

# M5M5256DFP,VP,RV -10VLL-I,-12VLL-I,-15VLL-I, -10VXL-I,-12VXL-I,-15VXL-I

262144-BIT (32768-WORD BY 8-BIT) CMOS STATIC RAM

## DESCRIPTION

The M5M5256DFP,VP,RV is 262,144-bit CMOS static RAMs organized as 32,768-words by 8-bits which is fabricated using high-performance 3 polysilicon CMOS technology. The use of resistive load NMOS cells and CMOS periphery results in a high density and low power static RAM. Stand-by current is small enough for battery back-up application. It is ideal for the memory systems which require simple interface.

Especially the M5M5256DVP,RV are packaged in a 28-pin thin small outline package. Two types of devices are available, M5M5256DVP(normal lead bend type package), M5M5256DRV(reverse lead bend type package). Using both types of devices, it becomes very easy to design a printed circuit board.

## FEATURE

| Type                   | Access time (max) | Power supply current |                               |
|------------------------|-------------------|----------------------|-------------------------------|
|                        |                   | Active (max)         | Stand-by (max)                |
| M5M5256DFP,VP,RV-10VLL | 100ns             | 20mA<br>(Vcc=3.6V)   | 24µA<br>(Vcc=3.6V)            |
| M5M5256DFP,VP,RV-12VLL | 120ns             |                      |                               |
| M5M5256DFP,VP,RV-15VLL | 150ns             |                      |                               |
| M5M5256DFP,VP,RV-10VXL | 100ns             | 4.8µA<br>(Vcc=3.6V)  | 0.05µA<br>(Vcc=3.0V, Typical) |
| M5M5256DFP,VP,RV-12VXL | 120ns             |                      |                               |
| M5M5256DFP,VP,RV-15VXL | 150ns             |                      |                               |

- Single +2.7~3.6V power supply
- No clocks, no refresh
- Data-Hold on +2.0V power supply
- Directly TTL compatible : all inputs and outputs
- Three-state outputs : OR-tie capability
- /OE prevents data contention in the I/O bus
- Common Data I/O
- Battery backup capability
- Low stand-by current.....0.05µA(typ.)

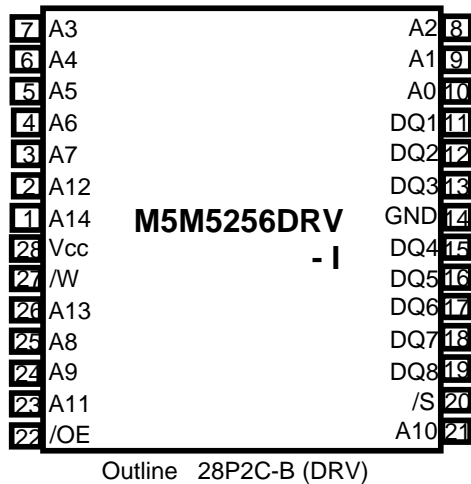
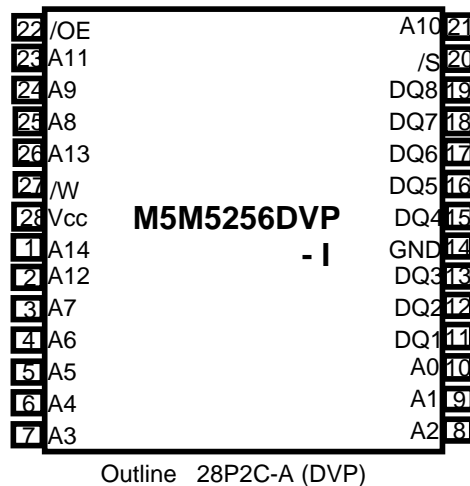
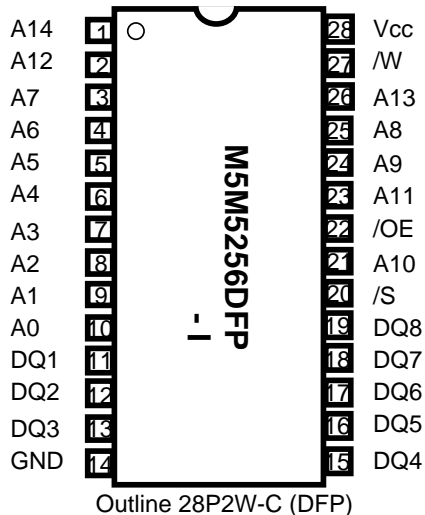
## PACKAGE

