00H = none exists)
18H	30H	0000H	
19H	32H	0000H	Address for Alternate OEM extended Table (00H = none exits)
1AH	34H	0000H	

T7.1 1313

1. Refer to CFI publication 100 for more details.
2. In x8 mode, only the lower byte of data is output.

TABLE 8: SYSTEM INTERFACE INFORMATION

Address x16 Mode	Address x8 Mode	Data[1]	Description
1BH	36H	0027H	V_{DD} Min (Program/Erase) DQ_7-DQ_4: Volts, DQ_3-DQ_0: 100 millivolts
1CH	38H	0036H	V_{DD} Max (Program/Erase) DQ_7-DQ_4: Volts, DQ_3-DQ_0: 100 millivolts
1DH	3AH	0000H	V_{PP} min (00H = no V_{PP} pin)
1EH	3CH	0000H	V_{PP} max (00H = no V_{PP} pin)
1FH	3EH	0004H	Typical time out for Program 2^N µs (2^4 = 16 µs)
20H	40H	0000H	Typical time out for min size buffer program 2^N µs (00H = not supported)
21H	42H	0004H	Typical time out for individual Sector/Block-Erase 2^N ms (2^4 = 16 ms)
22H	44H	0006H	Typical time out for Chip-Erase 2^N ms (2^6 = 64 ms)
23H	46H	0001H	Maximum time out for Program 2^N times typical (2^1 x 2^4 = 32 µs)
24H	48H	0000H	Maximum time out for buffer program 2^N times typical
25H	4AH	0001H	Maximum time out for individual Sector-/Block-Erase 2^N times typical (2^1 x 2^4 = 32 ms)
26H	4CH	0001H	Maximum time out for Chip-Erase 2^N times typical (2^1 x 2^6 = 128 ms)

T8.0 1313

1. In x8 mode, only the lower byte of data is output.

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TABLE 9: DEVICE GEOMETRY INFORMATION

Address x16 Mode	Address x8 Mode	Data[1]	Description
27H	4EH	0016H	Device size = 2^N Bytes (16H = 22; 2^{22} = 4 MByte)
28H	50H	0002H	Flash Device Interface description; 0002H = x8/x16 asynchronous interface
29H	52H	0000H	
2AH	54H	0000H	Maximum number of bytes in multi-byte write = 2^N (00H = not supported)
2BH	56H	0000H	
2CH	58H	0002H	Number of Erase Sector/Block sizes supported by device
2DH	5AH	003FH	Block Information (y + 1 = Number of blocks; z x 256B = block size)
2EH	5CH	0000H	y = 63 + 1 = 64 blocks (003FH = 63)
2FH	5EH	0000H	
30H	60H	0001H	z = 256 x 256 Bytes = 64 KByte/block (0100H = 256)
31H	62H	00FFH	Sector Information (y + 1 = Number of sectors; z x 256B = sector size)
32H	64H	0003H	y = 1023 + 1 = 1024 sectors (03FFH = 1023)
33H	66H	0010H	
34H	68H	0000H	z = 16 x 256 Bytes = 4 KByte/sector (0010H = 16)

T9.2 1313

1. In x8 mode, only the lower byte of data is output.

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.)

Operating Temperature . . . . . -20°C to +85°C
Storage Temperature . . . . . -65°C to +125°C
D. C. Voltage on Any Pin to Ground Potential . . . . . -0.5V to V_{DD}[1]+0.3V
Transient Voltage (<20 ns) on Any Pin to Ground Potential . . . . . -1.0V to V_{DD}[1]+1.0V
Package Power Dissipation Capability (T_A = 25°C) 1.0W
Surface Mount Solder Reflow Temperature . . . . . 260°C for 10 seconds
Output Short Circuit Current[2] . . . . . 50 mA

1. V_{DD} = V_{DDF} and V_{DDS}
2. Outputs shorted for no more than one second. No more than one output shorted at a time.

Operating Range

Range	Ambient Temp	V_{DD}
Extended	-20°C to +85°C	2.7-3.3V

AC Conditions of Test

Input Rise/Fall Time	5 ns
Output Load	C_L = 30 pF
See Figures 21 and 22	

TABLE 10: DC Operating Characteristics (V_{DD} = V_{DDF} and V_{DDS} = 2.7-3.3V)

Symbol	Parameter	Limits			Test Conditions
		Min	Max	Units	
I_{DD}[1]	Active V_{DD} Current				Address input = V_{ILT}/V_{IHT}, at f=5 MHz, $V_{DD}=V_{DD}$ Max, all DQs open
	Read				OE#=V_{IL}, WE#=V_{IH}
	Flash		35	mA	BEF#=V_{IL}, BES1#=V_{IH}, or BES2=V_{IL}
	PSRAM		30	mA	BEF#=V_{IH}, BES1#=V_{IL} , BES2=V_{IH}
	Concurrent Operation		60	mA	BEF#=V_{IH}, BES1#=V_{IL} , BES2=V_{IH}
	Write[2]				WE#=V_{IL}
	Flash		40	mA	BEF#=V_{IL}, BES1#=V_{IH}, or BES2=V_{IL}, OE#=V_{IH}
	PSRAM		30	mA	BEF#=V_{IH}, BES1#=V_{IL} , BES2=V_{IH}
I_{SB}	Standby V_{DD} Current		115	µA	V_{DD} = V_{DD} Max, BEF#=BES1#=V_{IHC}, BES2=V_{ILC}, RST# = V_{IHC}
I_{RT}	Reset V_{DD} Current		30	µA	RST#=GND
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# pin		10	µA	WP#=GND to V_{DD}, $V_{DD}=V_{DD}$ Max RST#=GND to V_{DD}, $V_{DD}=V_{DD}$ Max
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
V_{IH}	Input High Voltage	0.7 V_{DD}		V	$V_{DD}=V_{DD}$ Max
V_{IHC}	Input High Voltage (CMOS)	V_{DD}-0.3		V	$V_{DD}=V_{DD}$ Max
V_{OLF}	Flash Output Low Voltage		0.2	V	I_{OL}=100 µA, $V_{DD}=V_{DD}$ Min
V_{OHF}	Flash Output High Voltage	V_{DD}-0.2		V	I_{OH}=-100 µA, $V_{DD}=V_{DD}$ Min
V_{OLS}	PSRAM Output Low Voltage		0.4	V	IOL =1 mA, $V_{DD}=V_{DD}$ Min
V_{OHS}	PSRAM Output High Voltage	2.2		V	IOH =-500 µA, $V_{DD}=V_{DD}$ Min

T10.0 1313

1. Address input = V_{ILT}/V_{IHT}, $V_{DD}=V_{DD}$ Max (See Figure 21)
2. I_{DD} active while Erase or Program is in progress.

TABLE 11: 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 Write Operation	100	µs

T11.0 1313

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

TABLE 12: 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	20 pF
C_{IN}[1]	Input Capacitance	V_{IN} = 0V	16 pF

T12.0 1313

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

TABLE 13: Flash Reliability Characteristics

Symbol	Parameter	Minimum Specification	Units	Test Method
N_{END}[1]	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

T13.0 1313

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

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AC CHARACTERISTICS

TABLE 14: PSRAM Read Cycle Timing Parameters

		Min	Max	Units
T_{RCS}	Read Cycle Time	70		ns
T_{AAS}	Address Access Time		70	ns
T_{BES}	Bank Enable Access Time		70	ns
T_{OES}	Output Enable Access Time		35	ns
T_{BYES}	UBS#, LBS# Access Time		70	ns
T_{BLZS}[1]	BES# to Active Output	0		ns
T_{OLZS}[1]	Output Enable to Active Output	0		ns
T_{BYLZS}[1]	UBS#, LBS# to Active Output	0		ns
T_{BHZS}[1]	BES# to High-Z Output		25	ns
T_{OHZS}[1]	Output Disable to High-Z Output		25	ns
T_{BYHZS}[1]	UBS#, LBS# to High-Z Output		35	ns
T_{OHS}	Output Hold from Address Change	10		ns

T14.0 1313

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

TABLE 15: PSRAM Write Cycle Timing Parameters

Symbol	Parameter	Min	Max	Units
T_{WCS}	Write Cycle Time	70		ns
T_{BWS}	Bank Enable to End-of-Write	60		ns
T_{AWS}	Address Valid to End-of-Write	60		ns
T_{ASTS}	Address Set-up Time	0		ns
T_{WPS}	Write Pulse Width	60		ns
T_{WRS}	Write Recovery Time	0		ns
T_{BYWS}	UBS#, LBS# to End-of-Write	60		ns
T_{ODWS}	Output Disable from WE# Low		30	ns
T_{OEWS}	Output Enable from WE# High	0		ns
T_{DSS}	Data Set-up Time	30		ns
T_{DHS}	Data Hold from Write Time	0		ns

T15.0 1313

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TABLE 16: Flash Read Cycle Timing Parameters V_{DD} = 2.7-3.3V

Symbol	Parameter	Min	Max	Units
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]	BEF# Low to Active Output	0		ns
T_{OLZ}[1]	OE# Low to Active Output	0		ns
T_{CHZ}[1]	BEF# High to High-Z Output		16	ns
T_{OHZ}[1]	OE# High to High-Z Output		16	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		20	µs

T16.0 1313

1. This parameter is measured only for initial qualification and after the 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.

