1.8V 256M-BIT SERIAL FLASH MEMORY WITH DUAL/QUAD SPI & RPMC

Publication Release Date: September 07, 2018

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com
微信扫码咨询客服

Table of Contents

1. GENERAL DESCRIPTIONS 5
2. FEATURES 5
3. PACKAGE TYPES AND PIN CONFIGURATIONS 6
   - 3.1 Pad Configuration 6x5-mm/ 8x6-mm 6
   - 3.2 Pad Description WSON 8x6-mm 6
   - 3.3 Pin Configuration SOIC 300-mil 7
   - 3.4 Pin Description SOIC 300-mil 7
4. PIN DESCRIPTIONS 8
   - 4.1 Chip Select (/CS) 8
   - 4.2 Serial Data Input, Output and IOs (DI, DO and IO0, IO1, IO2, IO3) 8
   - 4.3 Serial Clock (CLK) 8
   - 4.4 Reset (/RESET) 8
5. BLOCK DIAGRAM 9
6. FUNCTIONAL DESCRIPTIONS 10
   - 6.1 SPI Operations 10
     - 6.1.1 Standard SPI Instructions 10
     - 6.1.2 Dual SPI Instructions 10
     - 6.1.3 Quad SPI Instructions 11
     - 6.1.4 3-Byte / 4-Byte Address Modes 11
     - 6.1.5 Software Reset 11
   - 6.2 RPMC OPERATIONS 12
     - 6.2.1 RPMC Initialization 12
     - 6.2.2 RPMC Operation Flow 13
     - 6.2.3 Operations Allowed / Disallowed During RPMC Operation 14
     - 6.2.4 RPMC Status Register Definition 15
   - 6.3 Write Protection 16
7. STATUS AND CONFIGURATION REGISTERS 17
   - 7.1 Status Registers 17
     - 7.1.1 Erase/Write In Progress (BUSY) – *Status Only* 17
     - 7.1.2 Write Enable Latch (WEL) – *Status Only* 17
     - 7.1.3 Block Protect Bits (BP3, BP2, BP1, BP0) – *Volatile/Non-Volatile Writable* 18
     - 7.1.4 Top/Bottom Block Protect (TB) – *Volatile/Non-Volatile Writable* 18
     - 7.1.5 Complement Protect (CMP) – *Volatile/Non-Volatile Writable* 18
     - 7.1.1 Status Register Protect (SRP, SRL) – *Volatile/Non-Volatile Writable* 19
     - 7.1.2 Erase/Program Suspend Status (SUS) – *Status Only* 20
     - 7.1.3 Security Register Lock Bits (LB3, LB2, LB1) – *Volatile/Non-Volatile OTP Writable* 20
     - 7.1.4 Quad Enable (QE) – *Volatile/Non-Volatile Writable* 20

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

7.1.5 Current Address Mode (ADS) – *Status Only* 21
7.1.6 Power-Up Address Mode (ADP) – *Non-Volatile Writable* 21
7.1.7 Write Protect Selection (WPS) – *Volatile/Non-Volatile Writable* 21
7.1.8 Output Driver Strength (DRV1, DRV0) – *Volatile/Non-Volatile Writable* 22
7.1.9 Reserved Bits – *Non Functional* 22
7.1.10 W25R256JW Status Register Memory Protection (WPS = 0, CMP = 0) 23
7.1.11 W25R256JW Status Register Memory Protection (WPS = 0, CMP = 1) 24
7.1.12 W25R256JW Individual Block Memory Protection (WPS=1) 25
7.2 Extended Address Register – *Volatile Writable Only* 26
8. INSTRUCTIONS 27
8.1 Device ID and Instruction Set Tables 27
8.1.1 Manufacturer and Device Identification 27
8.1.2 Instruction Set Table 1 (Standard/Dual/Quad SPI, 3-Byte & 4-Byte Address Mode)(1) 28
8.1.3 Instruction Set Table 2 (Standard/Dual/Quad SPI Instructions, 3-Byte Address Mode)(1) 29
8.1.4 Instruction Set Table 3 (Standard/Dual/Quad SPI Instructions, 4-Byte Address Mode)(1) 30
Notes: 31
8.1.5 Instruction Set Table 2-1 (RPMC Input Instruction, OP1)(1) 32
8.1.6 Instruction Set Table 2-2 (RPMC Output Instruction, OP2)(1) 32
8.2 Instruction Descriptions 33
8.2.1 Write Enable (06h) 33
8.2.2 Write Enable for Volatile Status Register (50h) 33
8.2.3 Write Disable (04h) 34
8.2.4 Read Status Register-1 (05h), Status Register-2 (35h) & Status Register-3 (15h) 34
8.2.5 Write Status Register-1 (01h), Status Register-2 (31h) & Status Register-3 (11h) 35
8.2.6 Read Extended Address Register (C8h) 37
8.2.7 Write Extended Address Register (C5h) 38
8.2.8 Enter 4-Byte Address Mode (B7h) 39
8.2.9 Exit 4-Byte Address Mode (E9h) 39
8.2.10 Read Data (03h) 40
8.2.11 Read Data with 4-Byte Address (13h) 41
8.2.12 Fast Read (0Bh) 42
8.2.13 Fast Read with 4-Byte Address (0Ch) 43
8.2.14 Fast Read Dual Output (3Bh) 44
8.2.15 Fast Read Dual Output with 4-Byte Address (3Ch) 45
8.2.16 Fast Read Quad Output (6Bh) 46
8.2.17 Fast Read Quad Output with 4-Byte Address (6Ch) 47
8.2.18 Fast Read Dual I/O (BBh) 48
8.2.19 Fast Read Dual I/O with 4-Byte Address (BCh) 49
8.2.20 Fast Read Quad I/O (EBh) 50
8.2.21 Fast Read Quad I/O with 4-Byte Address (ECh) 51
8.2.22 Page Program (02h) 52
8.2.23 Quad Input Page Program (32h) 53

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.24 Sector Erase (20h) 54
8.2.25 32KB Block Erase (52h) 55
8.2.26 64KB Block Erase (D8h) 56
8.2.27 Chip Erase (C7h / 60h) 57
8.2.28 Erase / Program Suspend (75h) 58
8.2.29 Erase / Program Resume (7Ah) 59
8.2.30 Power-down (B9h) 60
8.2.31 Release Power-down / Device ID (ABh) 61
8.2.32 Read Manufacturer / Device ID (90h) 62
8.2.33 Read Manufacturer / Device ID Dual I/O (92h) 63
8.2.34 Read Manufacturer / Device ID Quad I/O (94h) 64
8.2.35 Read Unique ID Number (4Bh) 65
8.2.36 Read JEDEC ID (9Fh) 66
8.2.37 Read SFDP Register (5Ah) 67
8.2.38 Erase Security Registers (44h) 68
8.2.39 Program Security Registers (42h) 69
8.2.40 Read Security Registers (48h) 70
8.2.41 Individual Block/Sector Lock (36h) 71
8.2.42 Individual Block/Sector Unlock (39h) 72
8.2.43 Read Block/Sector Lock (3Dh) 73
8.2.44 Global Block/Sector Lock (7Eh) 73
8.2.45 Global Block/Sector Unlock (98h) 74
8.2.46 Enable Reset (66h) and Reset Device (99h) 75
8.2.47 Write Root Key Register (9Bh + 00h) 76
8.2.48 Update HMAC Key (9Bh + 01h) 77
8.2.49 Increment Monotonic counters (9Bh + 02h) 78
8.2.50 Request Monotonic counters (9Bh + 03h) 79
8.2.51 Reserved RPMCCommands (9Bh + 04h~FFh) 79
8.2.52 Read RPMCStatus / Data (96h) 80
9. ELECTRICAL CHARACTERISTICS 81
9.1 Absolute Maximum Ratings (1)(2) 81
9.2 Operating Ranges 81
9.3 Power-up Timing and Write Inhibit Threshold(1) 82
9.4 DC Electrical Characteristics 83
9.5 AC Measurement Conditions(1) 84
9.6 AC Electrical Characteristics(4) 85
9.7 Serial Output Timing 87
9.8 Serial Input Timing 87
10. PACKAGE SPECIFICATIONS 88
10.1 8-Pad WSON 6x5-mm (Package Code P) 88
10.2 8-Pad WSON 8x6-mm (Package Code E) 89

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

10.3 16-Pin SOIC 300-mil (Package Code F) 90
11. ORDERING INFORMATION 91
11.1 Valid Part Numbers and Top Side Marking 92
12. REVISION B1ISTORY 93

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

1. GENERAL DESCRIPTIONS

The W25R256JW (256M-bit) Serial Flash memory provides a storage solution for systems with limited space, pins and power. The W25R series offers flexibility and performance well beyond ordinary Serial Flash devices. They are ideal for code shadowing to RAM, executing code directly from Dual/Quad SPI (XIP) and storing voice, text and data. The device operates on a single 1.7V to 1.95V power supply with current consumption as low as 1µA for power-down. All devices are offered in space-saving packages.

The W25R256JW support the standard Serial Peripheral Interface (SPI), Dual/Quad I/O SPI: Serial Clock, Chip Select, Serial Data I/O0 (DI), I/O1 (DO), I/O2, and I/O3. SPI clock frequencies of up to 104MHz are supported allowing equivalent clock rates of 208MHz (104Hz x 2) for Dual I/O and 416MHz (104MHz x 4) for Quad I/O when using the Fast Read Dual/Quad I/O instructions. These transfer rates can outperform standard Asynchronous 8 and 16-bit Parallel Flash memories.

The device supports JEDEC standard manufacturer and device ID and SFDP Register, a 64-bit Unique Serial Number and three 256-bytes Security Registers.

The W25R series is also equipped with an enhanced authentication security feature by Replay Protection Monotonic Counter (RPMC). It provides a high level secured communication between the flash device and the controller to reduce the system vulnerabilities to hardware attacks.

2. FEATURES

- **New Family of SpiFlash Memories**
  - W25R256JW: 256M-bit / 32M-byte
  - Standard SPI: CLK, /CS, DI, DO
  - Dual SPI: CLK, /CS, IO_0, IO_1
  - Quad SPI: CLK, /CS, IO_0, IO_1, IO_2, IO_3
  - 3 or 4-Byte Addressing Mode
  - Software Reset
- **Highest Performance Serial Flash**
  - 104MHz Standard/Dual/Quad SPI clocks
  - 208/416MHz equivalent Dual/Quad SPI
  - 50MB/S continuous data transfer rate
  - More than 100,000 erase/program cycles
  - More than 20-year data retention
- **Low Power, Wide Temperature Range**
  - Single 1.7 to 1.95V supply
  - 4mA active current, <1µA Power-down (typ.)
  - -40°C to +85°C operating range
- **Flexible Architecture with 4KB sectors**
  - Uniform Sector/Block Erase (4K/32K/64K-Byte)
  - Program 1 to 256 byte per programmable page
  - Erase/Program Suspend & Resume
- **Advanced Security Features**
  - Power Supply Lock-Down and OTP protection
  - Top/Bottom, Complement array protection
  - Individual Block/Sector array protection
  - 64-Bit Unique ID for each device
  - Discoverable Parameters (SFDP) Register
  - 3X256-Bytes Security Registers with OTP locks
  - Replay Protection Monotonic Counter (RPMC)
  - Volatile & Non-volatile Status Register Bits
- **Space Efficient Packaging**
  - 8-pad WSON 6x5-mm / 8x6-mm
  - 16-pin SOIC 300-mil(additional /RESET pin)(1)
  - Contact Winbond for other options

Note:

Hardware /RESET pin is available on Serial Flash memory SOIC-16 or TFBGA; RPMC counter will not be reset once the /RESET pin is pull low.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

3. PACKAGE TYPES AND PIN CONFIGURATIONS

3.1 Pad Configuration 6x5-mm/ 8x6-mm

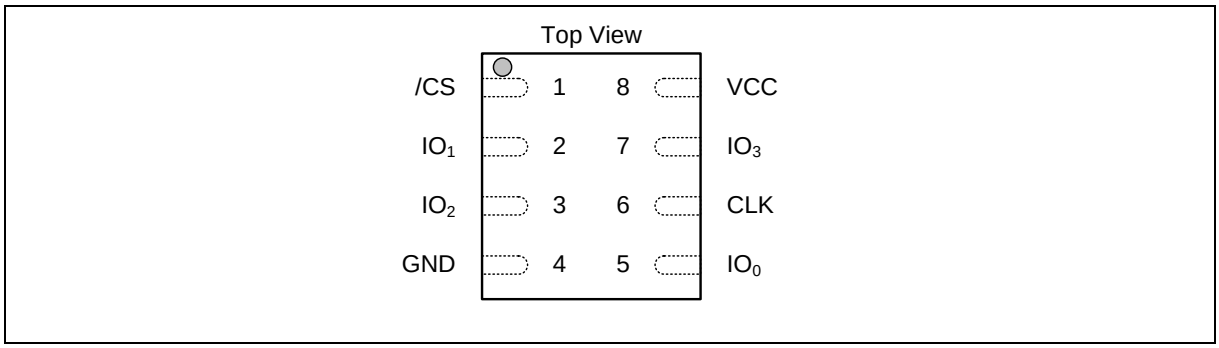


Figure 1a. W25R256JW Pad Assignments, 6X5 & 8x6-mm (Package Code P & E)

3.2 Pad Description WSON 8x6-mm

PIN NO.	PIN NAME	I/O	FUNCTION
1	/CS	I	Chip Select Input
2	IO1	I/O	Data Input Output 1(1)
3	IO2	I/O	Data Input Output 2(2)
4	GND		Ground
5	IO0	I/O	Data Input Output 0(1)
6	CLK	I	Serial Clock Input
7	IO3	I/O	Data Input Output 3(2)
8	VCC		Power Supply

Notes:

1. IO0 and IO1 are used for Standard and Dual SPI instructions
2. IO0 – IO3 are used for Quad SPI instructions.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

3.3 Pin Configuration SOIC 300-mil

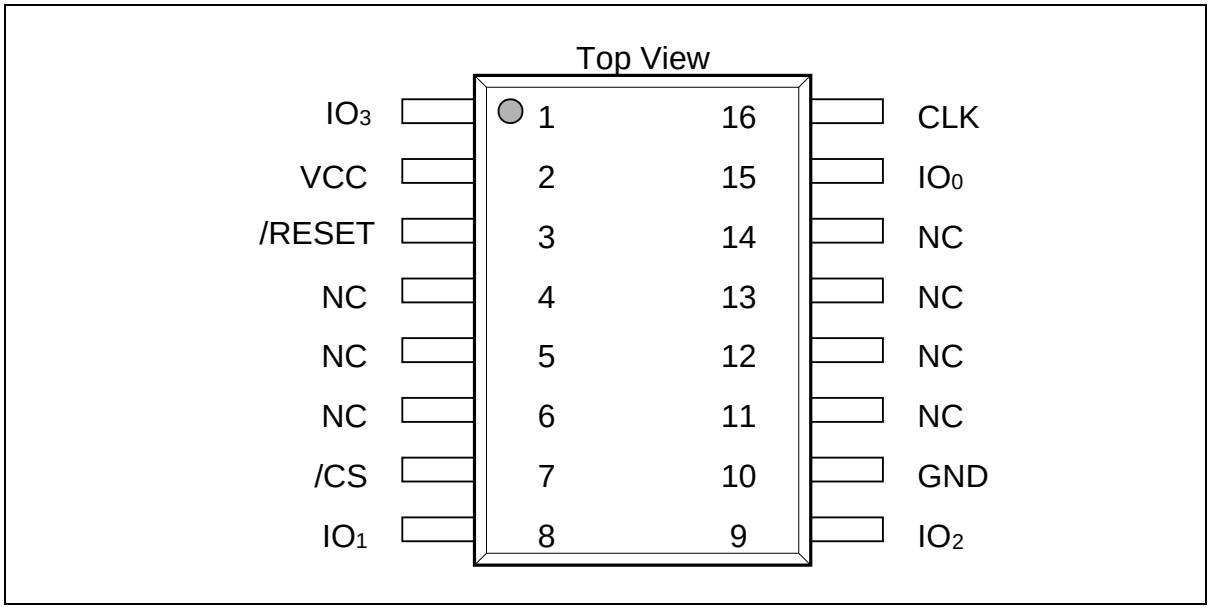


Figure 1d. W25R256JW Pin Assignments, 16-pin SOIC 300-mil (Package Code F)

3.4 Pin Description SOIC 300-mil

PIN NO.	PIN NAME	I/O	FUNCTION
1	IO3	I/O	Data Input Output 3
2	VCC		Power Supply
3	/RESET	I	Reset Input(3)
4	N/C		No Connect
5	N/C		No Connect
6	N/C		No Connect
7	/CS	I	Chip Select Input
8	IO1	I/O	Data Input Output 1
9	IO2	I/O	Data Input Output 2
10	GND		Ground
11	N/C		No Connect
12	N/C		No Connect
13	N/C		No Connect
14	N/C		No Connect
15	IO0	I/O	Data Input Output 0
16	CLK	I	Serial Clock Input

*1 IO0 and IO1 are used for Standard and Dual SPI instructions
*2 IO0 – IO3 are used for Quad SPI instructions
*3 Hardware /RESET pin is available on Serial Flash memory, and the /RESET pin is a dedicated hardware reset pin regardless of device settings or operation states. If the hardware reset function is not used, this pin can be left floating or connected to VCC in the system.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

4. PIN DESCRIPTIONS

4.1 Chip Select (/CS)

The SPI Chip Select (/CS) pin enables and disables device operation. When /CS is high the device is deselected and the Serial Data Output (DO, or IO0, IO1, IO2, IO3) pins are at high impedance. When deselected, the devices power consumption will be at standby levels unless an internal erase, program or write status register cycle is in progress. When /CS is brought low the device will be selected, power consumption will increase to active levels and instructions can be written to and data read from the device. After power-up, /CS must transition from high to low before a new instruction will be accepted. The /CS input must track the VCC supply level at power-up (see “Write Protection” and Figure 58). If needed a pull-up resister on the /CS pin can be used to accomplish this.

4.2 Serial Data Input, Output and IOs (DI, DO and IO0, IO1, IO2, IO3)

The W25R256JW supports standard SPI, Dual SPI, Quad SPI operation. Standard SPI instructions use the unidirectional DI (input) pin to serially write instructions, addresses or data to the device on the rising edge of the Serial Clock (CLK) input pin. Standard SPI also uses the unidirectional DO (output) to read data or status from the device on the falling edge of CLK.

Dual/Quad SPI instructions use the bidirectional IO pins to serially write instructions, addresses or data to the device on the rising edge of CLK and read data or status from the device on the falling edge of CLK

4.3 Serial Clock (CLK)

The SPI Serial Clock Input (CLK) pin provides the timing for serial input and output operations. ("See SPI Operations")

4.4 Reset (/RESET)

A dedicated hardware /RESET pin is available on SOIC-16 and TFBGA packages. When it’s driven low for a minimum period of ~1µS, this device will terminate any external or internal operations and return to its power-on state.

Note: Hardware /RESET pin is available on Serial Flash memory SOIC16. RPMC counter will not be reset once the /RESET pin is pull low.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

5. BLOCK DIAGRAM

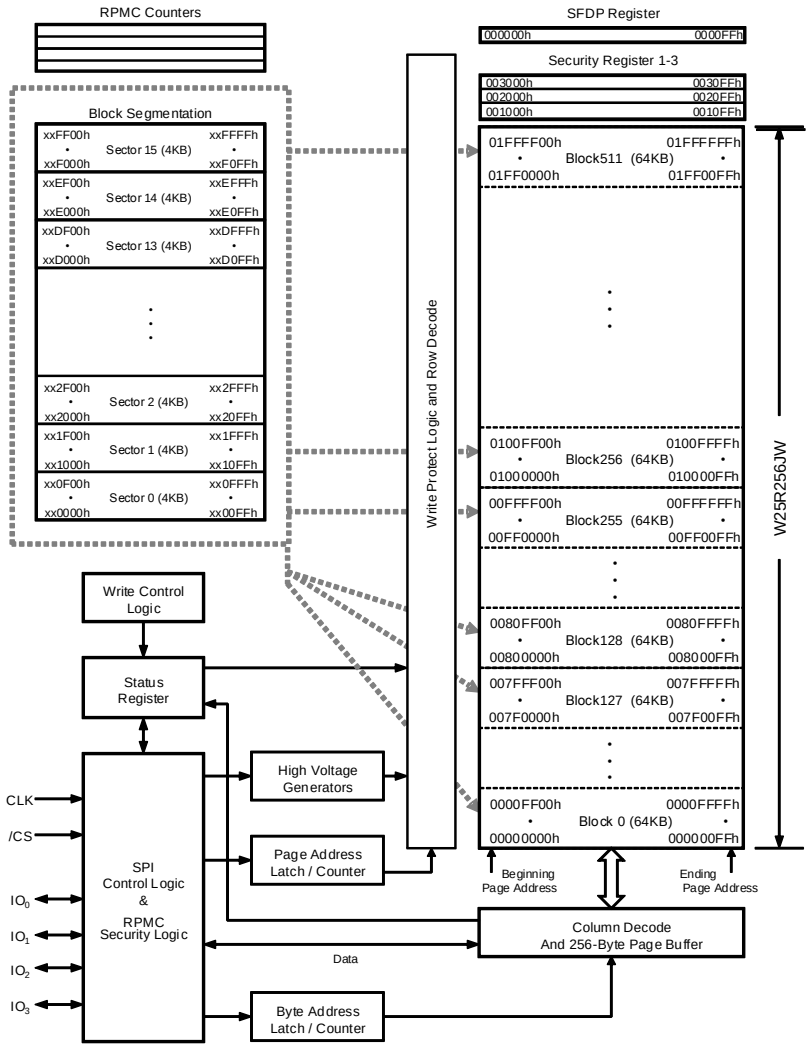


Figure 2. W25R256JW Serial Flash Memory Block Diagram

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

6. FUNCTIONAL DESCRIPTIONS

6.1 SPI Operations

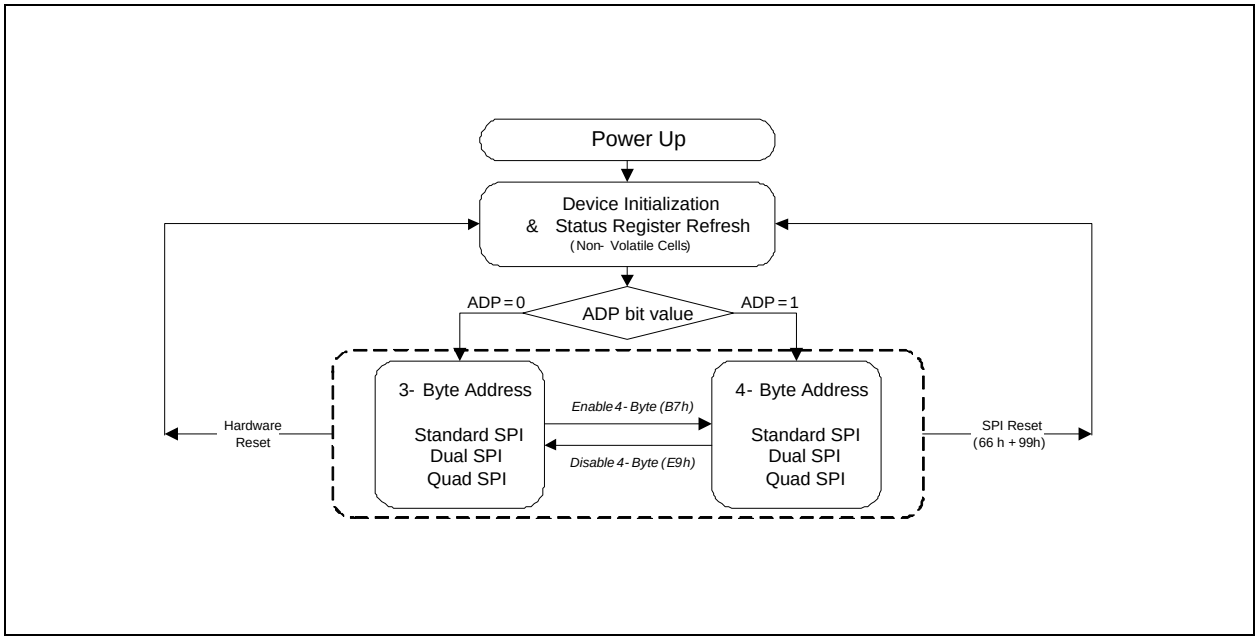


Figure 3. W25R256JW Serial Flash Memory Operation Diagram

6.1.1 Standard SPI Instructions

The W25R256JW is accessed through an SPI compatible bus consisting of four signals: Serial Clock (CLK), Chip Select (/CS), Serial Data Input (DI) and Serial Data Output (DO). Standard SPI instructions use the DI input pin to serially write instructions, addresses or data to the device on the rising edge of CLK. The DO output pin is used to read data or status from the device on the falling edge of CLK.

SPI bus operation Mode 0 (0,0) and 3 (1,1) are supported. The primary difference between Mode 0 and Mode 3 concerns the normal state of the CLK signal when the SPI bus master is in standby and data is not being transferred to the Serial Flash. For Mode 0, the CLK signal is normally low on the falling and rising edges of /CS. For Mode 3, the CLK signal is normally high on the falling and rising edges of /CS.

6.1.2 Dual SPI Instructions

The W25R256JW supports Dual SPI operation when using instructions such as “Fast Read Dual Output (3Bh)” and “Fast Read Dual I/O (BBh)”. These instructions allow data to be transferred to or from the device at two to three times the rate of ordinary Serial Flash devices. The Dual SPI Read instructions are ideal for quickly downloading code to RAM upon power-up (code-shadowing) or for executing non-speed-critical code directly from the SPI bus (XIP). When using Dual SPI instructions, the DI and DO pins become bidirectional I/O pins: IO0 and IO1.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

6.1.3 Quad SPI Instructions

The W25R256JW can be reset to the initial power-on state by a software Reset sequence. This sequence must include two consecutive commands: Enable Reset (66h) & Reset (99h). If the command sequence is successfully accepted, the device will take approximately 30uS (t_{RST}) to reset. No command will be accepted during the reset period.

6.1.4 3-Byte / 4-Byte Address Modes

The W25R256JW provides two Address Modes that can be used to specify any byte of data in the memory array. The 3-Byte Address Mode is backward compatible to older generations of serial flash memory that only support up to 128M-bit data. To address the 256M-bit or more data in 3-Byte Address Mode, Extended Address Register must be used in addition to the 3-Byte addresses.

4-Byte Address Mode is designed to support Serial Flash Memory devices from 256M-bit to 32G-bit. The extended Address Register is not necessary when the 4-Byte Address Mode is enabled.

Upon power up, the W25R256JW can operate in either 3-Byte Address Mode or 4-Byte Address Mode, depending on the Non-Volatile Status Register Bit ADP (S17) setting. If ADP=0, the device will operate in 3-Byte Address Mode; if ADP=1, the device will operate in 4-Byte Address Mode. The factory default value for ADP is 0.

To switch between the 3-Byte or 4-Byte Address Modes, “Enter 4-Byte Mode (B7h)” or “Exit 4-Byte Mode (E9h)” instructions must be used. The current address mode is indicated by the Status Register Bit ADS (S16).

6.1.5 Software Reset

The W25R256JW can be reset to the initial power-on state by a software Reset sequence. This sequence must include two consecutive instructions: Enable Reset (66h) & Reset (99h). If the instruction sequence is successfully accepted, the device will take approximately 30µS (t_{RST}) to reset. No instruction will be accepted during the reset period.).

For the SOIC-16 and TFBGA package, W25R256JW provides a dedicated /RESET pin. Drive the /RESET pin low for a minimum period of ~1us (tRESET*) will reset the device to its initial power-on state.

Hardware /RESET pin has the highest priority among all the input signals. Drive /RESET low for a minimum period of ~1us (tRESET*) will interrupt any on-going external/internal operations, regardless the status of other SPI signals (/CS, CLK, IOs).

Note:

1. While a faster /RESET pulse (as short as a few hundred nanoseconds) will often reset the device, a 1us minimum pulse is recommended to ensure reliable operation.

2. There is an internal pull-up resistor for the dedicated /RESET pin on the SOIC-16 & TFBGA package. If the reset function is not used, this pin can be left floating in the system

3. Hardware /RESET pin is available on Serial Flash memory SOIC16. RPMC counter will not be reset once the /RESET pin is pull low.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

6.2 RPMC OPERATIONS

To prevent hardware vulnerability attack, RPMC provides a building block towards providing Confidentiality and Integrity of read/write flash memory data. The W25R256JW is equipped with four 32-bit Monotonic counters and can be addressed individually by the 8-bit Counter_Address. These Monotonic counters are used by the SPI flash controllers to ensure the physical authenticity of the attached flash devices.

RPMC operation is based on the HMAC-SHA-256 cryptographic algorithm. HMAC-SHA-256 is a type of keyed hash algorithm that is constructed from the SHA-256 hash function and used as a Hash-based Message Authentication Code (HMAC). The HMAC process mixes a secret key with the message data, hashes the result with the hash function, mixes that hash value with the secret key again, and then applies the hash function a second time. The output hash is 256 bits in length.

An HMAC can be used to determine whether a message sent over an insecure channel has been tampered with, provided that the sender and receiver share a secret key. The sender computes the hash value for the original data and sends both the original data and hash value as a single message. The receiver recalculates the hash value on the received message and checks that the computed HMAC matches the transmitted HMAC.

Any change to the data or the hash value results in a mismatch, because knowledge of the secret key is required to change the message and reproduce the correct hash value. Therefore, if the original and computed hash values match, the message is authenticated.

6.2.1 RPMC Initialization

RPMC operation is initialized in an OEM manufacturing environment by issuing the “Write Root Key Register” command. When this command is successfully received and executed, a 256-bit Root Key will be written into the flash device permanently, and the corresponding Monotonic counters will also be initialized to 0. After the initialization procedure, the Root Key value can no longer be altered or accessed externally through the SPI interface. The initialized Monotonic counters is ready to accept the authenticated RPMC commands.

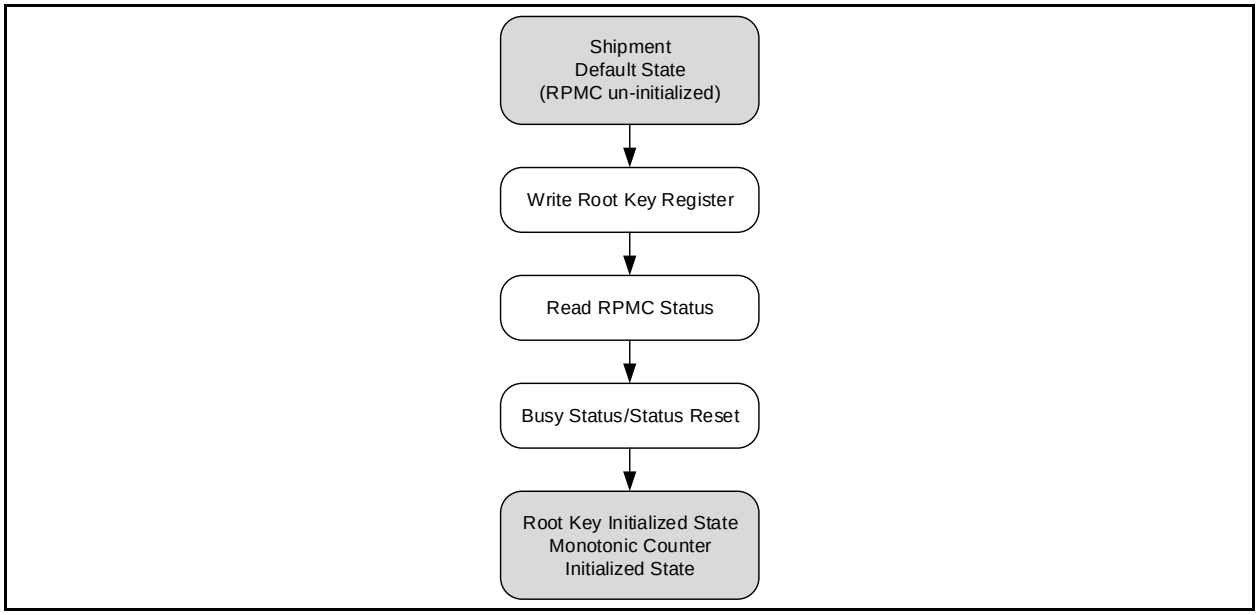


Figure 3a. W25R256JW RPMC Initialization Flow Diagram

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

6.2.2 RPMC Operation Flow

Once the root key and the Monotonic counters have been initialized, every time after the device is powered on, prior to any RPMC operations, the external SPI flash controller must update the HMAC Key register in the W25R256JW.

After initializing the HMAC key register, there are two different RPMC operations can be performed. “Increment Monotonic counters” is used to increase the Monotonic counters value by 1. “Request Monotonic counters” is used to read out the existing Monotonic counters data.

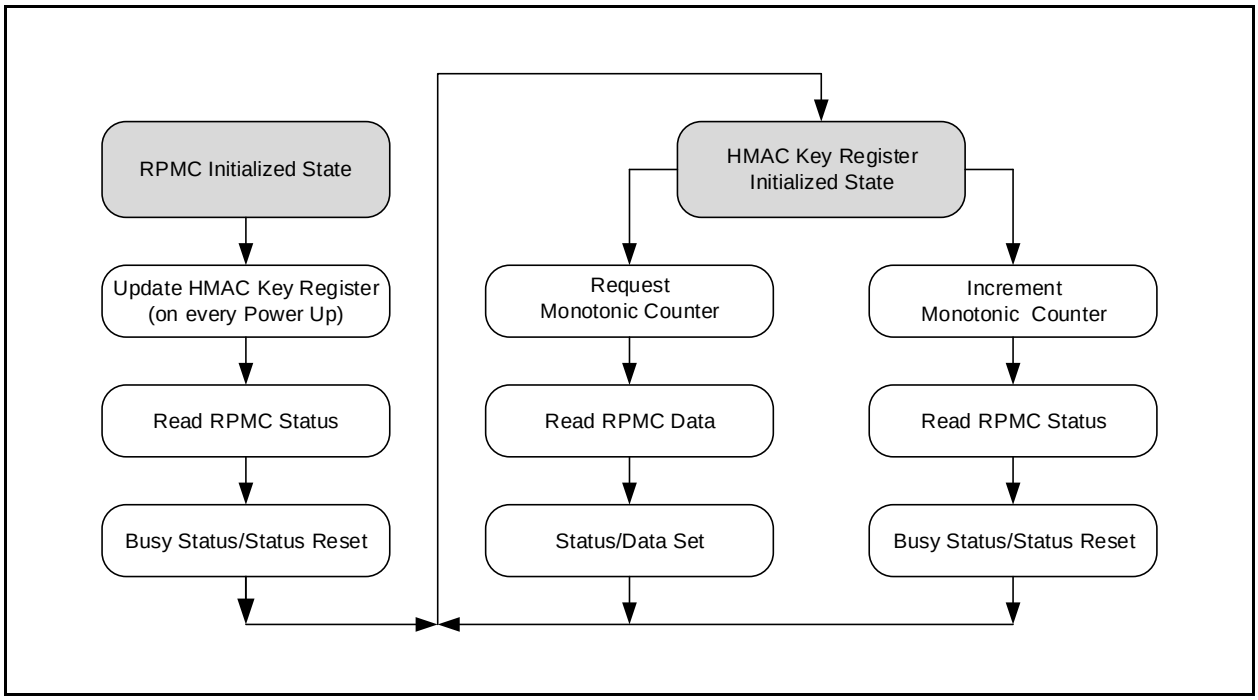


Figure 3b. W25R256JW RPMC Operation Flow Diagram

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

6.2.3 Operations Allowed / Disallowed During RPMC Operation

The RPMC operation is independent to the other SPI flash operations. The RPMC input command OP1 (9Bh) will initial internal operations after the authenticated command is accepted by the device. During the internal operation period, the BUSY bit in the RPMC Status Register (bit 0) will be set to 1. The RPMC internal operation cannot be suspended and can only be interrupted by the Device Reset command (99h). While the RPMC internal operation is going on, other SPI flash commands can be issued and executed. Please refer to the table below for details.

