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Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



MX25R3235F

**ULTRA LOW POWER, 32M-BIT [x 1/x 2/x 4]
CMOS MXSMIO[®] (SERIAL MULTI I/O)
FLASH MEMORY**

Key Features

- *Ultra Low Power Mode and High Performance Mode*
- *Wide Range VCC 1.65V-3.6V for Read, Erase and Program Operations*
- *Unique ID and Secure OTP Support*
- *Multi I/O Support - Single I/O, Dual I/O and Quad I/O*
- *Program Suspend/Resume & Erase Suspend/Resume*

Contents

| | |
|---|-----------|
| 1. FEATURES | 4 |
| 2. GENERAL DESCRIPTION | 6 |
| Table 1. Additional Feature | 7 |
| 3. PIN CONFIGURATIONS | 8 |
| 4. PIN DESCRIPTION | 8 |
| 5. BLOCK DIAGRAM | 9 |
| 6. DATA PROTECTION | 10 |
| Table 2. Protected Area Sizes | 11 |
| Table 3. 8K-bit Secured OTP Definition | 12 |
| 7. MEMORY ORGANIZATION | 13 |
| Table 4. Memory Organization | 13 |
| 8. DEVICE OPERATION | 14 |
| 9. HOLD FEATURE | 16 |
| 10. COMMAND DESCRIPTION | 17 |
| Table 5. Command Set..... | 17 |
| 10-1. Write Enable (WREN)..... | 20 |
| 10-2. Write Disable (WRDI)..... | 21 |
| 10-3. Read Identification (RDID)..... | 22 |
| 10-4. Read Electronic Signature (RES) | 23 |
| 10-5. Read Electronic Manufacturer ID & Device ID (REMS)..... | 24 |
| 10-6. ID Read..... | 25 |
| Table 6. ID Definitions | 25 |
| 10-7. Read Status Register (RDSR)..... | 26 |
| 10-8. Read Configuration Register (RDCR)..... | 27 |
| 10-9. Write Status Register (WRSR)..... | 32 |
| Table 7. Protection Modes..... | 33 |
| 10-10. Read Data Bytes (READ) | 36 |
| 10-11. Read Data Bytes at Higher Speed (FAST_READ) | 37 |
| 10-12. Dual Read Mode (DREAD)..... | 38 |
| 10-13. 2 x I/O Read Mode (2READ) | 39 |
| 10-14. Quad Read Mode (QREAD) | 40 |
| 10-15. 4 x I/O Read Mode (4READ) | 41 |
| 10-16. Burst Read..... | 43 |
| 10-17. Performance Enhance Mode | 44 |
| 10-18. Sector Erase (SE)..... | 46 |
| 10-19. Block Erase (BE32K) | 47 |
| 10-20. Block Erase (BE) | 48 |
| 10-21. Chip Erase (CE)..... | 49 |
| 10-22. Page Program (PP) | 50 |
| 10-23. 4 x I/O Page Program (4PP)..... | 51 |
| 10-24. Deep Power-down (DP)..... | 52 |
| 10-25. Enter Secured OTP (ENSO)..... | 53 |

| | |
|---|-----------|
| 10-26. Exit Secured OTP (EXSO)..... | 53 |
| 10-27. Read Security Register (RDSCUR)..... | 53 |
| Table 8. Security Register Definition | 54 |
| 10-28. Write Security Register (WRSCUR)..... | 54 |
| 10-29. Program Suspend and Erase Suspend | 55 |
| Table 9. Readable Area of Memory While a Program or Erase Operation is Suspended..... | 55 |
| Table 10. Acceptable Commands During Program/Erase Suspend after tPSL/tESL..... | 55 |
| Table 11. Acceptable Commands During Suspend (tPSL/tESL not required)..... | 56 |
| 10-30. Program Resume and Erase Resume | 57 |
| 10-31. No Operation (NOP) | 58 |
| 10-32. Software Reset (Reset-Enable (RSTEN) and Reset (RST)) | 58 |
| 10-33. High Voltage Operation..... | 60 |
| 10-34. Read SFDP Mode (RDSFDP)..... | 61 |
| 11. RESET..... | 62 |
| Table 12. Reset Timing-(Power On)..... | 62 |
| Table 13. Reset Timing-(Other Operation) | 62 |
| 12. POWER-ON STATE | 63 |
| 13. ELECTRICAL SPECIFICATIONS | 64 |
| Table 14. Absolute Maximum Ratings..... | 64 |
| Table 15. Capacitance..... | 64 |
| Table 16. DC Characteristics..... | 66 |
| Table 17. AC Characteristics | 68 |
| 14. OPERATING CONDITIONS..... | 72 |
| Table 18. Power-Up/Down Voltage and Timing..... | 74 |
| 14-1. Initial Delivery State | 74 |
| 15. ERASE AND PROGRAMMING PERFORMANCE | 75 |
| 16. LATCH-UP CHARACTERISTICS | 76 |
| 17. ORDERING INFORMATION | 77 |
| 18. PART NAME DESCRIPTION..... | 78 |
| 19. PACKAGE INFORMATION..... | 79 |
| 19-1. 8-pin SOP (150mil) | 79 |
| 19-2. 8-pin SOP (200mil) | 80 |
| 19-3. 8-land WSON (6x5mm)..... | 81 |
| 19-4. 8-land USON (4x3mm) | 82 |
| 19-5. 12-ball WLCSP (3-2-3 Ball Array) | 83 |
| 20. REVISION HISTORY | 84 |

**Ultra Low Power 32M-BIT [x 1/x 2/x 4] CMOS MXSMIO® (SERIAL MULTI I/O)
FLASH MEMORY****1. FEATURES****GENERAL**

- Supports Serial Peripheral Interface -- Mode 0 and Mode 3
- 33,554,432 x 1 bit structure or 16,777,216 x 2 bits (two I/O mode) structure or 8,388,608 x 4 bits (four I/O mode) structure
- Equal Sectors with 4K byte each, Equal Blocks with 32K byte each, or Equal Blocks with 64K byte each
 - Any Block can be erased individually
- Single Power Supply Operation
 - Operation Voltage: 1.65V-3.6V for Read, Erase, and Program Operations
- Latch-up protected to 100mA from -1V to Vcc +1V

PERFORMANCE

- High Performance
 - Fast read
 - 1 I/O: 80MHz with 8 dummy cycles
 - 2 I/O: 80MHz with 4 dummy cycles, equivalent to 160MHz
 - 4 I/O: 80MHz with 2+4 dummy cycles, equivalent to 320MHz
 - Fast program and erase time
 - 8/16/32/64 byte Wrap-Around Burst Read Mode
- Ultra Low Power Consumption
- Minimum 100,000 erase/program cycles
- 20 years data retention

SOFTWARE FEATURES

- Input Data Format
 - 1-byte Command code
- Advanced Security Features
 - Block lock protection
 - The BP0-BP3 status bit defines the size of the area to be software protection against program and erase instructions
- Additional 8K bits secured OTP
 - Features unique identifier.
 - Factory locked identifiable and customer lockable
- Auto Erase and Auto Program Algorithm
 - Automatically erases and verifies data at selected sector or block
 - Automatically programs and verifies data at selected page by an internal algorithm that automatically times the program pulse widths (Any page to be programmed should have page in the erased state first)
- Status Register Feature
- Command Reset
- Program/Erase Suspend and Program/Erase Resume
- Electronic Identification
 - JEDEC 1-byte manufacturer ID and 2-byte device ID
 - RES command for 1-byte Device ID
 - REMS command for 1-byte manufacturer ID and 1-byte device ID
- Support Serial Flash Discoverable Parameters (SFDP) mode
- Support Unique ID (Please contact local Macronix sales for detail information)