TABLE 17: Flash Program/Erase Cycle Timing Parameters

Symbol	Parameter	Min	Max	Units
T_{BP}	Program Time		10	µs
T_{AS}	Address Setup Time	0		ns
T_{AH}	Address Hold Time	40		ns
T_{CS}	WE# and BEF# Setup Time	0		ns
T_{CH}	WE# and BEF# Hold Time	0		ns
T_{OES}	OE# High Setup Time	0		ns
T_{OEH}	OE# High Hold Time	10		ns
T_{CP}	BEF# Pulse Width	40		ns
T_{WP}	WE# Pulse Width	40		ns
T_{WPH}[1]	WE# Pulse Width High	30		ns
T_{CPH}[1]	BEF# 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_{ES}	Erase-Suspend Latency		20	µs
T_{BY}[1,2]	RY/BY# Delay Time		90	ns
T_{BR}[1]	Bus Recovery Time		1	µs
T_{SE}	Sector-Erase		25	ms
T_{BE}	Block-Erase		25	ms
T_{SCE}	Chip-Erase		50	ms

T17.1 1313

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.

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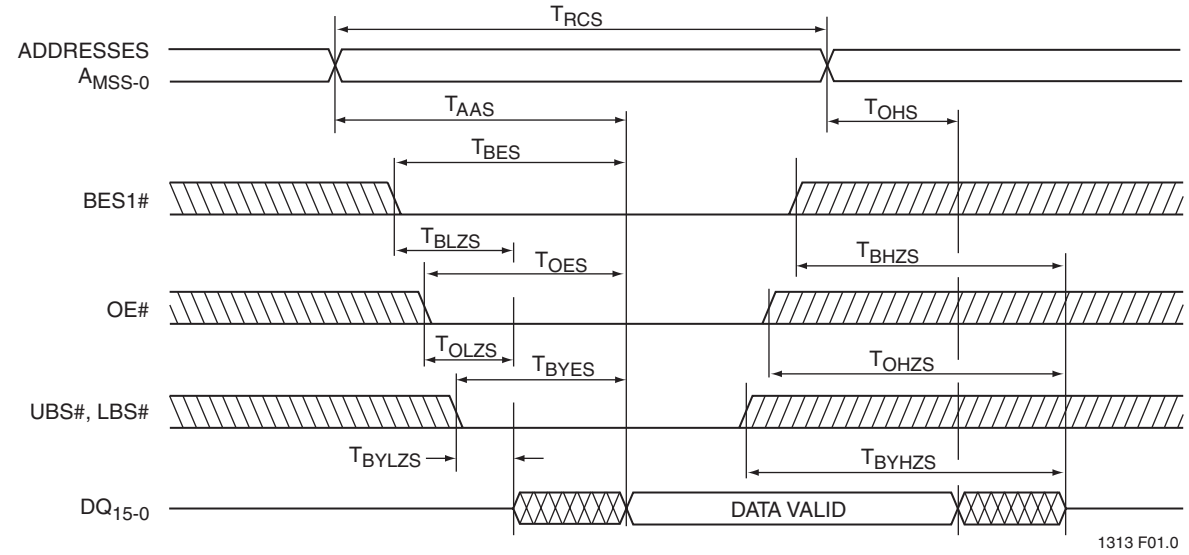
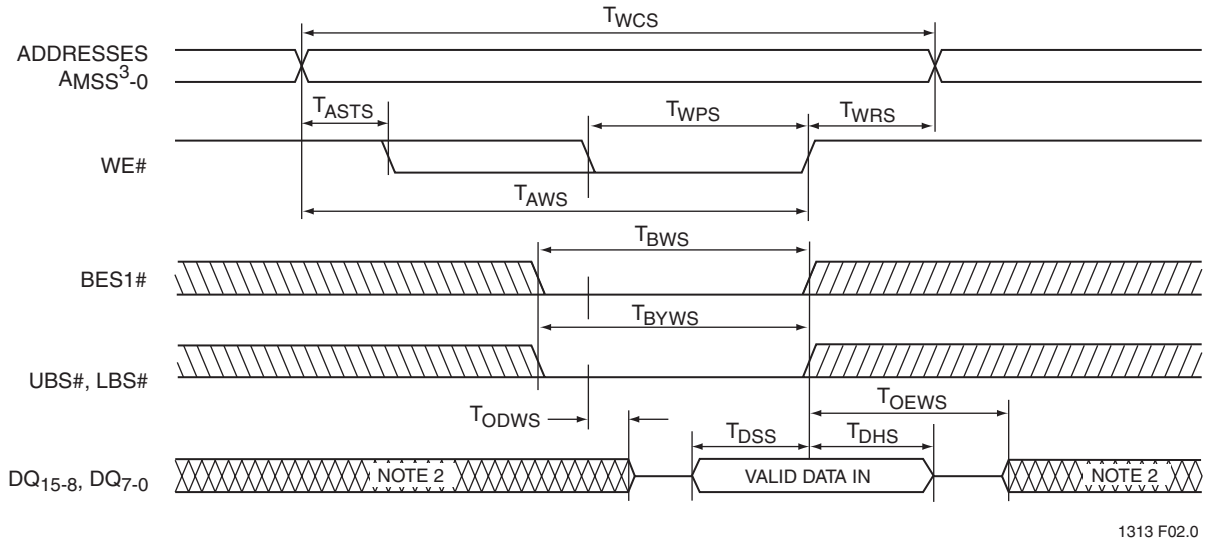


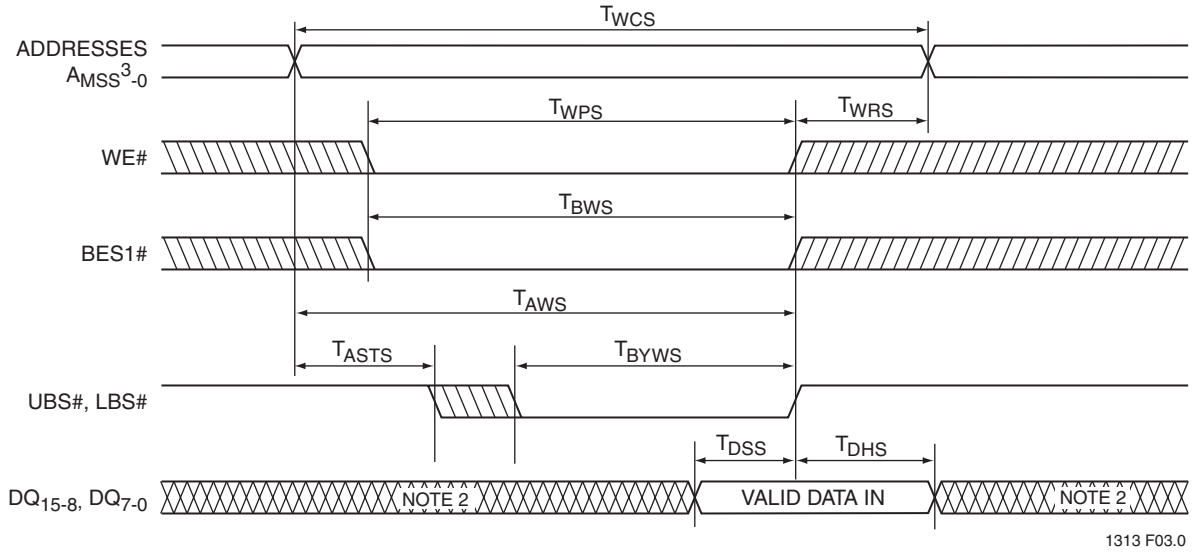
Note: A_{MSS} = Most Significant Address
A_{MSS} = A_{19} for SST34HF32A4

FIGURE 5: PSRAM Read Cycle Timing Diagram



Note: 1. If OE# is High during the Write cycle, the outputs will remain at high impedance.
2. If BES1# goes Low or BES2 goes high coincident with or after WE# goes Low, the output will remain at high impedance.
If BES1# goes High or BES2 goes low coincident with or before WE# goes High, the output will remain at high impedance.
Because D_{IN} signals may be in the output state at this time, input signals of reverse polarity must not be applied.
3. A_{MSS} = Most Significant PSRAM Address
A_{MSS} = A_{19} for SST34HF32A4

FIGURE 6: PSRAM Write Cycle Timing Diagram (WE# Controlled)[1]



Note: 1. If OE# is High during the Write cycle, the outputs will remain at high impedance.
2. Because D_{IN} signals may be in the output state at this time, input signals of reverse polarity must not be applied.
3. A_{MSS} = Most Significant PSRAM Address
$A_{MSS} = A_{19}$ for SST34HF32A4

FIGURE 7: PSRAM Write Cycle Timing Diagram (UBS#, LBS# Controlled)[1]