M5M5256DFP : 28 pin 450 mil SOP  
M5M5256DVP,RV : 28pin 8 X 13.4 mm<sup>2</sup> TSOP

## APPLICATION

Small capacity memory units

### PIN CONFIGURATION (TOP VIEW)



# M5M5256DFP,VP,RV -10VLL-I,-12VLL-I,-15VLL-I, -10VXL-I,-12VXL-I,-15VXL-I

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## FUNCTION

The operation mode of the M5M5256DP,KP,FP,VP,RV is determined by a combination of the device control inputs /S, /W and /OE. Each mode is summarized in the function table.

A write cycle is executed whenever the low level /W overlaps with the low level /S. The address must be set up before the write cycle and must be stable during the entire cycle. The data is latched into a cell on the trailing edge of /W, /S, whichever occurs first, requiring the set-up and hold time relative to these edge to be maintained. The output enable /OE directly controls the output stage. Setting the /OE at a high level, the output stage is in a high-impedance state, and the data bus contention problem in the write cycle is eliminated.

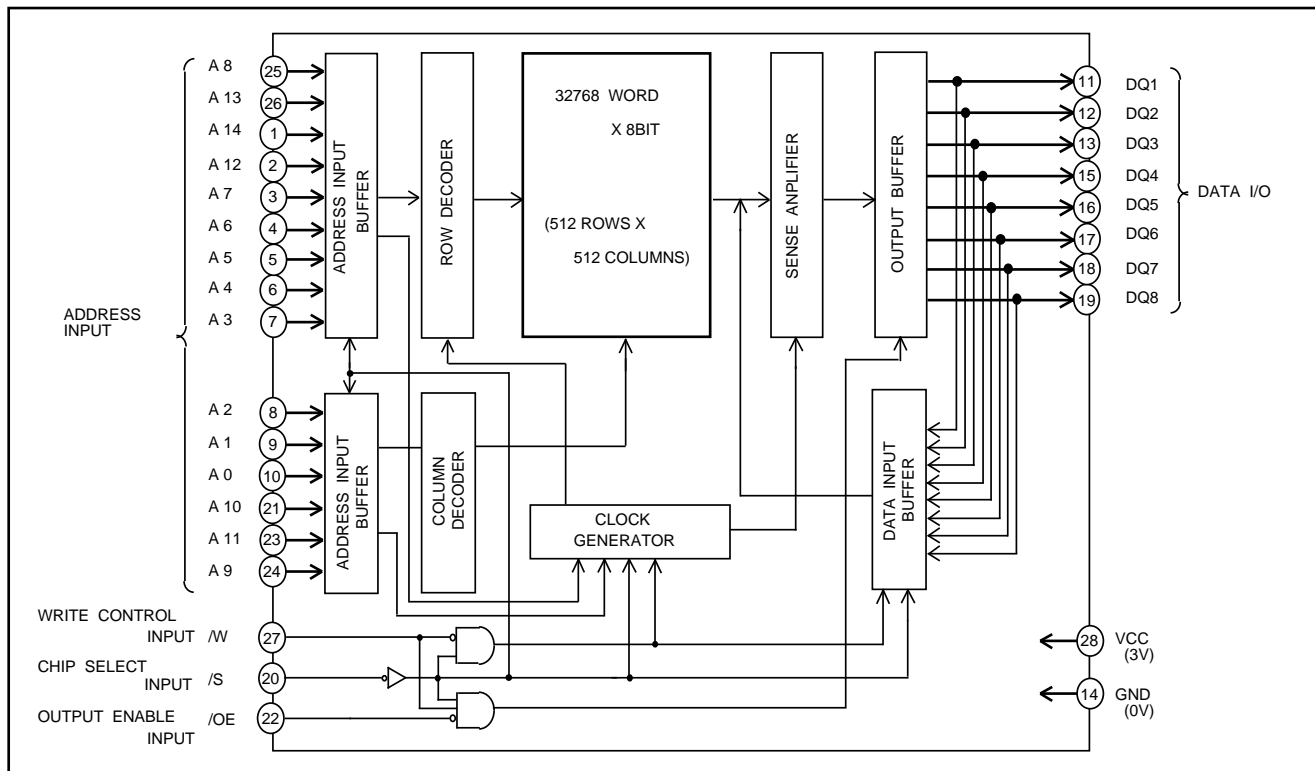
A read cycle is executed by setting /W at a high level and /OE at a low level while /S are in an active state.