Operations	Device Behavior
Suspend/Resume	Only main flash memory Program/Erase operations can be suspended and resumed later. RPMC operations cannot be suspended.
Read/Program/Erase main memory array	All memory Read/Program/Erase commands are accepted while a RPMC operation is on-going.
Read/Write SPI flash Status Registers	The SPI flash Status Register-1&2 can be read out or written to during any internal RPMC operations.
RPMC OP1 command	The RPMC input command OP1 will be ignored while a RPMC operation is on-going. This command can be accepted and executed while a main memory Program/Erase operation is on-going.
Read RPMC Status/Data OP2 command	The RPMC Status Register can be read out while a RPMC operation is on-going and this is the way to check if the RPMC operation has finished or not. If the BUSY bit of RPMC Status Register is set as 1, the RPMC data output following the Status Register is not reliable. During the SPI flash internal Program/Erase operations, this command can still be used to check the RPMC status or read out RPMC data.
Device Reset	The software reset sequence can be issued any time during SPI flash or RPMC internal operations. All volatile settings will be reset and data corruption may happen if there's an on-going Program/Erase operation.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

6.2.4 RPMC Status Register Definition

During the RPMC operations, an 8-bit Status Register is used to indicate various states of the command execution and device status. A “Read RPMC Status” command can be issued during any RPMC operation to check the Status Register.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Successful Completion	Not Defined	Fatal Error (Pgm/Erase Fail or no valid counter found)	Counter_AddressMismatch	HMAC Key Reg Uninitialized	Signature Mismatch or Counter Address out of range or Write_Mode out of range	Root Keys Overwrite or Root Keys length mismatch or TruncatedSig Mismatch	BUSY

RPMC Status Register[7:0]	Applicable CmdType(s)	Description
00000000	--	Power On State (Read RPMC Status is issued directly after power-up).
10000000	00, 01, 02, 03	This status must be set on successful completion (no errors) of OP1 command (9Bh).
0xxxxxx1	00, 01, 02, 03, 04-FF	This bit must be set to 1, when device is busy executing OP1 command (9Bh). It is reset to 0 when the command execution is done.
0xxxxx1x	00, 01	This bit is set only when the correct payload size is received. For CmdType = 00, this bit must be set on Root Key Register Overwrite or Counter Address out of range or Truncated Signature mis-match error. For CmdType = 01, this bit is set when the corresponding Monotonic counters is uninitialized.
0xxxx1xx	00, 01, 02, 03	This bit must be set on Signature Mismatch, Counter Address out of range when correct payload size is received; or CmdType is out of range; or incorrect payload size is received.
0xxx1xxx	02, 03	This bit must be set on HMAC Key Register (or Monotonic counters) uninitialized on previous OP1 command when correct payload size is received.
0xx1xxxx	02	This bit must be set on Counter_AddressMismatch on previous increment when correct payload size is received.
0x1xxxxx	--	Fatal Error, e.g. program fail, no valid counter found after initialization.
Current value	--	Status register will naturally not be updated until first 8 bits of OP1 (9Bh) is received. However it is expected that the correct error type is reflected for any OP1 operation that exceeds a minimum of 16 clocks with active chip-select.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

6.3 Write Protection

Applications that use non-volatile memory must take into consideration the possibility of noise and other adverse system conditions that may compromise data integrity. To address this concern, the W25R256JW provides several means to protect the data from inadvertent writes.

- Device resets when VCC is below threshold
- Time delay write disable after Power-up
- Write enable/disable instructions and automatic write disable after erase or program
- Software write protection using Status Registers
- Additional Individual Block/Sector Locks for array protection
- Write Protection using Power-down instruction
- Lock Down write protection for Status Register until the next power-up
- One Time Program (OTP) write protection for array and Security Registers using Status Register*

  * Note: This feature is available upon special order. Please contact Winbond for details.

Upon power-up or at power-down, the W25R256JW will maintain a reset condition while VCC is below the threshold value of V_{WI}, (See Power-up Timing and Voltage Levels and Figure 43). While reset, all operations are disabled and no instructions are recognized. During power-up and after the VCC voltage exceeds V_{WI}, all program and erase related instructions are further disabled for a time delay of t_{PUW}. This includes the Write Enable, Page Program, Sector Erase, Block Erase, Chip Erase and the Write Status Register instructions. Note that the chip select pin (/CS) must track the VCC supply level at power-up until the VCC-min level and t_{VSL} time delay is reached.

After power-up the device is automatically placed in a write-disabled state with the Status Register Write Enable Latch (WEL) set to a 0. A Write Enable instruction must be issued before a Page Program, Sector Erase, Block Erase, Chip Erase or Write Status Register instruction will be accepted. After completing a program, erase or write instruction the Write Enable Latch (WEL) is automatically cleared to a write-disabled state of 0.

Software controlled write protection is facilitated using the Write Status Register instruction and setting the Status Register Protect (SRP0, SRP1) and Block Protect (CMP, TB, BP[3:0]) bits. These settings allow a portion or the entire memory array to be configured as read only. Used in conjunction with the Write Protect (/WP) pin, changes to the Status Register can be enabled or disabled under hardware control. See Status Register section for further information. Additionally, the Power-down instruction offers an extra level of write protection as all instructions are ignored except for the Release Power-down instruction.

The W25R256JW also provides another Write Protect method using the Individual Block Locks. Each 64KB block (except the top and bottom blocks, total of 510 blocks) and each 4KB sector within the top/bottom blocks (total of 32 sectors) are equipped with an Individual Block Lock bit. When the lock bit is 0, the corresponding sector or block can be erased or programmed; when the lock bit is set to 1, Erase or Program commands issued to the corresponding sector or block will be ignored. When the device is powered on, all Individual Block Lock bits will be 1, so the entire memory array is protected from Erase/Program. An “Individual Block Unlock (39h)” instruction must be issued to unlock any specific sector or block.

The WPS bit in Status Register-3 is used to decide which Write Protect scheme should be used. When WPS=0 (factory default), the device will only utilize CMP, TB, BP[3:0] bits to protect specific areas of the array; when WPS=1, the device will utilize the Individual Block Locks for write protection.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

7. STATUS AND CONFIGURATION REGISTERS

Three Status and Configuration Registers are provided for W25R256JW. The Read Status Register-1/2/3 instructions can be used to provide status on the availability of the flash memory array, whether the device is write enabled or disabled, the state of write protection, Quad SPI setting, Security Register lock status, Erase/Program Suspend status, output driver strength, power-up and current Address Mode. The Write Status Register instruction can be used to configure the device write protection features, Quad SPI setting, Security Register OTP locks, output driver strength and power-up Address Mode. Write access to the Status Register is controlled by the state of the non-volatile Status Register Protect bits (SRP0, SRP1), the Write Enable instruction.

7.1 Status Registers

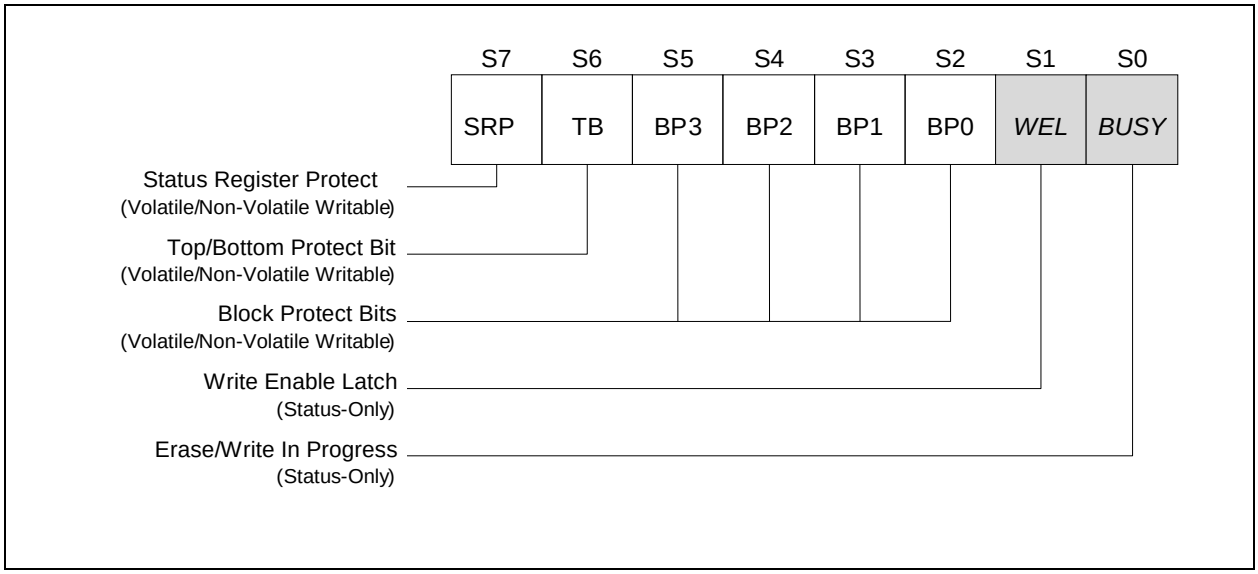


Figure 4a. Status Register-1

7.1.1 Erase/Write In Progress (BUSY) – *Status Only*

BUSY is a read only bit in the status register (S0) that is set to a 1 state when the device is executing a Page Program, Quad Page Program, Sector Erase, Block Erase, Chip Erase, Write Status Register or Erase/Program Security Register instruction. During this time the device will ignore further instructions except for the Read Status Register and Erase/Program Suspend instruction (see t_W, t_{PP}, t_{SE}, t_{BE}, and t_{CE} in AC Characteristics). When the program, erase or write status/security register instruction has completed, the BUSY bit will be cleared to a 0 state indicating the device is ready for further instructions.

7.1.2 Write Enable Latch (WEL) – *Status Only*

Write Enable Latch (WEL) is a read only bit in the status register (S1) that is set to 1 after executing a Write Enable Instruction. The WEL status bit is cleared to 0 when the device is write disabled. A write disable state occurs upon power-up or after any of the following instructions: Write Disable, Page Program, Quad Page Program, Sector Erase, Block Erase, Chip Erase, Write Status Register, Erase Security Register and Program Security Register.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

7.1.3 Block Protect Bits (BP3, BP2, BP1, BP0) – *Volatile/Non-Volatile Writable*

The Block Protect Bits (BP3, BP2, BP1, BP0) are non-volatile read/write bits in the status register (S5, S4, S3, and S2) that provide Write Protection control and status. Block Protect bits can be set using the Write Status Register Instruction (see tw in AC characteristics). All, none or a portion of the memory array can be protected from Program and Erase instructions (see Status Register Memory Protection table). The factory default setting for the Block Protection Bits is 0, none of the array protected.

7.1.4 Top/Bottom Block Protect (TB) – *Volatile/Non-Volatile Writable*

The non-volatile Top/Bottom bit (TB) controls if the Block Protect Bits (BP3, BP2, BP1, BP0) protect from the Top (TB=0) or the Bottom (TB=1) of the array as shown in the Status Register Memory Protection table. The factory default setting is TB=0. The TB bit can be set with the Write Status Register Instruction depending on the state of the SRP0, SRP1 and WEL bits.

7.1.5 Complement Protect (CMP) – *Volatile/Non-Volatile Writable*

The Complement Protect bit (CMP) is a non-volatile read/write bit in the status register (S14). It is used in conjunction with TB, BP3, BP2, BP1 and BP0 bits to provide more flexibility for the array protection. Once CMP is set to 1, previous array protection set by TB, BP3, BP2, BP1 and BP0 will be reversed. For instance, when CMP=0, a top 64KB block can be protected while the rest of the array is not; when CMP=1, the top 64KB block will become unprotected while the rest of the array become read-only. Please refer to the Status Register Memory Protection table for details. The default setting is CMP=0.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

7.1.1 Status Register Protect (SRP, SRL) – *Volatile/Non-Volatile Writable*

Three Status and Configuration Registers are provided for W25R256JW. The Read Status Register-1/2/3 instructions can be used to provide status on the availability of the flash memory array, whether the device is write enabled or disabled, the state of write protection, Quad SPI setting, Security Register lock status, Erase/Program Suspend status, and output driver strength, The Write Status Register instruction can be used to configure the device write protection features, Quad SPI setting, Security Register OTP locks, output driver. Write access to the Status Register is controlled by the state of the non-volatile Status Register Protect bits (SRP, SRL), the Write Enable instruction, and during Standard/Dual SPI operations, the /WP pin.

SRL	SRP	/WP	Status Register	Description
0	0	X	Software Protection	/WP pin has no control. The Status register can be written to after a Write Enable instruction, WEL=1. [Factory Default]
0	1	0	Hardware Protected	When /WP pin is low the Status Register locked and cannot be written to.
0	1	1	Hardware Unprotected	When /WP pin is high the Status register is unlocked and can be written to after a Write Enable instruction, WEL=1.
1	X	X	Power Supply Lock-Down	Status Register is protected and cannot be written to again until the next power-down, power-up cycle.(1)
1	X	X	One Time Program(2)	Status Register is permanently protected and cannot be written to. (**enabled by adding prefix command AAh, 55h)**

1. When SRL =1, a power-down, power-up cycle will change SRL =0 state.
2. Please contact Winbond for details regarding the special instruction sequence.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

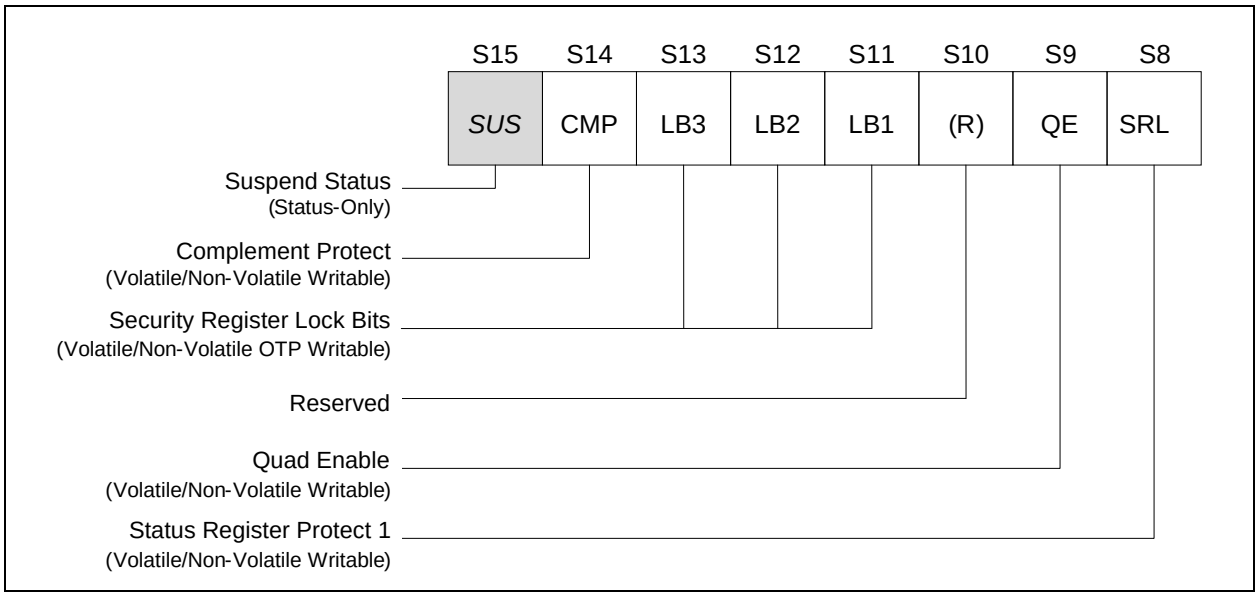


Figure 4b. Status Register-2

7.1.2 Erase/Program Suspend Status (SUS) – *Status Only*

The Suspend Status bit is a read only bit in the status register (S15) that is set to 1 after executing a Erase/Program Suspend (75h) instruction. The SUS status bit is cleared to 0 by Erase/Program Resume (7Ah) instruction as well as a power-down, power-up cycle.

7.1.3 Security Register Lock Bits (LB3, LB2, LB1) – *Volatile/Non-Volatile OTP Writable*

The Security Register Lock Bits (LB3, LB2, LB1) are non-volatile One Time Program (OTP) bits in Status Register (S13, S12, S11) that provide the write protect control and status to the Security Registers. The default state of LB3-1 is 0, Security Registers are unlocked. LB3-1 can be set to 1 individually using the Write Status Register instruction. LB3-1 are One Time Programmable (OTP), once it's set to 1, the corresponding 256-Byte Security Register will become read-only permanently.

7.1.4 Quad Enable (QE) – *Volatile/Non-Volatile Writable*

The Quad Enable (QE) bit is set to 1 by default in the factory, therefore the device supports Standard/Dual SPI as well as Quad SPI after power on. This bit cannot be reset to 0

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

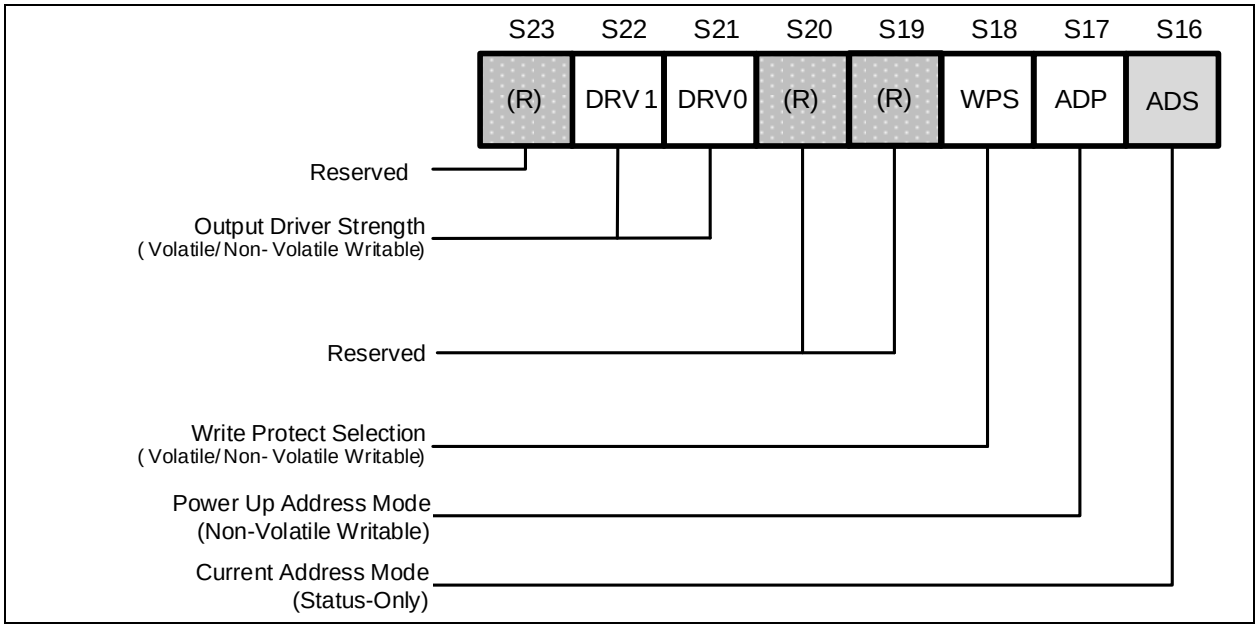


Figure 4c. Status Register-3

7.1.5 Current Address Mode (ADS) – *Status Only*

The Current Address Mode bit is a read only bit in the Status Register-3 that indicates which address mode the device is currently operating in. When ADS=0, the device is in the 3-Byte Address Mode, when ADS=1, the device is in the 4-Byte Address Mode.

7.1.6 Power-Up Address Mode (ADP) – *Non-Volatile Writable*

The ADP bit is a non-volatile bit that determines the initial address mode when the device is powered on or reset. This bit is only used during the power on or device reset initialization period, and it is only writable by the non-volatile Write Status sequence (06h + 11h). When ADP=0 (factory default), the device will power up into 3-Byte Address Mode, the Extended Address Register must be used to access memory regions beyond 128Mb. When ADP=1, the device will power up into 4-Byte Address Mode directly.

7.1.7 Write Protect Selection (WPS) – *Volatile/Non-Volatile Writable*

The WPS bit is used to select which Write Protect scheme should be used. When WPS=0, the device will use the combination of CMP, TB, BP[3:0] bits to protect a specific area of the memory array. When WPS=1, the device will utilize the Individual Block Locks to protect any individual sector or blocks. The default value for all Individual Block Lock bits is 1 upon device power on or after reset.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

7.1.8 Output Driver Strength (DRV1, DRV0) – *Volatile/Non-Volatile Writable*

The DRV1 & DRV0 bits are used to determine the output driver strength for the Read operations.

DRV1, DRV0	Driver Strength
0, 0	100%
0, 1	75%(default)
1, 0	50%
1, 1	25%

7.1.9 Reserved Bits – *Non Functional*

There are a few reserved Status Register bits that may be read out as a “0” or “1”. It is recommended to ignore the values of those bits. During a “Write Status Register” instruction, the Reserved Bits can be written as “0”, but there will not be any effects.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

7.1.10 W25R256JW Status Register Memory Protection (WPS = 0, CMP = 0)

STATUS REGISTER(1)					W25R256JW (256M-BIT / 32M-BYTE) MEMORY PROTECTION(2)			
TB	BP3	BP2	BP1	BP0	PROTECTED BLOCK(S)	PROTECTED ADDRESSES	PROTECTED DENSITY	PROTECTED PORTION
X	0	0	0	0	NONE	NONE	NONE	NONE
0	0	0	0	1	511	01FF0000h - 01FFFFFFh	64KB	Upper 1/512
0	0	0	1	0	510 thru 511	01FE0000h - 01FFFFFFh	128KB	Upper 1/256
0	0	0	1	1	508 thru 511	01FC0000h - 01FFFFFFh	256KB	Upper 1/128
0	0	1	0	0	504 thru 511	01F80000h - 01FFFFFFh	512KB	Upper 1/64
0	0	1	0	1	496 thru 511	01F00000h - 01FFFFFFh	1MB	Upper 1/32
0	0	1	1	0	480 thru 511	01E00000h - 01FFFFFFh	2MB	Upper 1/16
0	0	1	1	1	448 thru 511	01C00000h - 01FFFFFFh	4MB	Upper 1/8
0	1	0	0	0	384 thru 511	01800000h - 01FFFFFFh	8MB	Upper 1/4
0	1	0	0	1	256 thru 511	01000000h - 01FFFFFFh	16MB	Upper 1/2
1	0	0	0	1	0	00000000h - 0000FFFFh	64KB	Lower 1/512
1	0	0	1	0	0 thru 1	00000000h - 0001FFFFh	128KB	Lower 1/256
1	0	0	1	1	0 thru 3	00000000h - 0003FFFFh	256KB	Lower 1/128
1	0	1	0	0	0 thru 7	00000000h - 0007FFFFh	512KB	Lower 1/64
1	0	1	0	1	0 thru 15	00000000h - 000FFFFFh	1MB	Lower 1/32
1	0	1	1	0	0 thru 31	00000000h - 001FFFFFh	2MB	Lower 1/16
1	0	1	1	1	0 thru 63	00000000h - 003FFFFFh	4MB	Lower 1/8
1	1	0	0	0	0 thru 127	00000000h - 007FFFFFh	8MB	Lower 1/4
1	1	0	0	1	0 thru 255	00000000h - 00FFFFFFh	16MB	Lower 1/2
X	1	1	0	X	0 thru 511	00000000h - 01FFFFFFh	32MB	ALL
X	1	X	1	X	0 thru 511	00000000h - 01FFFFFFh	32MB	ALL

Notes:
1. X = don't care
2. If any Erase or Program command specifies a memory region that contains protected data portion, this command will be ignored.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

7.1.11 W25R256JW Status Register Memory Protection (WPS = 0, CMP = 1)

STATUS REGISTER(1)					W25R256JW (256M-BIT / 32M-BYTE) MEMORY PROTECTION(2)			
TB	BP3	BP2	BP1	BP0	PROTECTED BLOCK(S)	PROTECTED ADDRESSES	PROTECTED DENSITY	PROTECTED PORTION
X	0	0	0	0	ALL	00000000h - 01FFFFFFh	ALL	ALL
0	0	0	0	1	0 thru 510	00000000h - 01FEFFFFh	32,704KB	Lower 511/512
0	0	0	1	0	0 thru 509	00000000h - 01FDFFFFh	32,640KB	Lower 255/256
0	0	0	1	1	0 thru 507	00000000h - 01FBFFFFh	32,512KB	Lower 127/128
0	0	1	0	0	0 thru 503	00000000h - 01F7FFFFh	32,256KB	Lower 63/64
0	0	1	0	1	0 thru 495	00000000h - 01EFFFFFh	31MB	Lower 31/32
0	0	1	1	0	0 thru 479	00000000h - 01DFFFFFh	30MB	Lower 15/16
0	0	1	1	1	0 thru 447	00000000h - 01BFFFFFh	28MB	Lower 7/8
0	1	0	0	0	0 thru 383	00000000h - 017FFFFFh	24MB	Lower 3/4
0	1	0	0	1	0 thru 255	00000000h - 00FFFFFFh	16MB	Lower 1/2
1	0	0	0	1	1 thru 511	00010000h - 01FFFFFFh	32,704KB	Upper 511/512
1	0	0	1	0	2 thru 511	00020000h - 01FFFFFFh	32,640KB	Upper 255/256
1	0	0	1	1	4 thru 511	00040000h - 01FFFFFFh	32,512KB	Upper 127/128
1	0	1	0	0	8 thru 511	00080000h - 01FFFFFFh	32,256KB	Upper 63/64
1	0	1	0	1	16 thru 511	00100000h - 01FFFFFFh	31MB	Upper 31/32
1	0	1	1	0	32 thru 511	00200000h - 01FFFFFFh	30MB	Upper 15/16
1	0	1	1	1	64 thru 511	00400000h - 01FFFFFFh	28MB	Upper 7/8
1	1	0	0	0	128 thru 511	00800000h - 01FFFFFFh	24MB	Upper 3/4
1	1	0	0	1	256 thru 511	01000000h - 01FFFFFFh	16MB	Upper 1/2
X	1	1	0	X	NONE	NONE	NONE	NONE
X	1	X	1	X	NONE	NONE	NONE	NONE

Notes:
1. X = don't care
2. If any Erase or Program command specifies a memory region that contains protected data portion, this command will be ignored.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

7.1.12 W25R256JW Individual Block Memory Protection (WPS=1)

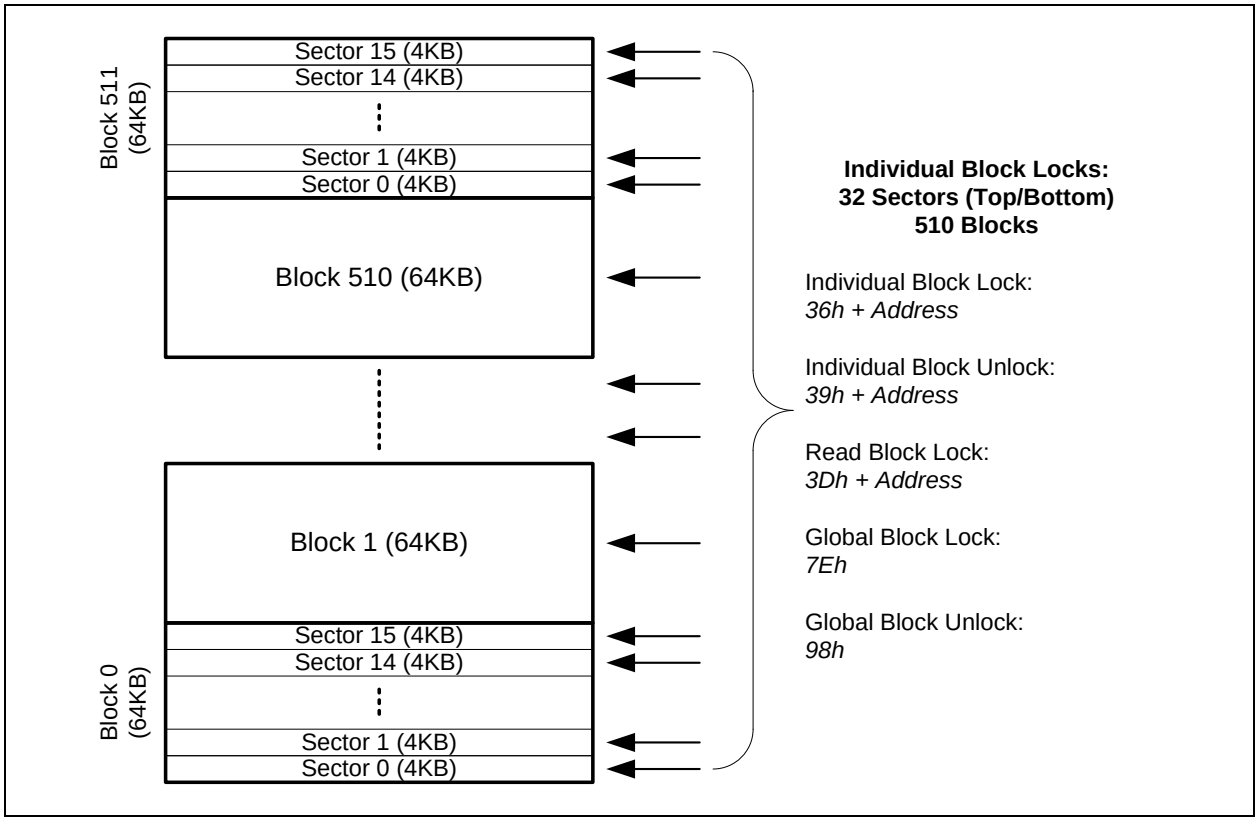


Figure 4d. Individual Block/Sector Locks

Notes:
1. Individual Block/Sector protection is only valid when WPS=1.
2. All individual block/sector lock bits are set to 1 by default after power up, all memory array is protected.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

7.2 Extended Address Register – *Volatile Writable Only*

In addition to the Status Registers, W25R256JW provides a volatile Extended Address Register which consists of the 4th byte of memory address. The Extended Address Register is used only when the device is operating in the 3-Byte Address Mode (ADS=0). The lower 128Mb memory array (00000000h – 00FFFFFFh) is selected when A24=0, all instructions with 3-Byte addresses will be executed within that region. When A24=1, the upper 128Mb memory array (01000000h – 01FFFFFFh) will be selected.

If the device powers up with ADP bit set to 1, or an "Enter 4-Byte Address Mode (B7h)" instruction is issued, the device will require 4-Byte address input for all address related instructions, and the Extended Address Register setting will be ignored. However, any command with 4-byte address input will replace the Extended Address Register Bits (A31-A24) with new settings.

Upon power up or after the execution of a Software Reset, the Extended Address Register values will be cleared to 0.

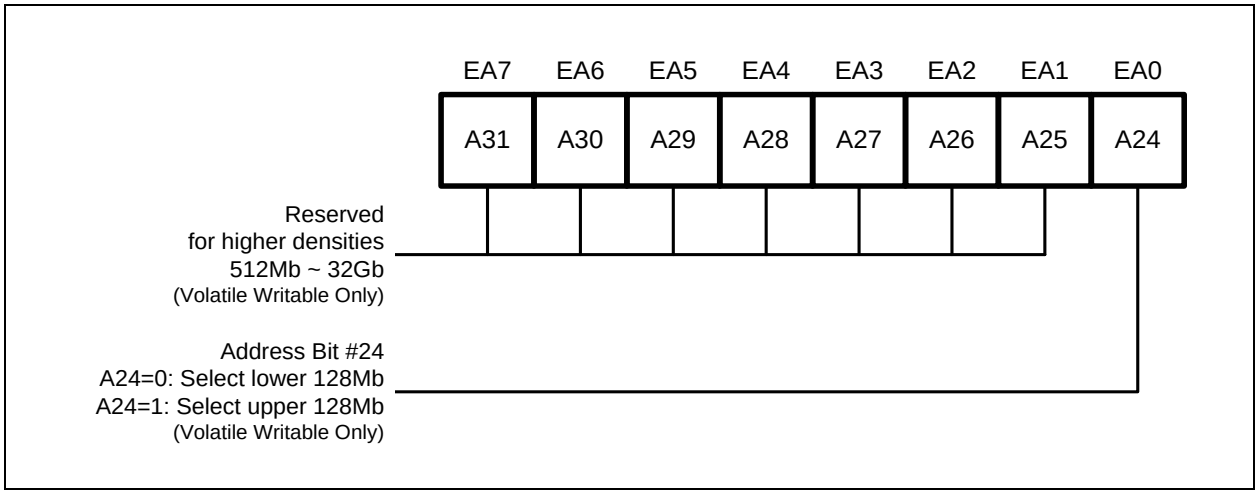


Figure 4e. Extended Address Register

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8. INSTRUCTIONS

The Standard/Dual/Quad SPI instruction set of the W25R256JW consists of 48 basic instructions that are fully controlled through the SPI bus (see Instruction Set Table1-3). Instructions are initiated with the falling edge of Chip Select (/CS). The first byte of data clocked into the DI input provides the instruction code. Data on the DI input is sampled on the rising edge of clock with most significant bit (MSB) first.

Instructions vary in length from a single byte to several bytes and may be followed by address bytes, data bytes, dummy bytes (don't care), and in some cases, a combination. Instructions are completed with the rising edge of edge /CS. Clock relative timing diagrams for each instruction are included in Figures 5 through 57. All read instructions can be completed after any clocked bit. However, all instructions that Write, Program or Erase must complete on a byte boundary (/CS driven high after a full 8-bits have been clocked) otherwise the instruction will be ignored. This feature further protects the device from inadvertent writes. Additionally, while the memory is being programmed or erased, or when the Status Register is being written, all instructions except for Read Status Register will be ignored until the program or erase cycle has completed.