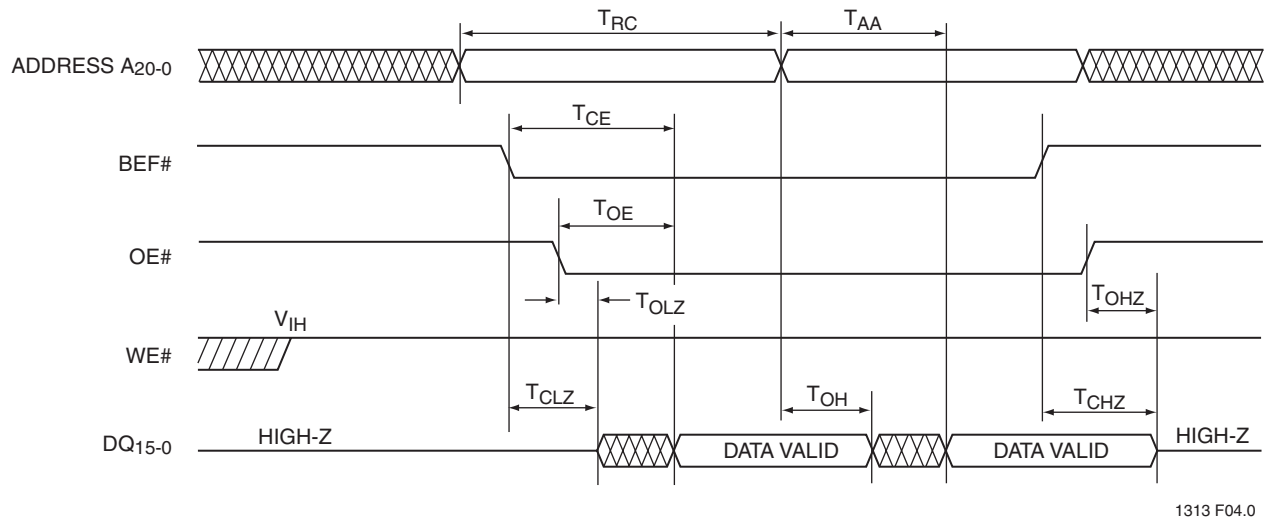
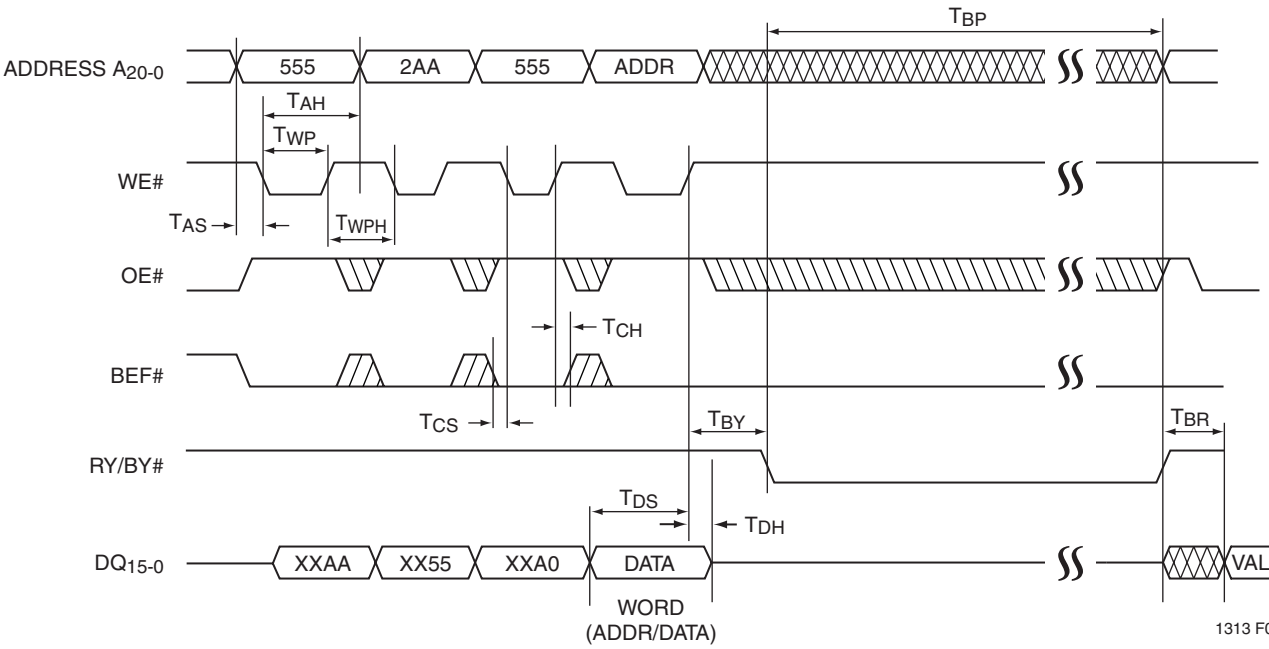
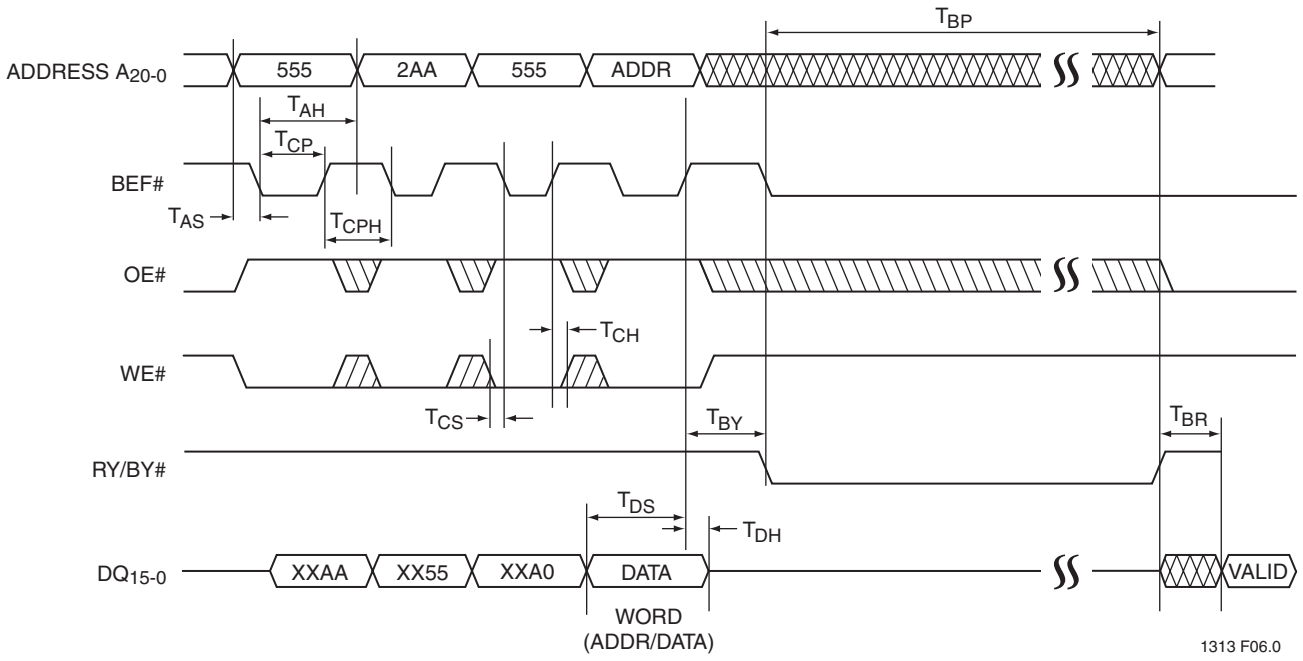


FIGURE 8: Flash Read Cycle Timing Diagram for Word Mode (For Byte Mode A_{-1} = Address Input)



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

FIGURE 9: Flash WE# Controlled Program Cycle Timing Diagram for Word Mode (For Byte Mode A_{-1} = Address Input)



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

FIGURE 10: Flash BEF# Controlled Program Cycle Timing Diagram for Word Mode (For Byte Mode A_{-1} = Address Input)

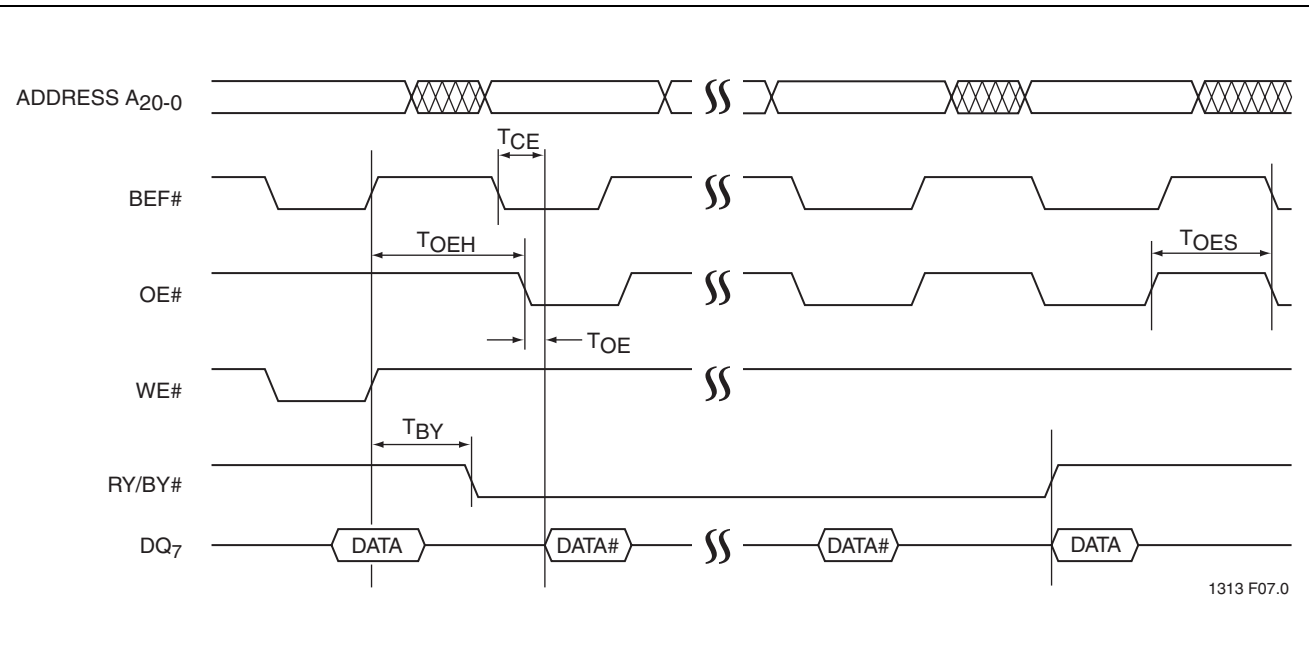


FIGURE 11: Flash Data# Polling Timing Diagram for Word Mode (For Byte Mode A_{-1} = Address Input)