HARDWARE FEATURES

- SCLK Input
 - Serial clock input
- SI/SIO0
 - Serial Data Input or Serial Data Input/Output for 2 x I/O read mode and 4 x I/O read mode
- SO/SIO1
 - Serial Data Output or Serial Data Input/Output for 2 x I/O read mode and 4 x I/O read mode
- WP#/SIO2
 - Hardware write protection or serial data Input/Output for 4 x I/O read mode
- RESET#/SIO3 * or HOLD#/SIO3 *
 - Hardware Reset pin or Serial input & Output for 4 x I/O read mode
 - or
 - HOLD feature, to pause the device without deselecting the device or Serial input & Output for 4 x I/O read mode
 - * **Depends on part number options**
- PACKAGE
 - 8-pin SOP (150mil/200mil)
 - 8-land WSON (6x5mm)
 - 8-land USON (4x3mm)
 - 12-ball WLCSP (3-2-3 Ball Array)
 - **All devices are RoHS Compliant and Halogen-free**

2. GENERAL DESCRIPTION

MX25R3235F is 32Mb bits Serial NOR Flash memory, which is configured as 4,194,304 x 8 internally. When it is in four I/O mode, the structure becomes 8,388,608 bits x 4 or 16,777,216 bits x 2. MX25R3235F feature a serial peripheral interface and software protocol allowing operation on a simple 3-wire bus while it is in single I/O mode. The three bus signals are a clock input (SCLK), a serial data input (SI), and a serial data output (SO). Serial access to the device is enabled by CS# input.

When it is in two I/O read mode, the SI pin and SO pin become SIO0 pin and SIO1 pin for address/dummy bits input and data output. When it is in four I/O read mode, the SI pin, SO pin, WP# pin and RESET#/HOLD# pin become SIO0 pin, SIO1 pin, SIO2 pin and SIO3 pin for address/dummy bits input and data output.

The MX25R3235F MXSMIO[®] (Serial Multi I/O) provides sequential read operation on whole chip.

After program/erase command is issued, auto program/erase algorithms which program/erase and verify the specified page or sector/block locations will be executed. Program command is executed on byte basis, or page (256 bytes) basis, or word basis for erase command is executed on sector (4K-byte), or 32KB block (32K-byte), or block (64K-byte), or whole chip basis.

To provide user with ease of interface, a status register is included to indicate the status of the chip. The status read command can be issued to detect completion status of a program or erase operation via WIP bit.

Advanced security features enhance the protection and security functions, please see security features section for more details.

The MX25R3235F utilizes Macronix's proprietary memory cell, which reliably stores memory contents even after 100,000 program and erase cycles.

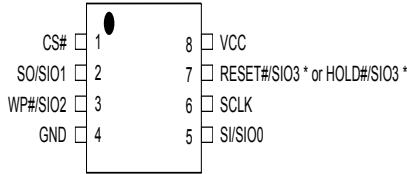
Table 1. Additional Feature

| | |
|-------------------------------------|-------------------|
| Protection and Security | MX25R3235F |
| Flexible Block Protection (BP0-BP3) | √ |
| 8K-bit security OTP | √ |

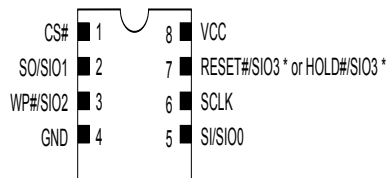
| Fast Read Performance | Ultra Low Power Mode (Configuration Register-2 bit1= 0) | | | | | High Performance Mode (Configuration Register-2 bit1= 1) | | | | |
|-----------------------|--|-------|-------|-------|-------|---|-------|-------|-------|-------|
| | 1 I/O | 1I/2O | 2 I/O | 1I/4O | 4 I/O | 1 I/O | 1I/2O | 2 I/O | 1I/4O | 4 I/O |
| I/O | 1 I/O | 1I/2O | 2 I/O | 1I/4O | 4 I/O | 1 I/O | 1I/2O | 2 I/O | 1I/4O | 4 I/O |
| Dummy Cycle | 8 | 8 | 4 | 8 | 6 | 8 | 8 | 4 | 8 | 6 |
| Frequency | 33MHz | 8MHz | 8MHz | 8MHz | 8MHz | 80MHz | 80MHz | 80MHz | 80MHz | 80MHz |

3. PIN CONFIGURATIONS

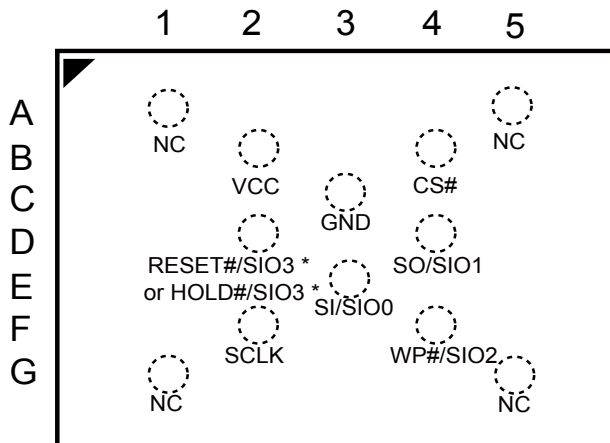
8-PIN SOP (150mil/200mil)



8-LAND WSON(6x5mm), USON(4x3mm)



3-2-3 Ball Array 12-WLCSP TOP View



* Depends on part number options.