8.1 Device ID and Instruction Set Tables

8.1.1 Manufacturer and Device Identification

MANUFACTURER ID	**(MF7 - MF0)**	
Winbond Serial Flash	EFh	
Device ID	**(ID7 - ID0)**	**(ID15 - ID0)**
Instruction	**ABh, 90h, 92h, 94h**	**9Fh**
W25R256JW	18h	6019h

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.1.2 Instruction Set Table 1 (Standard/Dual/Quad SPI, 3-Byte & 4-Byte Address Mode)(1)

Data Input Output	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Clock Number	**(0 – 7)**	**(8 – 15)**	**(16 – 23)**	**(24 – 31)**	**(32 – 39)**	**(40 – 47)**	**(48 – 55)**
Write Enable	**06h**						
Volatile SR Write Enable	**50h**						
Write Disable	**04h**						
Read Status Register-1	**05h**	(S7-S0)(2)					
Write Status Register-1(4)	**01h**	(S7-S0)(4)					
Read Status Register-2	**35h**	(S15-S8)(2)					
Write Status Register-2	**31h**	(S15-S8)					
Read Status Register-3	**15h**	(S23-S16)(2)					
Write Status Register-3	**11h**	(S23-S16)					
Read Extended Addr. Register	**C8h**	(EA7-EA0)(2)					
Write Extended Addr. Register	**C5h**	(EA7-EA0)					
Chip Erase	**C7h/60h**						
Erase / Program Suspend	**75h**						
Erase / Program Resume	**7Ah**						
Power-down	**B9h**						
Release Power-down / ID	**ABh**	Dummy	Dummy	Dummy	(ID7-ID0)(2)		
Manufacturer/Device ID	**90h**	Dummy	Dummy	00h	(MF7-MF0)	(ID7-ID0)	
JEDEC ID	**9Fh**	(MF7-MF0)	(ID15-ID8)	(ID7-ID0)			
Global Block Lock	**7Eh**						
Global Block Unlock	**98h**						
Enter 4-Byte Address Mode	**B7h**						
Exit 4-Byte Address Mode	**E9h**						
Enable Reset	**66h**						
Reset Device	**99h**						
Read Data with 4-Byte Address	**13h**	A31-A24	A23-A16	A15-A8	A7-A0	(D7-D0)	
Fast Read with 4-Byte Address	**0Ch**	A31-A24	A23-A16	A15-A8	A7-A0	Dummy	(D7-D0)
Fast Read Dual Output with 4-Byte Address	**3Ch**	A31-A24	A23-A16	A15-A8	A7-A0	Dummy	(D7-D0, …)(7)
Fast Read Quad Output with 4-Byte Address	**6Ch**	A31-A24	A23-A16	A15-A8	A7-A0	Dummy	(D7-D0, …)(9)
Data Input Output	**Byte 1**	**Byte 2**	**Byte 3**	**Byte 4**	**Byte 5**	**Byte 6**	**Byte 7**
Clock Number	**(0 – 7)**	**(8 – 11)**	**(12 – 15)**	**(16 – 19)**	**(20 – 23)**	**(24 – 27)**	**(28 – 31)**
Fast Read Dual I/O with 4-Byte Address	**BCh**	A31-A24	A23-A16	A15-A8	A7-A0	M7-M0(12)	(D7-D0)

Data Input Output	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9
Clock Number	**(0 – 7)**	**(8, 9)**	**(10, 11)**	**(12, 13)**	**(14, 15)**	**(16, 17)**	**(18, 19)**	**(20, 21)**	**(22, 23)**
Fast Read Quad I/O with 4-Byte Address	**ECh**	A31-A24	A23-A16	A15-A8	A7-A0	M7-M0(12)	Dummy	Dummy	(D7-D0)

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.1.3 Instruction Set Table 2 (Standard/Dual/Quad SPI Instructions, 3-Byte Address Mode)(1)

Data Input Output	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
Clock Number	**(0 – 7)**	**(8 – 15)**	**(16 – 23)**	**(24 – 31)**	**(32 – 39)**	**(40 – 47)**
Read Unique ID	**4Bh**	Dummy	Dummy	Dummy	Dummy	(UID63-UID0)
Page Program	**02h**	A23-A16	A15-A8	A7-A0	D7-D0	D7-D0(3)
Quad Page Program	**32h**	A23-A16	A15-A8	A7-A0	D7-D0, …(9)	D7-D0, …(3)
Sector Erase (4KB)	**20h**	A23-A16	A15-A8	A7-A0		
Block Erase (32KB)	**52h**	A23-A16	A15-A8	A7-A0		
Block Erase (64KB)	**D8h**	A23-A16	A15-A8	A7-A0		
Read Data	**03h**	A23-A16	A15-A8	A7-A0	(D7-D0)	
Fast Read	**0Bh**	A23-A16	A15-A8	A7-A0	Dummy	(D7-D0)
Fast Read Dual Output	**3Bh**	A23-A16	A15-A8	A7-A0	Dummy	(D7-D0, …)(7)
Fast Read Quad Output	**6Bh**	A23-A16	A15-A8	A7-A0	Dummy	(D7-D0, …)(9)
Read SFDP Register	**5Ah**	A23-A16	A15-A8	A7-A0	Dummy	(D7-D0)
Erase Security Register(5)	**44h**	A23-A16	A15-A8	A7-A0		
Program Security Register(5)	**42h**	A23-A16	A15-A8	A7-A0	D7-D0	D7-D0(3)
Read Security Register(5)	**48h**	A23-A16	A15-A8	A7-A0	Dummy	(D7-D0)
Individual Block Lock	**36h**	A23-A16	A15-A8	A7-A0		
Individual Block Unlock	**39h**	A23-A16	A15-A8	A7-A0		
Read Block Lock	**3Dh**	A23-A16	A15-A8	A7-A0	D7-D0	

Data Input Output	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Clock Number	**(0 – 7)**	**(8 – 11)**	**(12 – 15)**	**(16 – 19)**	**(20 – 23)**	**(24 – 27)**	**(28 – 31)**
Fast Read Dual I/O	**BBh**	A23-A16	A15-A8	A7-A0	Dummy(12)	(D7-D0)	
Mftr./Device ID Dual I/O	**92h**	A23-A16	A15-A8	A7-A0	Dummy	(MF7-MF0)	(ID7-ID0)

Data Input Output	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9
Clock Number	**(0 – 7)**	**(8, 9)**	**(10, 11)**	**(12, 13)**	**(14, 15)**	**(16, 17)**	**(18, 19)**	**(20, 21)**	**(22, 23)**
Fast Read Quad I/O	**EBh**	A23-A16	A15-A8	A7-A0	M7-M0	Dummy	Dummy (12)	(D7-D0)	(D7-D0)
Mftr./Device ID Quad I/O	**94h**	A23-A16	A15-A8	A7-A0	M7-M0	Dummy	Dummy	(MF7-MF0)	(ID7-ID0)

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.1.4 Instruction Set Table 3 (Standard/Dual/Quad SPI Instructions, 4-Byte Address Mode)(1)

Data Input Output	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Clock Number	**(0 – 7)**	**(8 – 15)**	**(16 – 23)**	**(24 – 31)**	**(32 – 39)**	**(40 – 47)**	**(48 – 55)**
Read Unique ID	**4Bh**	Dummy	Dummy	Dummy	Dummy	Dummy	(UID63-UID0)
Page Program	**02h**	A31-A24	A23-A16	A15-A8	A7-A0	D7-D0	D7-D0(3)
Quad Page Program	**32h**	A31-A24	A23-A16	A15-A8	A7-A0	D7-D0, …(9)	D7-D0, …(3)
Sector Erase (4KB)	**20h**	A31-A24	A23-A16	A15-A8	A7-A0		
Block Erase (32KB)	**52h**	A31-A24	A23-A16	A15-A8	A7-A0		
Block Erase (64KB)	**D8h**	A31-A24	A23-A16	A15-A8	A7-A0		
Read Data	**03h**	A31-A24	A23-A16	A15-A8	A7-A0	(D7-D0)	
Fast Read	**0Bh**	A31-A24	A23-A16	A15-A8	A7-A0	Dummy	(D7-D0)
Fast Read Dual Output	**3Bh**	A31-A24	A23-A16	A15-A8	A7-A0	Dummy	(D7-D0, …)(7)
Fast Read Quad Output	**6Bh**	A31-A24	A23-A16	A15-A8	A7-A0	Dummy	(D7-D0, …)(9)
Read SFDP Register	**5Ah**	A31-A24	A23-A16	A15-A8	A7-A0	Dummy	(D7-D0)
Erase Security Register(5)	**44h**	A31-A24	A23-A16	A15-A8	A7-A0		
Program Security Register(5)	**42h**	A31-A24	A23-A16	A15-A8	A7-A0	D7-D0	D7-D0(3)
Read Security Register(5)	**48h**	A31-A24	A23-A16	A15-A8	A7-A0	Dummy	(D7-D0)
Individual Block Lock	**36h**	A31-A24	A23-A16	A15-A8	A7-A0		
Individual Block Unlock	**39h**	A31-A24	A23-A16	A15-A8	A7-A0		
Read Block Lock	**3Dh**	A31-A24	A23-A16	A15-A8	A7-A0	D7-D0	

Data Input Output	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Clock Number	**(0 – 7)**	**(8 – 11)**	**(12 – 15)**	**(16 – 19)**	**(20 – 23)**	**(24 – 27)**	**(28 – 31)**	**(32 – 35)**
Fast Read Dual I/O	**BBh**	A31-A24	A23-A16	A15-A8	A7-A0	Dummy(12)	(D7-D0)	(D7-D0)
Mftr./Device ID Dual I/O	**92h**	A31-A24	A23-A16	A15-A8	A7-A0	Dummy	(MF7-MF0)	(ID7-ID0)

Data Input Output	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9	Byte 10
Clock Number	**(0 – 7)**	**(8, 9)**	**(10, 11)**	**(12, 13)**	**(14, 15)**	**(16, 17)**	**(18, 19)**	**(20, 21)**	**(22, 23)**	**(24, 25)**
Fast Read Quad I/O	**EBh**	A31-A24	A23-A16	A15-A8	A7-A0	M7-M0(12)	Dummy	Dummy	(D7-D0)	(D7-D0)
Mftr./Device ID Quad I/O	**94h**	A31-A24	A23-A16	A15-A8	A7-A0	M7-M0(12)	Dummy	Dummy	(MF7-MF0)	(ID7-ID0)

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

Notes:

1. Data bytes are shifted with Most Significant Bit first. Byte fields with data in parenthesis “( )” indicate data output from the device on either 1, 2 or 4 IO pins.
2. The Status Register contents and Device ID will repeat continuously until /CS terminates the instruction.
3. At least one byte of data input is required for Page Program, Quad Page Program and Program Security Registers, up to 256 bytes of data input. If more than 256 bytes of data are sent to the device, the addressing will wrap to the beginning of the page and overwrite previously sent data.
4. Write Status Register-1 (01h) can also be used to program Status Register-1&2, see section 8.2.5.
5. Security Register Address:
   Security Register 1: A23-16 = 00h; A15-8 = 10h; A7-0 = byte address
   Security Register 2: A23-16 = 00h; A15-8 = 20h; A7-0 = byte address
   Security Register 3: A23-16 = 00h; A15-8 = 30h; A7-0 = byte address
6. Dual SPI address input format:
   IO0 = A22, A20, A18, A16, A14, A12, A10, A8 A6, A4, A2, A0, M6, M4, M2, M0
   IO1 = A23, A21, A19, A17, A15, A13, A11, A9 A7, A5, A3, A1, M7, M5, M3, M1
7. Dual SPI data output format:
   IO0 = (D6, D4, D2, D0)
   IO1 = (D7, D5, D3, D1)
8. Quad SPI address input format:
   IO0 = A20, A16, A12, A8, A4, A0, M4, M0
   IO1 = A21, A17, A13, A9, A5, A1, M5, M1
   IO2 = A22, A18, A14, A10, A6, A2, M6, M2
   IO3 = A23, A19, A15, A11, A7, A3, M7, M3
9. Quad SPI data input/output format:
   IO0 = (D4, D0, …..)
   IO1 = (D5, D1, …..)
   IO2 = (D6, D2, …..)
   IO3 = (D7, D3, …..)
10. Fast Read Quad I/O data output format:
    IO0 = (x, x, x, x, D4, D0, D4, D0)
    IO1 = (x, x, x, x, D5, D1, D5, D1)
    IO2 = (x, x, x, x, D6, D2, D6, D2)
    IO3 = (x, x, x, x, D7, D3, D7, D3)
11. Word Read Quad I/O data output format:
    IO0 = (x, x, D4, D0, D4, D0, D4, D0)
    IO1 = (x, x, D5, D1, D5, D1, D5, D1)
    IO2 = (x, x, D6, D2, D6, D2, D6, D2)
    IO3 = (x, x, D7, D3, D7, D3, D7, D3)
12. The first dummy is M7-M0 should be set to Fxh.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.1.5 Instruction Set Table 2-1 (RPMC Input Instruction, OP1)(1)

INSTRUCTION NAME	BYTE 0	BYTE 1 (CmdType)	BYTE 2	BYTE 3(2)		
Write Root Key Register	**9Bh**	00h	CounterAddr[7:0]	Reserved[7:0]	Byte 4 - 35 RootKey[255:0]	Byte 36 - 63 TruncatedSign[223:0]
Update HMAC Key Register	**9Bh**	01h	CounterAddr[7:0]	Reserved[7:0]	Byte 4 - 7 KeyData[31:0]	Byte 8 - 39 Signature[255:0]
Increment Monotonic Counter	**9Bh**	02h	CounterAddr[7:0]	Reserved[7:0]	Byte 4 - 7 CounterData[31:0]	Byte 8 - 39 Signature[255:0]
Request Monotonic Counter	**9Bh**	03h	CounterAd dr[7:0]	Reserved[7:0]	Byte 4 - 15 Tag[95:0]	Byte 16 - 47 Signature[255:0]
Reserved Commands	**9Bh**	04h ~ FFh	Reserved			

8.1.6 Instruction Set Table 2-2 (RPMC Output Instruction, OP2)(1)

INSTRUCTION NAME	BYTE 0	BYTE 1	BYTE 2	BYTE 3 - 14	BYTE 15 - 18	BYTE 19 - 50
Read RPMC Status / Data(3)(4)	**96h**	dummy	(RPMC Status[7:0])	(Tag[95:0])	(CounterData[31:0])	(Signature[255:0])

Notes (For Instruction Set Table 2-1/2):

1. All RPMC instructions are in Standard SPI format. Each Input/Output Byte requires 8 clocks.
2. The Reserved[7:0] field for RPMC OP1 must be all 0s (00000000'b).
3. The controller may terminate the Read RPMC Status/Data instruction at any time without going through the entire data output sequence.
4. When BUSY=1, from Byte-3 and beyond, the device will output the RPMC_Status[7:0] value continuously until /CS terminates the instruction. The device will not output Tag, CounterData & Signature fields when BUSY=1. Once BUSY becomes 0, another OP2 command must be issued to read out the correct Tag, CounterData & Signature fields.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2 Instruction Descriptions

8.2.1 Write Enable (06h)

The Write Enable instruction (Figure 6) sets the Write Enable Latch (WEL) bit in the Status Register to a 1. The WEL bit must be set prior to every Page Program, Quad Page Program, Sector Erase, Block Erase, Chip Erase, Write Status Register and Erase/Program Security Registers instruction. The Write Enable instruction is entered by driving /CS low, shifting the instruction code “06h” into the Data Input (DI) pin on the rising edge of CLK, and then driving /CS high.

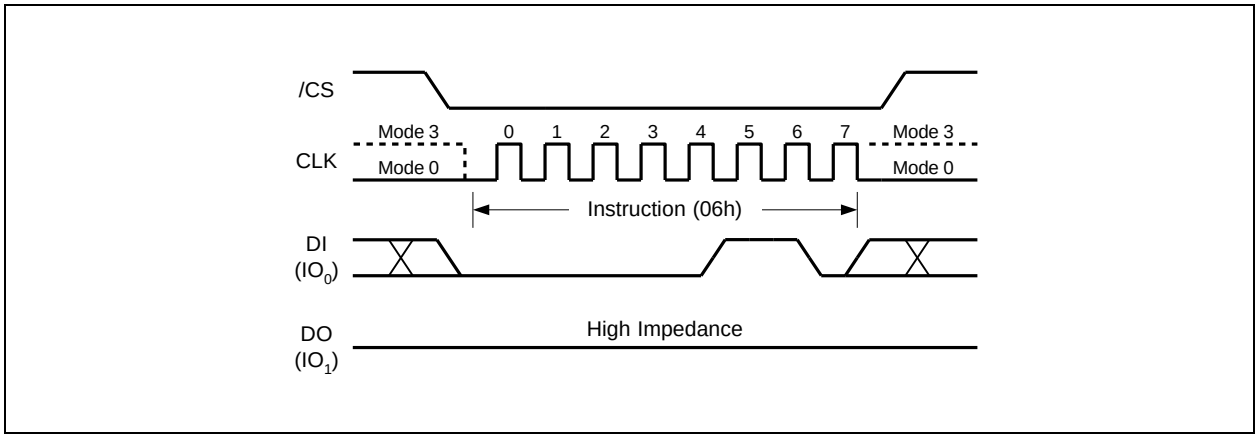


Figure 6. Write Enable Instruction

8.2.2 Write Enable for Volatile Status Register (50h)

The non-volatile Status Register bits described in section 7.1 can also be written to as volatile bits. This gives more flexibility to change the system configuration and memory protection schemes quickly without waiting for the typical non-volatile bit write cycles or affecting the endurance of the Status Register non-volatile bits. To write the volatile values into the Status Register bits, the Write Enable for Volatile Status Register (50h) instruction must be issued prior to a Write Status Register (01h) instruction. Write Enable for Volatile Status Register instruction (Figure 7) will not set the Write Enable Latch (WEL) bit, it is only valid for the Write Status Register instruction to change the volatile Status Register bit values.

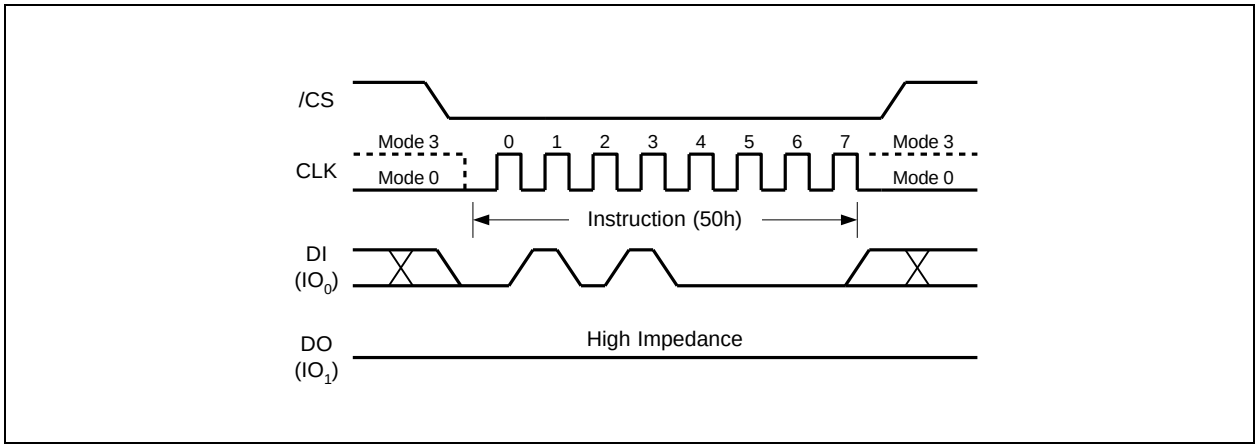


Figure 7. Write Enable for Volatile Status Register Instruction

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.3 Write Disable (04h)

The Write Disable instruction (Figure 8) resets the Write Enable Latch (WEL) bit in the Status Register to a 0. The Write Disable instruction is entered by driving /CS low, shifting the instruction code “04h” into the DI pin and then driving /CS high. Note that the WEL bit is automatically reset after Power-up and upon completion of the Write Status Register, Erase/Program Security Registers, Page Program, Quad Page Program, Sector Erase, Block Erase, Chip Erase and Reset instructions.

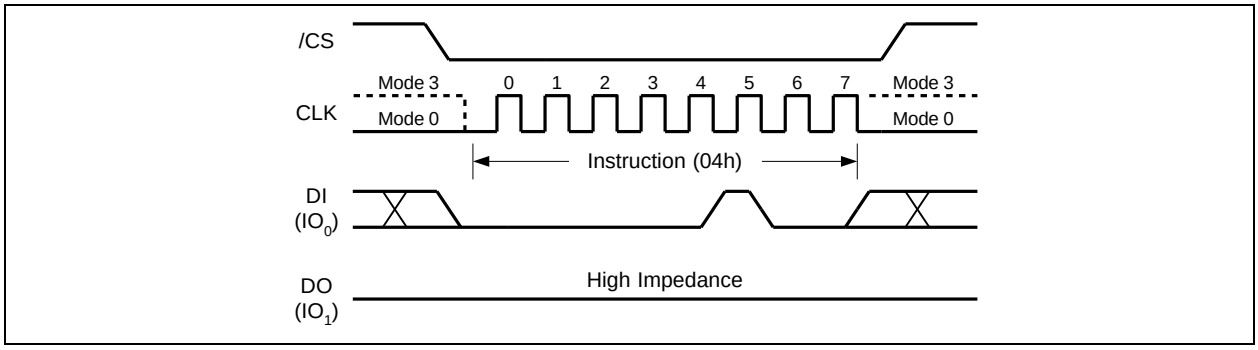


Figure 8. Write Disable Instruction

8.2.4 Read Status Register-1 (05h), Status Register-2 (35h) & Status Register-3 (15h)

The Read Status Register instructions allow the 8-bit Status Registers to be read. The instruction is entered by driving /CS low and shifting the instruction code “05h” for Status Register-1, “35h” for Status Register-2 or “15h” for Status Register-3 into the DI pin on the rising edge of CLK. The status register bits are then shifted out on the DO pin at the falling edge of CLK with most significant bit (MSB) first as shown in Figure 9. Refer to section 7.1 for Status Register descriptions.

The Read Status Register instruction may be used at any time, even while a Program, Erase or Write Status Register cycle is in progress. This allows the BUSY status bit to be checked to determine when the cycle is complete and if the device can accept another instruction. The Status Register can be read continuously, as shown in Figure 8. The instruction is completed by driving /CS high.

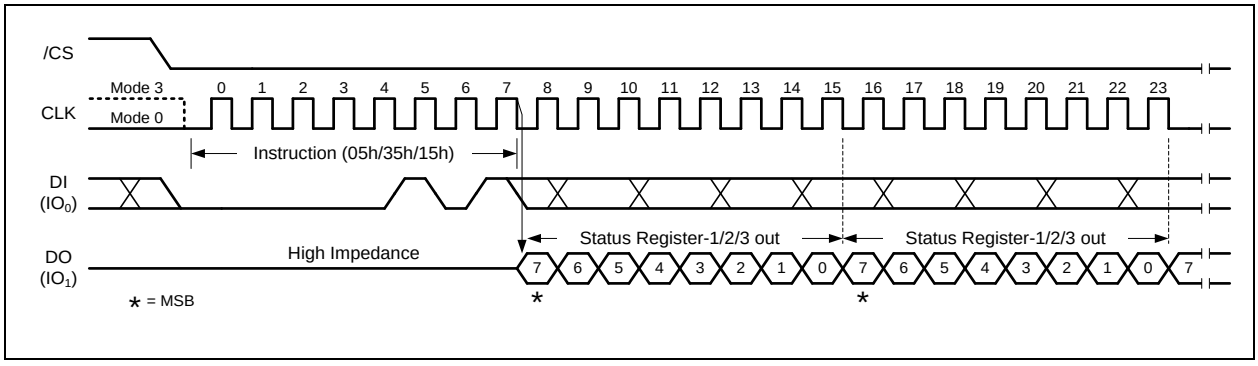


Figure 9. Read Status Register Instruction

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.5 Write Status Register-1 (01h), Status Register-2 (31h) & Status Register-3 (11h)

The Write Status Register instruction allows the Status Registers to be written. The writable Status Register bits include: SRP0, SEC, TB, BP[2:0] in Status Register-1; CMP, LB[3:1], QE, SRP1 in Status Register-2; DRV1, DRV0, WPS & ADP in Status Register-3. All other Status Register bit locations are read-only and will not be affected by the Write Status Register instruction. LB[3:1] are non-volatile OTP bits, once it is set to 1, it cannot be cleared to 0.

To write non-volatile Status Register bits, a standard Write Enable (06h) instruction must previously have been executed for the device to accept the Write Status Register instruction (Status Register bit WEL must equal 1). Once write enabled, the instruction is entered by driving /CS low, sending the instruction code “01h/31h/11h”, and then writing the status register data byte as illustrated in Figure 10a & 10b.

To write volatile Status Register bits, a Write Enable for Volatile Status Register (50h) instruction must have been executed prior to the Write Status Register instruction (Status Register bit WEL remains 0). However, SRP1 and LB[3:1] cannot be changed from “1” to “0” because of the OTP protection for these bits. Upon power off or the execution of a Software Reset or Power-down instruction, the volatile Status Register bit values will be lost, and the non-volatile Status Register bit values will be restored.

During non-volatile Status Register write operation (06h combined with 01h/31h/11h), after /CS is driven high, the self-timed Write Status Register cycle will commence for a time duration of t_W (See AC Characteristics). While the Write Status Register cycle is in progress, the Read Status Register instruction may still be accessed to check the status of the BUSY bit. The BUSY bit is a 1 during the Write Status Register cycle and a 0 when the cycle is finished and ready to accept other instructions again. After the Write Status Register cycle has finished, the Write Enable Latch (WEL) bit in the Status Register will be cleared to 0.

During volatile Status Register write operation (50h combined with 01h/31h/11h), after /CS is driven high, the Status Register bits will be refreshed to the new values within the time period of t_{SHSL2} (See AC Characteristics). BUSY bit will remain 0 during the Status Register bit refresh period.

Refer to section 7.1 for Status Register descriptions.

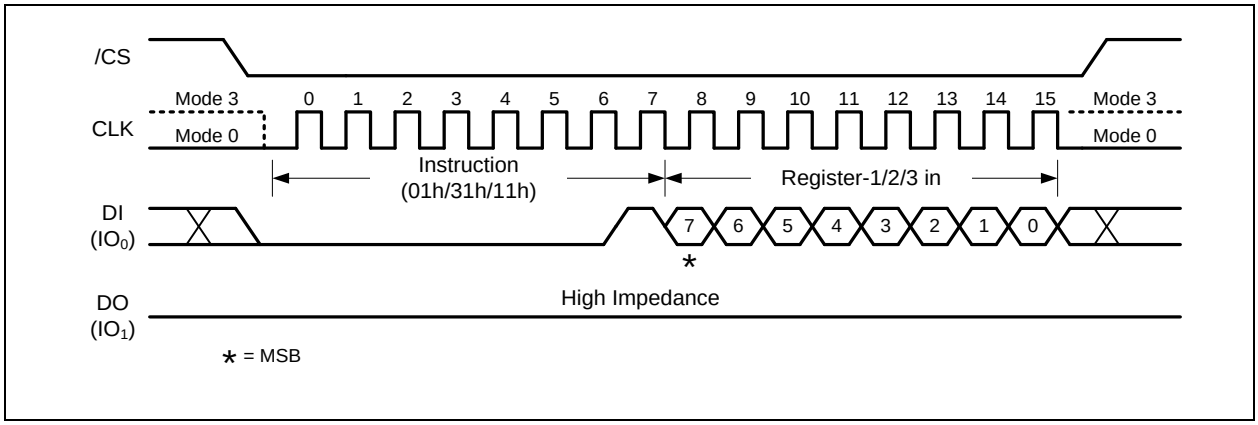


Figure 10a. Write Status Register-1/2/3 Instruction

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

The W25R256JW is also backward compatible to Winbond's previous generations of serial flash memories, in which the Status Register-1&2 can be written using a single "Write Status Register-1 (01h)" command. To complete the Write Status Register-1&2 instruction, the /CS pin must be driven high after the sixteenth bit of data that is clocked in as shown in Figure 10b. If /CS is driven high after the eighth clock, the Write Status Register-1 (01h) instruction will only program the Status Register-1, the Status Register-2 will not be affected (Previous generations will clear CMP and QE bits).

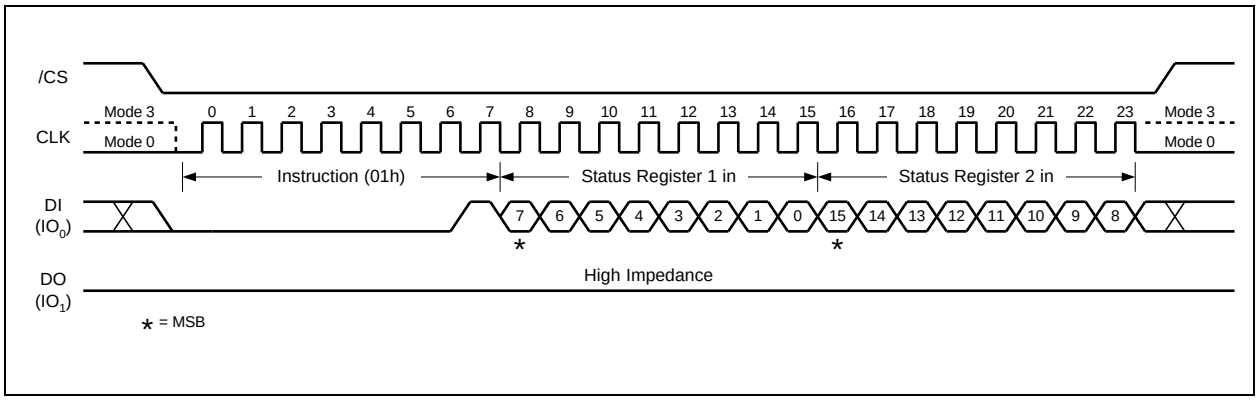


Figure 10b. Write Status Register-1/2 Instruction

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.6 Read Extended Address Register (C8h)

When the device is in the 3-Byte Address Mode, the Extended Address Register is used as the 4th address byte A[31:24] to access memory regions beyond 128Mb. The Read Extended Address Register instruction is entered by driving /CS low and shifting the instruction code "C8h" into the DI pin on the rising edge of CLK. The Extended Address Register bits are then shifted out on the DO pin at the falling edge of CLK with most significant bit (MSB) first as shown in Figure 10.

When the device is in the 4-Byte Address Mode, the Extended Address Register is not used.

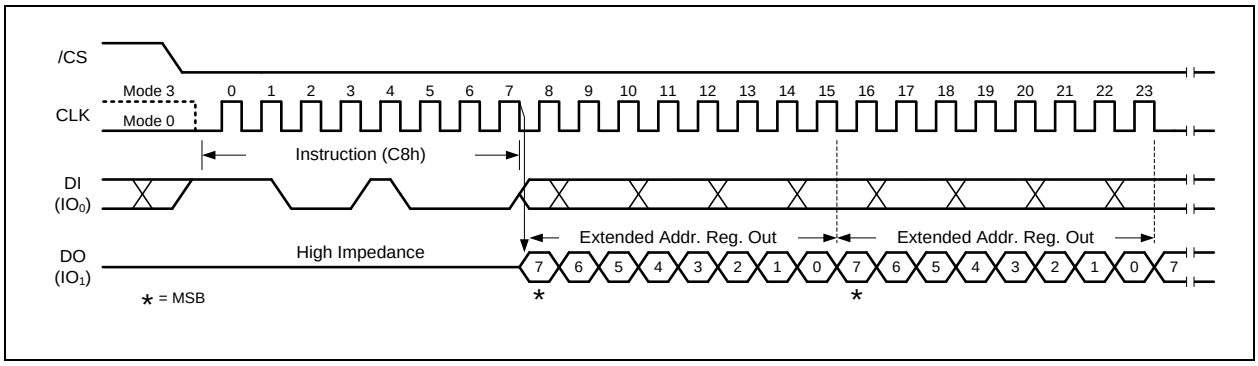


Figure 10a. Read Extended Address Register Instruction

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.7 Write Extended Address Register (C5h)

The Extended Address Register is a volatile register that stores the 4th byte address (A31-A24) when the device is operating in the 3-Byte Address Mode (ADS=0). To write the Extended Address Register bits, a Write Enable (06h) instruction must previously have been executed for the device to accept the Write Extended Address Register instruction (Status Register bit WEL must equal 1). Once write enabled, the instruction is entered by driving /CS low, sending the instruction code “C5h”, and then writing the Extended Address Register data byte as illustrated in Figure 11.

Upon power up or the execution of a Software Reset, the Extended Address Register bit values will be cleared to 0.

The Extended Address Register is only effective when the device is in the 3-Byte Address Mode. When the device operates in the 4-Byte Address Mode (ADS=1), any command with address input of A31-A24 will replace the Extended Address Register values. It is recommended to check and update the Extended Address Register if necessary when the device is switched from 4-Byte to 3-Byte Address Mode.

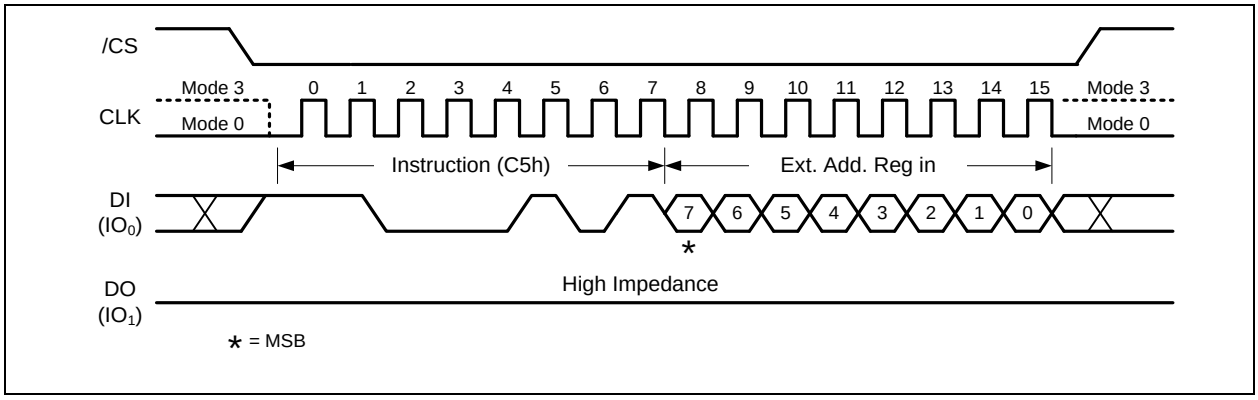


Figure 11a. Write Extended Address Register Instruction

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.8 Enter 4-Byte Address Mode (B7h)

The Enter 4-Byte Address Mode instruction (Figure 12) will allow 32-bit address (A31-A0) to be used to access the memory array beyond 128Mb. The Enter 4-Byte Address Mode instruction is entered by driving /CS low, shifting the instruction code “B7h” into the DI pin and then driving /CS high.

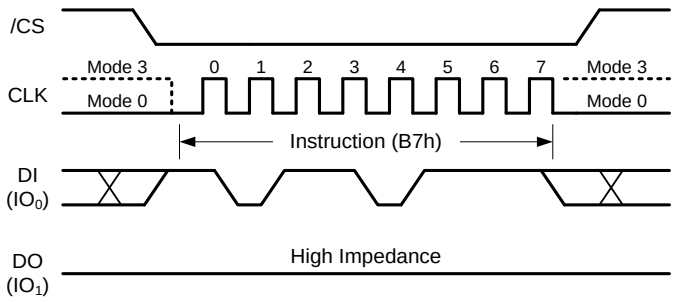


Figure 12. Enter 4-Byte Address Mode instruction

8.2.9 Exit 4-Byte Address Mode (E9h)

In order to be backward compatible, the Exit 4-Byte Address Mode instruction (Figure 13) will only allow 24-bit address (A23-A0) to be used to access the memory array up to 128Mb. The Extended Address Register must be used to access the memory array beyond 128Mb. The Exit 4-Byte Address Mode instruction is entered by driving /CS low, shifting the instruction code “E9h” into the DI pin and then driving /CS high.

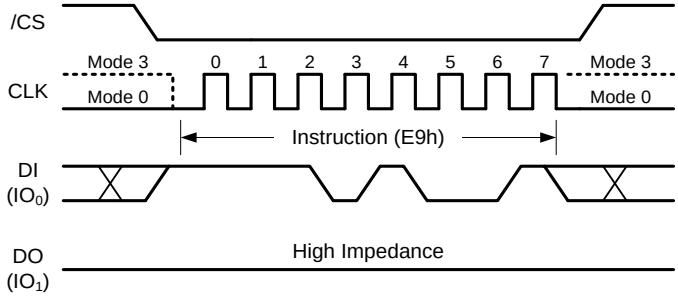


Figure 13. Exit 4-Byte Address Mode instruction

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.10 Read Data (03h)

The Read Data instruction allows one or more data bytes to be sequentially read from the memory. The instruction is initiated by driving the /CS pin low and then shifting the instruction code “03h” followed by a 24-bit address (A23-A0) or a 32-bit address (A31-A0) into the DI pin. The code and address bits are latched on the rising edge of the CLK pin. After the address is received, the data byte of the addressed memory location will be shifted out on the DO pin at the falling edge of CLK with most significant bit (MSB) first. The address is automatically incremented to the next higher address after each byte of data is shifted out allowing for a continuous stream of data. This means that the entire memory can be accessed with a single instruction as long as the clock continues. The instruction is completed by driving /CS high.