When setting /S at a high level, the chip is in a non-selectable mode in which both reading and writing are disabled. In this mode, the output stage is in a high-impedance state, allowing OR-tie with other chips and memory expansion by /S. The power supply current is reduced as low as the stand-by current which is specified as Icc3 or Icc4, and the memory data can be held at +2V power supply, enabling battery back-up operation during power failure or power-down operation in the non-selected mode.

## FUNCTION TABLE

| /S | /W | /OE | Mode          | DQ               | Icc      |
|----|----|-----|---------------|------------------|----------|
| H  | X  | X   | Non selection | High-impedance   | Stand-by |
| L  | L  | X   | Write         | D <sub>IN</sub>  | Active   |
| L  | H  | L   | Read          | D <sub>OUT</sub> | Active   |
| L  | H  | H   |               | High-impedance   | Active   |

## BLOCK DIAGRAM



# M5M5256DFP,VP,RV -10VLL-I,-12VLL-I,-15VLL-I, -10VXL-I,-12VXL-I,-15VXL-I

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## ABSOLUTE MAXIMUM RATINGS

| Symbol           | Parameter             | Conditions           | Ratings                                 | Unit |
|------------------|-----------------------|----------------------|---|------|
| V <sub>CC</sub>  | Supply voltage        | With respect to GND  | -0.3*~4.6                               | V    |
| V <sub>I</sub>   | Input voltage         |                      | -0.3*~V <sub>CC</sub> +0.3<br>(Max 4.6) | V    |
| V <sub>O</sub>   | Output voltage        |                      | 0~V <sub>CC</sub>                       | V    |
| P <sub>d</sub>   | Power dissipation     | T <sub>a</sub> =25°C | 700                                     | mW   |
| T <sub>opr</sub> | Operating temperature |                      | -40~85                                  | °C   |
| T <sub>stg</sub> | Storage temperature   |                      | -65~150                                 | °C   |

\* -3.0V in case of AC ( Pulse width 30ns )

## DC ELECTRICAL CHARACTERISTICS (T<sub>a</sub>=-40~85°C, V<sub>CC</sub>=2.7~3.6V, unless otherwise noted)

| Symbol           | Parameter                                 | Test conditions   | Limits               |      |                      | Unit |
|------------------|---|---|----------------------|------|----------------------|------|
|                  |   |   | Min                  | Typ  | Max                  |      |
| V <sub>IH</sub>  | High-level input voltage                  |   | 2.0                  |      | V <sub>CC</sub> +0.3 | V    |
| V <sub>IL</sub>  | Low-level input voltage                   |   | -0.3*                |      | 0.6                  | V    |
| V <sub>OH1</sub> | High-level output voltage 1               | I <sub>OH</sub> =-0.5mA   | 2.4                  |      |                      | V    |
| V <sub>OH2</sub> | High-level output voltage 2               | I <sub>OH</sub> =-0.05mA  | V <sub>CC</sub> -0.5 |      |                      | V    |
| V <sub>OL</sub>  | Low-level output voltage                  | I <sub>OL</sub> =1mA  |                      |      | 0.4                  | V    |
| I <sub>I</sub>   | Input current                             | V <sub>I</sub> =0~V <sub>CC</sub>   |                      |      | ±1                   | µA   |
| I <sub>O</sub>   | Output current in off-state               | /S=V <sub>IH</sub> or or /OE=V <sub>IH</sub> ,<br>V <sub>I/O</sub> =0~V <sub>CC</sub>             |                      |      | ±1                   | µA   |
| I <sub>CC1</sub> | Active supply current<br>(AC, MOS level ) | /S 0.2V,<br>Other inputs<0.2V or >V <sub>CC</sub> -0.2V<br>Output-open Min. cycle                 | Min. cycle           | 11   | 20                   | mA   |
|                  |   |   | 1MHz                 | 1.5  | 3                    |      |
| I <sub>CC2</sub> | Active supply current<br>(AC, TTL level ) | /S=V <sub>IL</sub> ,<br>other inputs=V <sub>IH</sub> or V <sub>IL</sub><br>Output-open Min. cycle | Min. cycle           | 11   | 20                   | mA   |
|                  |   |   | 1MHz                 | 1.5  | 3                    |      |
| I <sub>CC3</sub> | Stand-by current                          | /S V <sub>CC</sub> -0.2V,<br>other inputs=0~V <sub>CC</sub>                                       | -VLL                 |      | 24                   | µA   |
|                  |   |   | -VXL                 | 0.05 | 4.8                  |      |
| I <sub>CC4</sub> | Stand-by current                          | /S=V <sub>IH</sub> , other inputs=0~V <sub>CC</sub>   |                      |      | 0.33                 | mA   |