4. PIN DESCRIPTION

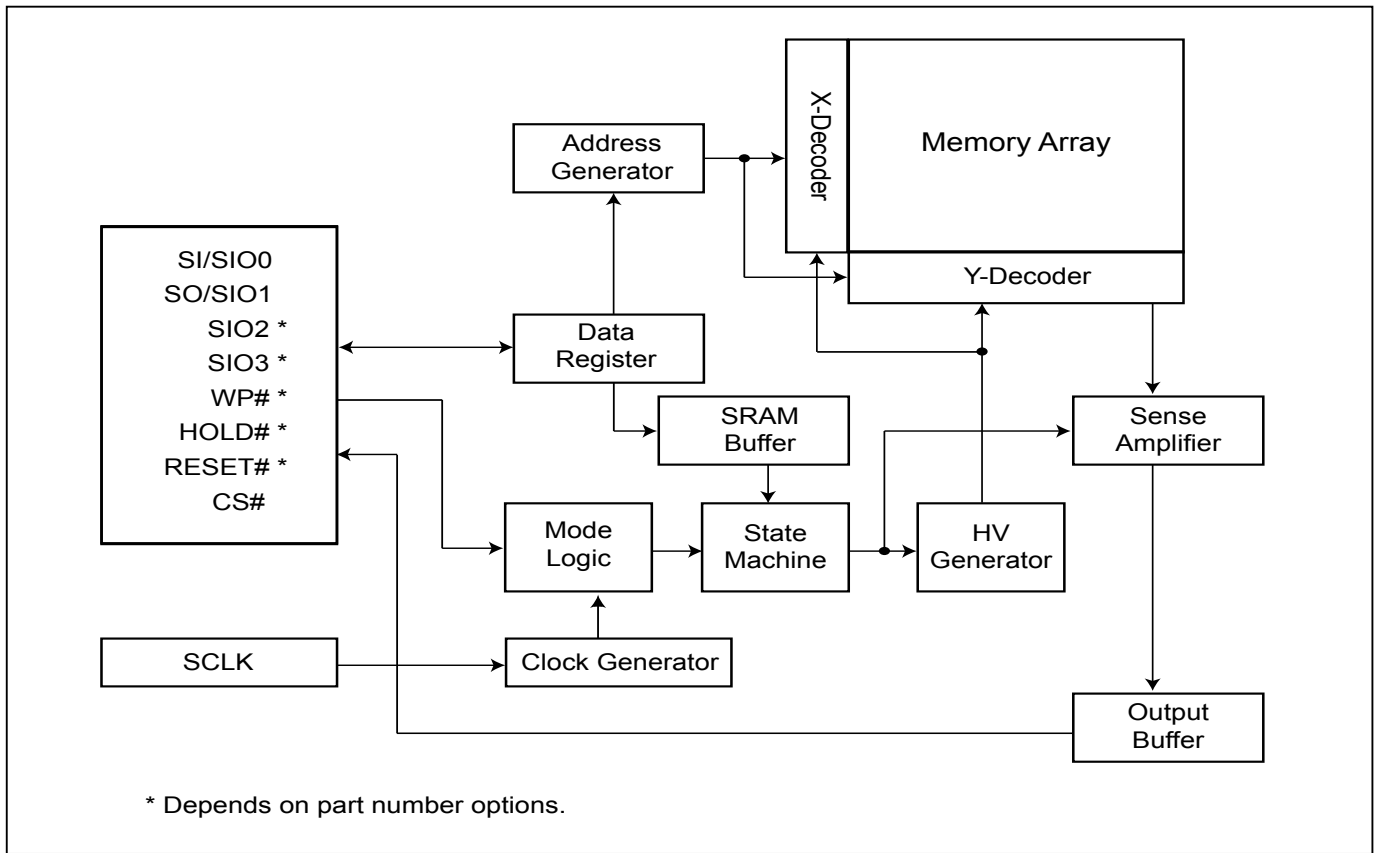
| SYMBOL | DESCRIPTION |
|---------------|--|
| CS# | Chip Select |
| SI/SIO0 | Serial Data Input (for 1 x I/O)/ Serial Data Input & Output (for 4xI/O read mode) |
| SO/SIO1 | Serial Data Output (for 1 x I/O)/ Serial Data Input & Output (for 4xI/O read mode) |
| SCLK | Clock Input |
| WP#/SIO2 | Write Protection Active Low or Serial Data Input & Output (for 4xI/O read mode) |
| RESET#/SIO3 * | Hardware Reset Pin Active low or Serial Data Input & Output (for 4xI/O read mode) |
| HOLD#/SIO3 * | To pause the device without deselecting the device or Serial Data Input & Output (for 4xI/O read mode) |
| VCC | Power Supply |
| GND | Ground |

* Depends on part number options.

Note:

1. RESET#, HOLD# and WP# with internal pull high circuit.

5. BLOCK DIAGRAM



6. DATA PROTECTION

During power transition, there may be some false system level signals which result in inadvertent erasure or programming. The device is designed to protect itself from these accidental write cycles.

The state machine will be reset as standby mode automatically during power up. In addition, the control register architecture of the device constrains that the memory contents can only be changed after specific command sequences have completed successfully.

In the following, there are several features to protect the system from the accidental write cycles during VCC power-up and power-down or from system noise.

- Power-on reset: to avoid sudden power switch by system power supply transition, the power-on reset may protect the Flash.
- Valid command length checking: The command length will be checked whether it is at byte base and completed on byte boundary.
- Write Enable (WREN) command: WREN command is required to set the Write Enable Latch bit (WEL) before issuing other commands to change data.
- Deep Power Down Mode: By entering deep power down mode, the flash device is under protected from writing all commands except toggling the CS#. For more detail please see "[10-24. Deep Power-down \(DP\)](#)".
- Advanced Security Features: there are some protection and security features which protect content from inadvertent write and hostile access.

I. Block lock protection

- The Software Protected Mode (SPM) use (BP3, BP2, BP1, BP0) bits to allow part of memory to be protected as read only. The protected area definition is shown as "[Table 2. Protected Area Sizes](#)", the protected areas are more flexible which may protect various area by setting value of BP0-BP3 bits.
- The Hardware Protected Mode (HPM) use WP#/SIO2 to protect the (BP3, BP2, BP1, BP0) bits and Status Register Write Protect (SRWD) bit. If the system goes into four I/O mode, the feature of HPM will be disabled.

Table 2. Protected Area Sizes

Protected Area Sizes (TB bit = 0)

| Status bit | | | | Protect Level |
|------------|-----|-----|-----|-------------------------------|
| BP3 | BP2 | BP1 | BP0 | 32Mb |
| 0 | 0 | 0 | 0 | 0 (none) |
| 0 | 0 | 0 | 1 | 1 (1block, block 63th) |
| 0 | 0 | 1 | 0 | 2 (2blocks, block 62nd-63rd) |
| 0 | 0 | 1 | 1 | 3 (4blocks, block 60th-63rd) |
| 0 | 1 | 0 | 0 | 4 (8blocks, block 56th-63rd) |
| 0 | 1 | 0 | 1 | 5 (16blocks, block 48th-63rd) |
| 0 | 1 | 1 | 0 | 6 (32blocks, block 32nd-63rd) |
| 0 | 1 | 1 | 1 | 7 (64blocks, protect all) |
| 1 | 0 | 0 | 0 | 8 (64blocks, protect all) |
| 1 | 0 | 0 | 1 | 9 (64blocks, protect all) |
| 1 | 0 | 1 | 0 | 10 (64blocks, protect all) |
| 1 | 0 | 1 | 1 | 11 (64blocks, protect all) |
| 1 | 1 | 0 | 0 | 12 (64blocks, protect all) |
| 1 | 1 | 0 | 1 | 13 (64blocks, protect all) |
| 1 | 1 | 1 | 0 | 14 (64blocks, protect all) |
| 1 | 1 | 1 | 1 | 15 (64blocks, protect all) |

Protected Area Sizes (TB bit = 1)

| Status bit | | | | Protect Level |
|------------|-----|-----|-----|------------------------------|
| BP3 | BP2 | BP1 | BP0 | 32Mb |
| 0 | 0 | 0 | 0 | 0 (none) |
| 0 | 0 | 0 | 1 | 1 (1block, block 0th) |
| 0 | 0 | 1 | 0 | 2 (2blocks, block 0th-1st) |
| 0 | 0 | 1 | 1 | 3 (4blocks, block 0th-3rd) |
| 0 | 1 | 0 | 0 | 4 (8blocks, block 0th-7th) |
| 0 | 1 | 0 | 1 | 5 (16blocks, block 0th-15th) |
| 0 | 1 | 1 | 0 | 6 (32blocks, block 0th-31st) |
| 0 | 1 | 1 | 1 | 7 (64blocks, protect all) |
| 1 | 0 | 0 | 0 | 8 (64blocks, protect all) |
| 1 | 0 | 0 | 1 | 9 (64blocks, protect all) |
| 1 | 0 | 1 | 0 | 10 (64blocks, protect all) |
| 1 | 0 | 1 | 1 | 11 (64blocks, protect all) |
| 1 | 1 | 0 | 0 | 12 (64blocks, protect all) |
| 1 | 1 | 0 | 1 | 13 (64blocks, protect all) |
| 1 | 1 | 1 | 0 | 14 (64blocks, protect all) |
| 1 | 1 | 1 | 1 | 15 (64blocks, protect all) |

Note: The device is ready to accept a Chip Erase instruction if, and only if, all Block Protect (BP3, BP2, BP1, BP0) are 0.

II. Additional 8K-bit secured OTP for unique identifier: to provide 8K-bit One-Time Program area for setting device unique serial number - Which may be set by factory or system maker.

The 8K-bit secured OTP area is composed of two rows of 4K-bit. Customer could lock the first 4K-bit OTP area and factory could lock the other.