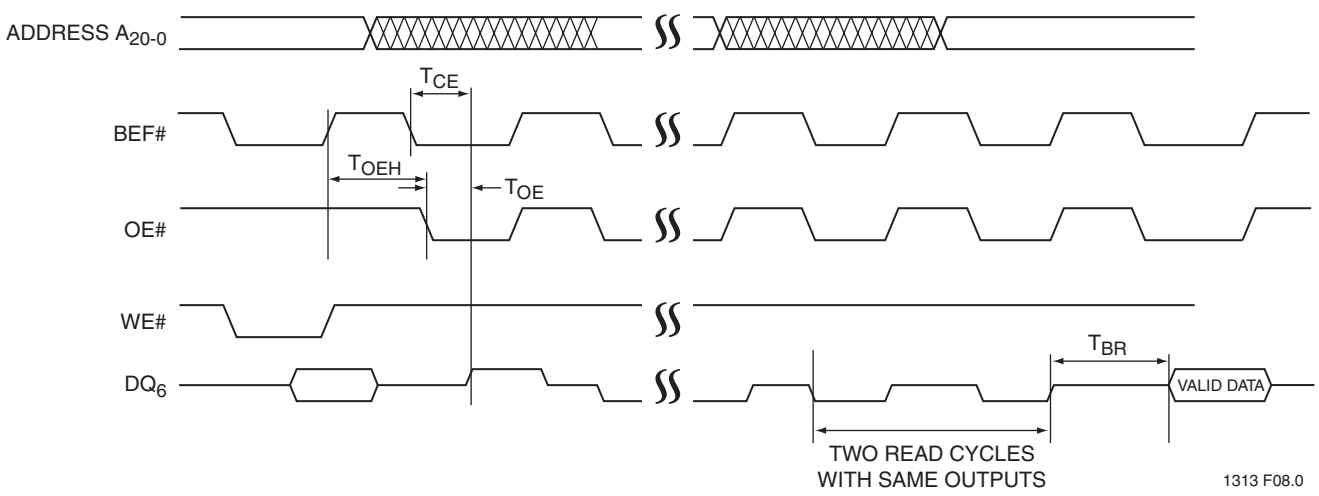
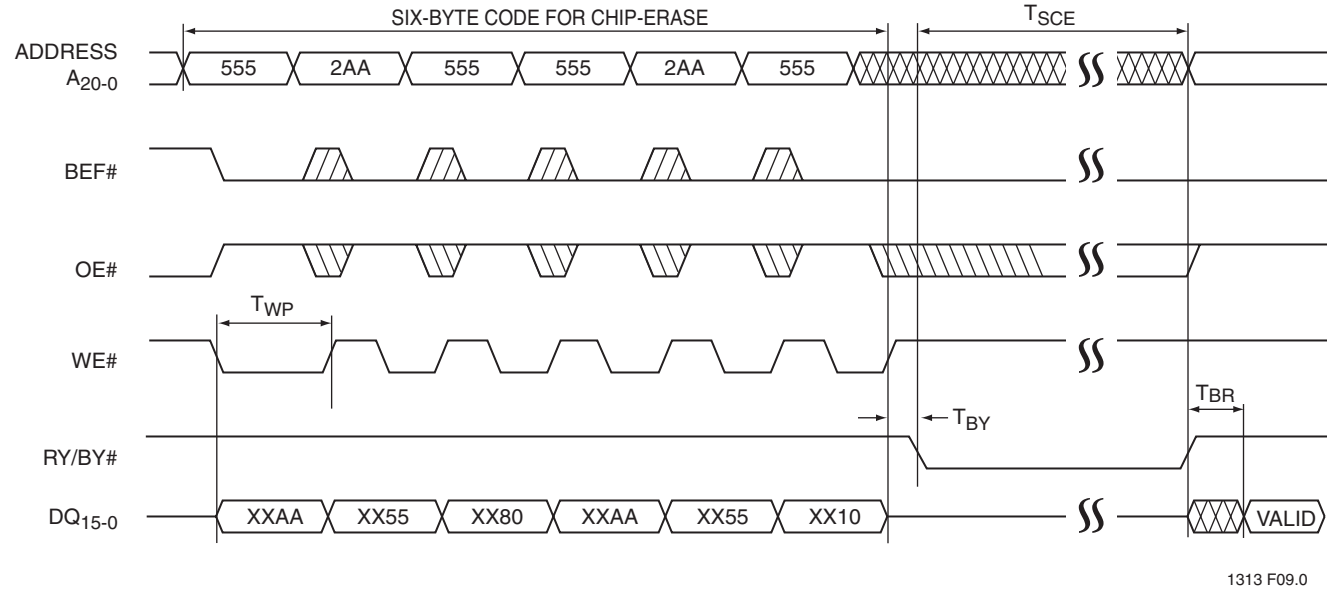
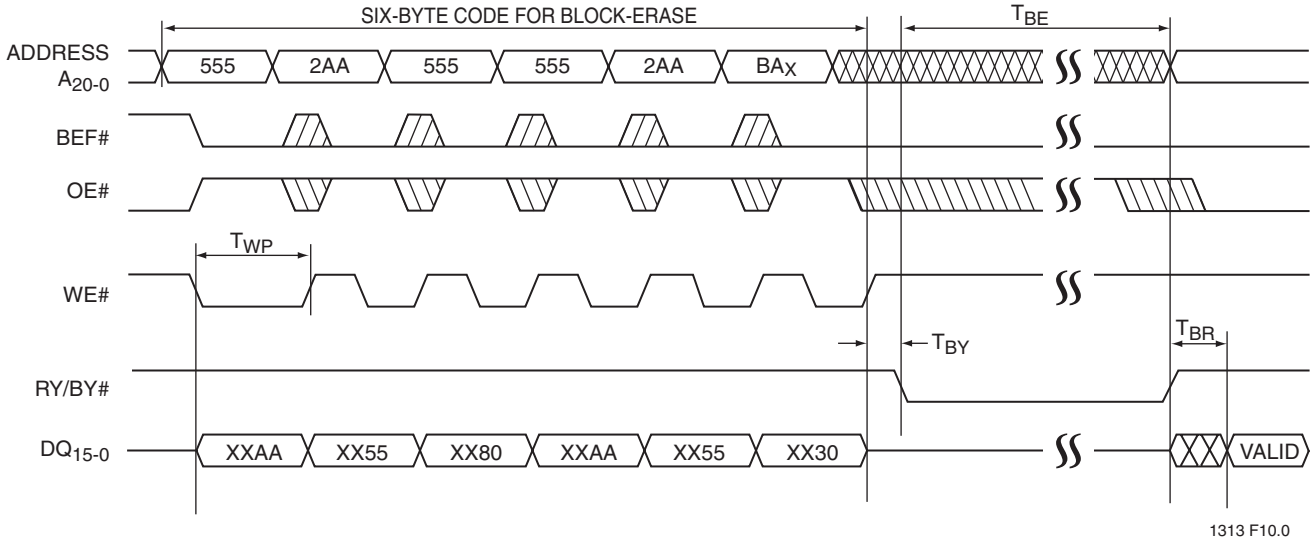


FIGURE 12: Flash Toggle Bit Timing Diagram for Word Mode (For Byte Mode A_{-1} = Don't Care)



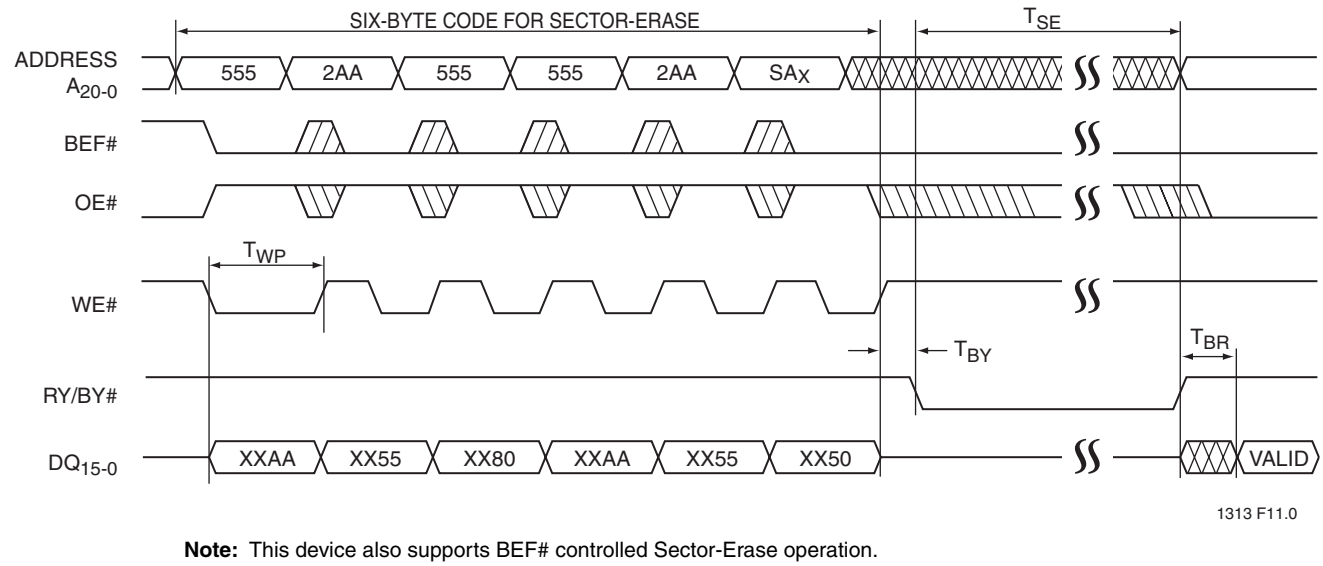
Note: This device also supports BEF# controlled Chip-Erase operation.
The WE# and BEF# signals are interchangeable as long as minimum timings are met. (See Table 17.)
X can be V_{IL} or V_{IH}, but no other value.