The Read Data instruction sequence is shown in Figure 14. If a Read Data instruction is issued while an Erase, Program or Write cycle is in process (BUSY=1) the instruction is ignored and will not have any effects on the current cycle. The Read Data instruction allows clock rates from D.C. to a maximum of f_R (see AC Electrical Characteristics).

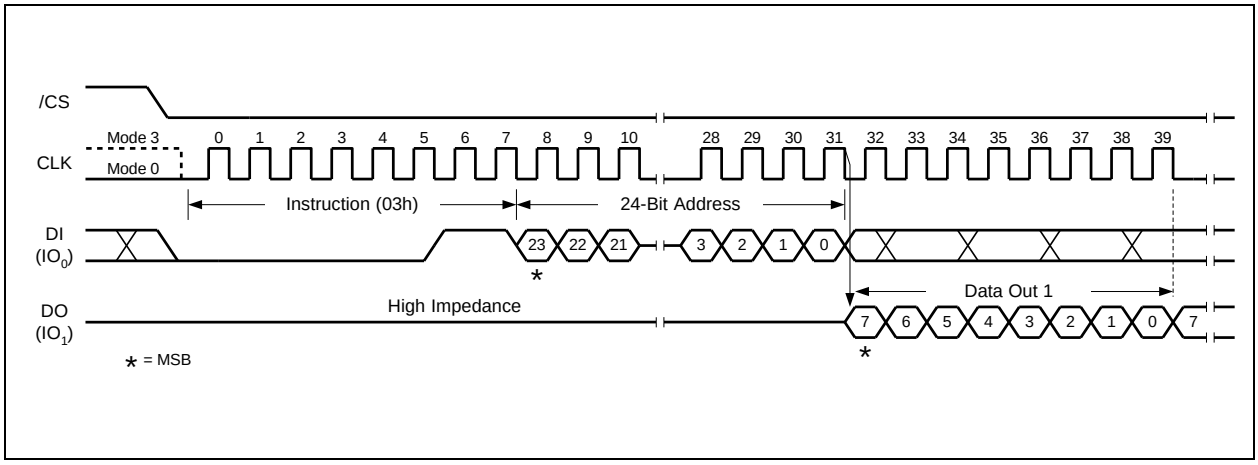


Figure 14. Read Data Instruction

32-Bit Address is required when the device is operating in 4-Byte Address Mode

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.11 Read Data with 4-Byte Address (13h)

The Read Data with 4-Byte Address instruction is similar to the Read Data (03h) instruction. Instead of 24-bit address, 32-bit address is needed following the instruction code 13h. No matter the device is operating in 3-Byte Address Mode or 4-byte Address Mode, the Read Data with 4-Byte Address instruction will always require 32-bit address to access the entire 256Mb memory.

The Read Data with 4-Byte Address instruction sequence is shown in Figure 15. If this instruction is issued while an Erase, Program or Write cycle is in process (BUSY=1) the instruction is ignored and will not have any effects on the current cycle. The Read Data with 4-Byte Address instruction allows clock rates from D.C. to a maximum of f_R (see AC Electrical Characteristics).

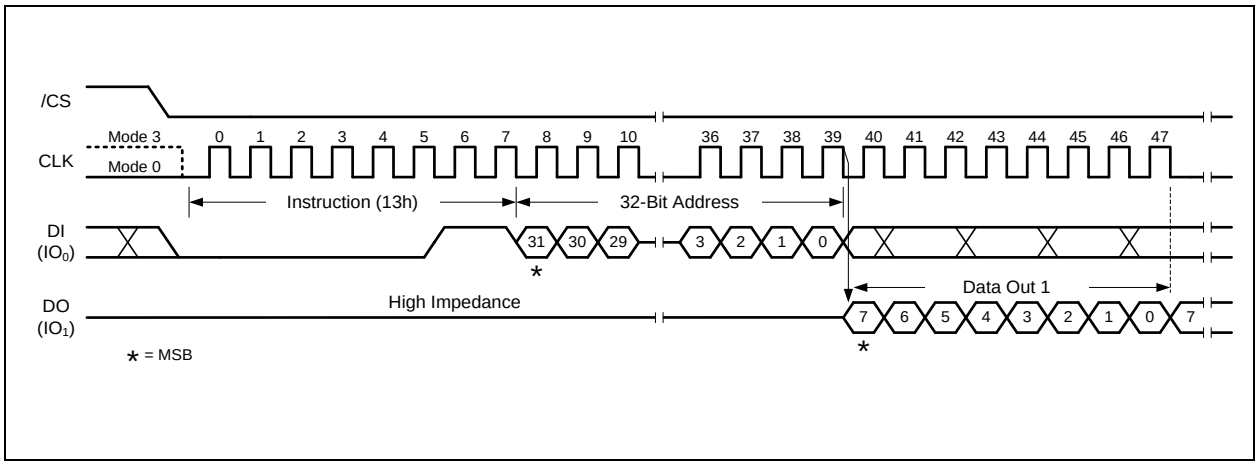


Figure 15. Read Data with 4-Byte Address Instruction

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.12 Fast Read (0Bh)

The Fast Read instruction is similar to the Read Data instruction except that it can operate at the highest possible frequency of FR (see AC Electrical Characteristics). This is accomplished by adding eight "dummy" clocks after the 24/32-bit address as shown in Figure 16. The dummy clocks allow the devices internal circuits additional time for setting up the initial address. During the dummy clocks the data value on the DO pin is a "don't care".

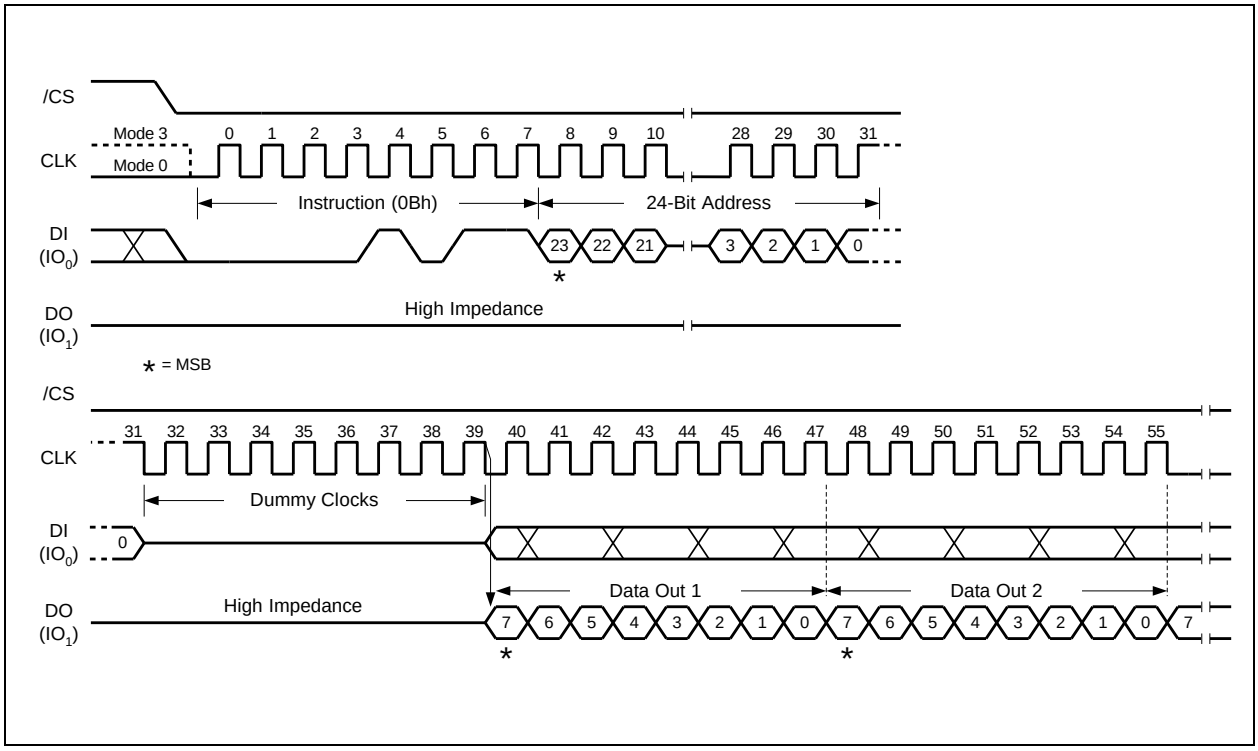


Figure 16a. Fast Read Instruction

32-Bit Address is required when the device is operating in 4-Byte Address Mode

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.13 Fast Read with 4-Byte Address (0Ch)

The Fast Read with 4-Byte Address instruction is similar to the Fast Read instruction except that it requires 32-bit address instead of 24-bit address. No matter the device is operating in 3-Byte Address Mode or 4-byte Address Mode, the Read Data with 4-Byte Address instruction will always require 32-bit address to access the entire 256Mb memory.

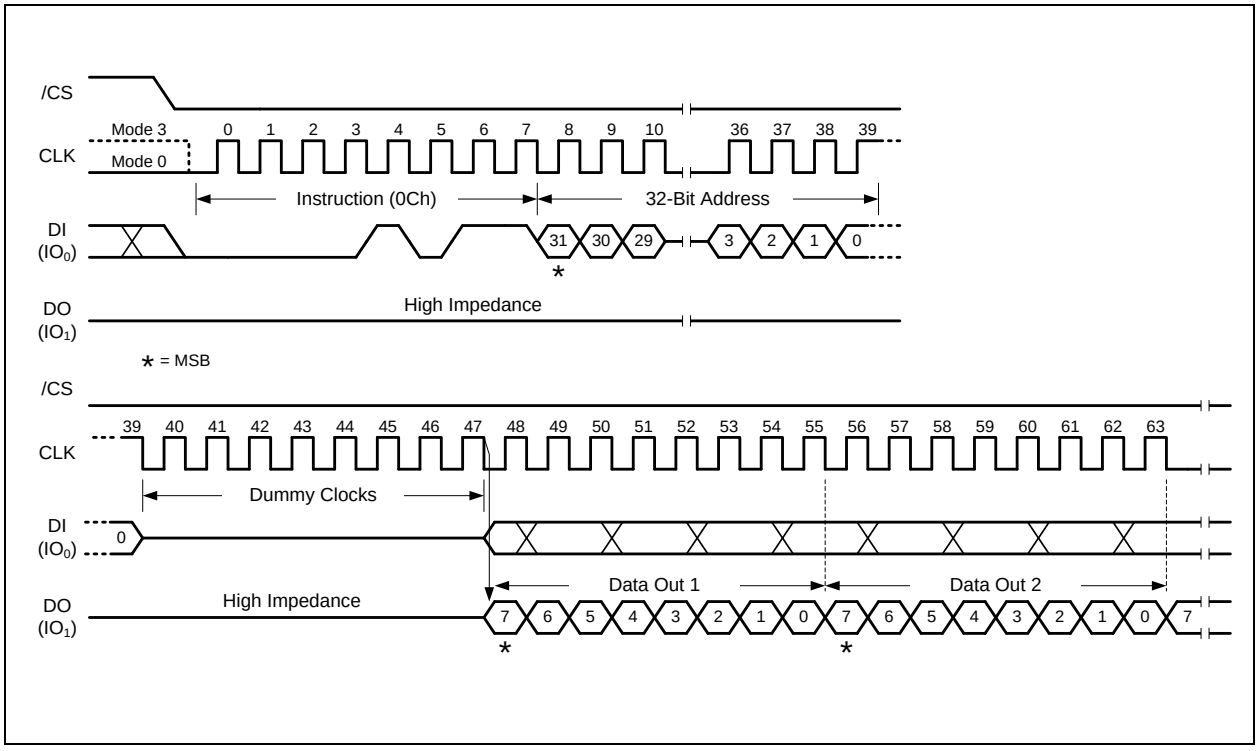


Figure 17. Fast Read with 4-Byte Address Instruction

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.14 Fast Read Dual Output (3Bh)

The Fast Read Dual Output (3Bh) instruction is similar to the standard Fast Read (0Bh) instruction except that data is output on two pins; IO_0 and IO_1. This allows data to be transferred at twice the rate of standard SPI devices. The Fast Read Dual Output instruction is ideal for quickly downloading code from Flash to RAM upon power-up or for applications that cache code-segments to RAM for execution.

Similar to the Fast Read instruction, the Fast Read Dual Output instruction can operate at the highest possible frequency of FR (see AC Electrical Characteristics). This is accomplished by adding eight "dummy" clocks after the 24/32-bit address as shown in Figure 18. The dummy clocks allow the device's internal circuits additional time for setting up the initial address. The input data during the dummy clocks is "don't care". However, the IO_0 pin should be high-impedance prior to the falling edge of the first data out clock.

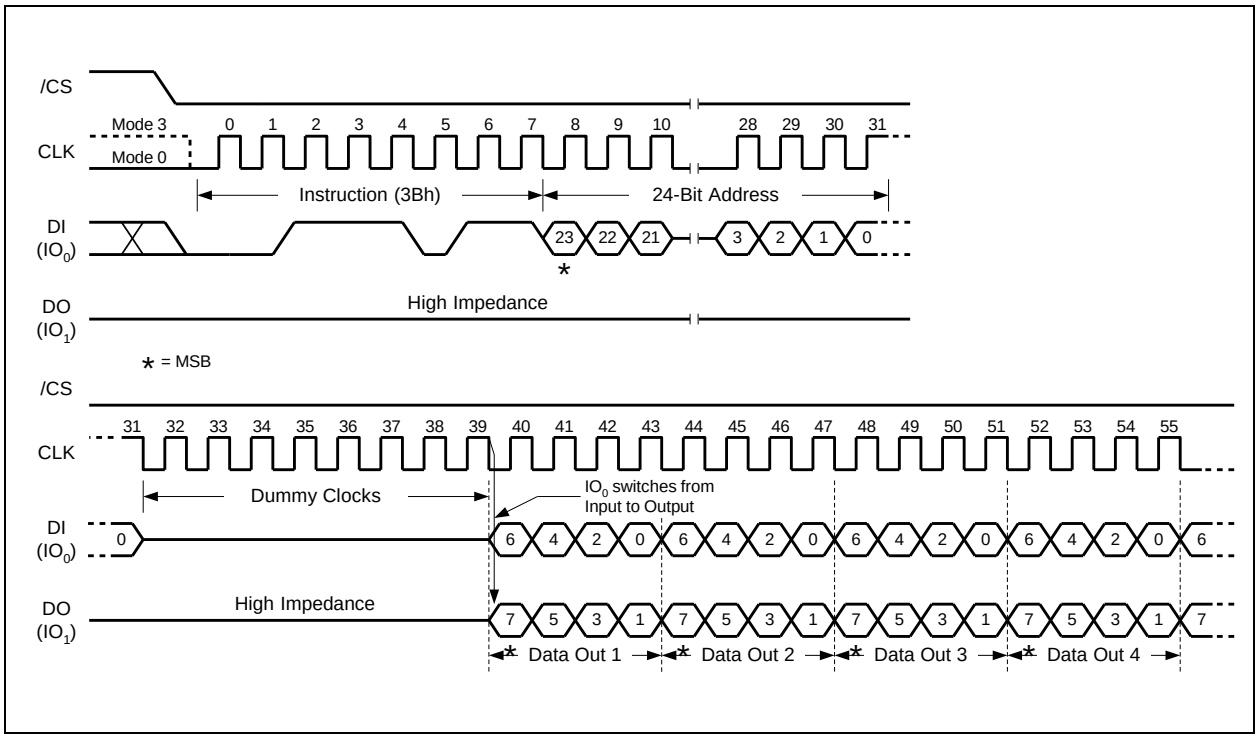


Figure 18. Fast Read Dual Output Instruction

32-Bit Address is required when the device is operating in 4-Byte Address Mode

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.15 Fast Read Dual Output with 4-Byte Address (3Ch)

The Fast Read Dual Output with 4-Byte Address instruction is similar to the Fast Read Dual Output instruction except that it requires 32-bit address instead of 24-bit address. No matter the device is operating in 3-Byte Address Mode or 4-byte Address Mode, the Fast Read Dual Output with 4-Byte Address instruction will always require 32-bit address to access the entire 256Mb memory.

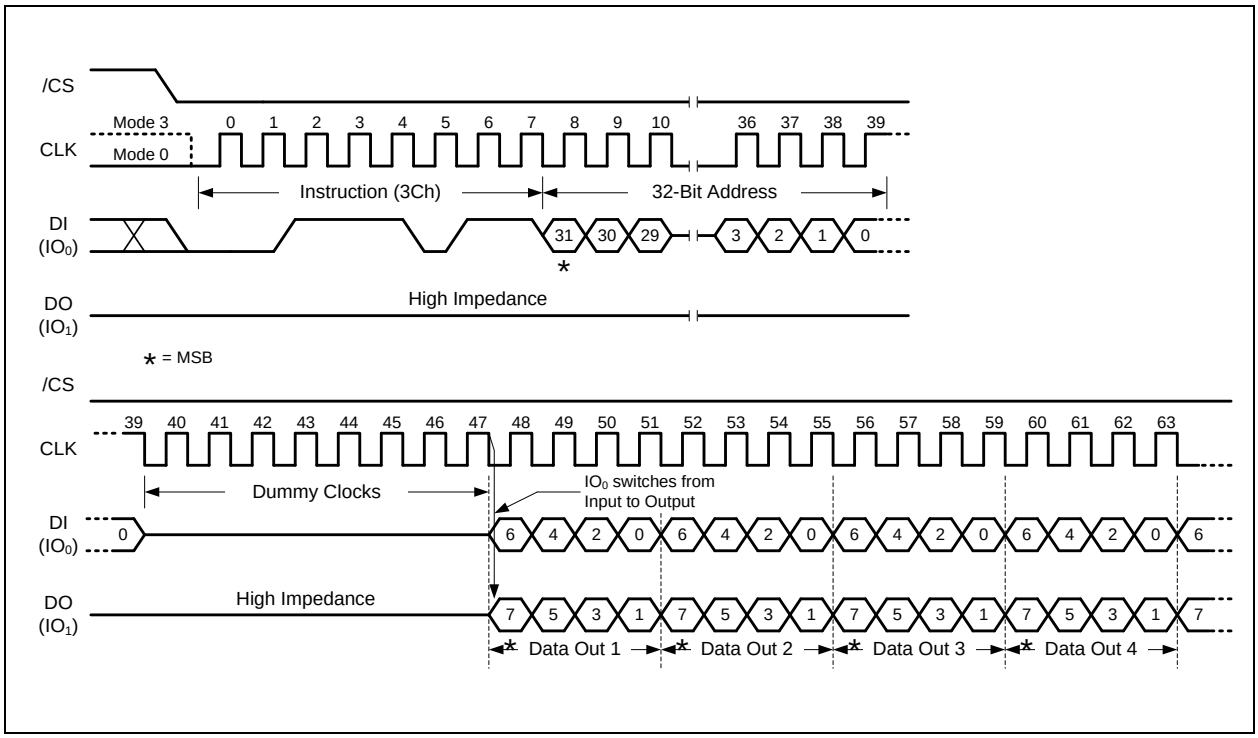


Figure 19. Fast Read Dual Output with 4-Byte Address Instruction

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.16 Fast Read Quad Output (6Bh)

The Fast Read Quad Output (6Bh) instruction is similar to the Fast Read Dual Output (3Bh) instruction except that data is output on four pins, IO_0, IO_1, IO_2, and IO_3. The Quad Enable (QE) bit in Status Register-2 must be set to 1 before the device will accept the Fast Read Quad Output Instruction. The Fast Read Quad Output Instruction allows data to be transferred at four times the rate of standard SPI devices.

The Fast Read Quad Output instruction can operate at the highest possible frequency of FR (see AC Electrical Characteristics). This is accomplished by adding eight "dummy" clocks after the 24/32-bit address as shown in Figure 20. The dummy clocks allow the device's internal circuits additional time for setting up the initial address. The input data during the dummy clocks is "don't care". However, the IO pins should be high-impedance prior to the falling edge of the first data out clock.

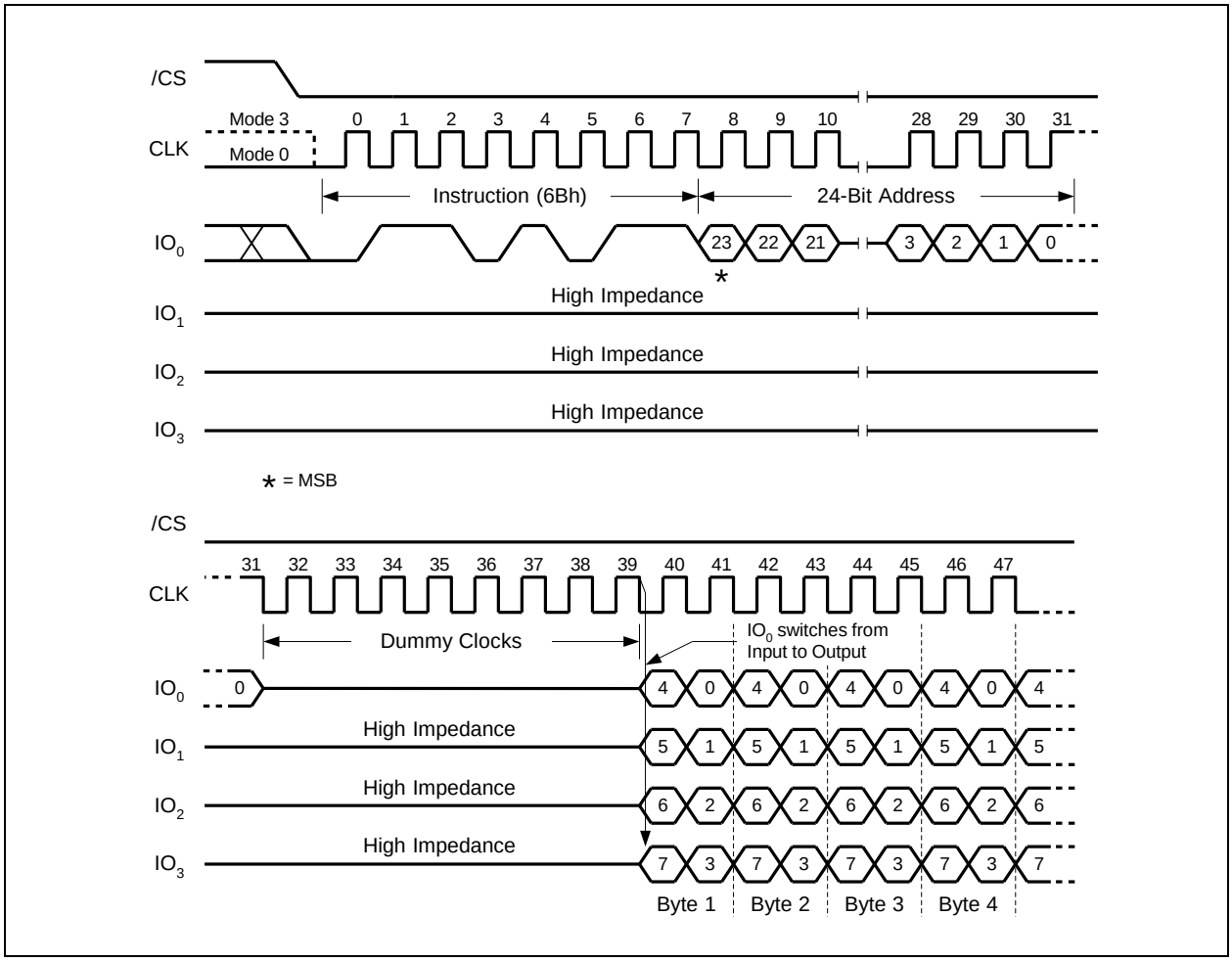


Figure 20. Fast Read Quad Output Instruction

32-Bit Address is required when the device is operating in 4-Byte Address Mode

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.17 Fast Read Quad Output with 4-Byte Address (6Ch)

The Fast Read Quad Output with 4-Byte Address instruction is similar to the Fast Read Quad Output instruction except that it requires 32-bit address instead of 24-bit address. No matter the device is operating in 3-Byte Address Mode or 4-byte Address Mode, the Fast Read Quad Output with 4-Byte Address instruction will always require 32-bit address to access the entire 256Mb memory.

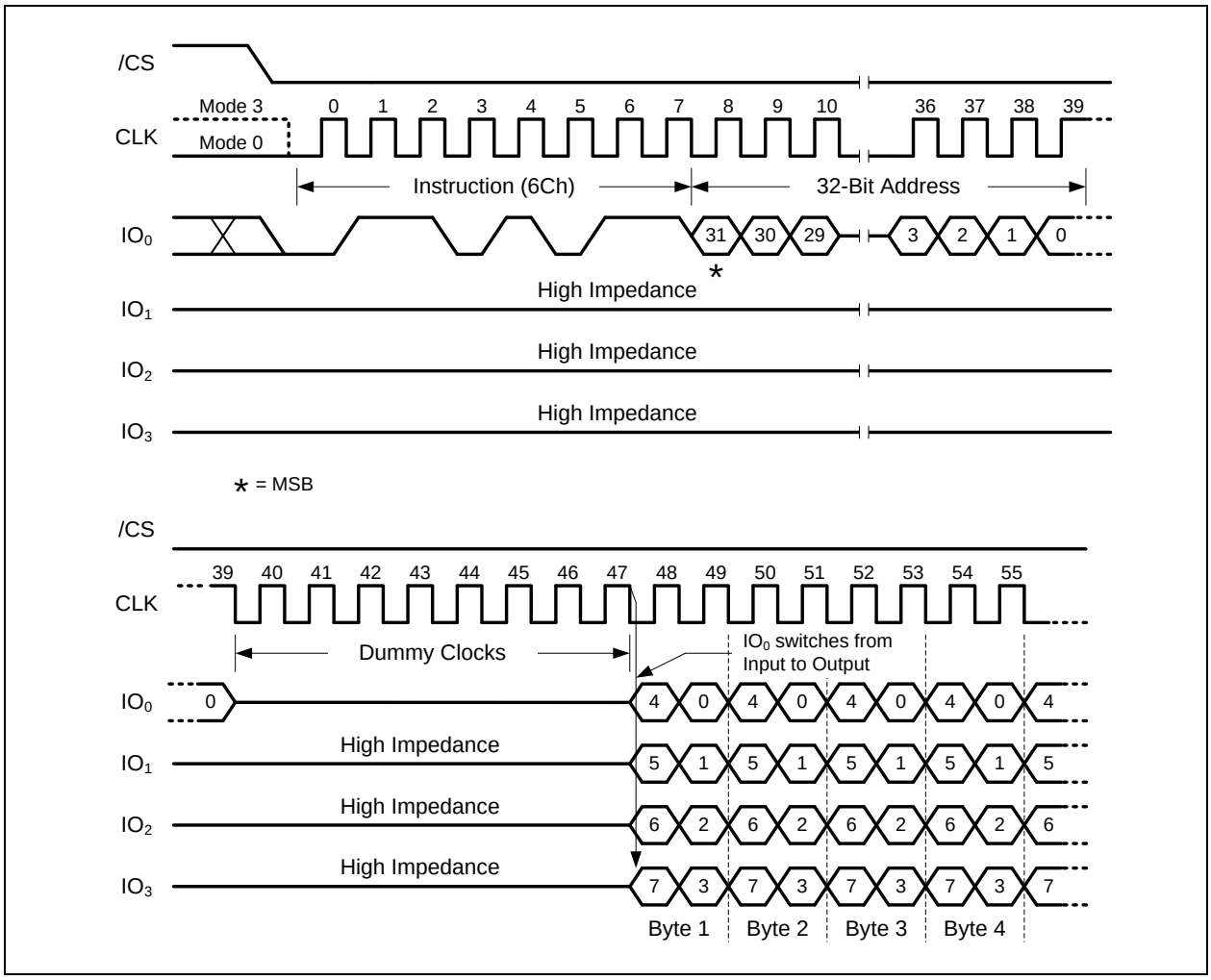


Figure 21. Fast Read Quad Output with 4-Byte Address Instruction

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.18 Fast Read Dual I/O (BBh)

The Fast Read Dual I/O (BBh) instruction allows for improved random access while maintaining two IO pins, IO_0 and IO_1. It is similar to the Fast Read Dual Output (3Bh) instruction but with the capability to input the Address bits (A23/A31-0) two bits per clock. This reduced instruction overhead may allow for code execution (XIP) directly from the Dual SPI in some applications.

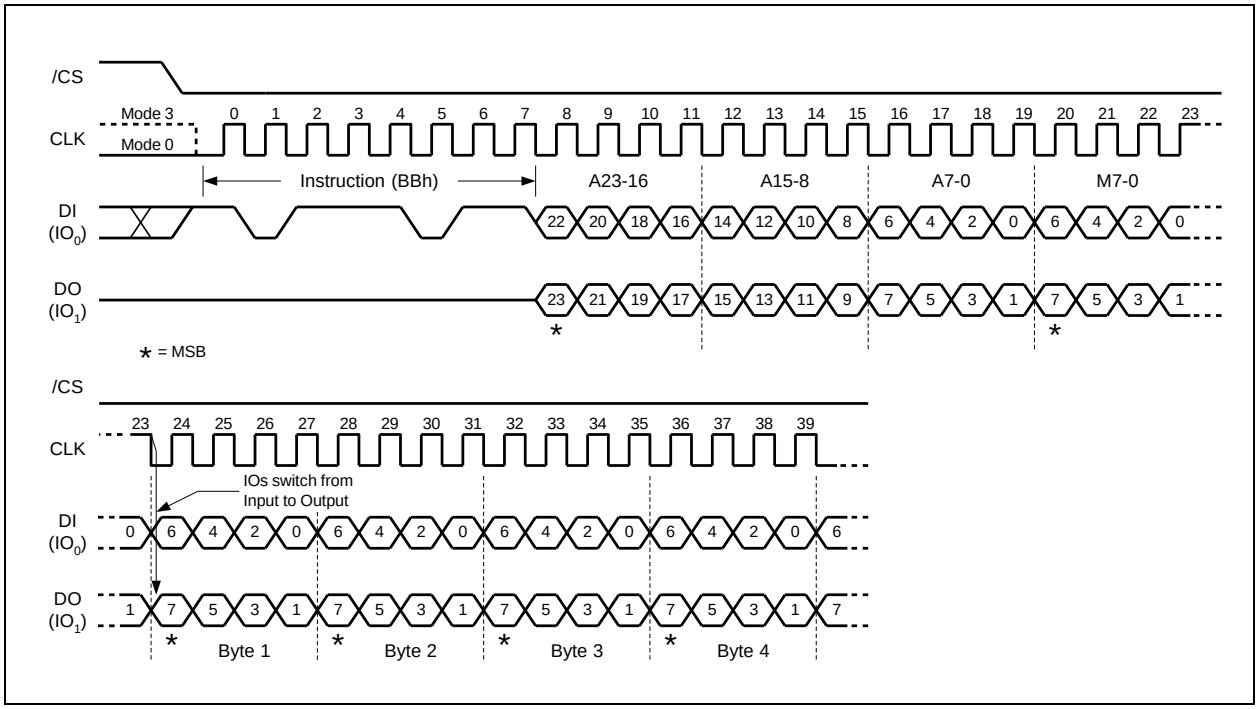


Figure 22a. Fast Read Dual I/O Instruction (Initial instruction or previous M5-4 ≠ 10)

32-Bit Address is required when the device is operating in 4-Byte Address Mode

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.19 Fast Read Dual I/O with 4-Byte Address (BCh)

The Fast Read Dual I/O with 4-Byte Address instruction is similar to the Fast Read Dual I/O instruction except that it requires 32-bit address instead of 24-bit address. No matter the device is operating in 3-Byte Address Mode or 4-byte Address Mode, the Fast Read Dual I/O with 4-Byte Address instruction will always require 32-bit address to access the entire 256Mb memory.

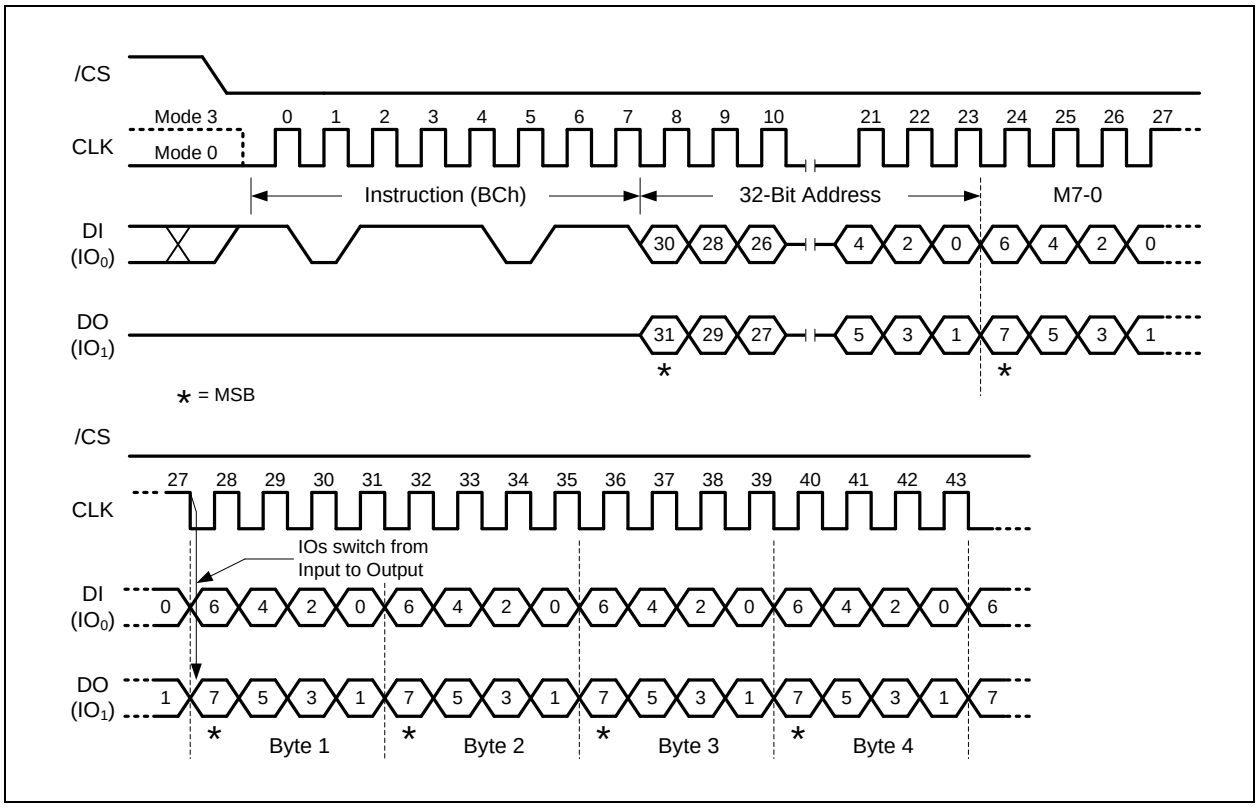


Figure 23a. Fast Read Dual I/O with 4-Byte Address Instruction (Initial instruction or previous M5-4 ≠ 10)

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.20 Fast Read Quad I/O (EBh)

The Fast Read Quad I/O (EBh) instruction is similar to the Fast Read Dual I/O (BBh) instruction except that address and data bits are input and output through four pins IO_0, IO_1, IO_2 and IO_3 and four Dummy clocks are required prior to the data output. The Quad I/O dramatically reduces instruction overhead allowing faster random access for code execution (XIP) directly from the Quad SPI. The Quad Enable bit (QE) of Status Register-2 must be set to enable the Fast Read Quad I/O Instruction.