- Security register bit 0 indicates whether the second 4K-bit is locked by factory or not.
- Customer may lock-down the customer lockable secured OTP by writing WRSCUR(write security register) command to set customer lock-down bit1 as "1". Please refer to "[Table 8. Security Register Definition](#)" for security register bit definition and "[Table 3. 8K-bit Secured OTP Definition](#)" for address range definition.
- To program 8K-bit secured OTP by entering secured OTP mode (with ENSO command), and going through normal program procedure, and then exiting secured OTP mode by writing EXSO command.

Note: Once lock-down whatever by factory or customer, the corresponding secured area cannot be changed any more. While in 8K-bit Secured OTP mode, array access is not allowed.

Table 3. 8K-bit Secured OTP Definition

| Address range | Size | Customer Lock | Standard Factory Lock |
|---------------|----------|------------------------|-----------------------|
| xxx000~xxx1FF | 4096-bit | Determined by customer | N/A |
| xxx200~xxx3FF | 4096-bit | N/A | Determined by factory |

7. MEMORY ORGANIZATION

Table 4. Memory Organization

| Block(64K-byte) | Block(32K-byte) | Sector (4K-byte) | Address Range | |
|-----------------|-----------------|------------------|---------------|----------|
| 63 | 127 | 1023 | 3FF000h | 3FFFFFFh |
| | | ⋮ | | |
| | | 1016 | 3F8000h | 3F8FFFh |
| | 126 | 1015 | 3F7000h | 3F7FFFh |
| | | ⋮ | | |
| 1008 | | 3F0000h | 3F0FFFh | |
| 62 | 125 | 1007 | 3EF000h | 3EFFFFh |
| | | ⋮ | | |
| | | 1000 | 3E8000h | 3E8FFFh |
| | 124 | 999 | 3E7000h | 3E7FFFh |
| | | ⋮ | | |
| 992 | | 3E0000h | 3E0FFFh | |
| 61 | 123 | 991 | 3DF000h | 3DFFFFh |
| | | ⋮ | | |
| | | 984 | 3D8000h | 3D8FFFh |
| | 122 | 983 | 3D7000h | 3D7FFFh |
| | | ⋮ | | |
| 976 | | 3D0000h | 3D0FFFh | |

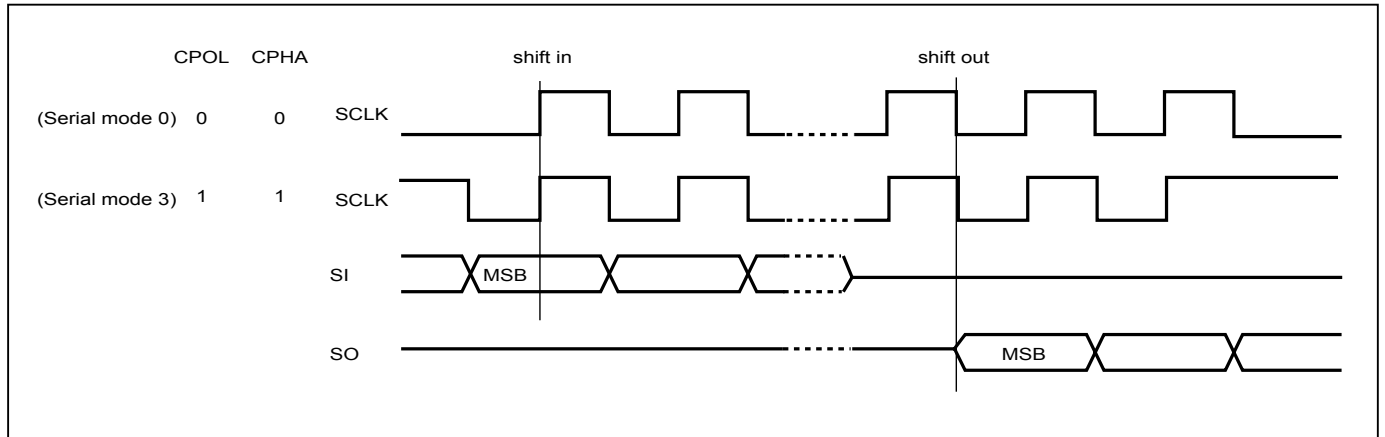


| | | | | |
|---|---|---------|---------|---------|
| 2 | 5 | 47 | 02F000h | 02FFFFh |
| | | ⋮ | | |
| | | 40 | 028000h | 028FFFh |
| 1 | 4 | 39 | 027000h | 027FFFh |
| | | ⋮ | | |
| | | 32 | 020000h | 020FFFh |
| 1 | 3 | 31 | 01F000h | 01FFFFh |
| | | ⋮ | | |
| | 2 | 24 | 018000h | 018FFFh |
| | | 23 | 017000h | 017FFFh |
| 0 | 1 | ⋮ | | |
| | | 16 | 010000h | 010FFFh |
| | | 15 | 00F000h | 00FFFFh |
| | 0 | 8 | 008000h | 008FFFh |
| | | 7 | 007000h | 007FFFh |
| ⋮ | | | | |
| 0 | 0 | 000000h | 000FFFh | |

8. DEVICE OPERATION

1. Before a command is issued, status register should be checked to ensure device is ready for the intended operation.
2. When incorrect command is inputted to this device, it enters standby mode and remains in standby mode until next CS# falling edge. In standby mode, SO pin of the device is High-Z.
3. When correct command is inputted to this device, it enters active mode and remains in active mode until next CS# rising edge.
4. Input data is latched on the rising edge of Serial Clock (SCLK) and data shifts out on the falling edge of SCLK. The difference of Serial mode 0 and mode 3 is shown as "[Figure 1. Serial Modes Supported](#)".
5. For the following instructions: RDID, RDSR, RDCR, RDSCUR, READ, FAST_READ, DREAD, 2READ, 4READ, QREAD, RDSFDP, RES, REMS, the shifted-in instruction sequence is followed by a data-out sequence. After any bit of data being shifted out, the CS# can be high. For the following instructions: WREN, WRDI, WRSR, SE, BE, BE32K, CE, PP, 4PP, DP, ENSO, EXSO, WRSCUR, SUSPEND, RESUME, NOP, RSTEN, RST, the CS# must go high exactly at the byte boundary; otherwise, the instruction will be rejected and not executed.
6. While a Write Status Register, Program or Erase operation is in progress, access to the memory array is neglected and will not affect the current operation of Write Status Register, Program, Erase.

Figure 1. Serial Modes Supported



Note:

CPOL indicates clock polarity of Serial master, CPOL=1 for SCLK high while idle, CPOL=0 for SCLK low while not transmitting. CPHA indicates clock phase. The combination of CPOL bit and CPHA bit decides which Serial mode is supported.