FIGURE 13: Flash WE# Controlled Chip-Erase Timing Diagram for Word Mode (For Byte Mode A_{-1} = Don't Care)



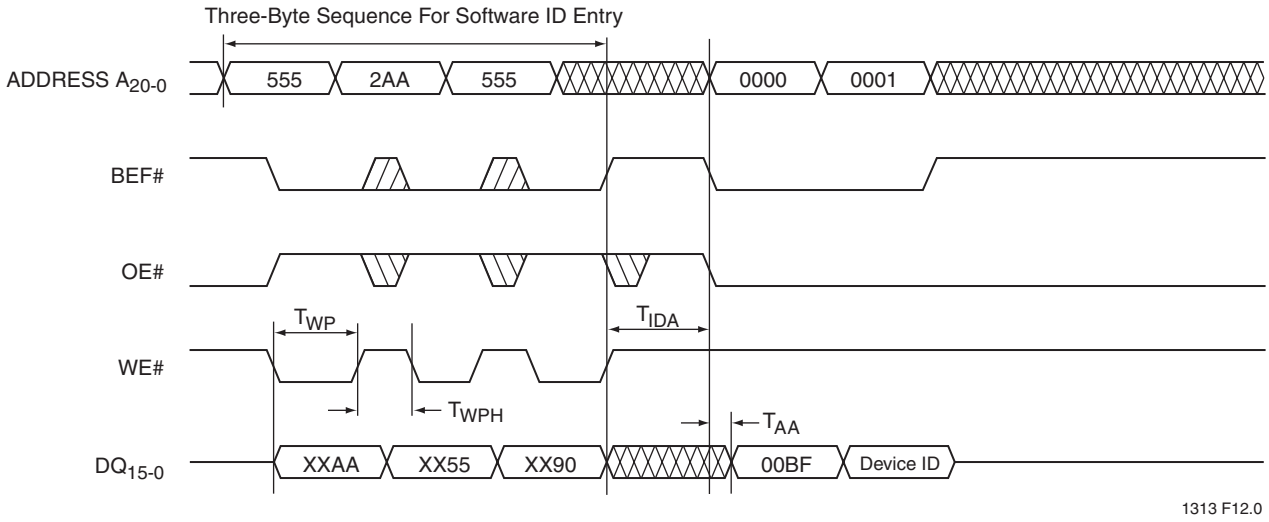
Note: This device also supports BEF# controlled Block-Erase operation.
The WE# and BEF# signals are interchangeable as long as minimum timings are met. (See Table 17.)
BA_X = Block Address
X can be V_{IL} or $V_{IH,}$ but no other value.

FIGURE 14: Flash WE# Controlled Block-Erase Timing Diagram for Word Mode (For Byte Mode A_{-1} = Don't Care)



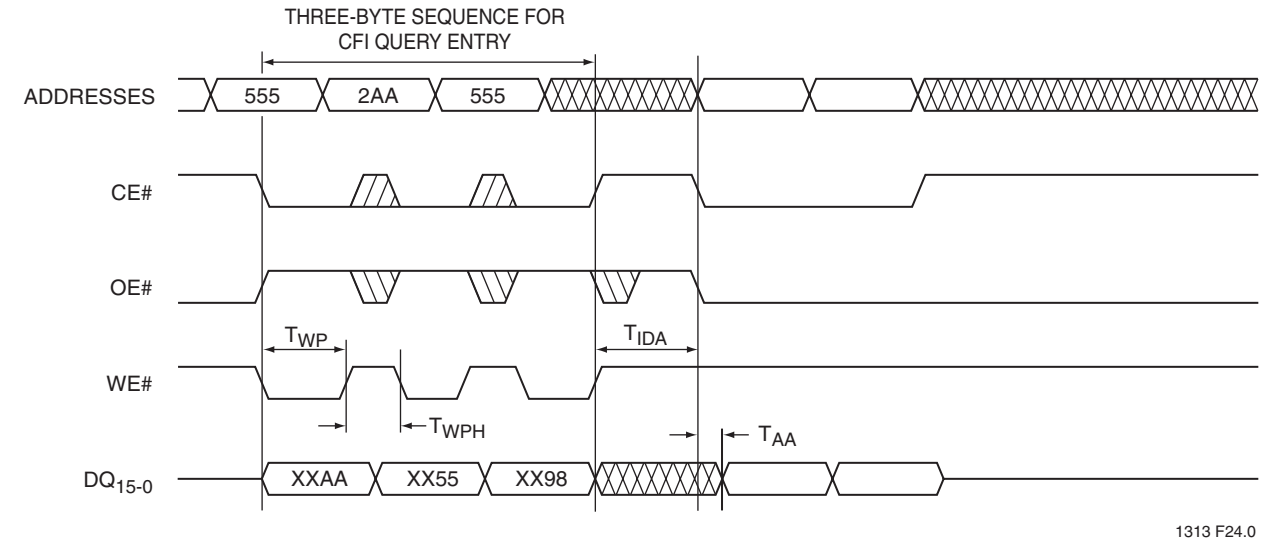
Note: This device also supports BEF# controlled Sector-Erase operation.
The WE# and BEF# signals are interchangeable as long as minimum timings are met. (See Table 17.)
SA_X = Sector Address
X can be V_{IL} or $V_{IH,}$ but no other value.

FIGURE 15: Flash WE# Controlled Sector-Erase Timing Diagram for Word Mode (For Byte Mode A_{-1} = Don't Care)



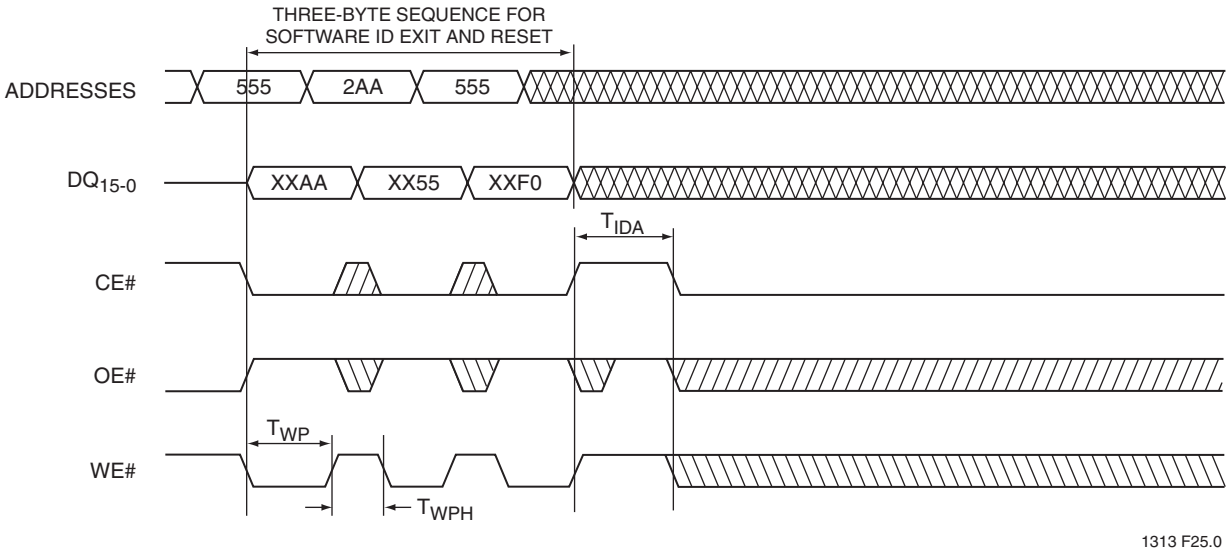
Note: X can be V_{IL} or $V_{IH,}$ but no other value.
Device ID - 7353H for SST34HF32A4

FIGURE 16: Flash Software ID Entry and Read (For Byte Mode A_{-1} = 0)



Note: X can be V_{IL} or $V_{IH,}$ but no other value.

FIGURE 17: CFI Entry and Read



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

FIGURE 18: Software ID Exit/CFI Exit

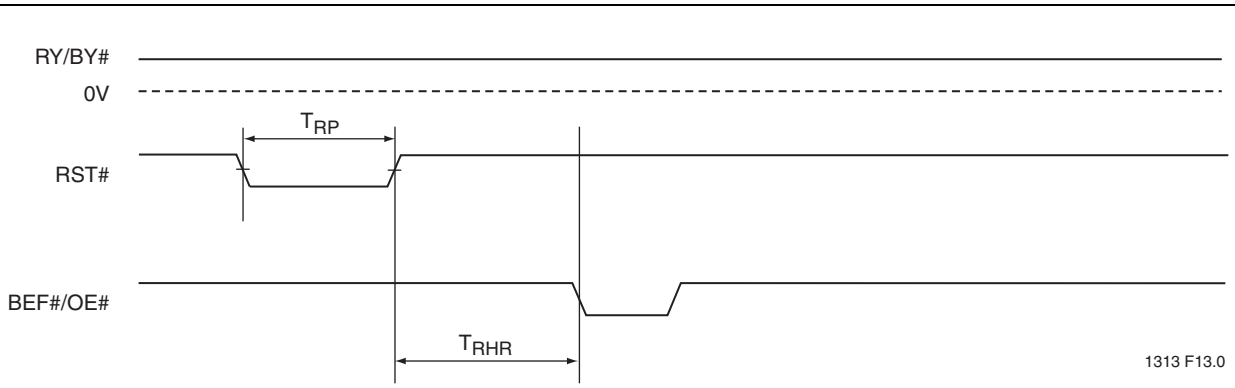


FIGURE 19: RST# Timing (when no internal operation is in progress)