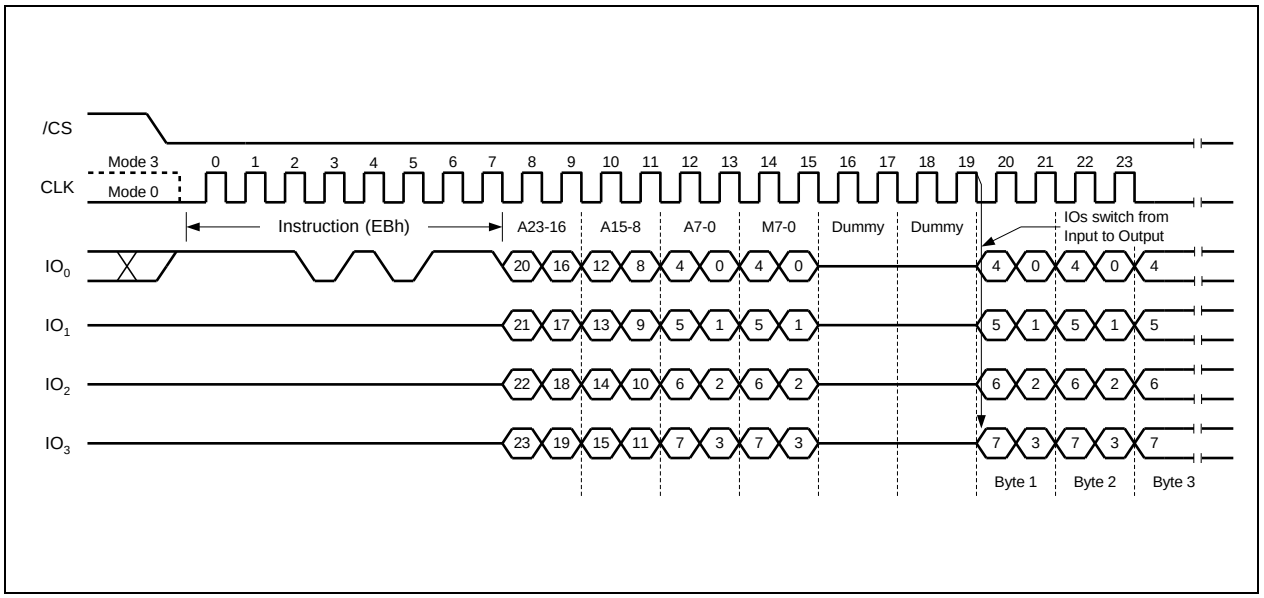


Figure 24a. Fast Read Quad I/O Instruction (Initial instruction or previous M5-4≠10)

32-Bit Address is required when the device is operating in 4-Byte Address Mode

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.21 Fast Read Quad I/O with 4-Byte Address (ECh)

The Fast Read Quad I/O with 4-Byte Address instruction is similar to the Fast Read Dual I/O instruction except that it requires 32-bit address instead of 24-bit address. No matter the device is operating in 3-Byte Address Mode or 4-byte Address Mode, the Fast Read Quad I/O with 4-Byte Address instruction will always require 32-bit address to access the entire 256Mb memory.

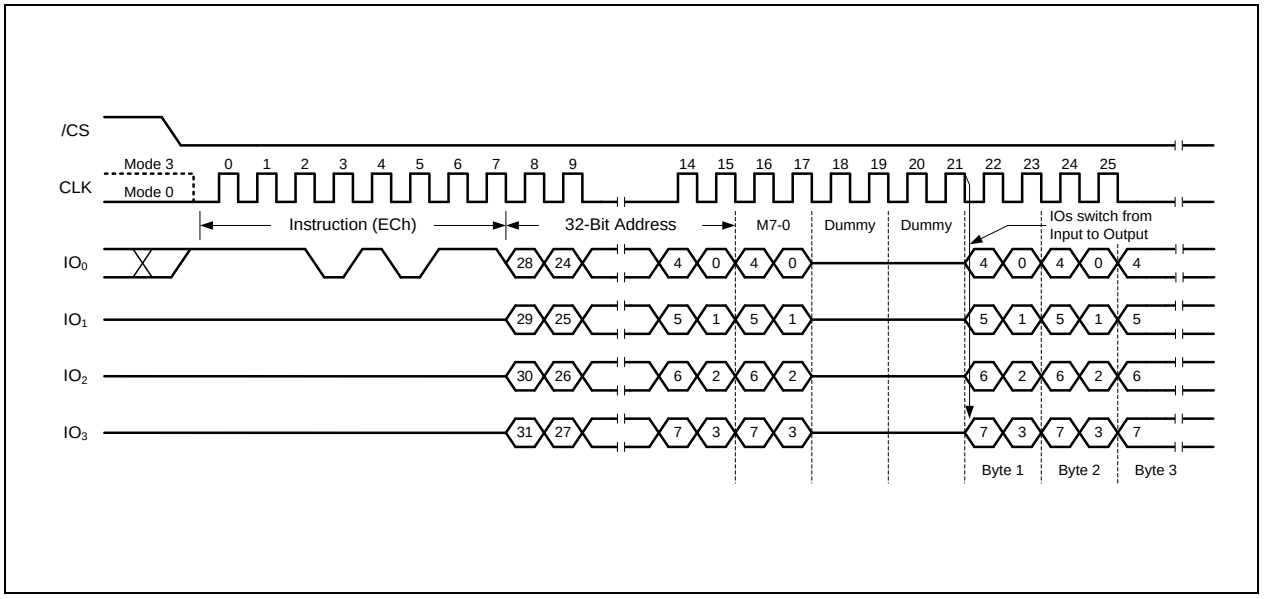


Figure 25a. Fast Read Quad I/O with 4-Byte Address Instruction (Initial instruction or previous M5-4≠10)

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.22 Page Program (02h)

The Page Program instruction allows from one byte to 256 bytes (a page) of data to be programmed at previously erased (FFh) memory locations. A Write Enable instruction must be executed before the device will accept the Page Program Instruction (Status Register bit WEL= 1). The instruction is initiated by driving the /CS pin low then shifting the instruction code “02h” followed by a 24/32-bit address (A23/A31-A0) and at least one data byte, into the DI pin. The /CS pin must be held low for the entire length of the instruction while data is being sent to the device. The Page Program instruction sequence is shown in Figure 29.

If an entire 256 byte page is to be programmed, the last address byte (the 8 least significant address bits) should be set to 0. If the last address byte is not zero, and the number of clocks exceeds the remaining page length, the addressing will wrap to the beginning of the page. In some cases, less than 256 bytes (a partial page) can be programmed without having any effect on other bytes within the same page. One condition to perform a partial page program is that the number of clocks cannot exceed the remaining page length. If more than 256 bytes are sent to the device the addressing will wrap to the beginning of the page and overwrite previously sent data.

As with the write and erase instructions, the /CS pin must be driven high after the eighth bit of the last byte has been latched. If this is not done the Page Program instruction will not be executed. After /CS is driven high, the self-timed Page Program instruction will commence for a time duration of tpp (See AC Characteristics). While the Page Program cycle is in progress, the Read Status Register instruction may still be accessed for checking the status of the BUSY bit. The BUSY bit is a 1 during the Page Program cycle and becomes a 0 when the cycle is finished and the device is ready to accept other instructions again. After the Page Program cycle has finished the Write Enable Latch (WEL) bit in the Status Register is cleared to 0. The Page Program instruction will not be executed if the addressed page is protected by the Block Protect (CMP, TB, BP3, BP2, BP1, and BP0) bits or the Individual Block/Sector Locks.

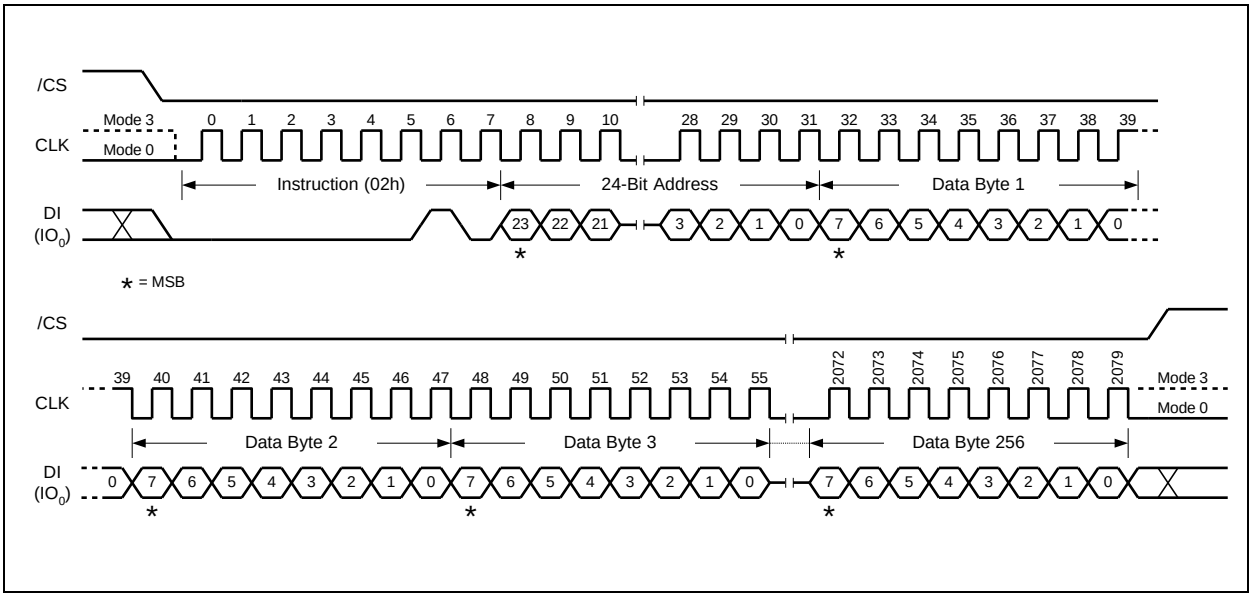


Figure 29a. Page Program Instruction

32-Bit Address is required when the device is operating in 4-Byte Address Mode

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.23 Quad Input Page Program (32h)

The Quad Page Program instruction allows up to 256 bytes of data to be programmed at previously erased (FFh) memory locations using four pins: IO_0, IO_1, IO_2, and IO_3. The Quad Page Program can improve performance for PROM Programmer and applications that have slow clock speeds <5MHz. Systems with faster clock speed will not realize much benefit for the Quad Page Program instruction since the inherent page program time is much greater than the time it take to clock-in the data.

To use Quad Page Program the Quad Enable (QE) bit in Status Register-2 must be set to 1. A Write Enable instruction must be executed before the device will accept the Quad Page Program instruction (Status Register-1, WEL=1). The instruction is initiated by driving the /CS pin low then shifting the instruction code "32h" followed by a 24/32-bit address (A23/A31-A0) and at least one data byte, into the IO pins. The /CS pin must be held low for the entire length of the instruction while data is being sent to the device. All other functions of Quad Page Program are identical to standard Page Program. The Quad Page Program instruction sequence is shown in Figure 30.

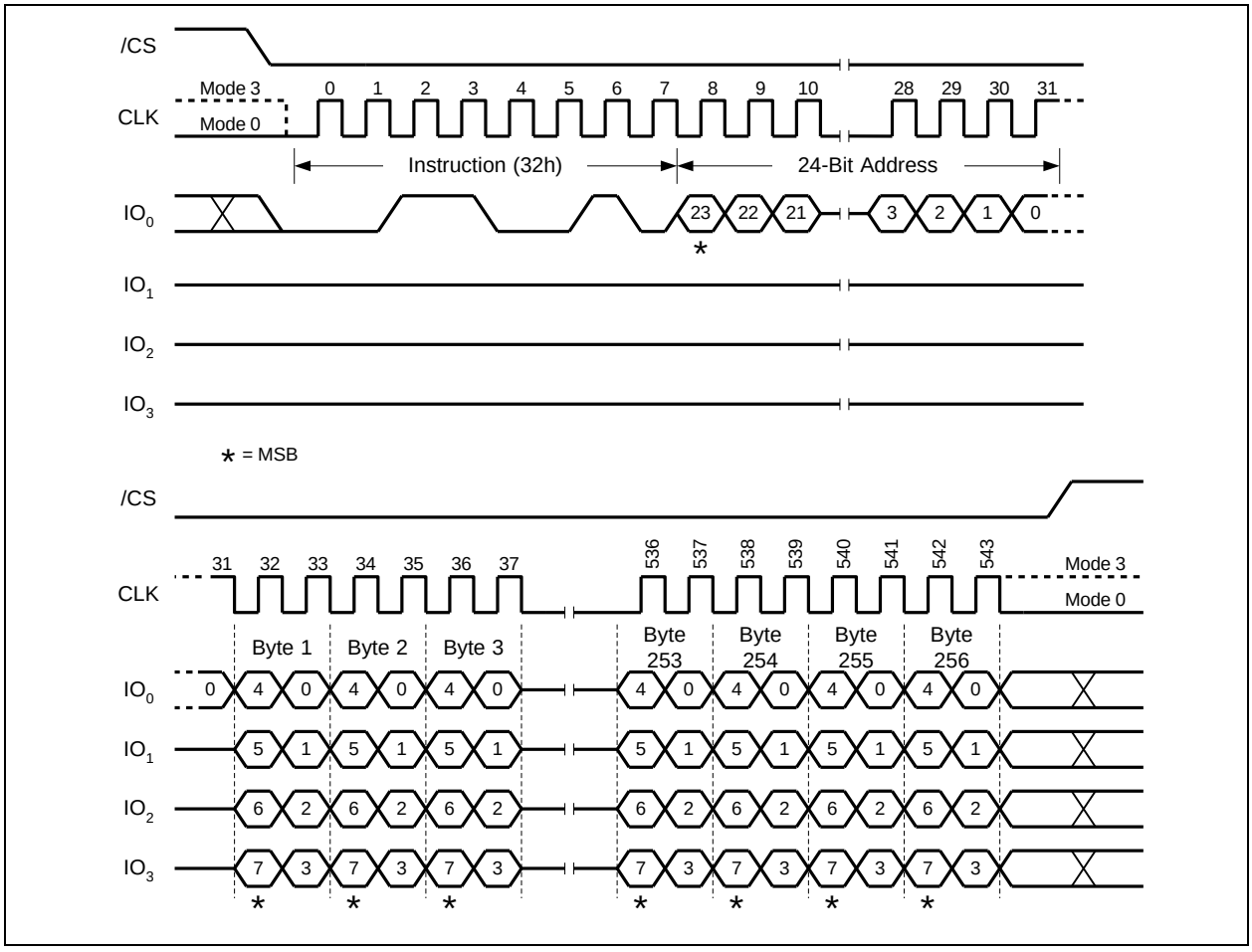


Figure 30. Quad Input Page Program Instruction

32-Bit Address is required when the device is operating in 4-Byte Address Mode

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.24 Sector Erase (20h)

The Sector Erase instruction sets all memory within a specified sector (4K-bytes) to the erased state of all 1s (FFh). A Write Enable instruction must be executed before the device will accept the Sector Erase Instruction (Status Register bit WEL must equal 1). The instruction is initiated by driving the /CS pin low and shifting the instruction code “20h” followed a 24/32-bit sector address (A23/A31-A0). The Sector Erase instruction sequence is shown in Figure 31a & 31b.

The /CS pin must be driven high after the eighth bit of the last byte has been latched. If this is not done the Sector Erase instruction will not be executed. After /CS is driven high, the self-timed Sector Erase instruction will commence for a time duration of t_{SE} (See AC Characteristics). While the Sector Erase cycle is in progress, the Read Status Register instruction may still be accessed for checking the status of the BUSY bit. The BUSY bit is a 1 during the Sector Erase cycle and becomes a 0 when the cycle is finished and the device is ready to accept other instructions again. After the Sector Erase cycle has finished the Write Enable Latch (WEL) bit in the Status Register is cleared to 0. The Sector Erase instruction will not be executed if the addressed page is protected by the Block Protect (CMP, TB, BP3, BP2, BP1, and BP0) bits or the Individual Block/Sector Locks.

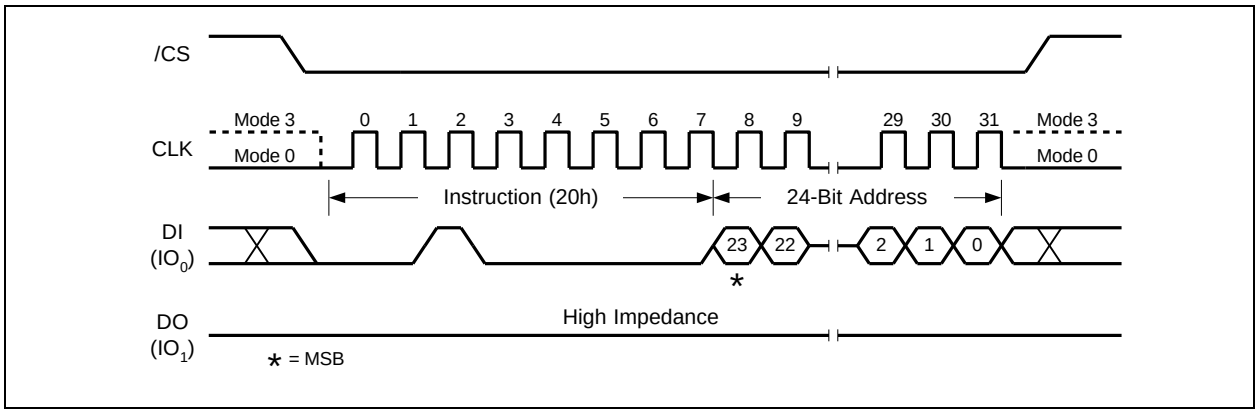


Figure 31a. Sector Erase Instruction

32-Bit Address is required when the device is operating in 4-Byte Address Mode

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.25 32KB Block Erase (52h)

The Block Erase instruction sets all memory within a specified block (32K-bytes) to the erased state of all 1s (FFh). A Write Enable instruction must be executed before the device will accept the Block Erase Instruction (Status Register bit WEL must equal 1). The instruction is initiated by driving the /CS pin low and shifting the instruction code “52h” followed a 24/32-bit block address (A23/A31-A0). The Block Erase instruction sequence is shown in Figure 32a & 32b.

The /CS pin must be driven high after the eighth bit of the last byte has been latched. If this is not done the Block Erase instruction will not be executed. After /CS is driven high, the self-timed Block Erase instruction will commence for a time duration of t_{BE1} (See AC Characteristics). While the Block Erase cycle is in progress, the Read Status Register instruction may still be accessed for checking the status of the BUSY bit. The BUSY bit is a 1 during the Block Erase cycle and becomes a 0 when the cycle is finished and the device is ready to accept other instructions again. After the Block Erase cycle has finished the Write Enable Latch (WEL) bit in the Status Register is cleared to 0. The Block Erase instruction will not be executed if the addressed page is protected by the Block Protect (CMP, TB, BP3, BP2, BP1, and BP0) bits or the Individual Block/Sector Locks.

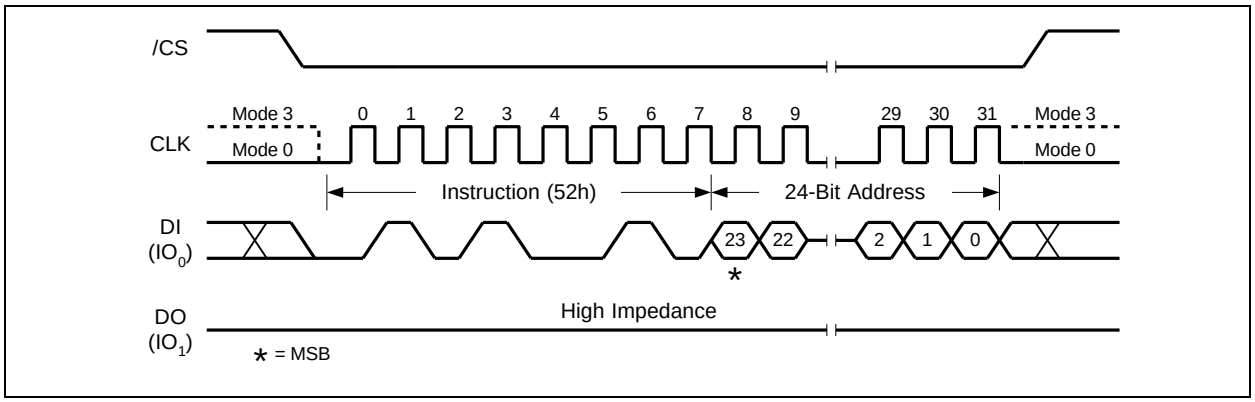


Figure 32a. 32KB Block Erase Instruction

32-Bit Address is required when the device is operating in 4-Byte Address Mode

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.26 64KB Block Erase (D8h)

The Block Erase instruction sets all memory within a specified block (64K-bytes) to the erased state of all 1s (FFh). A Write Enable instruction must be executed before the device will accept the Block Erase Instruction (Status Register bit WEL must equal 1). The instruction is initiated by driving the /CS pin low and shifting the instruction code “D8h” followed a 24/32-bit block address (A23/A31-A0). The Block Erase instruction sequence is shown in Figure 33a & 33b.

The /CS pin must be driven high after the eighth bit of the last byte has been latched. If this is not done the Block Erase instruction will not be executed. After /CS is driven high, the self-timed Block Erase instruction will commence for a time duration of t_{BE} (See AC Characteristics). While the Block Erase cycle is in progress, the Read Status Register instruction may still be accessed for checking the status of the BUSY bit. The BUSY bit is a 1 during the Block Erase cycle and becomes a 0 when the cycle is finished and the device is ready to accept other instructions again. After the Block Erase cycle has finished the Write Enable Latch (WEL) bit in the Status Register is cleared to 0. The Block Erase instruction will not be executed if the addressed page is protected by the Block Protect (CMP, TB, BP3, BP2, BP1, and BP0) bits or the Individual Block/Sector Locks.

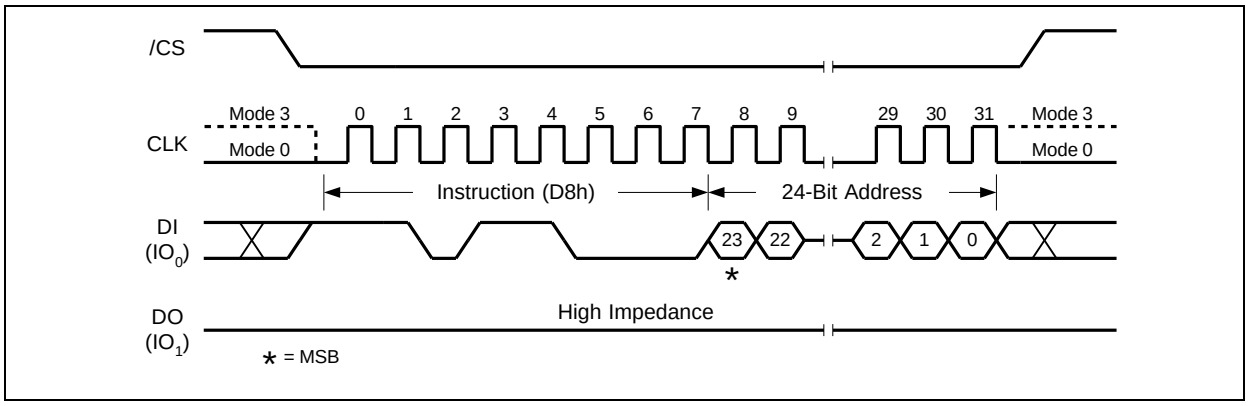


Figure 33a. 64KB Block Erase Instruction

32-Bit Address is required when the device is operating in 4-Byte Address Mode

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.27 Chip Erase (C7h / 60h)

The Chip Erase instruction sets all memory within the device to the erased state of all 1s (FFh). A Write Enable instruction must be executed before the device will accept the Chip Erase Instruction (Status Register bit WEL must equal 1). The instruction is initiated by driving the /CS pin low and shifting the instruction code “C7h” or “60h”. The Chip Erase instruction sequence is shown in Figure 34.

The /CS pin must be driven high after the eighth bit has been latched. If this is not done the Chip Erase instruction will not be executed. After /CS is driven high, the self-timed Chip Erase instruction will commence for a time duration of t_{CE} (See AC Characteristics). While the Chip Erase cycle is in progress, the Read Status Register instruction may still be accessed to check the status of the BUSY bit. The BUSY bit is a 1 during the Chip Erase cycle and becomes a 0 when finished and the device is ready to accept other instructions again. After the Chip Erase cycle has finished the Write Enable Latch (WEL) bit in the Status Register is cleared to 0. The Chip Erase instruction will not be executed if any memory region is protected by the Block Protect (CMP, TB, BP3, BP2, BP1, and BP0) bits or the Individual Block/Sector Locks.

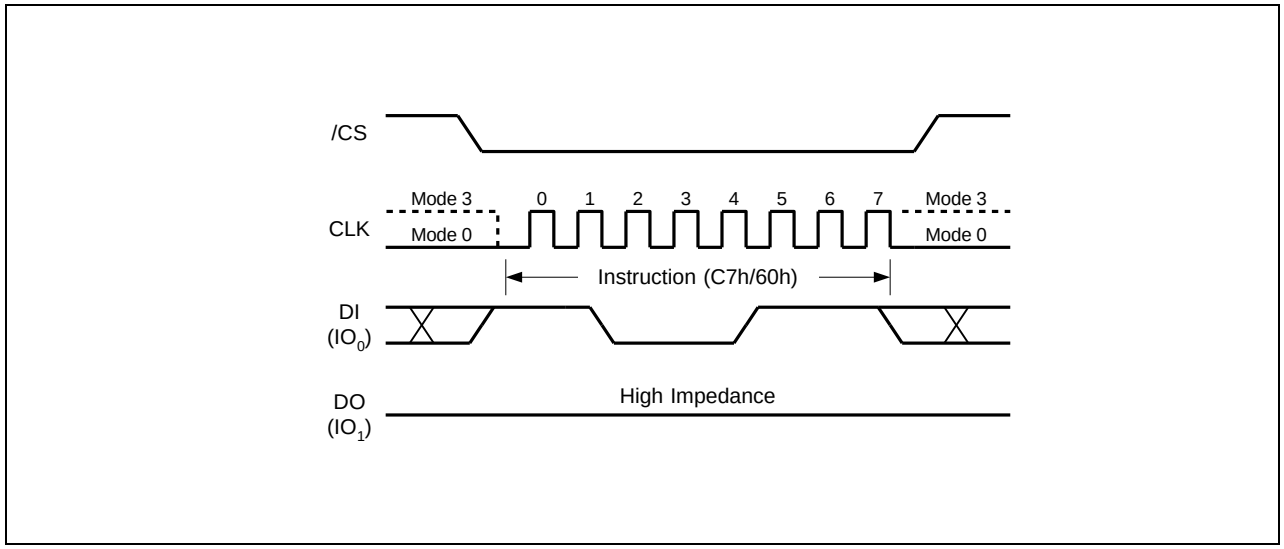


Figure 34. Chip Erase Instruction

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.28 Erase / Program Suspend (75h)

The Erase/Program Suspend instruction “75h”, allows the system to interrupt a Sector or Block Erase operation or a Page Program operation and then read from or program/erase data to, any other sectors or blocks. The Erase/Program Suspend instruction sequence is shown in Figure 35a & 35b.

The Write Status Register instruction (01h) and Erase instructions (20h, 52h, D8h, C7h, 60h, 44h) are not allowed during Erase Suspend. Erase Suspend is valid only during the Sector or Block erase operation. If written during the Chip Erase operation, the Erase Suspend instruction is ignored. The Write Status Register instruction (01h) and Program instructions (02h, 32h, 42h) are not allowed during Program Suspend. Program Suspend is valid only during the Page Program or Quad Page Program operation.

The Erase/Program Suspend instruction “75h” will be accepted by the device only if the SUS bit in the Status Register equals to 0 and the BUSY bit equals to 1 while a Sector or Block Erase or a Page Program operation is on-going. If the SUS bit equals to 1 or the BUSY bit equals to 0, the Suspend instruction will be ignored by the device. A maximum of time of “t_{SUS}” (See AC Characteristics) is required to suspend the erase or program operation. The BUSY bit in the Status Register will be cleared from 1 to 0 within “t_{SUS}” and the SUS bit in the Status Register will be set from 0 to 1 immediately after Erase/Program Suspend. For a previously resumed Erase/Program operation, it is also required that the Suspend instruction “75h” is not issued earlier than a minimum of time of “t_{SUS}” following the preceding Resume instruction “7Ah”.

Unexpected power off during the Erase/Program suspend state will reset the device and release the suspend state. SUS bit in the Status Register will also reset to 0. The data within the page, sector or block that was being suspended may become corrupted. It is recommended for the user to implement system design techniques against the accidental power interruption and preserve data integrity during erase/program suspend state. Note that once the Suspend instruction (75h) is accepted, the following Power-down instruction (B9h) will be ignored.

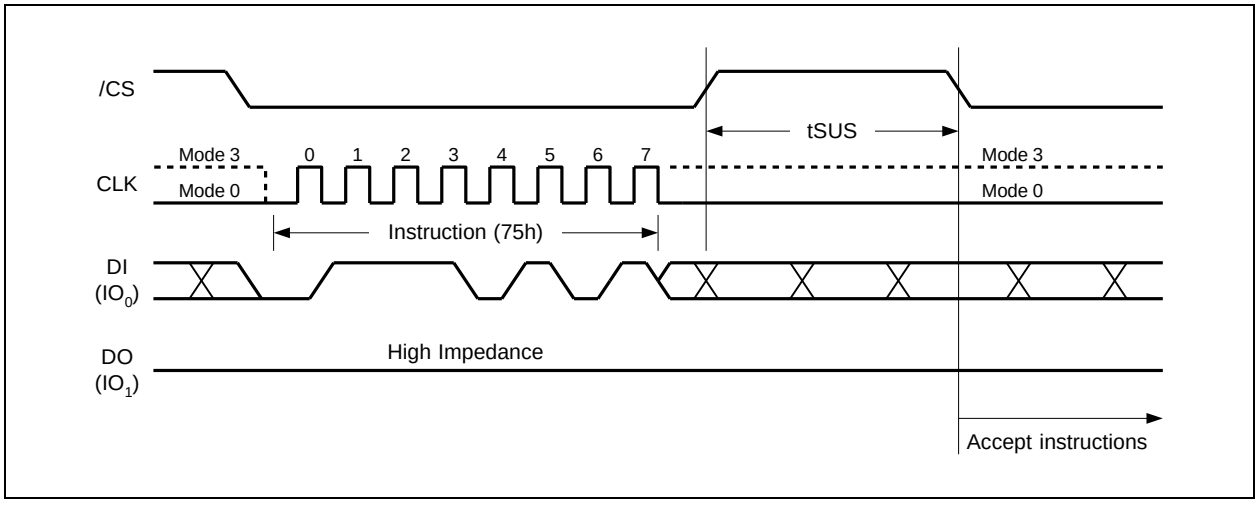


Figure 35a. Erase/Program Suspend Instruction

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.29 Erase / Program Resume (7Ah)

The Erase/Program Resume instruction “7Ah” must be written to resume the Sector or Block Erase operation or the Page Program operation after an Erase/Program Suspend. The Resume instruction “7Ah” will be accepted by the device only if the SUS bit in the Status Register equals to 1 and the BUSY bit equals to 0. After issued the SUS bit will be cleared from 1 to 0 immediately, the BUSY bit will be set from 0 to 1 within 200ns and the Sector or Block will complete the erase operation or the page will complete the program operation. If the SUS bit equals to 0 or the BUSY bit equals to 1, the Resume instruction “7Ah” will be ignored by the device. The Erase/Program Resume instruction sequence is shown in Figure 36a & 36b.

Resume instruction is ignored if the previous Erase/Program Suspend operation was interrupted by unexpected power off. It is also required that a subsequent Erase/Program Suspend instruction not to be issued with in a minimum of time of “t_{SUS}” following a previous Resume instruction.

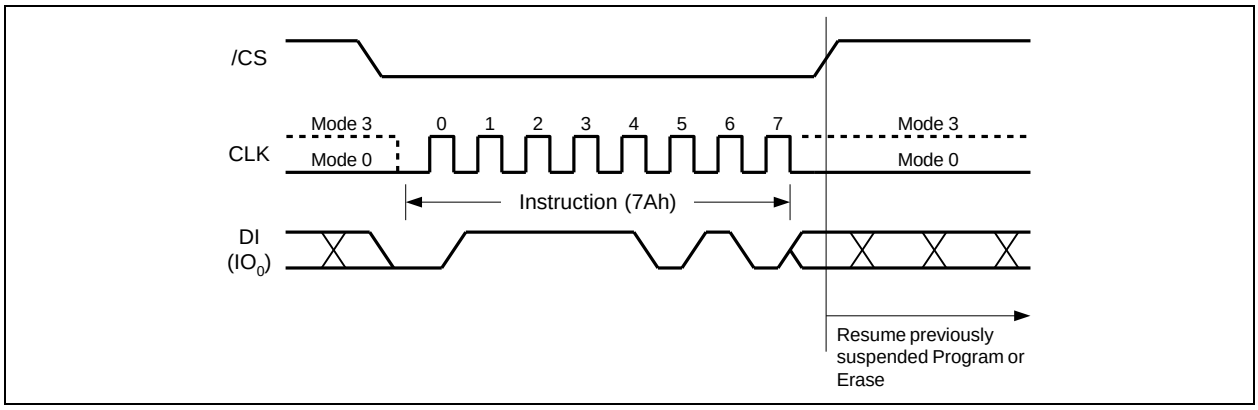


Figure 36a. Erase/Program Resume Instruction

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.30 Power-down (B9h)

Although the standby current during normal operation is relatively low, standby current can be further reduced with the Power-down instruction. The lower power consumption makes the Power-down instruction especially useful for battery powered applications (See ICC1 and ICC2 in AC Characteristics). The instruction is initiated by driving the /CS pin low and shifting the instruction code “B9h” as shown in Figure 37a & 37b.

The /CS pin must be driven high after the eighth bit has been latched. If this is not done the Power-down instruction will not be executed. After /CS is driven high, the power-down state will entered within the time duration of t_{DP} (See AC Characteristics). While in the power-down state only the Release Power-down / Device ID (ABh) instruction, which restores the device to normal operation, will be recognized. All other instructions are ignored. This includes the Read Status Register instruction, which is always available during normal operation. Ignoring all but one instruction makes the Power Down state a useful condition for securing maximum write protection. The device always powers-up in the normal operation with the standby current of ICC1. After the Power-down instruction is accepted, the device will lose all the current volatile Status Register bits, please refer to section 7.1. Note that once the Suspend instruction (75h) is accepted, the following Power-down instruction (B9h) will be ignored.