Figure 2. Serial Input Timing

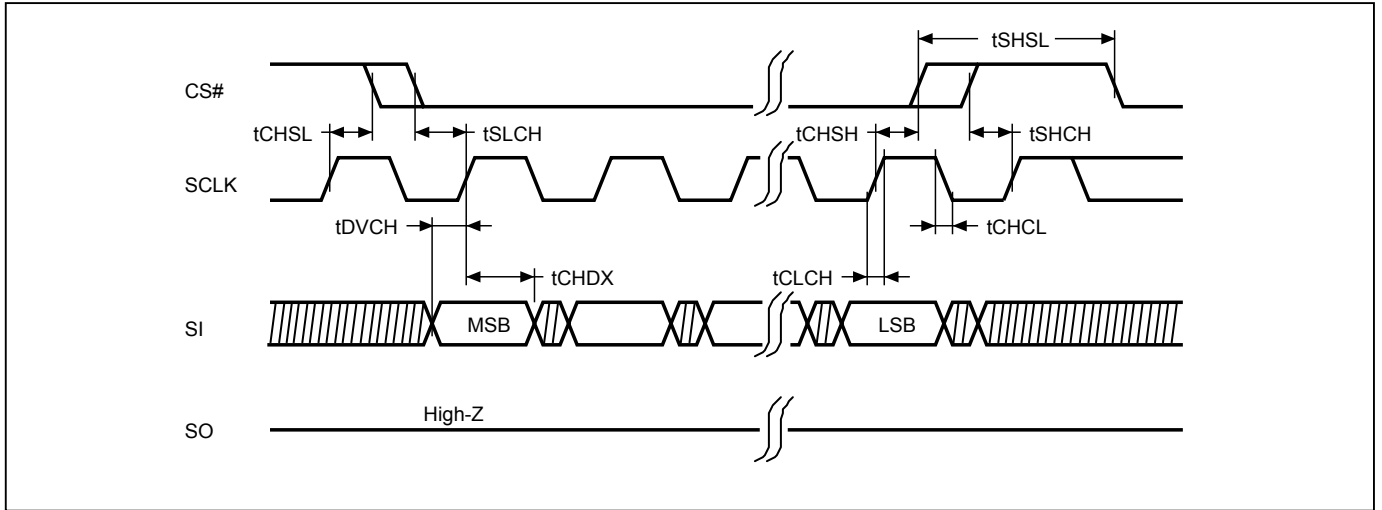
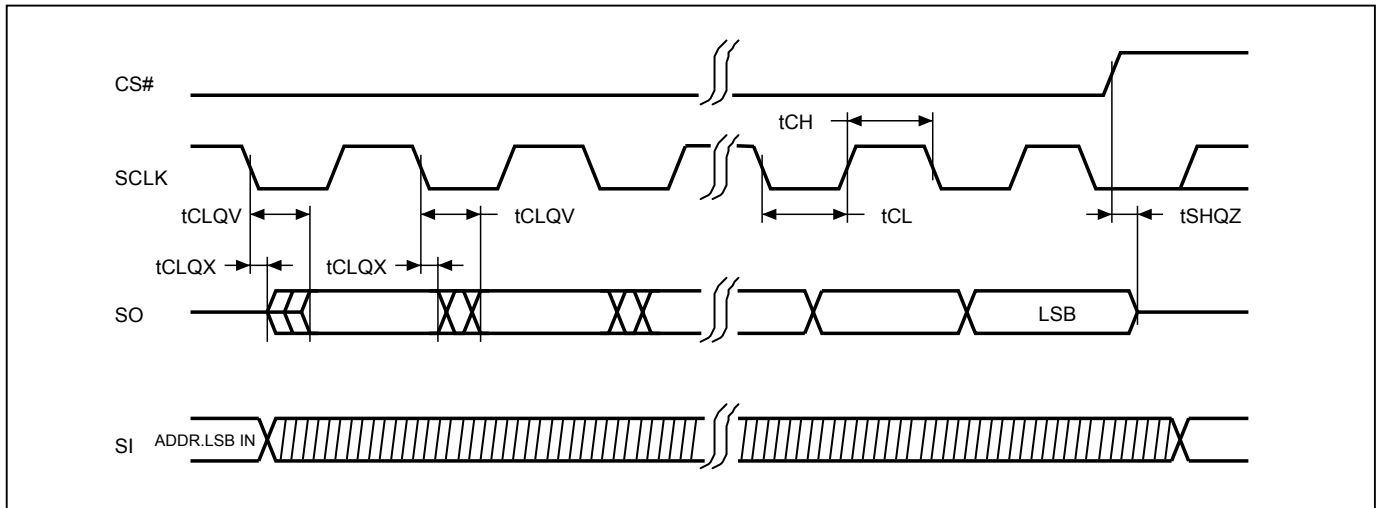


Figure 3. Output Timing

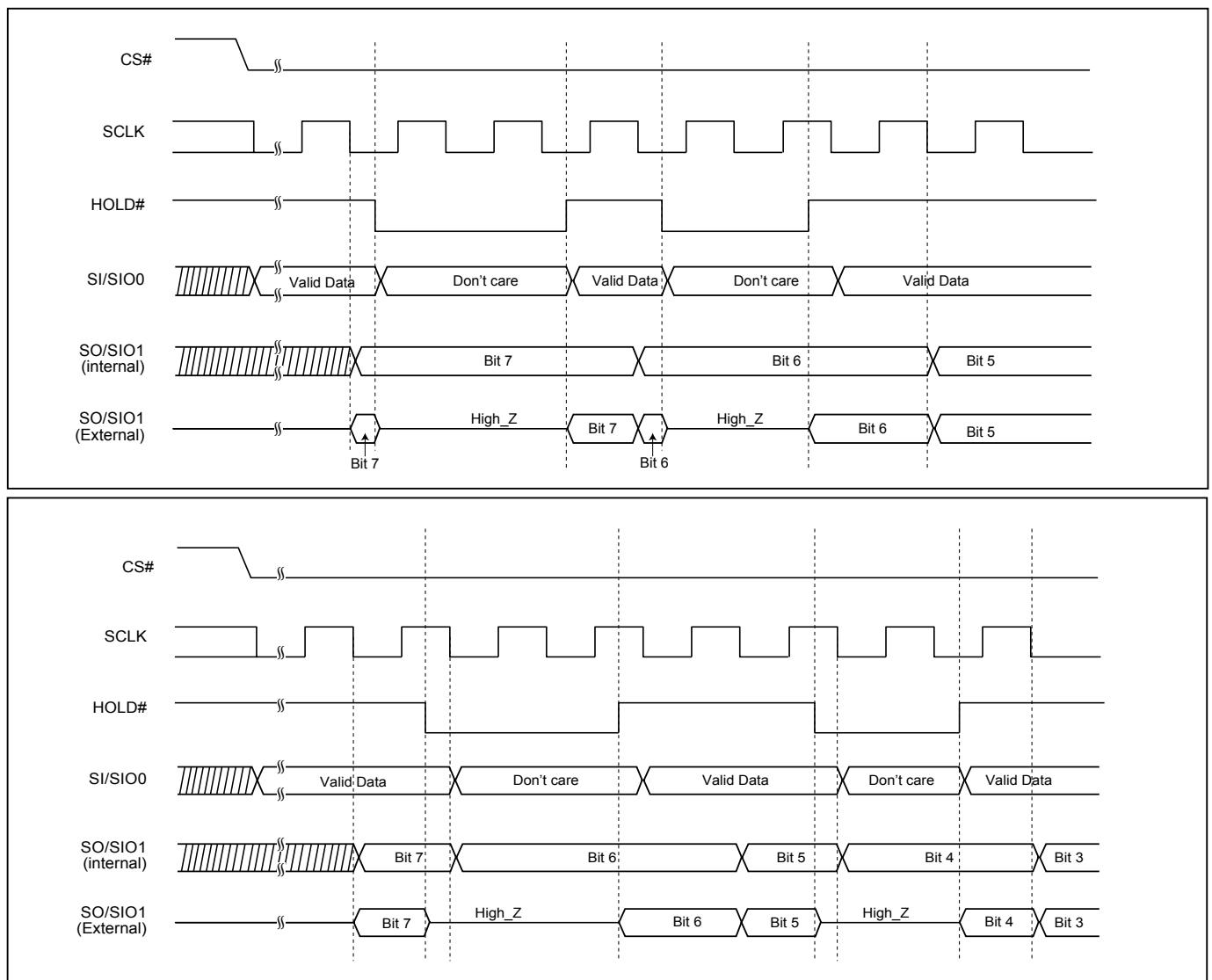


9. HOLD FEATURE

HOLD# pin signal goes low to hold any serial communications with the device. The HOLD feature will not stop the operation of write status register, programming, or erasing in progress.