\* -3.0V in case of AC ( Pulse width 30ns )

## CAPACITANCE (T<sub>a</sub>=-40~85°C, V<sub>CC</sub>=2.7~3.6V, unless otherwise noted)

| Symbol         | Parameter          | Test conditions                                      | Limits |     |     | Unit |
|----------------|--------------------|--|--------|-----|-----|------|
|                |                    |  | Min    | Typ | Max |      |
| C <sub>I</sub> | Input capacitance  | V <sub>I</sub> =GND, V <sub>I</sub> =25mVrms, f=1MHz |        |     | 6   | pF   |
| C <sub>O</sub> | Output capacitance | V <sub>O</sub> =GND, V <sub>O</sub> =25mVrms, f=1MHz |        |     | 8   | pF   |

Note 0: Direction for current flowing into an IC is positive (no mark).

1: Typical value is one at T<sub>a</sub> = 25°C.2: C<sub>I</sub>, C<sub>O</sub> are periodically sampled and are not 100% tested.

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## AC ELECTRICAL CHARACTERISTICS (Ta = -40~85°C, Vcc=2.7~3.6V, unless otherwise noted )

### (1) MEASUREMENT CONDITIONS

Input pulse level..... $V_{IH}=2.2V, V_{IL}=0.4V$

Input rise and fall time.....5ns

Reference level..... $V_{OH}=V_{OL}=1.5V$

Output loads.....Fig.1,  $CL=30pF$  (-10VLL,-10VXL )

$CL=50pF$  (-12VLL,-12VXL )

$CL=100pF$  (-15VLL,-15VXL )

$CL=5pF$  (for  $t_{en}, t_{dis}$ )

Transition is measured  $\pm 500mV$  from steady state voltage. (for  $t_{en}, t_{dis}$ )

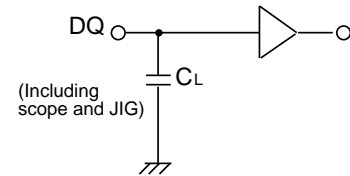


Fig.1 Output load

### (2) READ CYCLE

| Symbol        | Parameter                          | Limits      |     |             |     |             |     | Unit |
|---------------|------------------------------------|-------------|-----|-------------|-----|-------------|-----|------|
|               |                                    | -10VLL, VXL |     | -12VLL, VXL |     | -15VLL, VXL |     |      |
|               |                                    | Min         | Max | Min         | Max | Min         | Max |      |
| $t_{CR}$      | Read cycle time                    | 100         |     | 120         |     | 150         |     | ns   |
| $t_a(A)$      | Address access time                |             | 100 |             | 120 |             | 150 | ns   |
| $t_a(S)$      | Chip select access time            |             | 100 |             | 120 |             | 150 | ns   |
| $t_a(OE)$     | Output enable access time          |             | 50  |             | 60  |             | 75  | ns   |
| $t_{dis}(S)$  | Output disable time after /S high  |             | 30  |             | 35  |             | 40  | ns   |
| $t_{dis}(OE)$ | Output disable time after /OE high |             | 30  |             | 35  |             | 40  | ns   |
| $t_{en}(S)$   | Output enable time after /S low    | 10          |     | 10          |     | 10          |     | ns   |
| $t_{en}(OE)$  | Output enable time after /OE low   | 10          |     | 10          |     | 10          |     | ns   |
| $t_v(A)$      | Data valid time after address      | 10          |     | 10          |     | 10          |     | ns   |