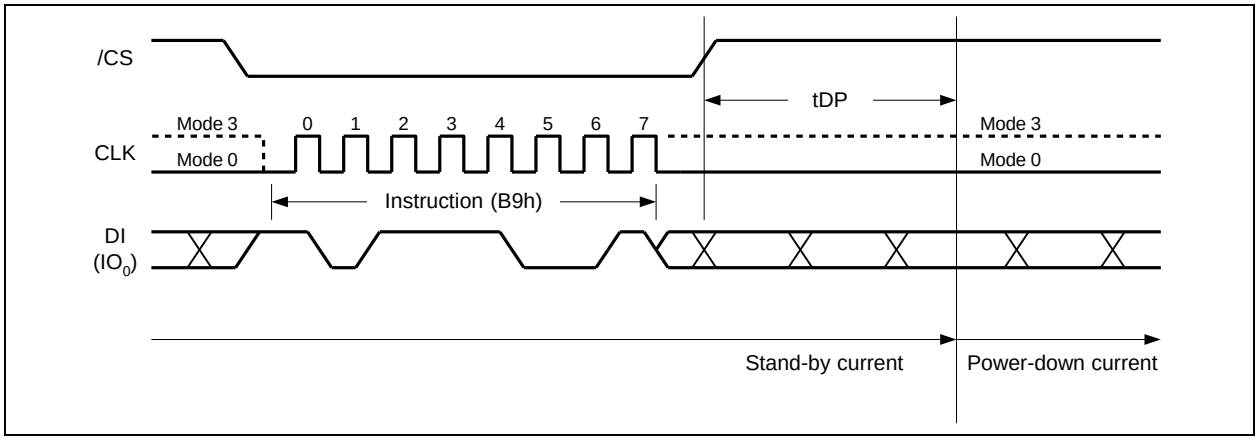


Figure 37a. Deep Power-down Instruction

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.31 Release Power-down / Device ID (ABh)

The Release from Power-down / Device ID instruction is a multi-purpose instruction. It can be used to release the device from the power-down state, or obtain the devices electronic identification (ID) number.

To release the device from the power-down state, the instruction is issued by driving the /CS pin low, shifting the instruction code “ABh” and driving /CS high as shown in Figure 38a & 38b. Release from power-down will take the time duration of t_{RES1} (See AC Characteristics) before the device will resume normal operation and other instructions are accepted. The /CS pin must remain high during the t_{RES1} time duration.

When used only to obtain the Device ID while not in the power-down state, the instruction is initiated by driving the /CS pin low and shifting the instruction code “ABh” followed by 3-dummy bytes. The Device ID bits are then shifted out on the falling edge of CLK with most significant bit (MSB) first. The Device ID values for the W25R256JW is listed in Manufacturer and Device Identification table. The Device ID can be read continuously. The instruction is completed by driving /CS high.

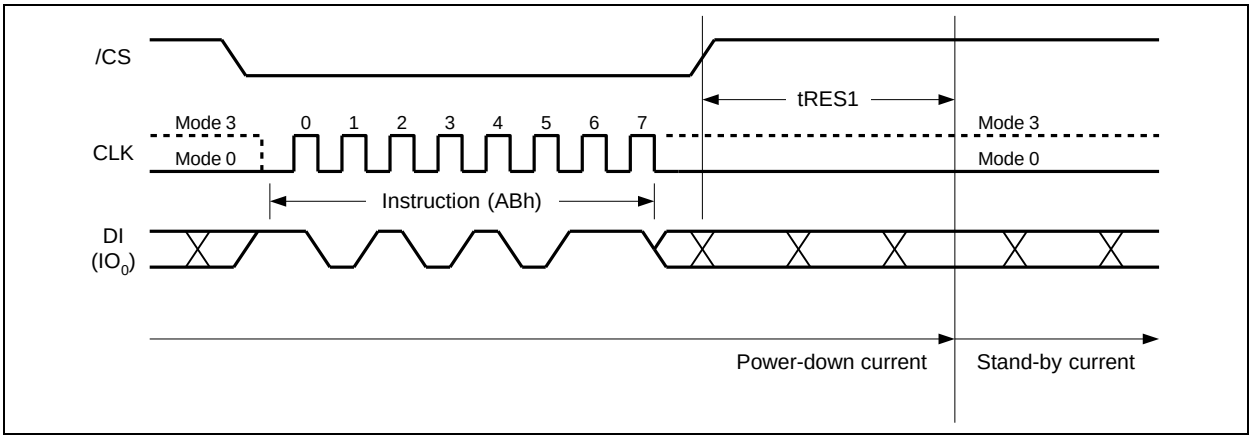


Figure 38a. Release Power-down Instruction

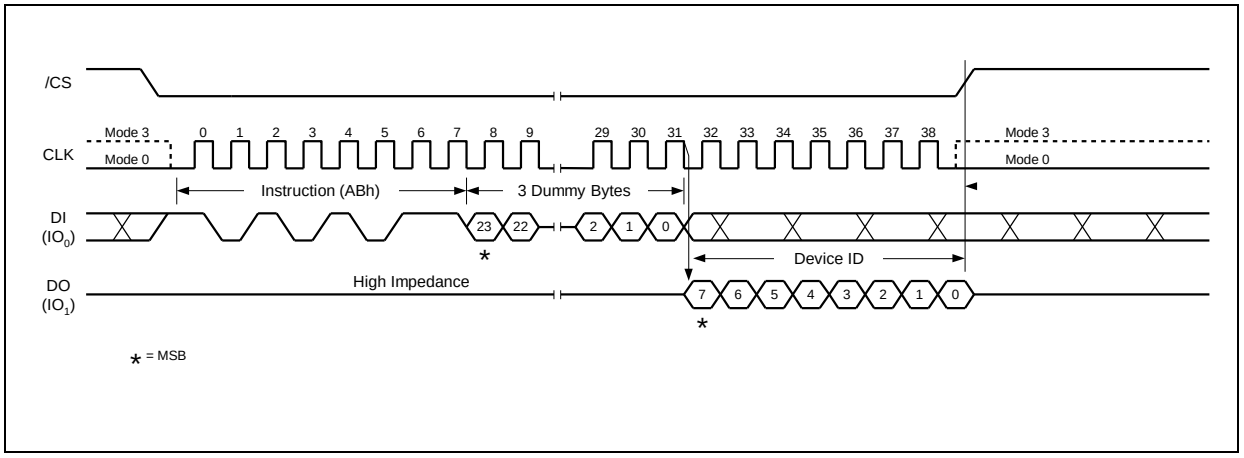


Figure 38b. Device ID Instruction

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.32 Read Manufacturer / Device ID (90h)

The Read Manufacturer/Device ID instruction is an alternative to the Release from Power-down / Device ID instruction that provides both the JEDEC assigned manufacturer ID and the specific device ID.

The Read Manufacturer/Device ID instruction is very similar to the Release from Power-down / Device ID instruction. The instruction is initiated by driving the /CS pin low and shifting the instruction code “90h” followed by a 24-bit address (A23-A0) of 000000h. After which, the Manufacturer ID for Winbond (EFh) and the Device ID are shifted out on the falling edge of CLK with most significant bit (MSB) first as shown in Figure 39. The Device ID values for the W25R256JW are listed in Manufacturer and Device Identification table. The instruction is completed by driving /CS high.

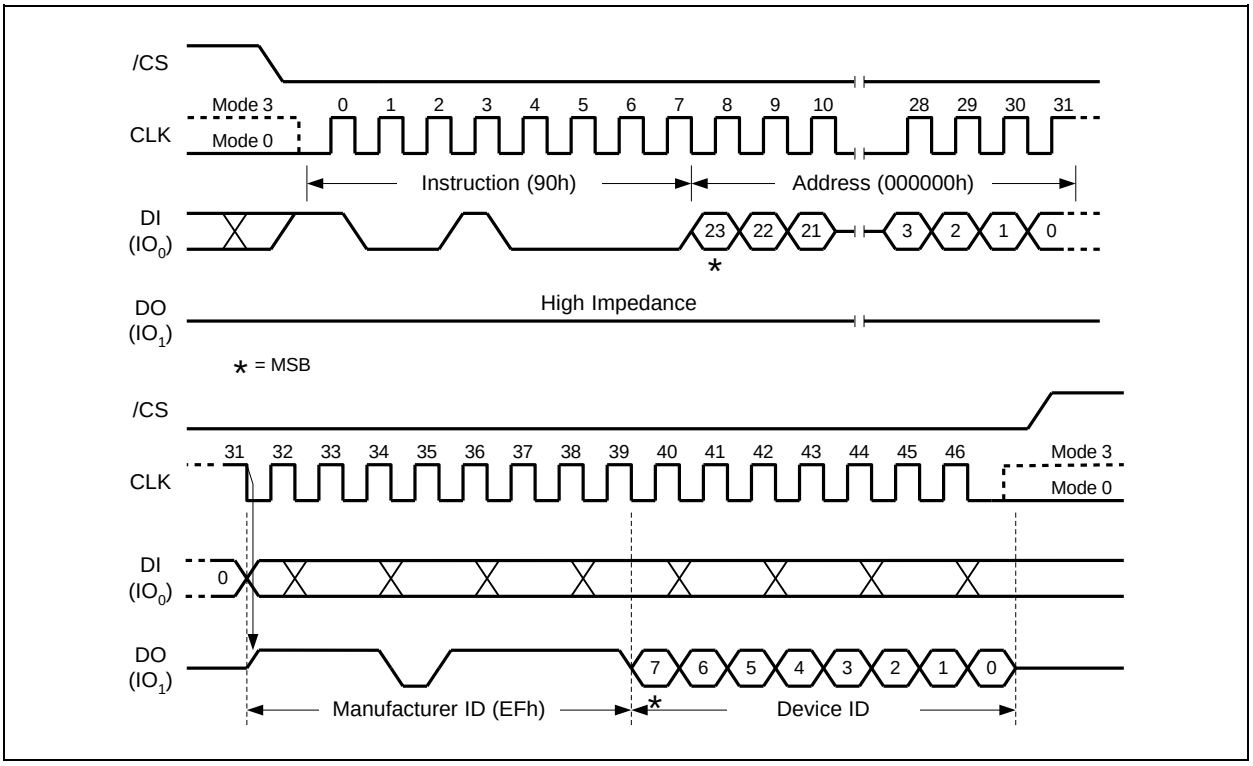


Figure 39. Read Manufacturer / Device ID Instruction

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.33 Read Manufacturer / Device ID Dual I/O (92h)

The Read Manufacturer / Device ID Dual I/O instruction is an alternative to the Read Manufacturer / Device ID instruction that provides both the JEDEC assigned manufacturer ID and the specific device ID at 2x speed.

The Read Manufacturer / Device ID Dual I/O instruction is similar to the Fast Read Dual I/O instruction. The instruction is initiated by driving the /CS pin low and shifting the instruction code “92h” followed by a 24/32-bit address (A23/A31-A0) of 000000h, but with the capability to input the Address bits two bits per clock. After which, the Manufacturer ID for Winbond (EFh) and the Device ID are shifted out 2 bits per clock on the falling edge of CLK with most significant bits (MSB) first as shown in Figure 40. The Device ID values for the W25R256JW are listed in Manufacturer and Device Identification table. The Manufacturer and Device IDs can be read continuously, alternating from one to the other. The instruction is completed by driving /CS high.

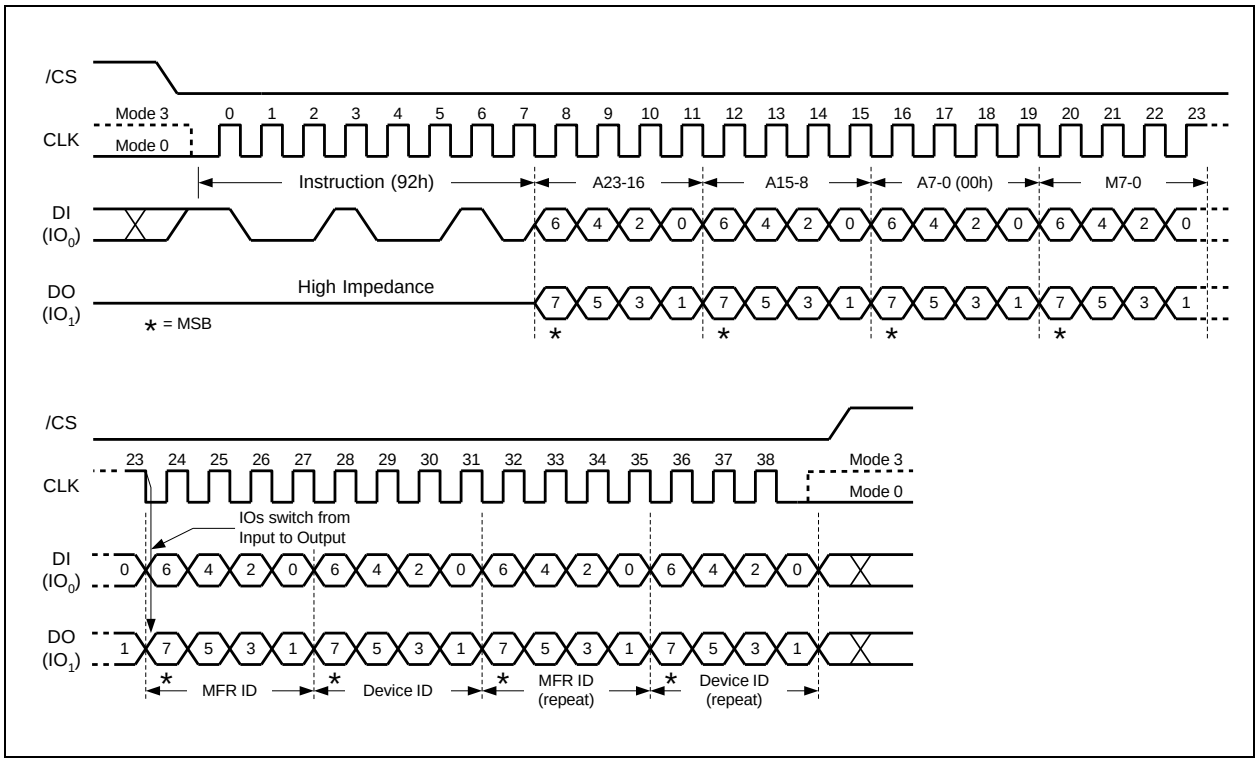


Figure 40. Read Manufacturer / Device ID Dual I/O Instruction

32-Bit Address is required when the device is operating in 4-Byte Address Mode

Note:

The “Continuous Read Mode” bits M(7-0) must be set to Fxh to be compatible with Fast Read Dual I/O instruction.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.34 Read Manufacturer / Device ID Quad I/O (94h)

The Read Manufacturer / Device ID Quad I/O instruction is an alternative to the Read Manufacturer / Device ID instruction that provides both the JEDEC assigned manufacturer ID and the specific device ID at 4x speed.

The Read Manufacturer / Device ID Quad I/O instruction is similar to the Fast Read Quad I/O instruction. The instruction is initiated by driving the /CS pin low and shifting the instruction code “94h” followed by a four clock dummy cycles and then a 24/32-bit address (A23/A31-A0) of 000000h, but with the capability to input the Address bits four bits per clock. After which, the Manufacturer ID for Winbond (EFh) and the Device ID are shifted out four bits per clock on the falling edge of CLK with most significant bit (MSB) first as shown in Figure 41. The Device ID values for the W25R256JW are listed in Manufacturer and Device Identification table. The Manufacturer and Device IDs can be read continuously, alternating from one to the other. The instruction is completed by driving /CS high.

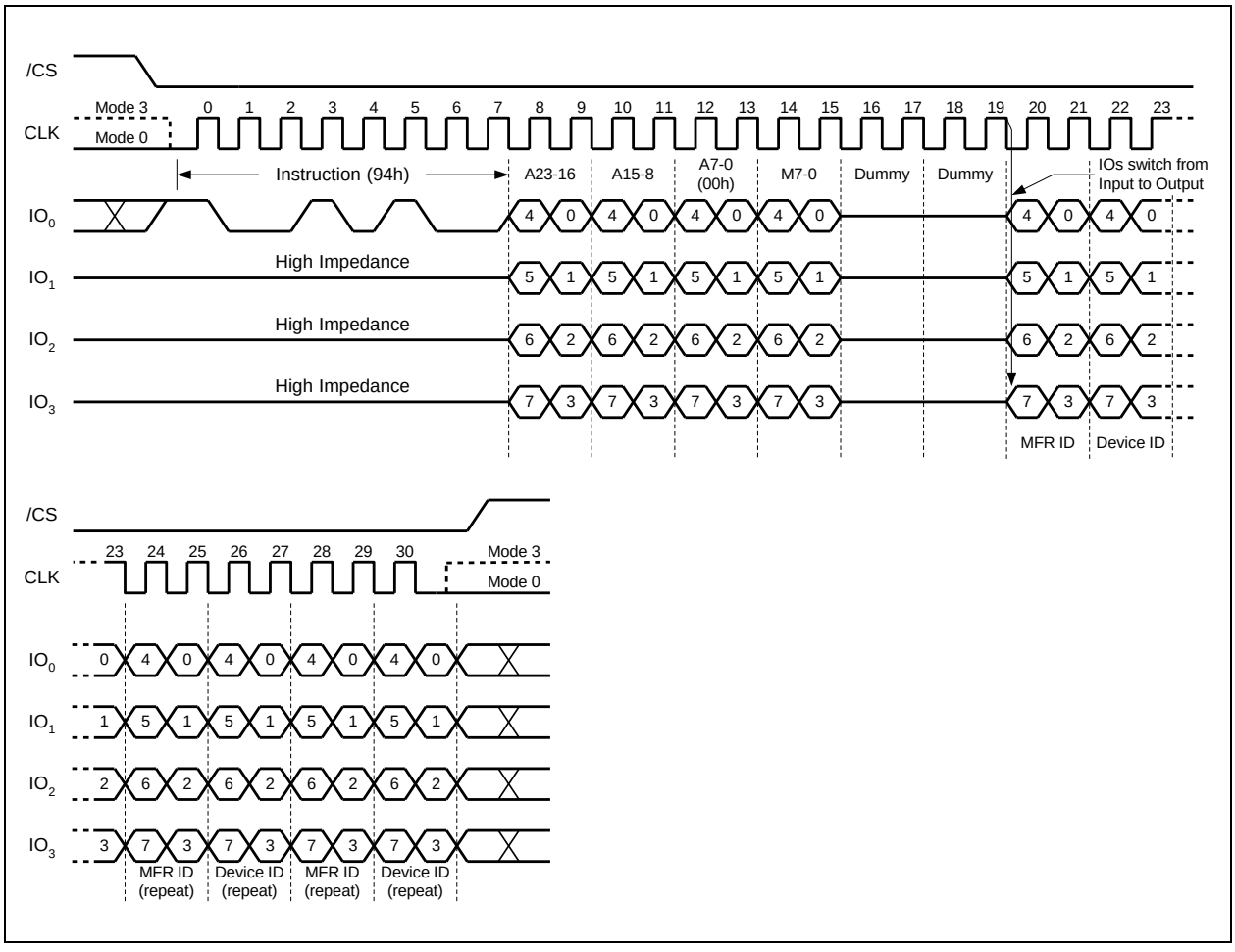


Figure 41. Read Manufacturer / Device ID Quad I/O Instruction

32-Bit Address is required when the device is operating in 4-Byte Address Mode

Note:

The “Continuous Read Mode” bits M(7-0) must be set to Fxh to be compatible with Fast Read Quad I/O instruction.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.35 Read Unique ID Number (4Bh)

The Read Unique ID Number instruction accesses a factory-set read-only 64-bit number that is unique to each W25R256JW device. The ID number can be used in conjunction with user software methods to help prevent copying or cloning of a system. The Read Unique ID instruction is initiated by driving the /CS pin low and shifting the instruction code “4Bh” followed by a four bytes of dummy clocks. After which, the 64-bit ID is shifted out on the falling edge of CLK as shown in Figure 42.

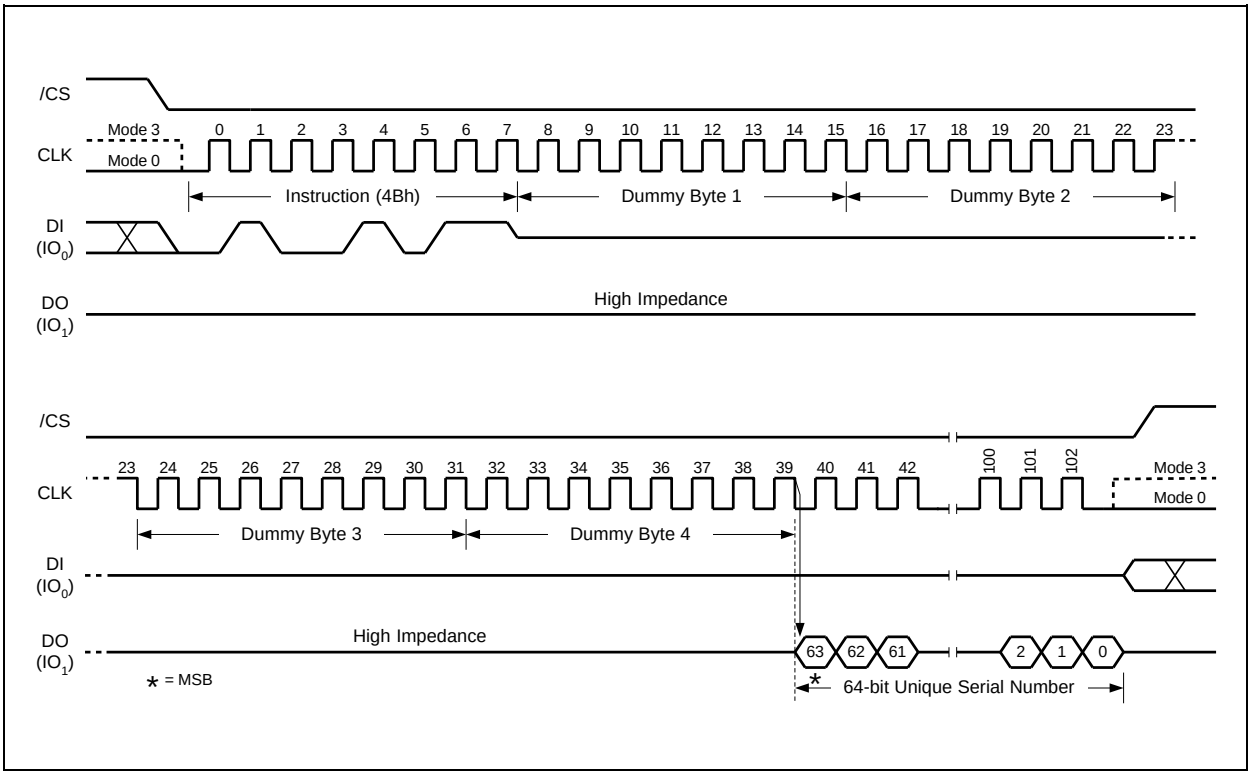


Figure 42. Read Unique ID Number Instruction

5 Dummy Bytes are required when the device is operating in 4-Byte Address Mode

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.36 Read JEDEC ID (9Fh)

For compatibility reasons, the W25R256JW provides several instructions to electronically determine the identity of the device. The Read JEDEC ID instruction is compatible with the JEDEC standard for SPI compatible serial memories that was adopted in 2003. The instruction is initiated by driving the /CS pin low and shifting the instruction code “9Fh”. The JEDEC assigned Manufacturer ID byte for Winbond (EFh) and two Device ID bytes, Memory Type (ID15-ID8) and Capacity (ID7-ID0) are then shifted out on the falling edge of CLK with most significant bit (MSB) first as shown in Figure 43a & 43b. For memory type and capacity values refer to Manufacturer and Device Identification table.

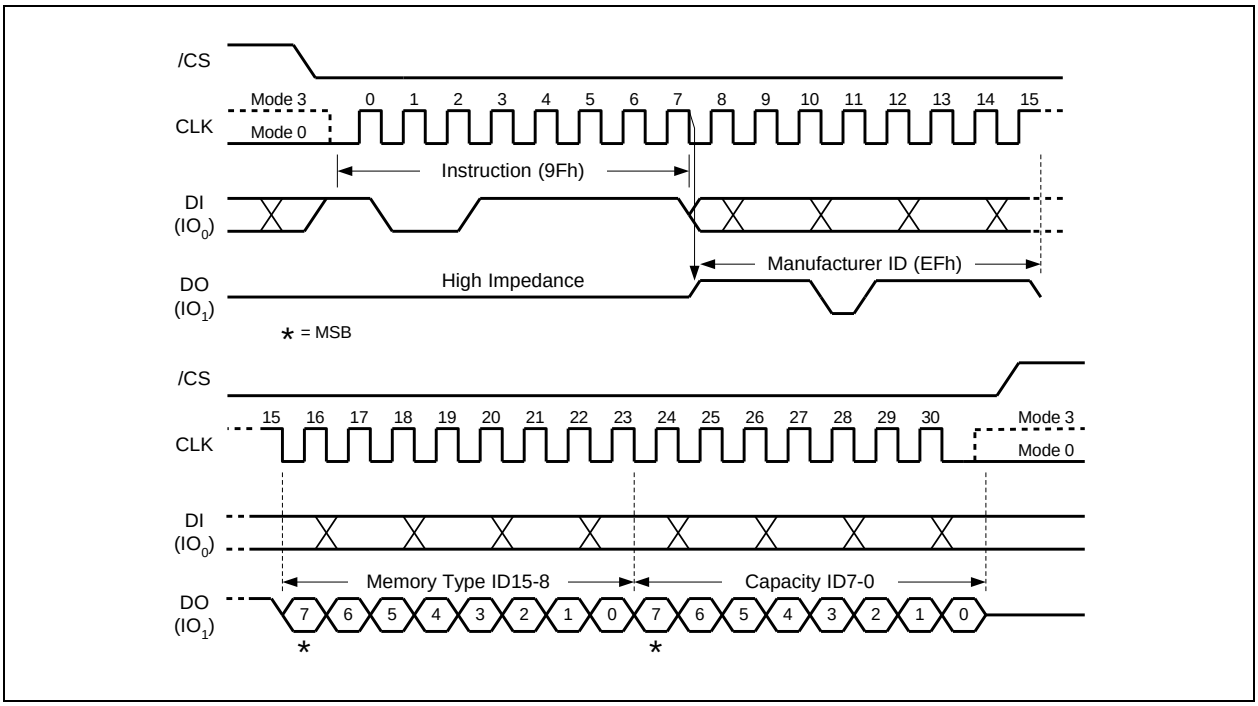


Figure 43a. Read JEDEC ID Instruction

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.37 Read SFDP Register (5Ah)

The W25R256JW features a 256-Byte Serial Flash Discoverable Parameter (SFDP) register that contains information about device configurations, available instructions and other features. The SFDP parameters are stored in one or more Parameter Identification (PID) tables. Currently only one PID table is specified, but more may be added in the future. The Read SFDP Register instruction is compatible with the SFDP standard initially established in 2010 for PC and other applications, as well as the JEDEC standard JESD216 that is published in 2011. Most Winbond SpiFlash Memories shipped after June 2011 (date code 1124 and beyond) support the SFDP feature as specified in the applicable datasheet.

The Read SFDP instruction is initiated by driving the /CS pin low and shifting the instruction code "5Ah" followed by a 24-bit address (A23-A0)(1) into the DI pin. Eight "dummy" clocks are also required before the SFDP register contents are shifted out on the falling edge of the 40th CLK with most significant bit (MSB) first as shown in Figure 44. For SFDP register values and descriptions, please refer to the Winbond Application Note for SFDP Definition Table.

Note: 1. A23-A8 = 0; A7-A0 are used to define the starting byte address for the 256-Byte SFDP Register.

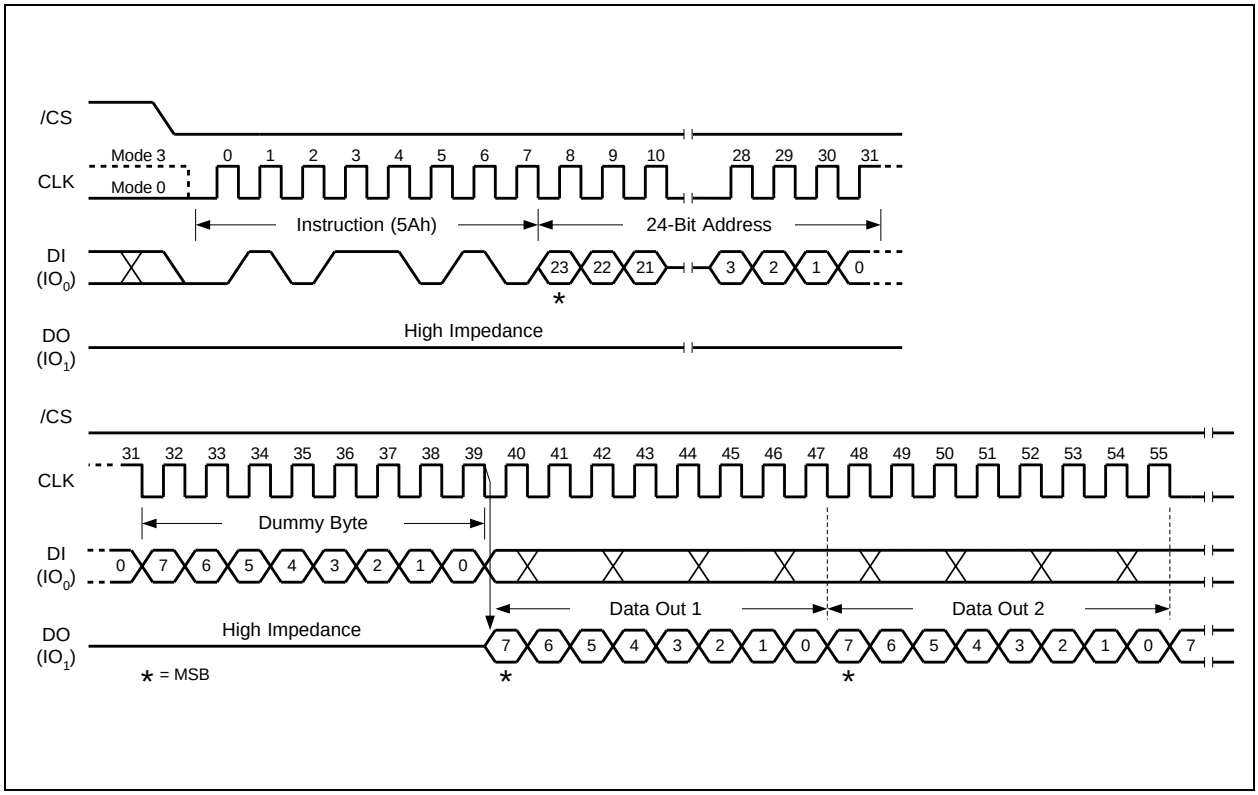


Figure 44. Read SFDP Register Instruction Sequence Diagram

Only 24-Bit Address is required when the device is operating in either 3-Byte or 4-Byte Address Mode

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.38 Erase Security Registers (44h)

The W25R256JW offers three 256-byte Security Registers which can be erased and programmed individually. These registers may be used by the system manufacturers to store security and other important information separately from the main memory array.

The Erase Security Register instruction is similar to the Sector Erase instruction. A Write Enable instruction must be executed before the device will accept the Erase Security Register Instruction (Status Register bit WEL must equal 1). The instruction is initiated by driving the /CS pin low and shifting the instruction code “44h” followed by a 24/32-bit address (A23/A31-A0) to erase one of the three security registers.

ADDRESS	{A23/A31}-16	A15-12	A11-8	A7-0
Security Register #1	00h	0 0 0 1	0 0 0 0	Don’t Care
Security Register #2	00h	0 0 1 0	0 0 0 0	Don’t Care
Security Register #3	00h	0 0 1 1	0 0 0 0	Don’t Care

The Erase Security Register instruction sequence is shown in Figure 45. The /CS pin must be driven high after the eighth bit of the last byte has been latched. If this is not done the instruction will not be executed. After /CS is driven high, the self-timed Erase Security Register operation will commence for a time duration of t_{SE} (See AC Characteristics). While the Erase Security Register cycle is in progress, the Read Status Register instruction may still be accessed for checking the status of the BUSY bit. The BUSY bit is a 1 during the erase cycle and becomes a 0 when the cycle is finished and the device is ready to accept other instructions again. After the Erase Security Register cycle has finished the Write Enable Latch (WEL) bit in the Status Register is cleared to 0. The Security Register Lock Bits (LB3-1) in the Status Register-2 can be used to OTP protect the security registers. Once a lock bit is set to 1, the corresponding security register will be permanently locked, Erase Security Register instruction to that register will be ignored (Refer to section 7.1.8 for detail descriptions).

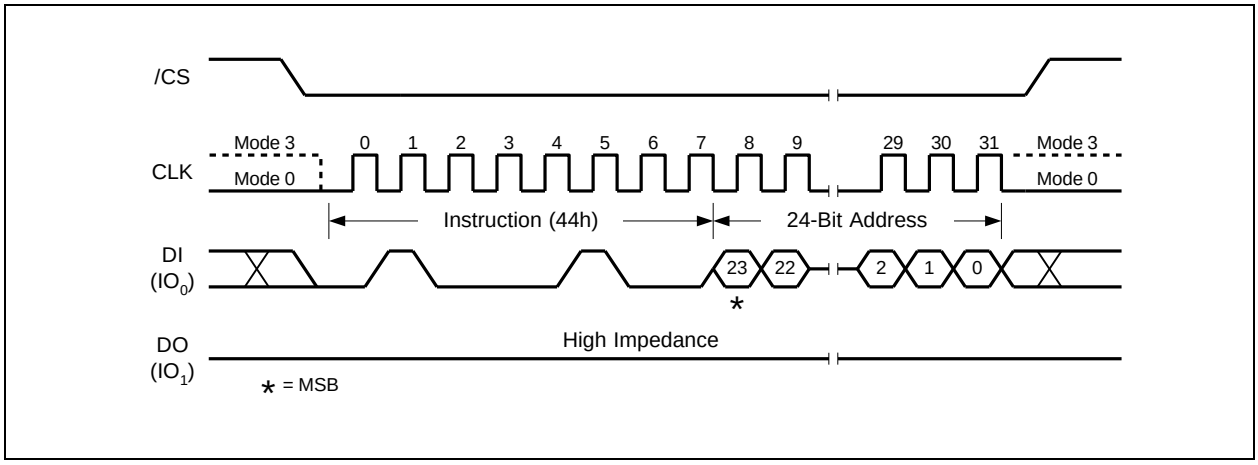


Figure 45. Erase Security Registers Instruction

32-Bit Address is required when the device is operating in 4-Byte Address Mode

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.39 Program Security Registers (42h)

The Program Security Register instruction is similar to the Page Program instruction. It allows from one byte to 256 bytes of security register data to be programmed at previously erased (FFh) memory locations. A Write Enable instruction must be executed before the device will accept the Program Security Register Instruction (Status Register bit WEL= 1). The instruction is initiated by driving the /CS pin low then shifting the instruction code "42h" followed by a 24/32-bit address (A23/A31-A0) and at least one data byte, into the DI pin. The /CS pin must be held low for the entire length of the instruction while data is being sent to the device.

ADDRESS	{A23/A31}-16	A15-12	A11-8	A7-0
Security Register #1	00h	0 0 0 1	0 0 0 0	Byte Address
Security Register #2	00h	0 0 1 0	0 0 0 0	Byte Address
Security Register #3	00h	0 0 1 1	0 0 0 0	Byte Address

The Program Security Register instruction sequence is shown in Figure 46. The Security Register Lock Bits (LB3-1) in the Status Register-2 can be used to OTP protect the security registers. Once a lock bit is set to 1, the corresponding security register will be permanently locked, Program Security Register instruction to that register will be ignored (See 7.1.8, 8.2.25 for detail descriptions).