The operation of HOLD requires Chip Select (CS#) keeping low and starts on falling edge of HOLD# pin signal while Serial Clock (SCLK) signal is being low (if Serial Clock signal is not being low, HOLD operation will not start until Serial Clock signal being low). The HOLD condition ends on the rising edge of HOLD# pin signal while Serial Clock(SCLK) signal is being low (if Serial Clock signal is not being low, HOLD operation will not end until Serial Clock being low).

Figure 4. Hold Condition Operation



During the HOLD operation, the Serial Data Output (SO) is high impedance when Hold# pin goes low and will keep high impedance until Hold# pin goes high. The Serial Data Input (SI) is don't care if both Serial Clock (SCLK) and Hold# pin goes low and will keep the state until SCLK goes low and Hold# pin goes high. If Chip Select (CS#) drives high during HOLD operation, it will reset the internal logic of the device. To re-start communication with chip, the HOLD# must be at high and CS# must be at low.

Note: The HOLD feature is disabled during Quad I/O mode.

10. COMMAND DESCRIPTION

Table 5. Command Set

Read/Write Array Commands

| I/O | 1 | 1 | 2 | 2 | 4 | 4 |
|----------------|--------------------------------------|--------------------------------------|---|---|-----------------------------------|---|
| Command (byte) | READ (normal read) | FAST READ (fast read data) | 2READ (2 x I/O read command) | DREAD (1I / 2O read command) | 4READ (4 x I/O read) | QREAD (1I/4O read) |
| 1st byte | 03 (hex) | 0B (hex) | BB (hex) | 3B (hex) | EB (hex) | 6B (hex) |
| 2nd byte | ADD1 | ADD1 | ADD1 | ADD1 | ADD1 | ADD1 |
| 3rd byte | ADD2 | ADD2 | ADD2 | ADD2 | ADD2 | ADD2 |
| 4th byte | ADD3 | ADD3 | ADD3 | ADD3 | ADD3 | ADD3 |
| 5th byte | | Dummy | Dummy | Dummy | Dummy | Dummy |
| Action | n bytes read out until CS# goes high | n bytes read out until CS# goes high | n bytes read out by 2 x I/O until CS# goes high | n bytes read out by Dual Output until CS# goes high | Quad I/O read with 6 dummy cycles | n bytes read out by Quad output until CS# goes high |

| Mode | 1 | 4 | 1 | 1 | 1 | 1 | 1 |
|----------------|------------------------------|---|------------------------------|----------------------------------|-----------------------------|---------------------|--------------------|
| Command (byte) | PP (page program) | 4PP (quad page program) | SE (sector erase) | BE 32K (block erase 32KB) | BE (block erase 64KB) | CE (chip erase) | RDSFDP (Read SFDP) |
| 1st byte | 02 (hex) | 38 (hex) | 20 (hex) | 52 (hex) | D8 (hex) | 60 or C7 (hex) | 5A (hex) |
| 2nd byte | ADD1 | ADD1 | ADD1 | ADD1 | ADD1 | | ADD1 |
| 3rd byte | ADD2 | ADD2 | ADD2 | ADD2 | ADD2 | | ADD2 |
| 4th byte | ADD3 | ADD3 | ADD3 | ADD3 | ADD3 | | ADD3 |
| 5th byte | | | | | | | Dummy |
| Action | to program the selected page | quad input to program the selected page | to erase the selected sector | to erase the selected 32KB block | to erase the selected block | to erase whole chip | Read SFDP mode |

Register/Setting Commands

| Command (byte) | WREN (write enable) | WRDI (write disable) | RDSR (read status register) | RDCR (read configuration register) | WRSR (write status register) | PGM/ERS Suspend (Suspends Program/Erase) |
|----------------|---------------------------------------|---|---|---|--|---|
| 1st byte | 06 (hex) | 04 (hex) | 05 (hex) | 15 (hex) | 01 (hex) | 75 or B0 (hex) |
| 2nd byte | | | | | Values | |
| 3rd byte | | | | | Values | |
| 4th byte | | | | | Values | |
| 5th byte | | | | | | |
| Action | sets the (WEL) write enable latch bit | resets the (WEL) write enable latch bit | to read out the values of the status register | to read out the values of the configuration register -1 & configuration register -2 | to write new values of the configuration/status register | program/erase operation is interrupted by suspend command |

| Command (byte) | PGM/ERS Resume (Resumes Program/Erase) | DP (Deep power down) | SBL (Set Burst Length) |
|----------------|---|-----------------------------|------------------------|
| 1st byte | 7A or 30 (hex) | B9 (hex) | C0 (hex) |
| 2nd byte | | | Value |
| 3rd byte | | | |
| 4th byte | | | |
| 5th byte | | | |
| Action | to continue performing the suspended program/erase sequence | enters deep power down mode | to set Burst length |

ID/Reset Commands

| Command (byte) | RDID (read identification) | RES (read electronic ID) | REMS (read electronic manufacturer & device ID) | ENSO (enter secured OTP) | EXSO (exit secured OTP) | RDSCUR (read security register) | WRSCUR (write security register) |
|----------------|---|------------------------------|---|--------------------------------------|-------------------------------------|------------------------------------|--|
| 1st byte | 9F (hex) | AB (hex) | 90 (hex) | B1 (hex) | C1 (hex) | 2B (hex) | 2F (hex) |
| 2nd byte | | x | x | | | | |
| 3rd byte | | x | x | | | | |
| 4th byte | | x | ADD <i>(Note 1)</i> | | | | |
| 5th byte | | | | | | | |
| Action | outputs JEDEC ID: 1-byte Manufacturer ID & 2-byte Device ID | to read out 1-byte Device ID | output the Manufacturer ID & Device ID | to enter the 8K-bit secured OTP mode | to exit the 8K-bit secured OTP mode | to read value of security register | to set the lock-down bit as "1" (once lock-down, cannot be update) |

| COMMAND (byte) | NOP (No Operation) | RSTEN (Reset Enable) | RST (Reset Memory) |
|----------------|--------------------|----------------------|--------------------|
| 1st byte | 00 (hex) | 66 (hex) | 99 (hex) |
| 2nd byte | | | |
| 3rd byte | | | |
| 4th byte | | | |
| 5th byte | | | |
| Action | | | <i>(Note 3)</i> |

Note 1: ADD=00H will output the manufacturer ID first and ADD=01H will output device ID first.

Note 2: It is not recommended to adopt any other code not in the command definition table, which will potentially enter the hidden mode.

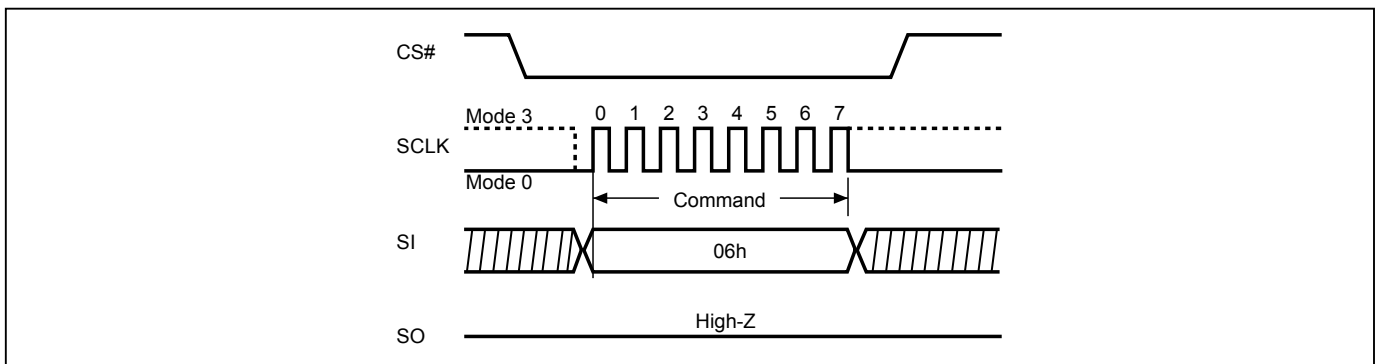
Note 3: The RSTEN command must be executed before executing the RST command. If any other command is issued in-between RSTEN and RST, the RST command will be ignored.