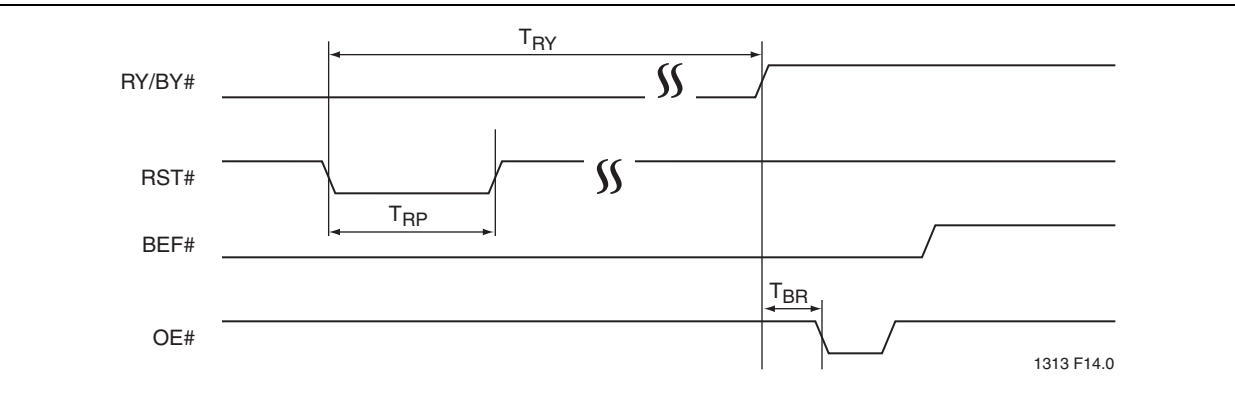


FIGURE 20: RST# Timing (during Sector- or Block-Erase operation)

AC test inputs are driven at V_{IHT} (V_{DD}-0.2V) for a logic '1' and V_{ILT} (0.2V) 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 21: AC Input/Output Reference Waveforms

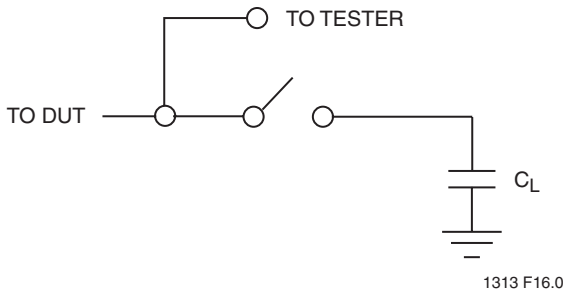
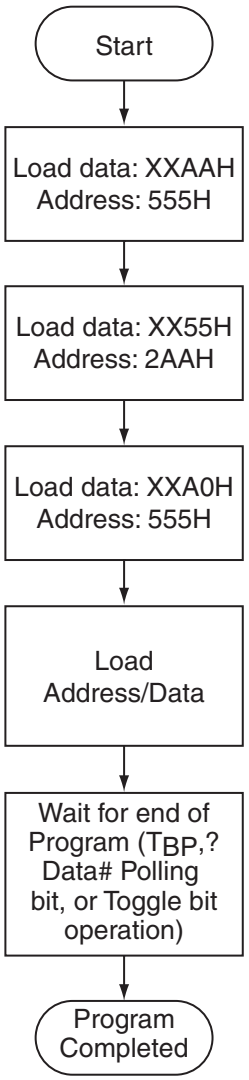


FIGURE 22: A Test Load Example



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

FIGURE 23: Program Algorithm

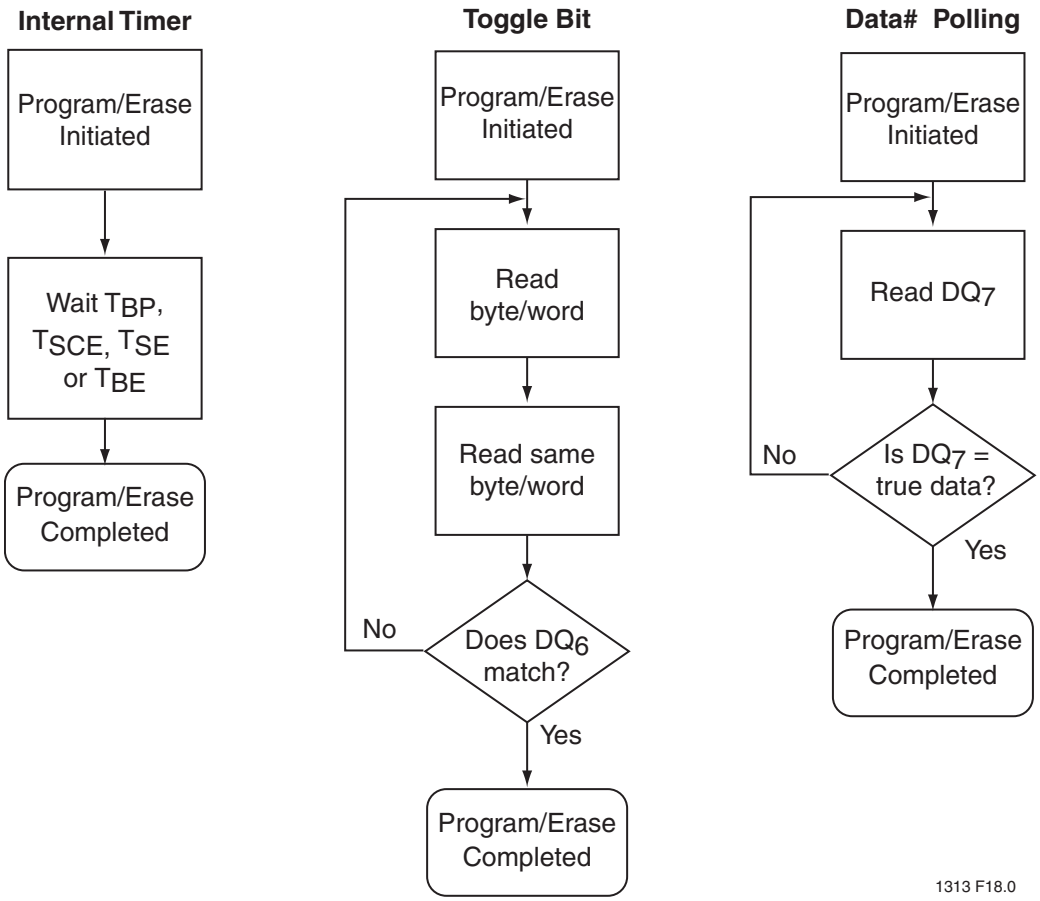
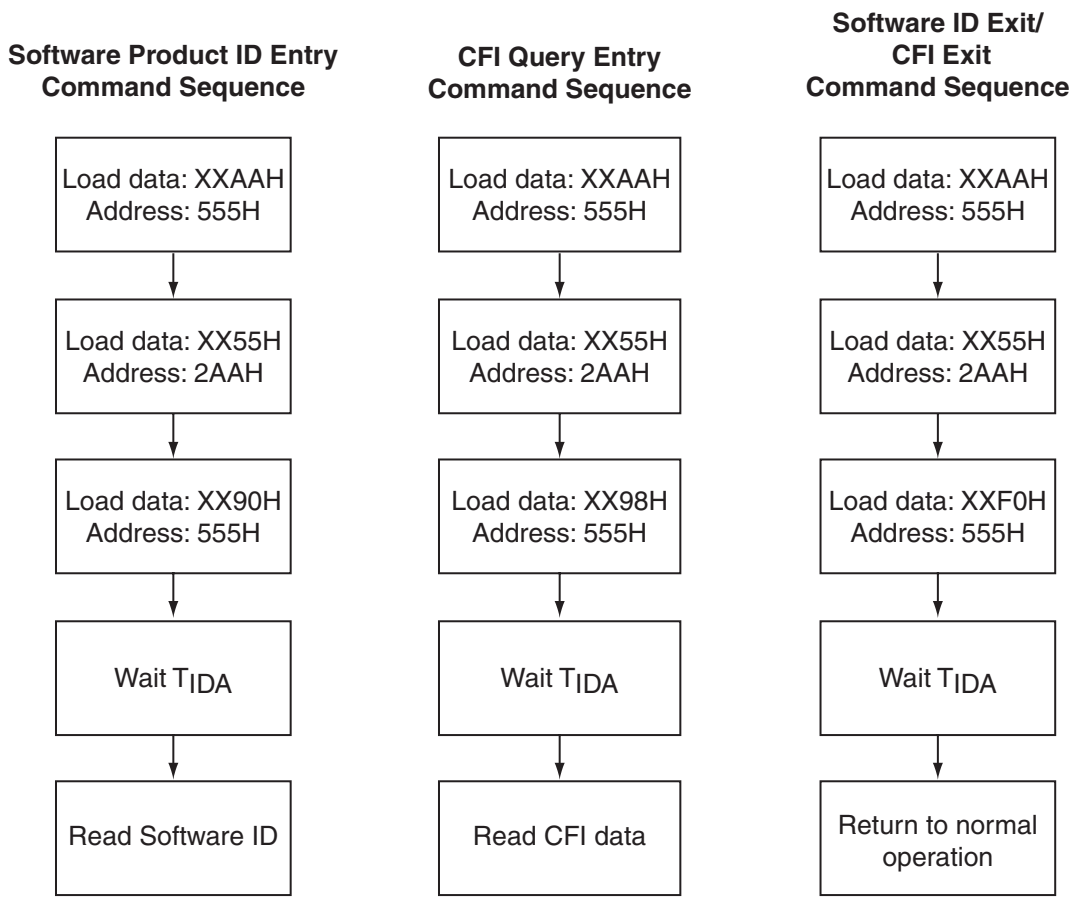