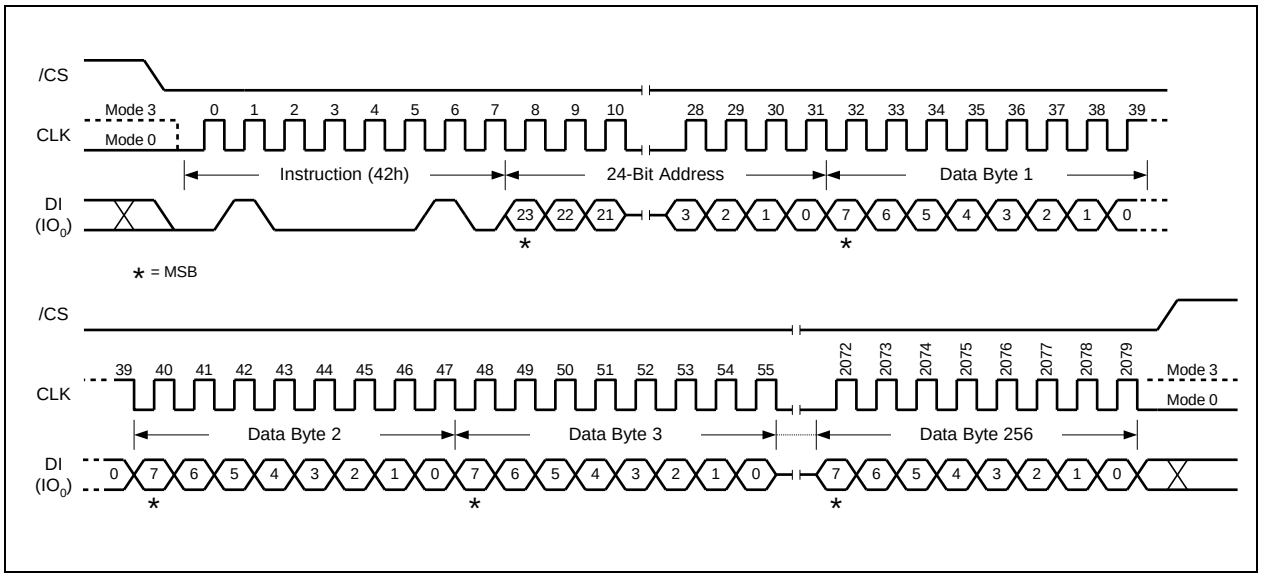


Figure 46. Program Security Registers Instruction

32-Bit Address is required when the device is operating in 4-Byte Address Mode

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.40 Read Security Registers (48h)

The Read Security Register instruction is similar to the Fast Read instruction and allows one or more data bytes to be sequentially read from one of the four security registers. The instruction is initiated by driving the /CS pin low and then shifting the instruction code “48h” followed by a 24/32-bit address (A23/A31-A0) and eight “dummy” clocks into the DI pin. The code and address bits are latched on the rising edge of the CLK pin. After the address is received, the data byte of the addressed memory location will be shifted out on the DO pin at the falling edge of CLK with most significant bit (MSB) first. The byte address is automatically incremented to the next byte address after each byte of data is shifted out. Once the byte address reaches the last byte of the register (byte address FFh), it will reset to address 00h, the first byte of the register, and continue to increment. The instruction is completed by driving /CS high. The Read Security Register instruction sequence is shown in Figure 47. If a Read Security Register instruction is issued while an Erase, Program or Write cycle is in process (BUSY=1) the instruction is ignored and will not have any effects on the current cycle. The Read Security Register instruction allows clock rates from D.C. to a maximum of FR (see AC Electrical Characteristics).

ADDRESS	{A23/A31}-16	A15-12	A11-8	A7-0
Security Register #1	00h	0 0 0 1	0 0 0 0	Byte Address
Security Register #2	00h	0 0 1 0	0 0 0 0	Byte Address
Security Register #3	00h	0 0 1 1	0 0 0 0	Byte Address

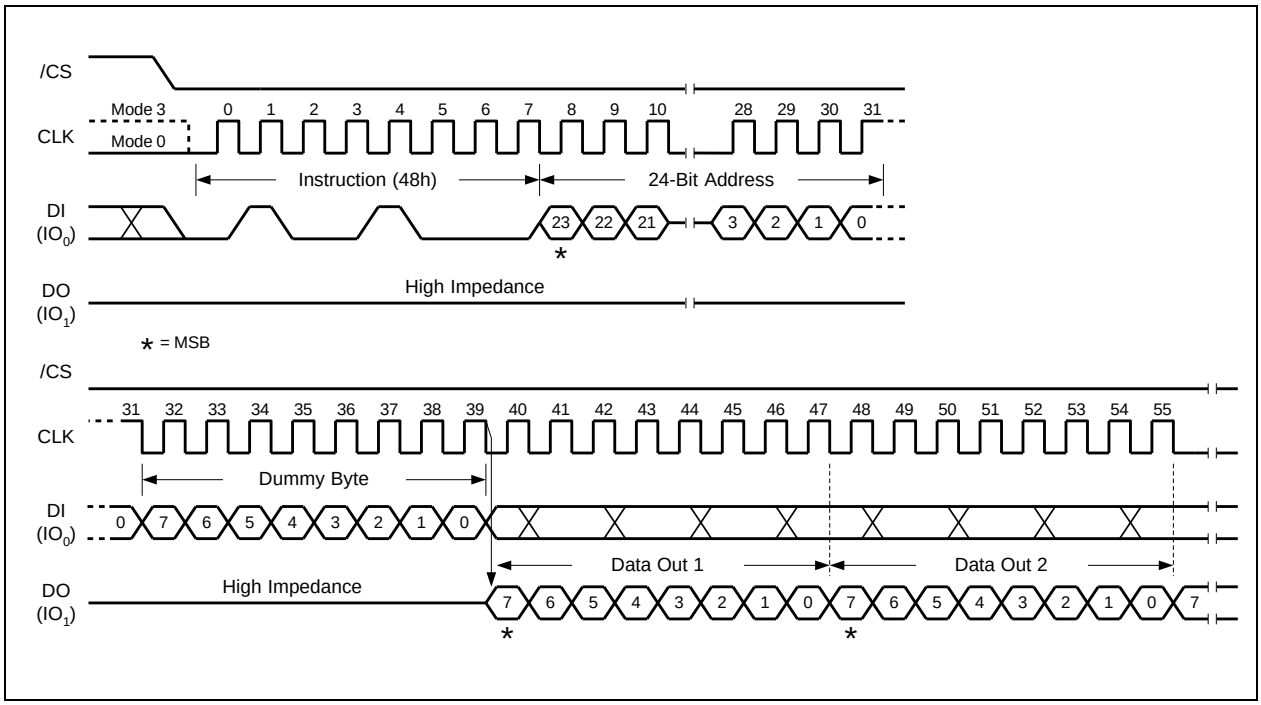


Figure 47. Read Security Registers Instruction

32-Bit Address is required when the device is operating in 4-Byte Address Mode

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.41 Individual Block/Sector Lock (36h)

The Individual Block/Sector Lock provides an alternative way to protect the memory array from adverse Erase/Program. In order to use the Individual Block/Sector Locks, the WPS bit in Status Register-3 must be set to 1. If WPS=0, the write protection will be determined by the combination of CMP, TB, BP[3:0] bits in the Status Registers. The Individual Block/Sector Lock bits are volatile bits. The default values after device power up or after a Reset are 1, so the entire memory array is being protected.

To lock a specific block or sector as illustrated in Figure 4d, an Individual Block/Sector Lock command must be issued by driving /CS low, shifting the instruction code “36h” into the Data Input (DI) pin on the rising edge of CLK, followed by a 24/32-bit address and then driving /CS high.

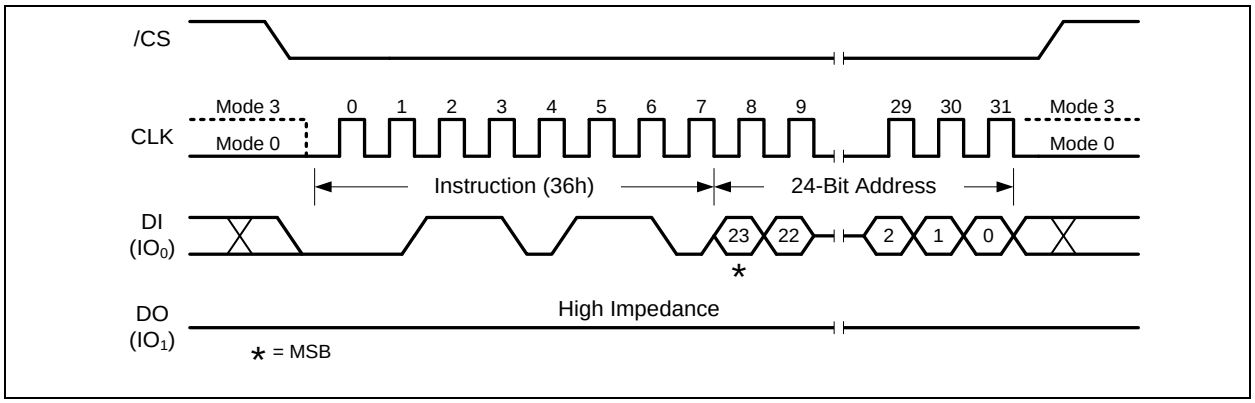


Figure 52a. Individual Block/Sector Lock Instruction

32-Bit Address is required when the device is operating in 4-Byte Address Mode

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.42 Individual Block/Sector Unlock (39h)

The Individual Block/Sector Lock provides an alternative way to protect the memory array from adverse Erase/Program. In order to use the Individual Block/Sector Locks, the WPS bit in Status Register-3 must be set to 1. If WPS=0, the write protection will be determined by the combination of CMP, TB, BP[3:0] bits in the Status Registers. The Individual Block/Sector Lock bits are volatile bits. The default values after device power up or after a Reset are 1, so the entire memory array is being protected.

To unlock a specific block or sector as illustrated in Figure 4d, an Individual Block/Sector Unlock command must be issued by driving /CS low, shifting the instruction code “39h” into the Data Input (DI) pin on the rising edge of CLK, followed by a 24/32-bit address and then driving /CS high.

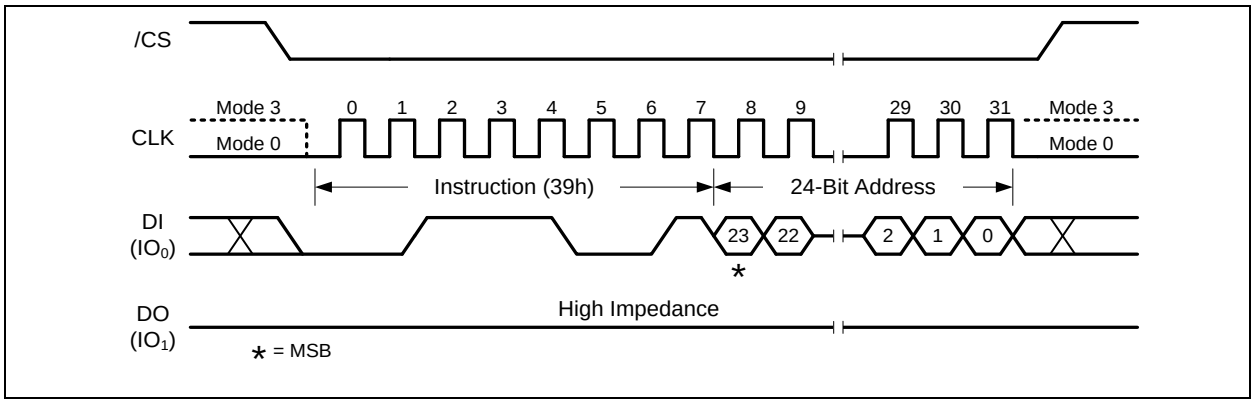


Figure 53a. Individual Block Unlock Instruction

32-Bit Address is required when the device is operating in 4-Byte Address Mode

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.43 Read Block/Sector Lock (3Dh)

The Individual Block/Sector Lock provides an alternative way to protect the memory array from adverse Erase/Program. In order to use the Individual Block/Sector Locks, the WPS bit in Status Register-3 must be set to 1. If WPS=0, the write protection will be determined by the combination of CMP, TB, BP[3:0] bits in the Status Registers. The Individual Block/Sector Lock bits are volatile bits. The default values after device power up or after a Reset are 1, so the entire memory array is being protected.

To read out the lock bit value of a specific block or sector as illustrated in Figure 4d, a Read Block/Sector Lock command must be issued by driving /CS low, shifting the instruction code “3Dh” into the Data Input (DI) pin on the rising edge of CLK, followed by a 24/32-bit address. The Block/Sector Lock bit value will be shifted out on the DO pin at the falling edge of CLK with most significant bit (MSB) first as shown in Figure 54. If the least significant bit (LSB) is 1, the corresponding block/sector is locked; if LSB=0, the corresponding block/sector is unlocked, Erase/Program operation can be performed.

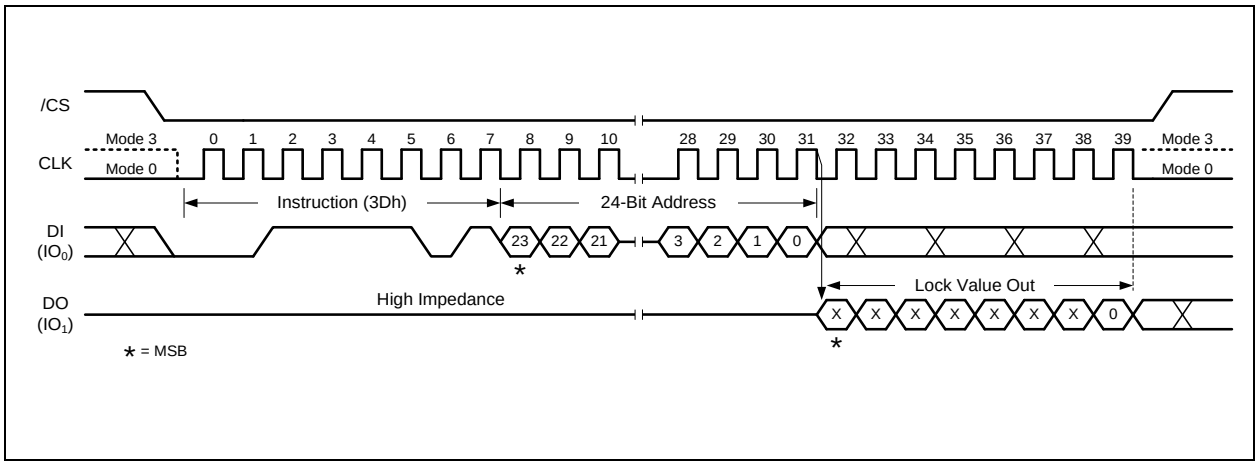


Figure 54a. Read Block Lock Instruction

32-Bit Address is required when the device is operating in 4-Byte Address Mode

8.2.44 Global Block/Sector Lock (7Eh)

All Block/Sector Lock bits can be set to 1 by the Global Block/Sector Lock instruction. The command must be issued by driving /CS low, shifting the instruction code “7Eh” into the Data Input (DI) pin on the rising edge of CLK, and then driving /CS high.

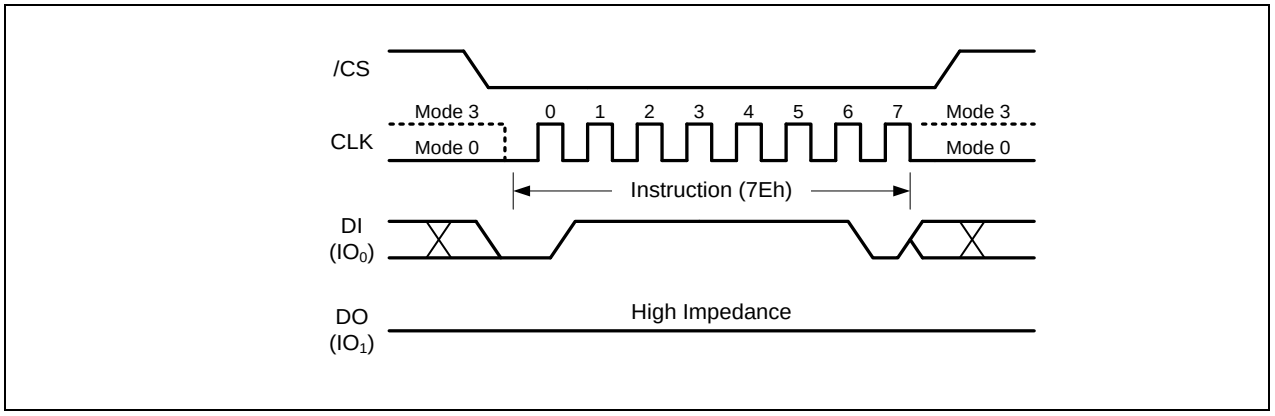


Figure 55. Global Block Lock Instruction

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.45 Global Block/Sector Unlock (98h)

All Block/Sector Lock bits can be set to 0 by the Global Block/Sector Unlock instruction. The command must be issued by driving /CS low, shifting the instruction code “98h” into the Data Input (DI) pin on the rising edge of CLK, and then driving /CS high.

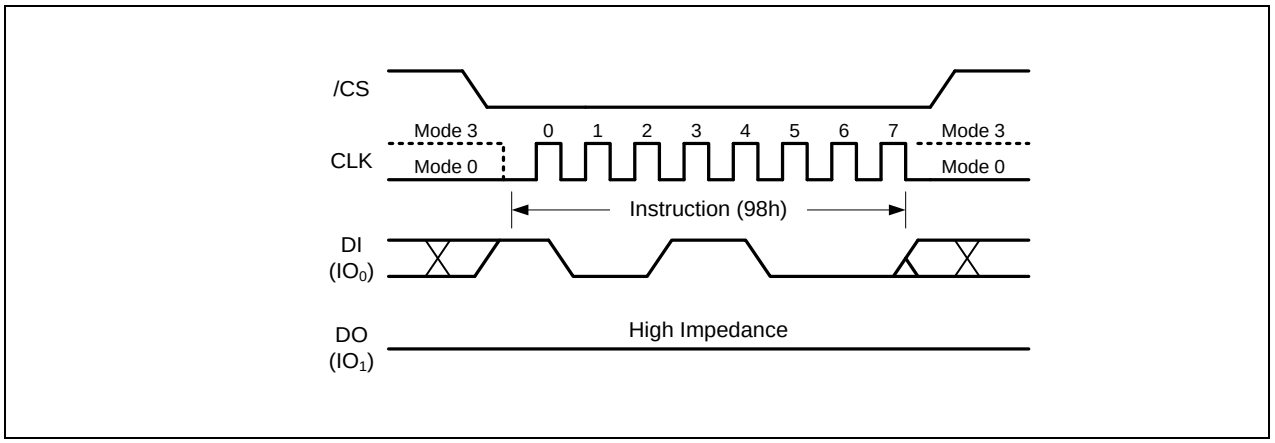


Figure 56. Global Block Unlock Instruction

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.46 Enable Reset (66h) and Reset Device (99h)

Because of the small package and the limitation on the number of pins, the W25R256JW provide a software Reset instruction instead of a dedicated RESET pin. Once the Reset instruction is accepted, any on-going internal operations will be terminated and the device will return to its default power-on state and lose all the current volatile settings, such as Volatile Status Register bits, Write Enable Latch (WEL) status, Program/Erase Suspend status, Read parameter setting (P7-P0), Continuous Read Mode bit setting (M7-M0).

To avoid accidental reset, both instructions must be issued in sequence. Any other commands other than "Reset (99h)" after the "Enable Reset (66h)" command will disable the "Reset Enable" state. A new sequence of "Enable Reset (66h)" and "Reset (99h)" is needed to reset the device. Once the Reset command is accepted by the device, the device will take approximately tRST=30us to reset. During this period, no command will be accepted.

Data corruption may happen if there is an on-going or suspended internal Erase or Program operation when Reset command sequence is accepted by the device. It is recommended to check the BUSY bit and the SUS bit in Status Register before issuing the Reset command sequence.

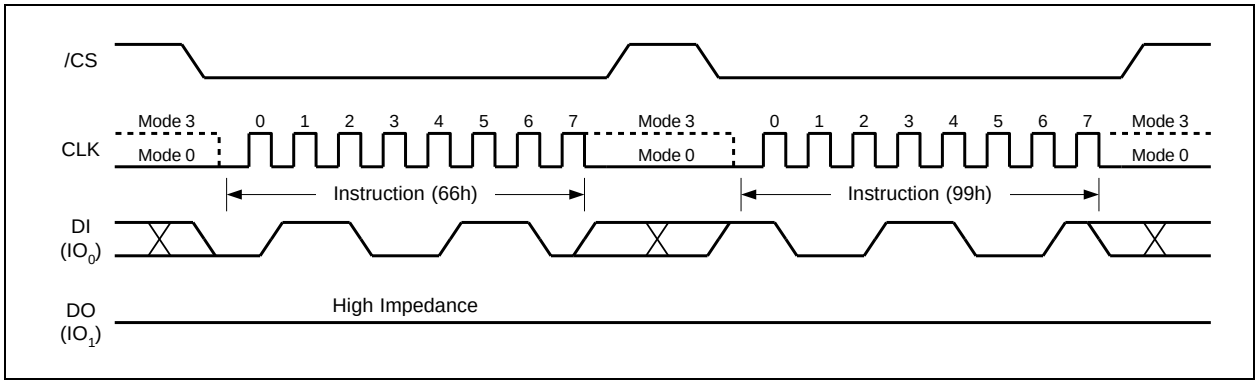


Figure 57a. Enable Reset and Reset Instruction Sequence

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.47 Write Root Key Register (9Bh + 00h)

This command is used by the SPI Flash Controller to initialize the Root Key Register corresponding to the received Counter Address with the received Root Key. It is expected to be used in an OEM manufacturing environment when the SPI Flash Controller and SPI Flash are powered together for the first time.

After the command is issued on the interface the SPI Flash device must ensure that the received transaction is error free. This includes checking following conditions:

- Payload size is correct. (including OP1 is 64 bytes)
- Counter Address falls within the range of supported counters.
- The Root Key Register corresponding to the requested Counter Address was previously uninitialized. [Root_Key_Reg_Init_State[Counter_Address] = 0xFFh]
- Truncated signature field is the same as least significant 224 bits of HMAC-SHA-256 based signature computed based on received input parameters.

If the received transaction is error free SPI Flash device successfully executes the command and posts “successful completion” in the RPMC Status Register. This command must be executed to ensure that power cycling in the middle of command execution is properly handled. This requires that the internal state tracking the root key register initialization is written as the last operation of the command execution. (Root_Key_Reg_Init_State[Counter_Address] = 0]

Root Key Register Write with root key is = 256’hFF…FF is used as a temporary key. When this request is received error-free Root_Key_Reg_Init_State[Counter_Address] is not affected. Instead only the corresponding Monotonic counters is initialized to 0 if previously uninitialized. This state is tracked as separate state using MC_Init_State[Counter_Address]. This state is used to leave the Monotonic counters at the current value when an error free Root Key Register Write operation is received. (Both 256’hFF..FF and non 256’hFF..FF)

Once this command is successfully executed with a non 256’hFF..FF Root Key, the device will not accept the “Write Root Key Register” command any more, and the Root Key value cannot be read out by any instructions.

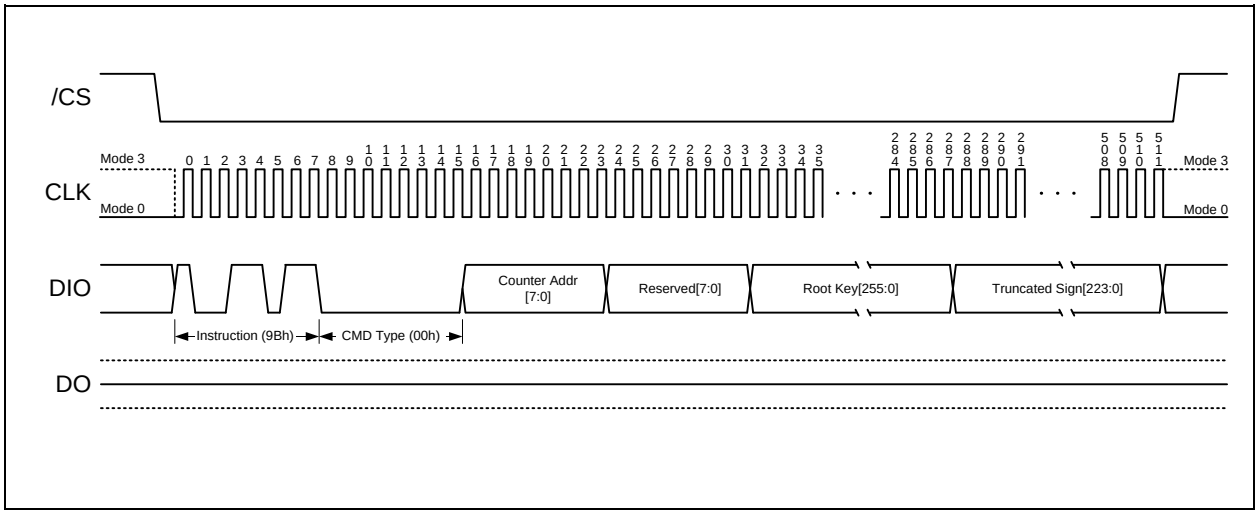


Figure 43. Write Root Key Register Instruction

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.48 Update HMAC Key (9Bh + 01h)

This command is used by the SPI Flash Controller to update the HMAC-Key register corresponding to the received Counter Address with a new HMAC key calculated based on received input. This command must be issued once only on every power cycle event on the interface. This allows the HMAC key storage to be implemented using volatile memory. Status register busy indication is expected to indicate busy for double the amount of Read_Counter_Polling_Delay specified in SFDP table since this command performs two distinct HMAC-SHA-256 computations.

After the command is issued on the interface the SPI Flash device must ensure that the received transaction is error free. This includes checking following conditions:

- Payload size is correct. (including OP1 = 40 bytes)
- Counter Address falls within the range of supported counters.
- The Monotonic counters corresponding to the requested Counter Address was previously initialized.
- Signature matches the HMAC-SHA-256 based signature computed based on received input parameters. This command performs two HMAC-SHA-256 operations.

If the received transaction is error free, the SPI Flash device successfully executes the command and posts “successful completion” in the RPMC Status Register.

If the received transaction has errors, the SPI Flash device does not execute the transaction and posts the corresponding error in the RPMC Status Register.

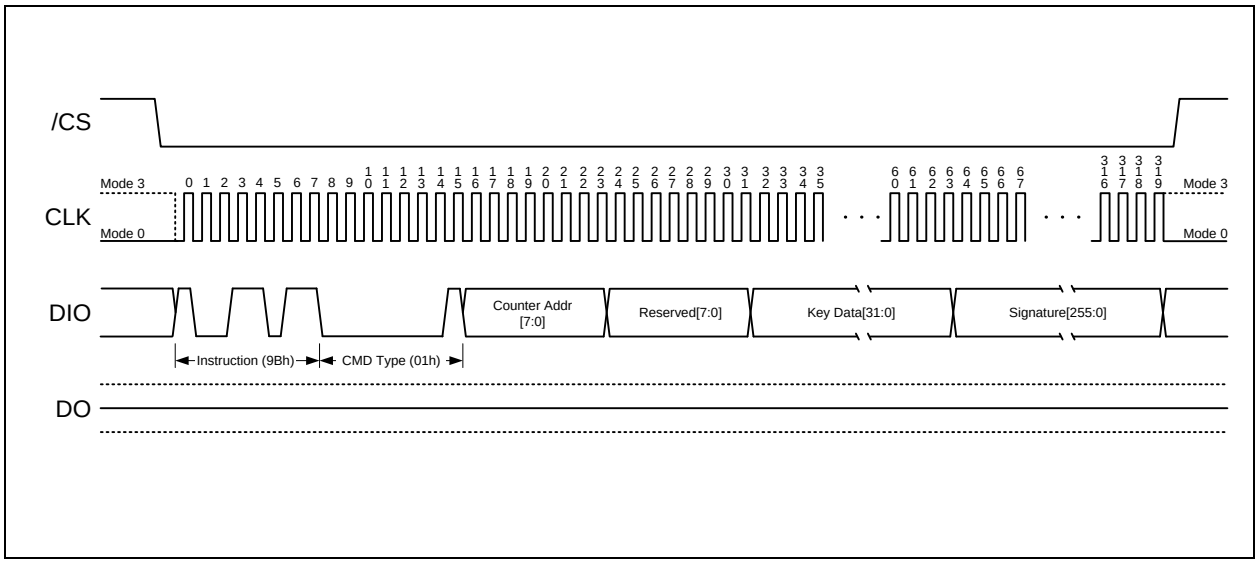


Figure 44. Update HMAC Key Register Instruction

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.49 Increment Monotonic counters (9Bh + 02h)

This command is used by the SPI Flash Controller to increment the Monotonic counters by 1 inside the SPI Flash Device.

After the command is issued on the interface the SPI Flash device must ensure that the received transaction is error free. This includes checking following conditions:

- Payload size is correct. (including OP1 = 40 bytes)
- Counter Address falls within the range of supported counters.
- The Monotonic counters corresponding to the requested Counter Address was previously initialized.
- The HMAC Key Register corresponding to the requested Counter Address was previously initialized.
- The requested Signature matches the HMAC-SHA-256 based signature computed based on received input parameters.
- The received Counter_Addressmatches the current value of the counter read from the SPI Flash.

If the received transaction is error free, the SPI Flash device successfully executes the command and posts “successful completion” in the RPMC Status Register. The increment counter implementation should make sure that the counter increment operation is performed in a power glitch aware manner.

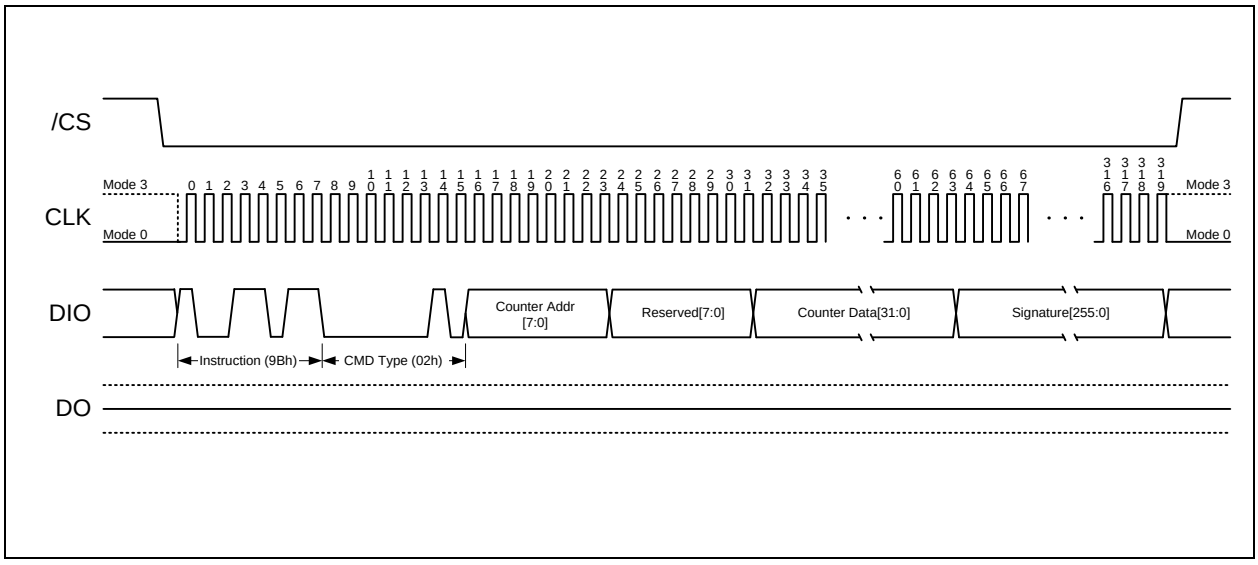


Figure 45. Increment Monotonic counters Instruction

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.50 Request Monotonic counters (9Bh + 03h)

This command is used by the SPI Flash Controller to request the Monotonic counters value inside the SPI Flash Device.

After the command is issued on the interface the SPI Flash device must ensure that the received transaction is error free. This includes checking following conditions:

- Payload size is correct. (including OP1 = 48 bytes)
- Counter Address falls within the range of supported counters.
- The Monotonic counters corresponding to the requested Counter Address was previously initialized.
- The HMAC Key Register corresponding to the requested Counter Address was previously initialized.
- The requested Signature matches the HMAC-SHA-256 based signature computed based on received input parameters.

If the received transaction is error free, the SPI Flash device successfully executes the command and posts “successful completion” in the RPMC Status Register. In response to this command, the SPI flash reads the Monotonic counters addressed by counter address. It calculates HMAC-SHA-256 signatures the second time, based on following parameters.

- HMAC Message[127:0] = Tag [95:0], Counter_Data_Read[31:0]
- HMAC Key[255:0] = HMAC_Key_Register[Counter_Address][255:0]

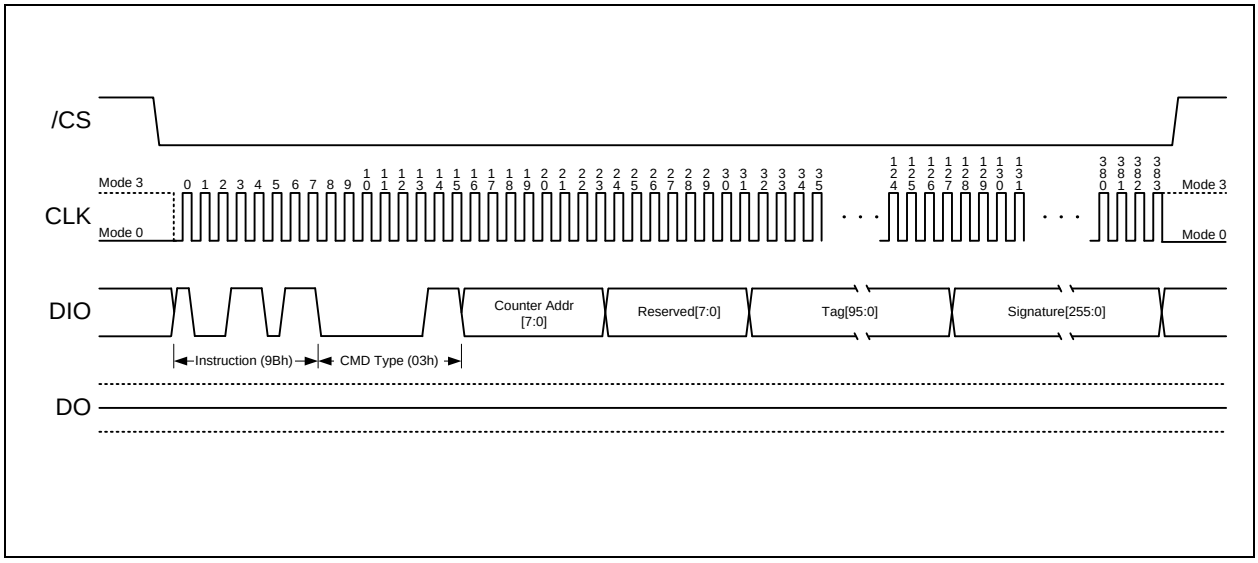


Figure 46. Request Monotonic counters Instruction

8.2.51 Reserved RPMCCommands (9Bh + 04h~FFh)

If the SPI Flash Controller issues any of the reserved command-types, the SPI Flash Device must return Error status in the RPMC Status Register. It asserts bit 2 to indicate that a reserved command-type was issued.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

8.2.52 Read RPMCStatus / Data (96h)

This command is used by the SPI Flash Controller to read the RPMC status from any previously issued OP1 command. In addition, if previous OP1 command is Request Monotonic counters and if SPI Flash returns successful completion (BUSY=0) in the RPMC Status Register, then it must also return valid values in the Tag, Counter_Addressand Signature field. If there're other error flags, the values returned in Tag, Counter and Signature field are invalid. The controller may abort the read prematurely prior to completely reading the entire payload. This may occur when the controller wants to simply read the RPMC status or when it observes an error being returned in the RPMC status field. The controller may also continue reading past the defined payload size of 49 bytes. Since this is an error condition, the SPI Flash may return any data past the defined payload size. The controller must ignore the data.