10-1. Write Enable (WREN)

The Write Enable (WREN) instruction is for setting Write Enable Latch (WEL) bit. For those instructions like PP, 4PP, SE, BE32K, BE, CE, and WRSR, which are intended to change the device content WEL bit should be set every time after the WREN instruction setting the WEL bit.

The sequence of issuing WREN instruction is: CS# goes low→sending WREN instruction code→ CS# goes high.

The SIO[3:1] are "don't care" .

Figure 5. Write Enable (WREN) Sequence

10-2. Write Disable (WRDI)

The Write Disable (WRDI) instruction is to reset Write Enable Latch (WEL) bit.

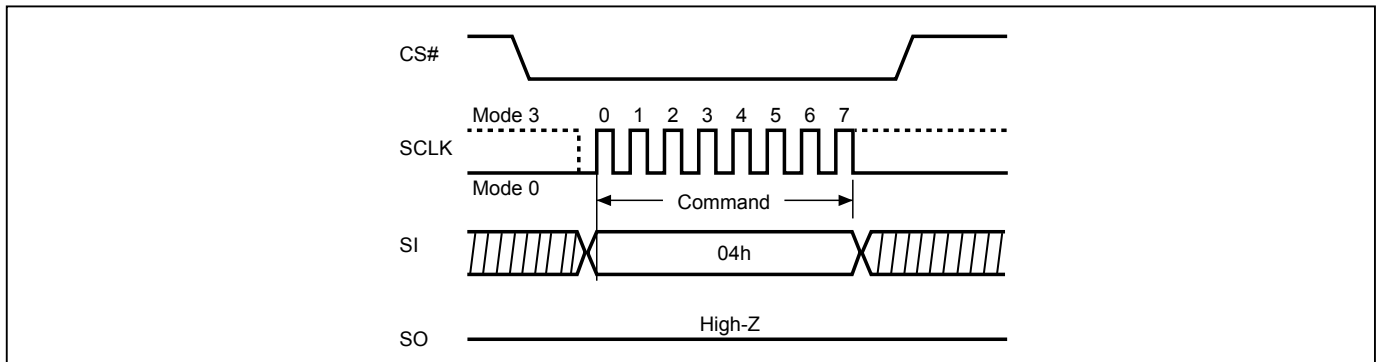
The sequence of issuing WRDI instruction is: CS# goes low→sending WRDI instruction code→CS# goes high.

The SIO[3:1] are "don't care".

The WEL bit is reset by following situations:

- Power-up
- Reset# pin driven low
- Completion of Write Disable (WRDI) instruction
- Completion of Write Status Register (WRSR) instruction
- Completion of Page Program (PP) instruction
- Completion of Quad Page Program (4PP) instruction
- Completion of Sector Erase (SE) instruction
- Completion of Block Erase 32KB (BE32K) instruction
- Completion of Block Erase (BE) instruction
- Completion of Chip Erase (CE) instruction
- Program/Erase Suspend
- Completion of Softreset command
- Completion of Write Security Register (WRSCUR) command

Figure 6. Write Disable (WRDI) Sequence



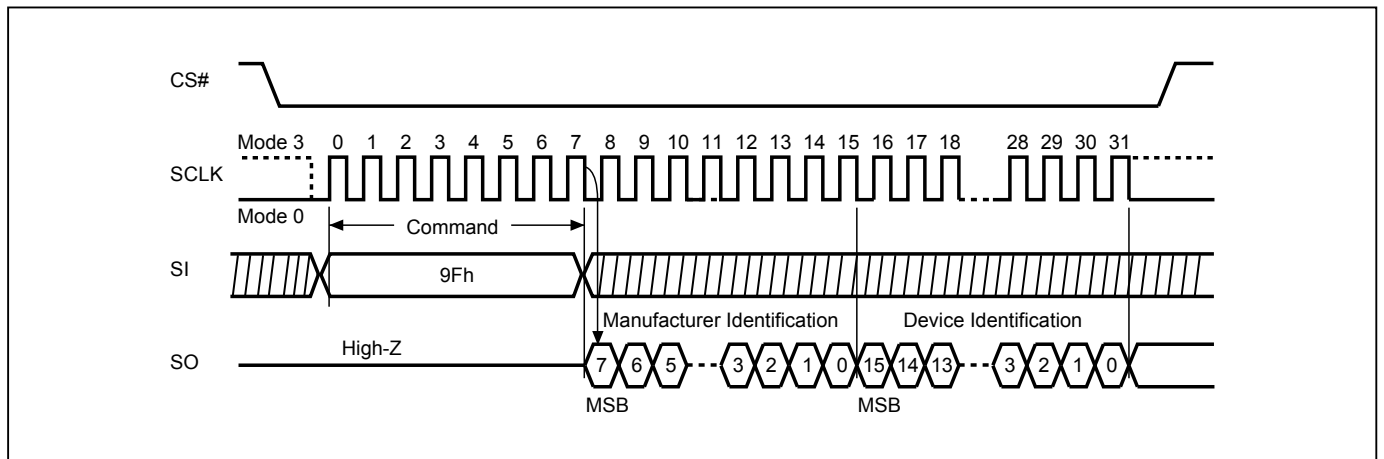
10-3. Read Identification (RDID)

The RDID instruction is for reading the manufacturer ID of 1-byte and followed by Device ID of 2-byte. The Macronix Manufacturer ID and Device ID are listed as "Table 6. ID Definitions".

The sequence of issuing RDID instruction is: CS# goes low→ sending RDID instruction code→24-bits ID data out on SO→ to end RDID operation can drive CS# to high at any time during data out.

While Program/Erase operation is in progress, it will not decode the RDID instruction, therefore there's no effect on the cycle of program/erase operation which is currently in progress. When CS# goes high, the device is at standby stage.