FIGURE 24: Wait Options



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

FIGURE 25: Software Product ID/CFI Command Flowcharts

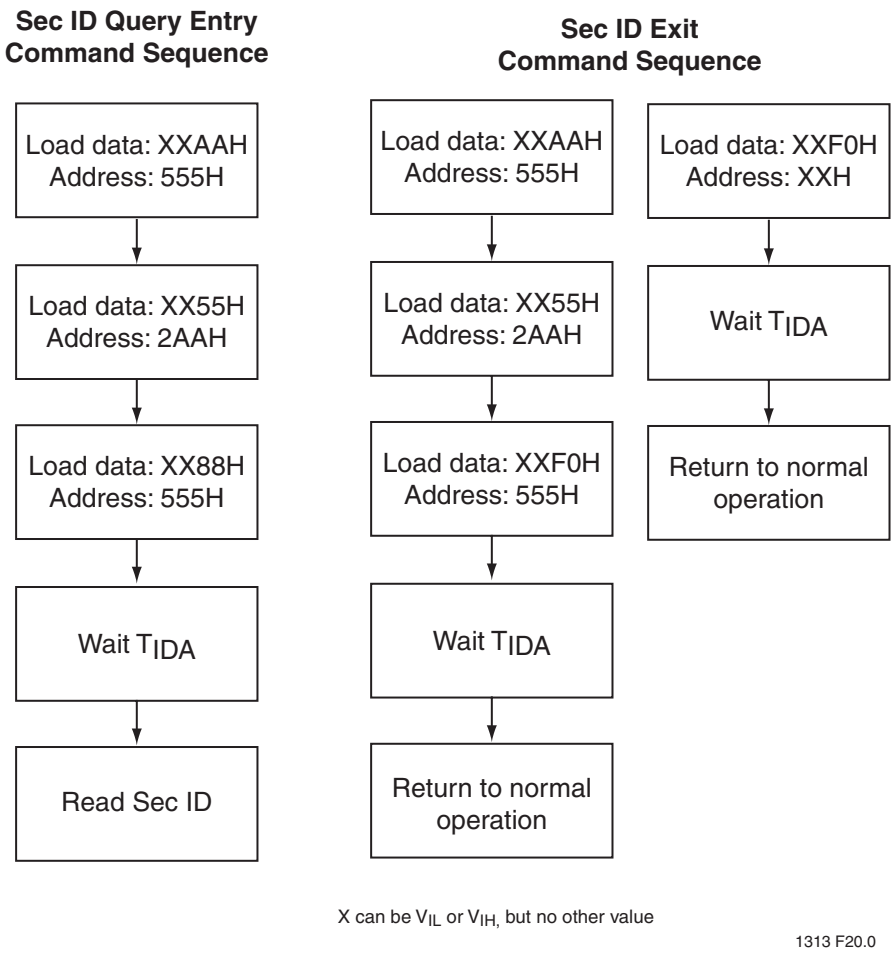


FIGURE 26: Software Sec ID/CFI Command Flowcharts

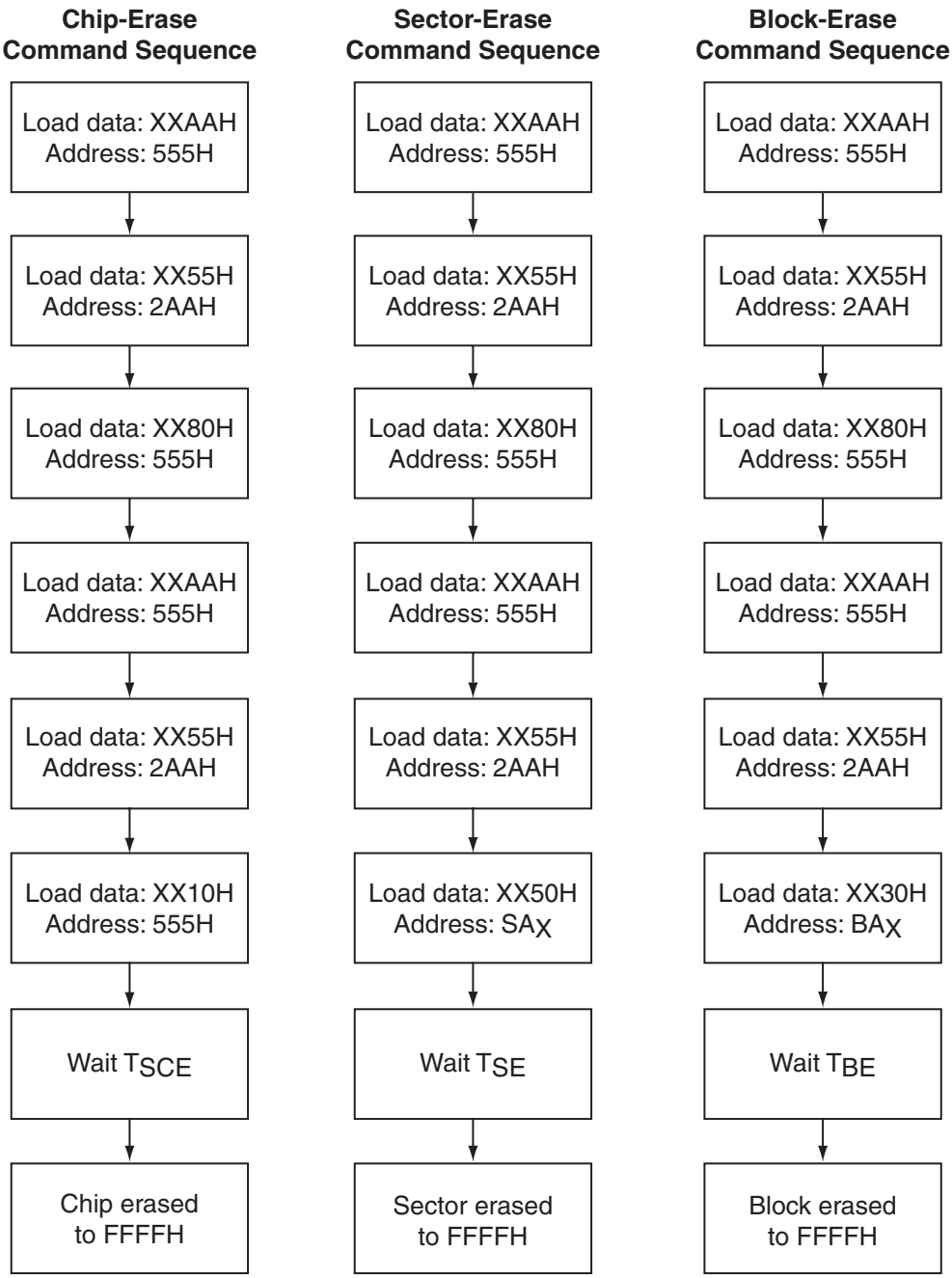
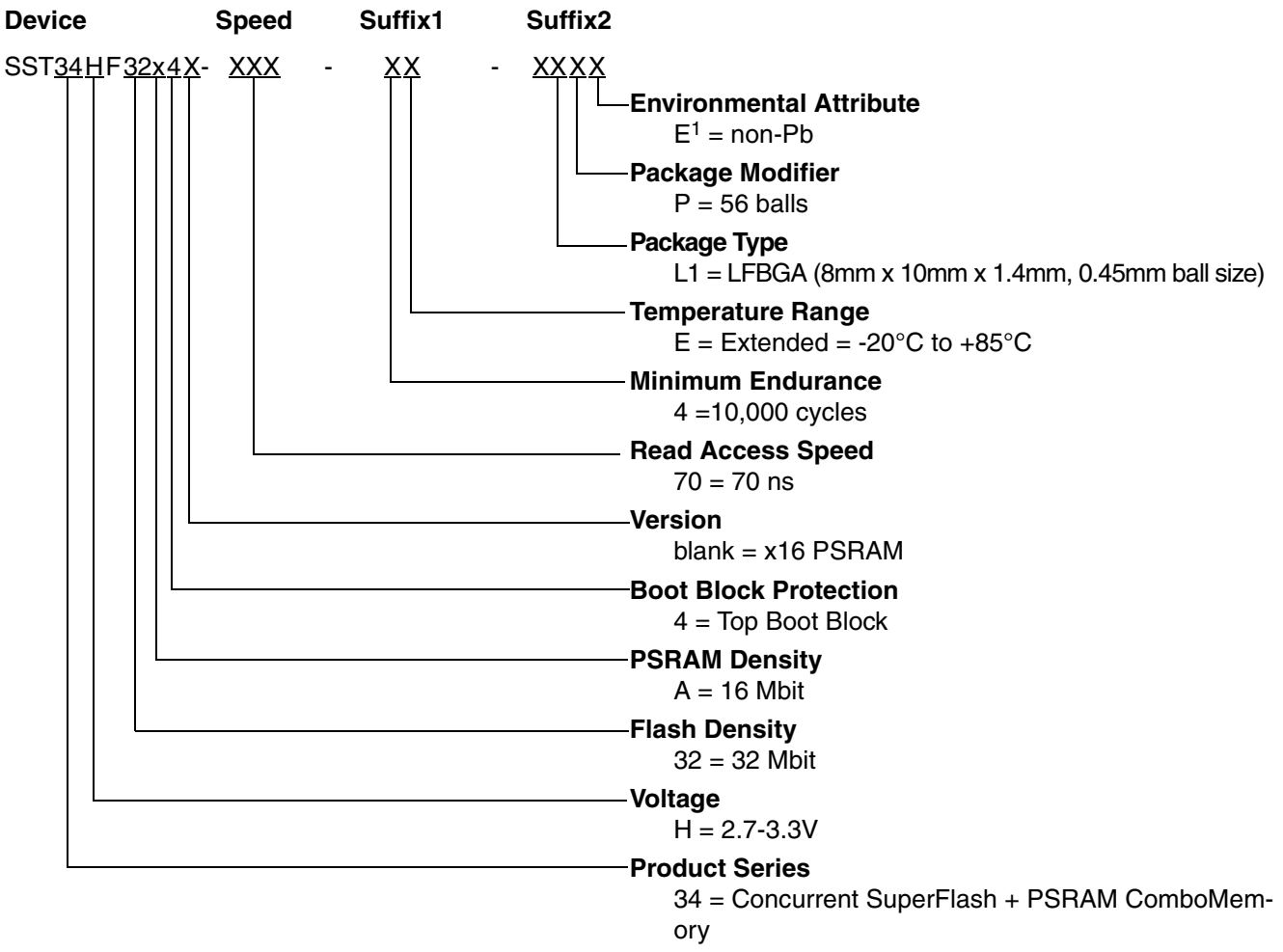