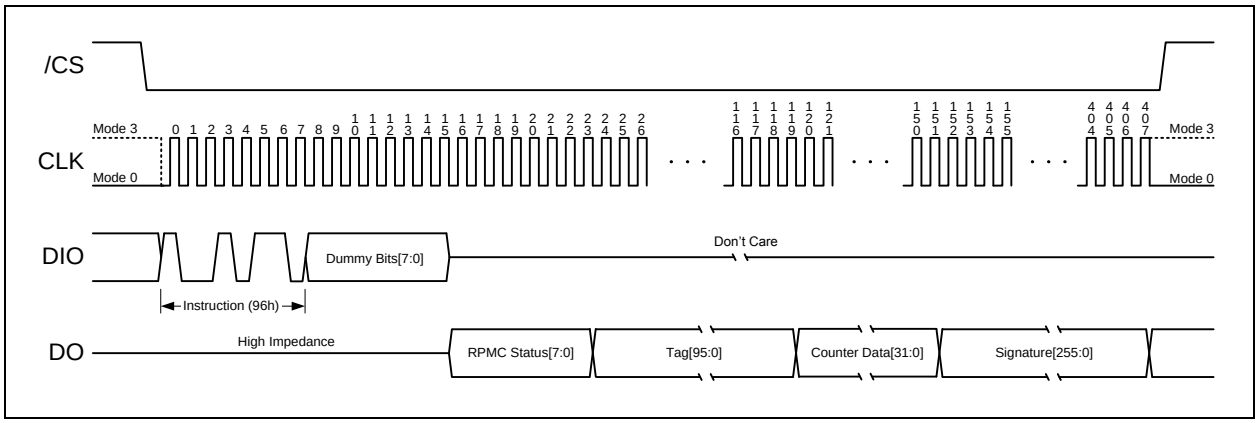


Figure 47a. Read RPMC Data Instruction (BUSY=0)

When BUSY=1, from Byte-3 and beyond, the device will output the RPMC Status[7:0] value continuously until /CS terminates the instruction. The device will not output Tag, CounterData & Signature fields when BUSY=1. Once BUSY becomes 0, another OP2 command must be issued to read out the correct Tag, CounterData & Signature fields.

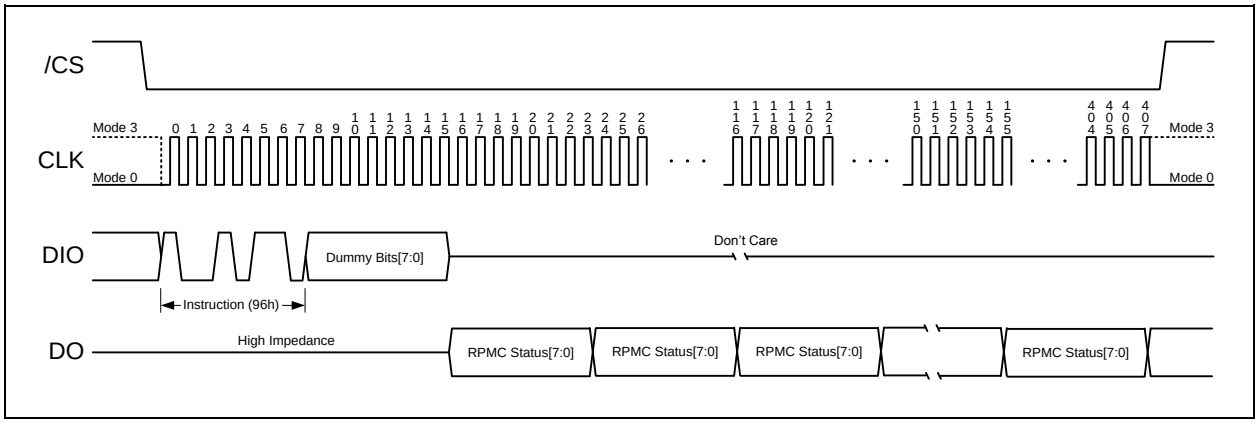


Figure 47b. Read RPMC Data Instruction (BUSY=1)

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

9. ELECTRICAL CHARACTERISTICS

9.1 Absolute Maximum Ratings (1)(2)

PARAMETERS	SYMBOL	CONDITIONS	RANGE	UNIT
Supply Voltage	VCC		–0.6 to 2.5V	V
Voltage Applied to Any Pin	V_{IO}	Relative to Ground	–0.6 to VCC+0.4	V
Transient Voltage on any Pin	V_{IOT}	<20nS Transient Relative to Ground	–2.0V to VCC+2.0V	V
Storage Temperature	T_{STG}		–65 to +150	°C
Lead Temperature	T_{LEAD} (3)		See Note (3)	°C
Electrostatic Discharge Voltage	V_{ESD}(2)	Human Body Model	–2000 to +2000	V

Notes:

1.This device has been designed and tested for the specified operation ranges. Proper operation outside of these levels is not guaranteed. Exposure to absolute maximum ratings may affect device reliability. Exposure beyond absolute maximum ratings may cause permanent damage.

2.JEDEC Std JESD22-A114A (C1=100pF, R1=1500 ohms, R2=500 ohms).

3.Compliant with JEDEC Standard J-STD-20C for small body Sn-Pb or Pb-free (Green) assembly and the European directive on restrictions on hazardous substances (RoHS) 2002/95/EU.

9.2 Operating Ranges

PARAMETER	SYMBOL	CONDITIONS	SPEC		UNIT
			MIN	MAX	
Supply Voltage	VCC (1)	F_R = 104MHz, f_R = 50MHz	1.7	1.95	V
Ambient Temperature, Operating	T_A	Industrial	–40	+85	°C

Note:

1.VCC voltage during Read can operate across the min and max range but should not exceed ±10% of the programming (erase/write) voltage.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

9.3 Power-up Timing and Write Inhibit Threshold(1)

PARAMETER	SYMBOL	SPEC		UNIT
		MIN	MAX	
VCC (min) to /CS Low	t_{VSL}	20		µs
Time Delay Before Write Instruction	t_{PUW}	5		ms
Write Inhibit Threshold Voltage	V_{WI}	1.0	1.4	V

Note:

1. These parameters are characterized only.

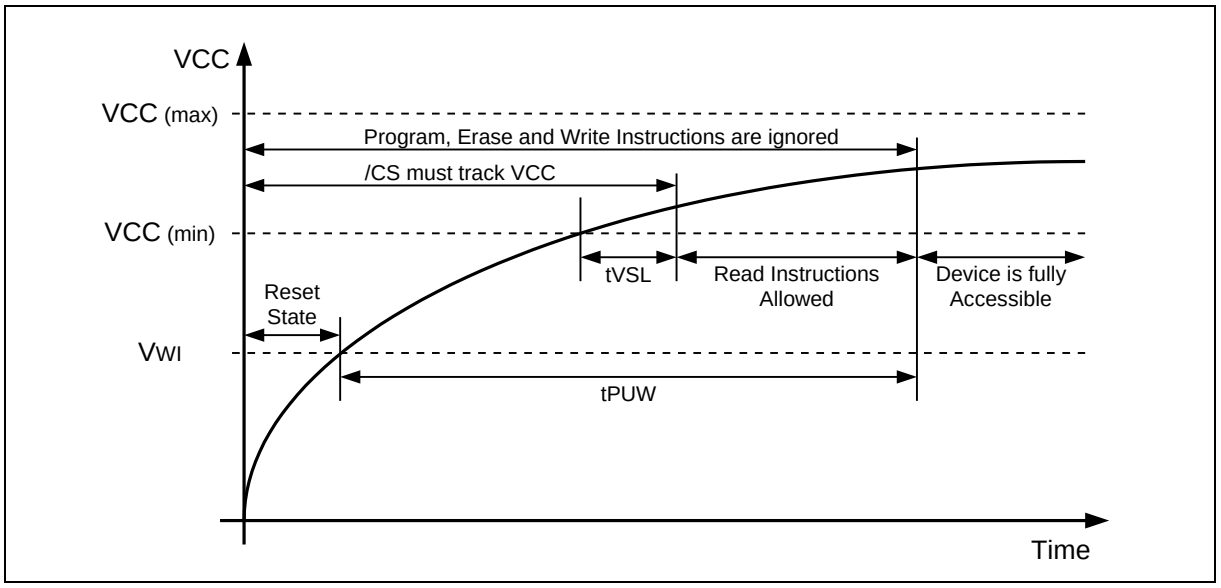


Figure 58. Power-up Timing and Voltage Levels

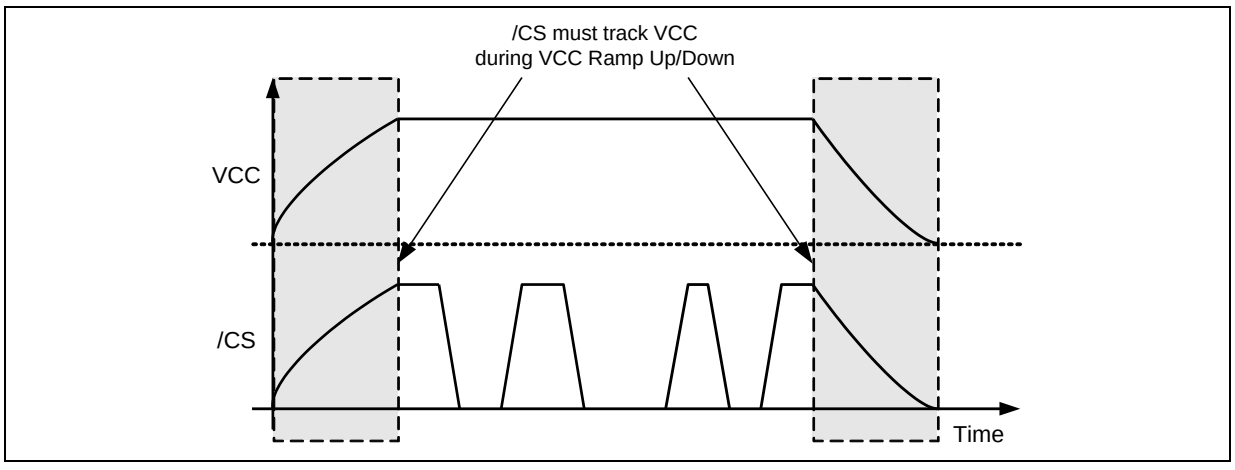


Figure 58b. Power-up, Power-Down Requirement

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

9.4 DC Electrical Characteristics

PARAMETER	SYMBOL	CONDITIONS	SPEC			UNIT
			MIN	TYP	MAX	
Input Capacitance	C_{IN}	V_{IN} = 0V			12	pF
Output Capacitance	Cout	V_{OUT} = 0V			16	pF
Input Leakage	I_{LI}				±4	µA
I/O Leakage	I_{LO}				±4	µA
Standby Current	I_{CC1}	/CS = VCC, VIN = GND or VCC		35	100	µA
Power-down Current	I_{CC2}	/CS = VCC, VIN = GND or VCC		2	25	µA
Current Read Data / Dual /Quad 50MHz(2)	I_{CC3}	C = 0.1 VCC / 0.9 VCC DO = Open			10	mA
Current Read Data / Dual /Quad 80MHz(2)	I_{CC3}	C = 0.1 VCC / 0.9 VCC DO = Open			12	mA
Current Read Data / Dual Output Read/Quad Output Read 104MHz(2)	I_{CC3}	C = 0.1 VCC / 0.9 VCC DO = Open			15	mA
Current Write Status Register	I_{CC4}	/CS = VCC		12	20	mA
Current Page Program	I_{CC5}	/CS = VCC		12	20	mA
Current Sector/Block Erase	I_{CC6}	/CS = VCC		12	20	mA
Current Chip Erase	I_{CC7}	/CS = VCC		12	20	mA
RPMC OP1 Write Only	I_{CC8}	/CS = VCC		15	20	mA
RPMC OP1 & Array Read	I_{CC9}	C = 0.1 VCC / 0.9 VCC DO = Open		19	40	mA
RPMC OP1 & Array Program/Erase	I_{CC10}	/CS = VCC		35	45	mA
RPMC OP2 Read Only	I_{CC11}	C = 0.1 VCC / 0.9 VCC			30	mA
RPMC OP2 & Array Program/Erase	I_{CC12}	C = 0.1 VCC / 0.9 VCC		30	45	mA
Input Low Voltage	V_{IL}				VCC x 0.3	V
Input High Voltage	V_{IH}		VCC x 0.7			V
Output Low Voltage	V_{OL}	I_{OL} = 100 µA			0.2	V
Output High Voltage	V_{OH}	I_{OH} = –100 µA	VCC – 0.2			V

Notes:

1. Tested on sample basis and specified through design and characterization data. TA = 25° C, VCC = 1.8V.
2. Checker Board Pattern.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

9.5 AC Measurement Conditions(1)

PARAMETER	SYMBOL	SPEC		UNIT
		MIN	MAX	
Load Capacitance	C_L		30	pF
Input Rise and Fall Times	T_R, T_F		5	ns
Input Pulse Voltages	V_{IN}	0.1 VCC to 0.9 VCC		V
Input Timing Reference Voltages	IN	0.3 VCC to 0.7 VCC		V
Output Timing Reference Voltages	OUT	0.5 VCC to 0.5 VCC		V

Note:

1. Output Hi-Z is defined as the point where data out is no longer driven.

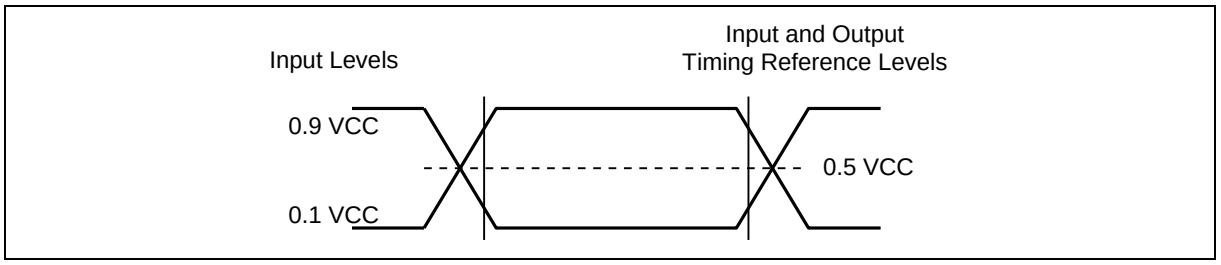


Figure 59. AC Measurement I/O Waveform

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

9.6 AC Electrical Characteristics(4)

DESCRIPTION	SYMBOL	ALT	SPEC			UNIT
			MIN	TYP	MAX	
Clock frequency except 03h & RPMC instructions	F_{R1}	f_{C1}	D.C.		104	MHz
Clock frequency for RPMC instructions	F_{R2}	f_{C2}	D.C.		80	MHz
Clock frequency for Read Data instruction (03h)	f_R		D.C.		50	MHz
Clock High, Low Time for all instructions except for Read Data (03h)	t_{CLH}, t_{CLL}(1)		45% P_C			ns
Clock High, Low Time for Read Data (03h) instruction	t_{CRLH}, t_{CRLL}(1)		45% P_C			ns
Clock Rise Time peak to peak	t_{CLCH}(2)		0.1			V/ns
Clock Fall Time peak to peak	t_{CHCL}(2)		0.1			V/ns
/CS Active Setup Time relative to CLK	t_{SLCH}	t_{CSS}	5			ns
/CS Not Active Hold Time relative to CLK	t_{CHSL}		5			ns
Data In Setup Time	t_{DVCH}	t_{DSU}	2			ns
Data In Hold Time	t_{CHDX}	t_{DH}	3			ns
/CS Active Hold Time relative to CLK	t_{CHSH}		5			ns
/CS Not Active Setup Time relative to CLK	t_{SHCH}		5			ns
/CS Deselect Time (During Read)	t_{SHSL1}	t_{CSH}	10			ns
/CS Deselect Time (During Erase or Program or Write)	t_{SHSL2}	t_{CSH}	50			ns
Output Disable Time	t_{SHQZ}(2)	t_{DIS}			10	ns
Clock Low to Output Valid	t_{CLQV1}	t_{V1}			7.5	ns
Output Hold Time	t_{CLQX}	t_{HO}	2			ns

Continued – next page

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

AC Electrical Characteristics (cont'd)

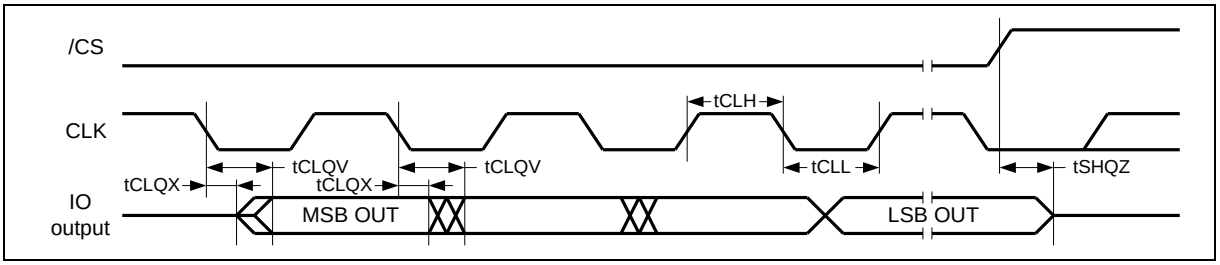
DESCRIPTION	SYMBOL	ALT	SPEC			UNIT
			MIN	TYP	MAX	
/CS High to Power-down Mode	t_{DP}(2)				3	µs
/CS High to Standby Mode without ID Read	t_{RES1}(2)				3	µs
/CS High to Standby Mode with ID Read	t_{RES2}(2)				1.8	µs
/CS High to next Instruction after Suspend	t_{SUS}(2)				20	µs
/CS High to next Instruction after Reset	t_{RST}(2)				30	µs
/RESET pin Low period to reset the device	t_{RESET}(2)		1(3)			µs
RPMC Write Root Key Register	t_{KEY}			170	250	µs
RPMC Update HMAC Key Register	t_{HMAC}			50	75	µs
RPMC Increment Monotonic Counter	t_{INC1}			80	200	µs
RPMC Increment Monotonic Counter (Counter Switching)	t_{INC2}			75	250	ms
RPMC Request Monotonic Counter	t_{REQ}			80	120	µs
Write Status Register Time	t_W			2	30	ms
Page Program Time	t_{PP}			0.8	5	ms
Sector Erase Time (4KB)	t_{SE}			50	400	ms
Block Erase Time (32KB)	t_{BE_1}			120	1,600	ms
Block Erase Time (64KB)	t_{BE_2}			200	2,000	ms
Chip Erase Time	t_{CE}			90	400	s

Notes:

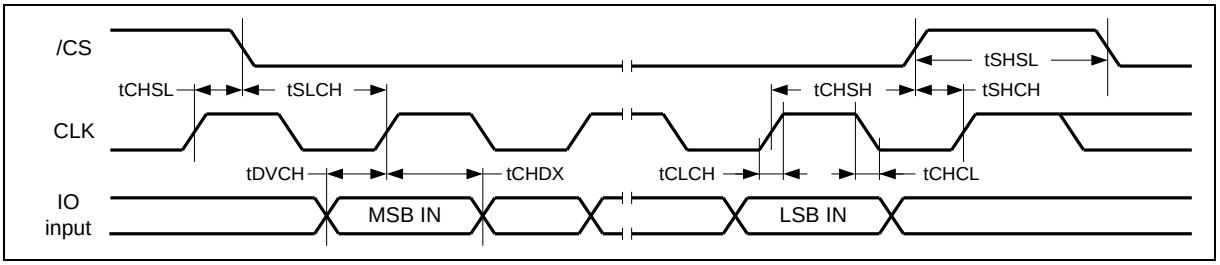
1.Clock high + Clock low must be less than or equal to 1/fC.
2.Value guaranteed by design and/or characterization, not 100% tested in production.
3.Only avaiable for Serial Flash memory, RPMC conunter will not be reset once /RESET is pull low. It is possible to reset the device with shorter tRESET (as short as a few hundred ns), a 1us minimum is recommended to ensure reliable operation.
4.4-bytes address alignment for Quad Read

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

9.7 Serial Output Timing



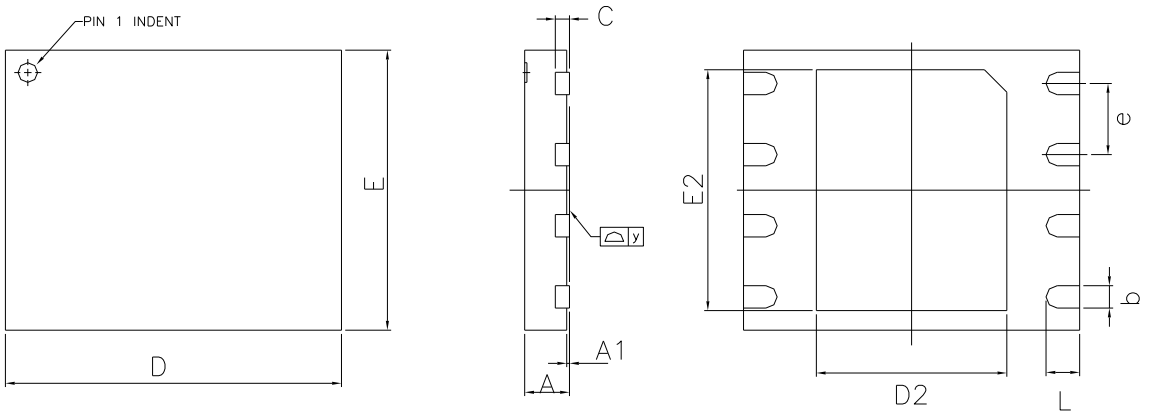
9.8 Serial Input Timing



深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

10. PACKAGE SPECIFICATIONS

10.1 8-Pad WSON 6x5-mm (Package Code P)



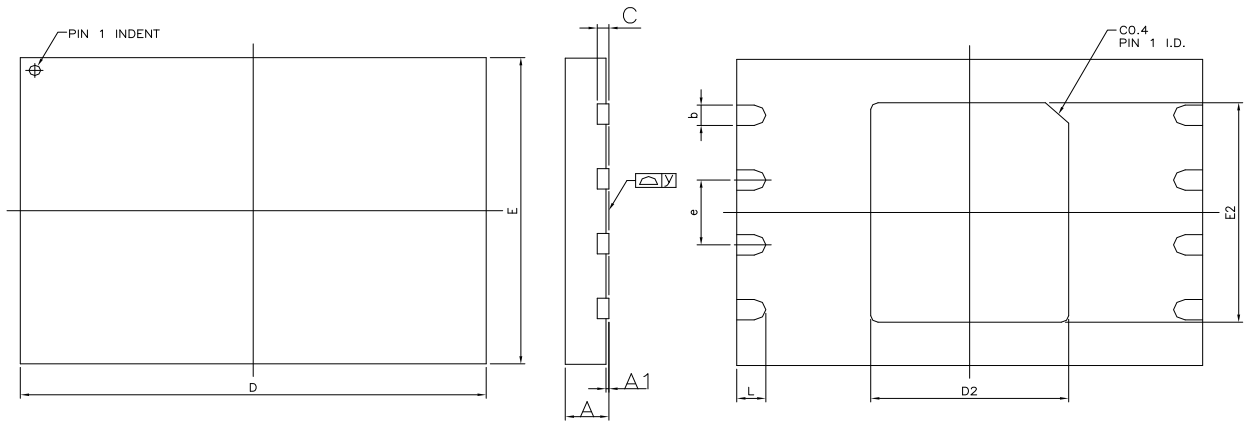
Symbol	Millimeters			Inches		
	Min	Nom	Max	Min	Nom	Max
A	0.70	0.75	0.80	0.028	0.030	0.031
A1	0.00	0.02	0.05	0.000	0.001	0.002
b	0.35	0.40	0.48	0.014	0.016	0.019
C	---	0.20 REF	---	---	0.008 REF	---
D	5.90	6.00	6.10	0.232	0.236	0.240
D2	3.35	3.40	3.45	0.132	0.134	0.136
E	4.90	5.00	5.10	0.193	0.197	0.201
E2	4.25	4.30	4.35	0.167	0.169	0.171
e	1.27 BSC			0.050 BSC		
L	0.55	0.60	0.65	0.022	0.024	0.026
y	0.00	---	0.075	0.000	---	0.003

Note:

The metal pad area on the bottom center of the package is not connected to any internal electrical signals. It can be left floating or connected to the device ground (GND pin). Avoid placement of exposed PCB vias under the pad.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

10.2 8-Pad WSON 8x6-mm (Package Code E)



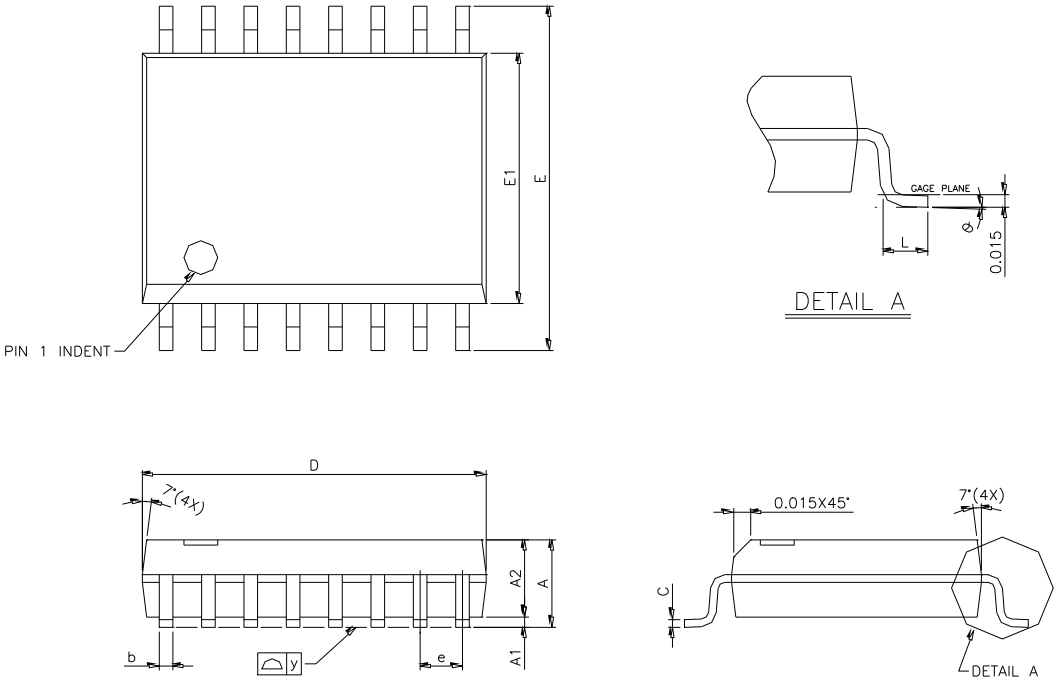
Symbol	Millimeters			Inches		
	Min	Nom	Max	Min	Nom	Max
A	0.70	0.75	0.80	0.028	0.030	0.031
A1	0.00	0.02	0.05	0.000	0.001	0.002
b	0.35	0.40	0.48	0.014	0.016	0.019
C	---	0.20 REF	---	---	0.008 REF	---
D	7.90	8.00	8.10	0.311	0.315	0.319
D2	3.35	3.40	3.45	0.132	0.134	0.136
E	5.90	6.00	6.10	0.232	0.236	0.240
E2	4.25	4.30	4.35	0.167	0.169	0.171
e	---	1.27	---	---	0.050	---
L	0.45	0.50	0.55	0.018	0.020	0.022
y	0.00	---	0.050	0.000	---	0.002

Note:

The metal pad area on the bottom center of the package is not connected to any internal electrical signals. It can be left floating or connected to the device ground (GND pin). Avoid placement of exposed PCB vias under the pad.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

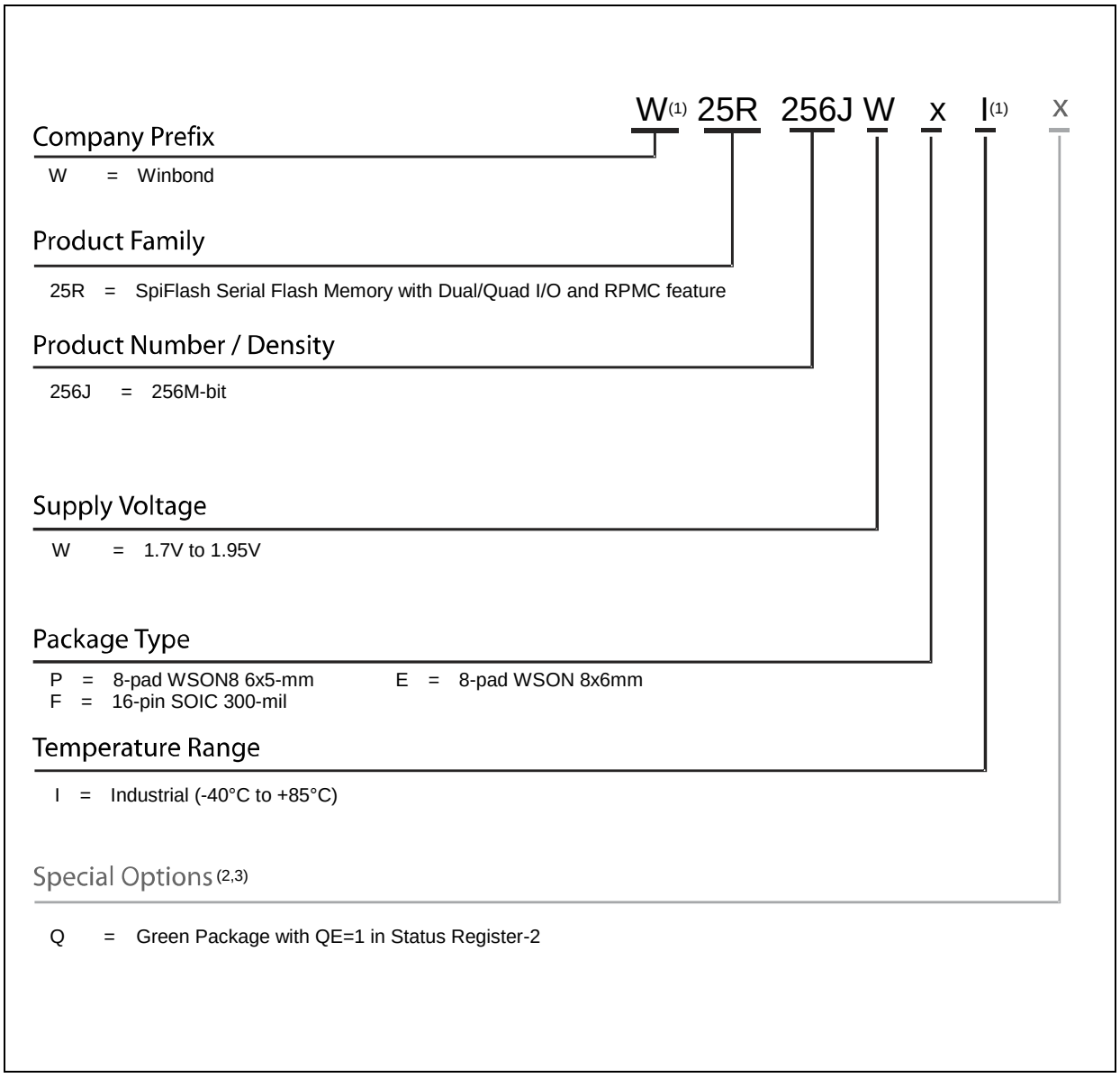
10.3 16-Pin SOIC 300-mil (Package Code F)



Symbol	Millimeters			Inches		
	Min	Nom	Max	Min	Nom	Max
A	2.36	2.49	2.64	0.093	0.098	0.104
A1	0.10	---	0.30	0.004	---	0.012
A2	---	2.31	---	---	0.091	---
b	0.33	0.41	0.51	0.013	0.016	0.020
C	0.18	0.23	0.28	0.007	0.009	0.011
D	10.08	10.31	10.49	0.397	0.406	0.413
E	10.01	10.31	10.64	0.394	0.406	0.419
E1	7.39	7.49	7.59	0.291	0.295	0.299
e	1.27 BSC			0.050 BSC		
L	0.38	0.81	1.27	0.015	0.032	0.050
y	---	---	0.076	---	---	0.003
θ	0°	---	8°	0°	---	8°

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

11. ORDERING INFORMATION



Notes:

1. The “W” prefix and the Temperature designator “I” are not included on the part marking.
2. Standard bulk shipments are in Tube (shape E). Please specify alternate packing method, such as Tape and Reel (shape T) or Tray (shape S), when placing orders.
3. For shipments with OTP enabled feature, please contact Winbond.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

11.1 Valid Part Numbers and Top Side Marking

The following table provides the valid part numbers for the W25R256JW SpiFlash Memory. Please contact Winbond for specific availability by density and package type. Winbond SpiFlash memories use a 12-digit Product Number for ordering. However, due to limited space, the Top Side Marking on all packages uses an abbreviated 10-digit number.

PACKAGE TYPE	DENSITY	PRODUCT NUMBER	TOP SIDE MARKING
P WSON-8 6x5-mm	256M-bit	W25R256JWPIQ	25R256JWPQ
E WSON-8 8x6mm	256M-bit	W25R256JWEIQ	25R256JWEQ
F SOIC-16 300mil	256M-bit	W25R256JWFIQ	25R256JWFQ

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com

12. REVISION B1ISTORY

VERSION	DATE	PAGE	DESCRIPTION
A1	10/18/2017		New Create Preliminary
A2	10/25/2017	98	Updated order information
B	01/23/2018	92 92	Removed “Preliminary” Updated CLK(max.) of f_{c1} & f_{c2} Updated t_{CLQV}(max.) as 7.5nS
B1	06/25/2018	5,7,11,86 7,98-100	Removed continuous read informaion Added /RESET pin informaion Added SOIC-16 package inforamtion
B2	09/0/2018	22 58,60	Updated DRV default value Added Power down description

Trademarks

Winbond and *SpiFlash* are trademarks of *Winbond Electronics Corporation.*
All other marks are the property of their respective owner.

Important Notice

Winbond products are not designed, intended, authorized or warranted for use as components in systems or equipment intended for surgical implantation, atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, or for other applications intended to support or sustain life. Furthermore, *Winbond* products are not intended for applications wherein failure of *Winbond* products could result or lead to a situation wherein personal injury, death or severe property or environmental damage could occur. *Winbond* customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify *Winbond* for any damages resulting from such improper use or sales.

Information in this document is provided solely in connection with Winbond products. Winbond reserves the right to make changes, corrections, modifications or improvements to this document and the products and services described herein at any time, without notice.

Please note that all data and specifications are subject to change without notice.
All the trademarks of products and companies mentioned in this datasheet belong to their respective owners.

深圳市满度科技有限公司
Web:www.manduic.com
Tel:150-1290-5940
Email:sales@manduic.com