Figure 7. Read Identification (RDID) Sequence



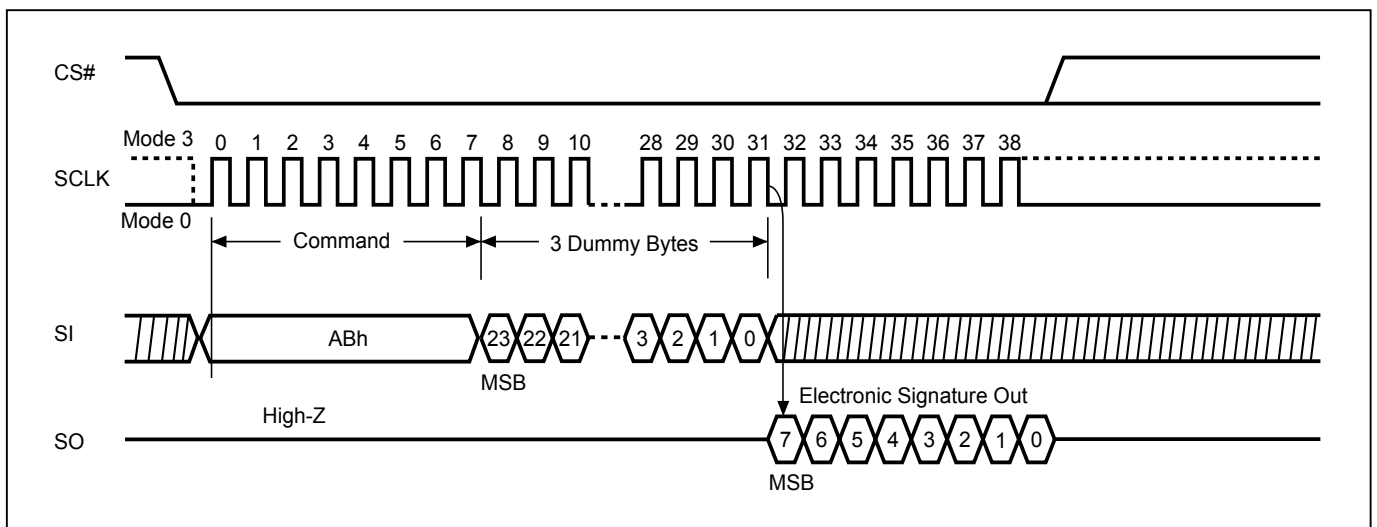
10-4. Read Electronic Signature (RES)

RES instruction is for reading out the old style of 8-bit Electronic Signature, whose values are shown as "Table 6. ID Definitions". This is not the same as RDID instruction. It is not recommended to use for new design. For new design, please use RDID instruction.

The SIO[3:1] are "don't care".

The RES instruction is ended by CS# goes high after the ID been read out at least once. The ID outputs repeatedly if continuously send the additional clock cycles on SCLK while CS# is at low.

Figure 8. Read Electronic Signature (RES) Sequence

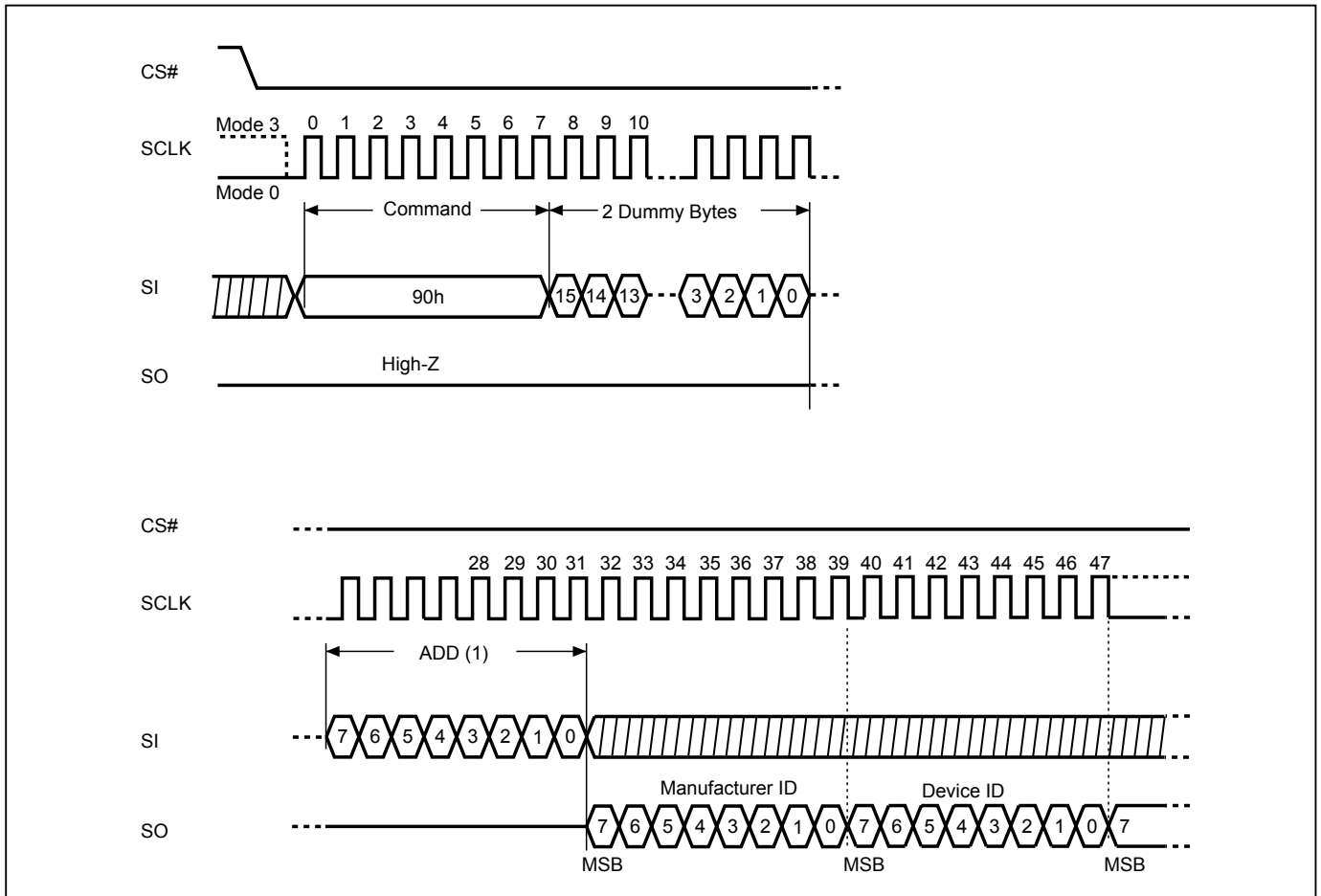


10-5. Read Electronic Manufacturer ID & Device ID (REMS)

The REMS instruction returns both the JEDEC assigned manufacturer ID and the device ID. The Device ID values are listed in "Table 6. ID Definitions".

The REMS instruction is initiated by driving the CS# pin low and sending the instruction code "90h" followed by two dummy bytes and one address byte (A7~A0). After which the manufacturer ID for Macronix (C2h) and the device ID are shifted out on the falling edge of SCLK with the most significant bit (MSB) first. If the address byte is 00h, the manufacturer ID will be output first, followed by the device ID. If the address byte is 01h, then the device ID will be output first, followed by the manufacturer ID. While CS# is low, the manufacturer and device IDs can be read continuously, alternating from one to the other. The instruction is completed by driving CS# high.

Figure 9. Read Electronic Manufacturer & Device ID (REMS) Sequence



Notes:

(1) ADD=00H will output the manufacturer's ID first and ADD=01H will output device ID first.

10-6. ID Read

User can execute this ID Read instruction to identify the Device ID and Manufacturer ID. The sequence of issuing RDID instruction is: CS# goes low→ sending RDID instruction code→24-bits ID data out on SO→ to end RDID operation can drive CS# to high at any time during data out.

After the command cycle, the device will immediately output data on the falling edge of SCLK. The manufacturer ID, memory type, and device ID data byte will be output continuously, until the CS# goes high.

While Program/Erase operation is in progress, it will not decode the RDID instruction, therefore there's no effect on the cycle of program/erase operation which is currently in progress. When CS# goes high, the device is at standby stage.

Table 6. ID Definitions

| Command Type | Command | MX25R3235F | | |
|--------------|---------|-----------------|-------------|----------------|
| RDID | 9Fh | Manufacturer ID | Memory type | Memory density |
| | | C2 | 28 | 16 |
| RES | ABh | Electronic ID | | |
| | | 16 | | |
| REMS | 90h | Manufacturer ID | Device ID | |
| | | C2 | 16 | |