FIGURE 27: Erase Command Sequence

PRODUCT ORDERING INFORMATION



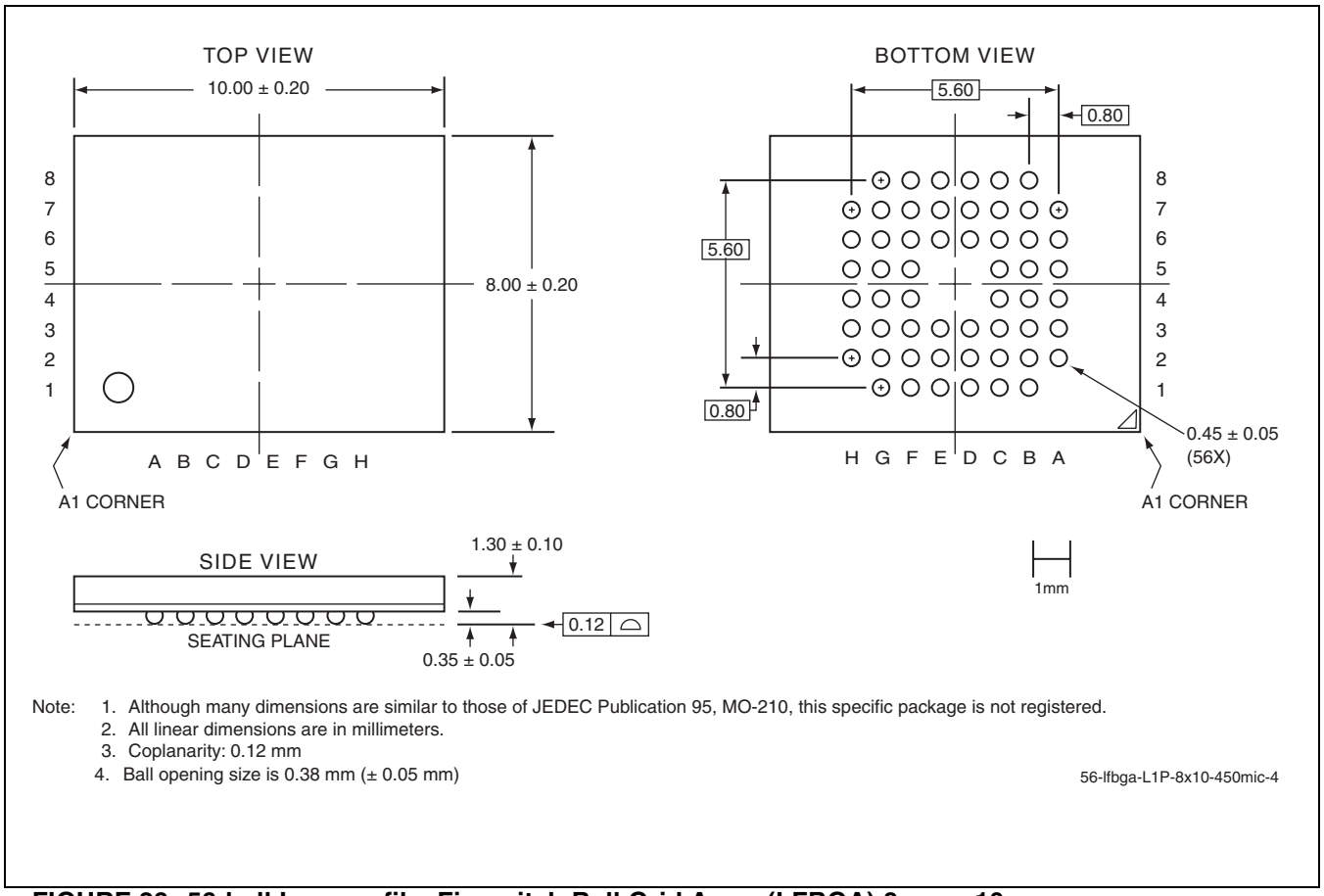
1. Environmental suffix “E” denotes non-Pb solder.
SST non-Pb solder devices are “RoHS Compliant”.

Valid combinations for SST34HF32A4

SST34HF32A4-70-4E-L1PE SST34HF32A4-70-4E-LSE

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

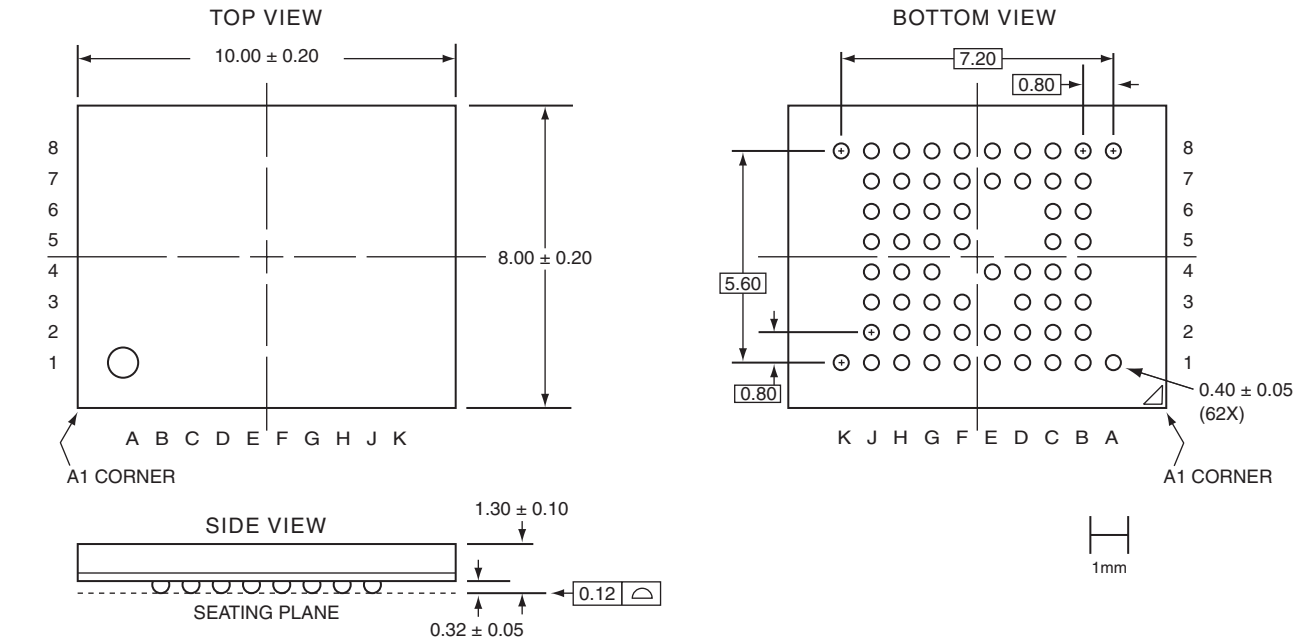
PACKAGING DIAGRAMS



Note: 1. Although many dimensions are similar to those of JEDEC Publication 95, MO-210, this specific package is not registered.
2. All linear dimensions are in millimeters.
3. Coplanarity: 0.12 mm
4. Ball opening size is 0.38 mm (± 0.05 mm)

56-lfbga-L1P-8x10-450mic-4

FIGURE 28: 56-ball Low-profile, Fine-pitch Ball Grid Array (LFBGA) 8mm x 10mm
SST Package Code: L1P



Note: 1. Although many dimensions are similar to those of JEDEC Publication 95, MO-210, this specific package is not registered.
2. All linear dimensions are in millimeters.
3. Coplanarity: 0.12 mm
4. Ball opening size is 0.32 mm (± 0.05 mm)

62-lfbga-LS-8x10-400mic-4

FIGURE 29: 62-Ball Low-Profile, Fine-Pitch Ball Grid Array (LFBGA) 8mm x 10mm
SST Package Code: LS

TABLE 18: Revision History

Number	Description	Date
00	• Initial Release	Feb 2006
01	• Made minor textual updates to “Features:” on page 1 and “Security ID” on page 6 • Updated I_{SB} values in Table 10 on page 17. • Migrated document from “Advanced Information” to “Preliminary Specifications”	Aug 2006
02	• Updated I_{SB} values in Table 10 on page 17.	Aug 2006
03	• Changed Heading “Product Identification Mode Exit” to “Product Identification Mode Exit/CFI Mode Exit” on page 6 • Added Figure 18 on page 28 • Changed V_{IHT} ($0.9V_{DD}$) to V_{IHT} (V_{DD}-0.2V) and V_{ILT} ($0.1V_{DD}$) to V_{ILT} (0.2V) in Figure 21 notes.	Aug 2007
04	• Changed ‘Program Time: 7 µs’ to ‘Word-Program Time: 7 µs’ on page 1, Features • Edited Product Description on page 1	Aug 2007
05	• Edited Tby TY/BY# Delay Time in Table 17 on page 20 from 90ns Min to 90ns Max	Nov 2009

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