### (3) WRITE CYCLE

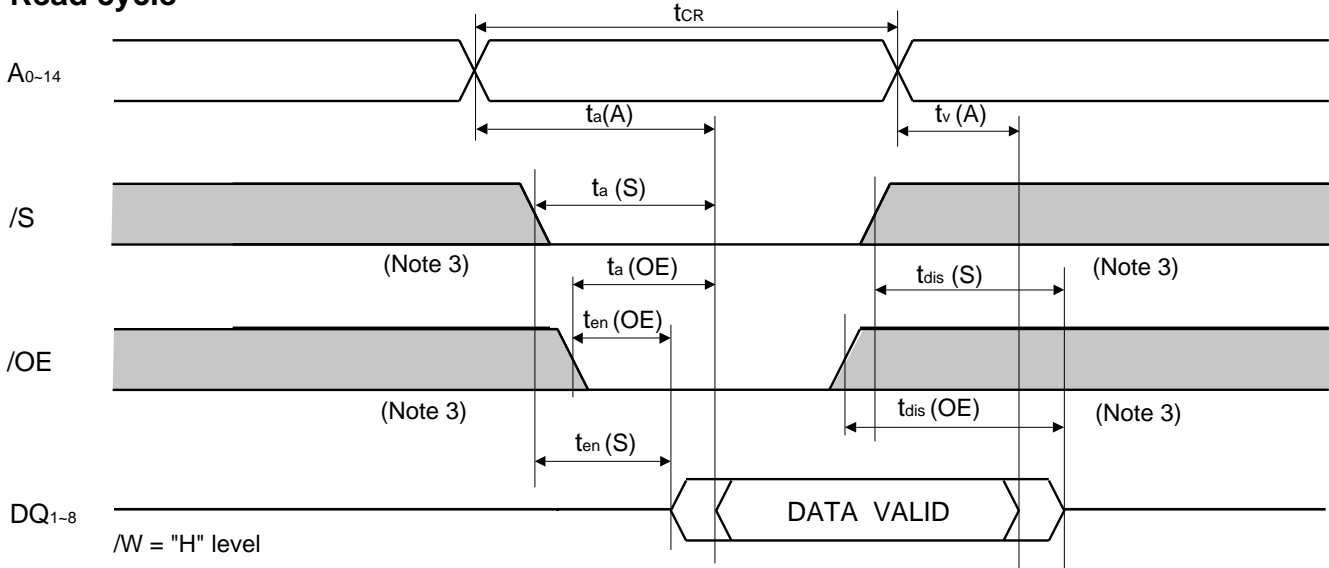
| Symbol         | Parameter                                  | Limits      |     |             |     |             |     | Unit |
|----------------|--|-------------|-----|-------------|-----|-------------|-----|------|
|                |  | -10VLL, VXL |     | -12VLL, VXL |     | -15VLL, VXL |     |      |
|                |  | Min         | Max | Min         | Max | Min         | Max |      |
| $t_{CW}$       | Write cycle time                           | 100         |     | 120         |     | 150         |     | ns   |
| $t_w(W)$       | Write pulse width                          | 70          |     | 80          |     | 90          |     | ns   |
| $t_{su}(A)$    | Address setup time                         | 0           |     | 0           |     | 0           |     | ns   |
| $t_{su}(A-WH)$ | Address setup time with respect to /W high | 80          |     | 90          |     | 100         |     | ns   |
| $t_{su}(S)$    | Chip select setup time                     | 80          |     | 90          |     | 100         |     | ns   |
| $t_{su}(D)$    | Data setup time                            | 40          |     | 45          |     | 50          |     | ns   |
| $t_h(D)$       | Data hold time                             | 0           |     | 0           |     | 0           |     | ns   |
| $t_{rec}(W)$   | Write recovery time                        | 0           |     | 0           |     | 0           |     | ns   |
| $t_{dis}(W)$   | Output disable time from /W low            |             | 30  |             | 35  |             | 40  | ns   |
| $t_{dis}(OE)$  | Output disable time from /OE high          |             | 30  |             | 35  |             | 40  | ns   |
| $t_{en}(W)$    | Output enable time from /W high            | 10          |     | 10          |     | 10          |     | ns   |
| $t_{en}(OE)$   | Output enable time from /OE low            | 10          |     | 10          |     | 10          |     | ns   |

# M5M5256DFP,VP,RV -10VLL-I,-12VLL-I,-15VLL-I, -10VXL-I,-12VXL-I,-15VXL-I

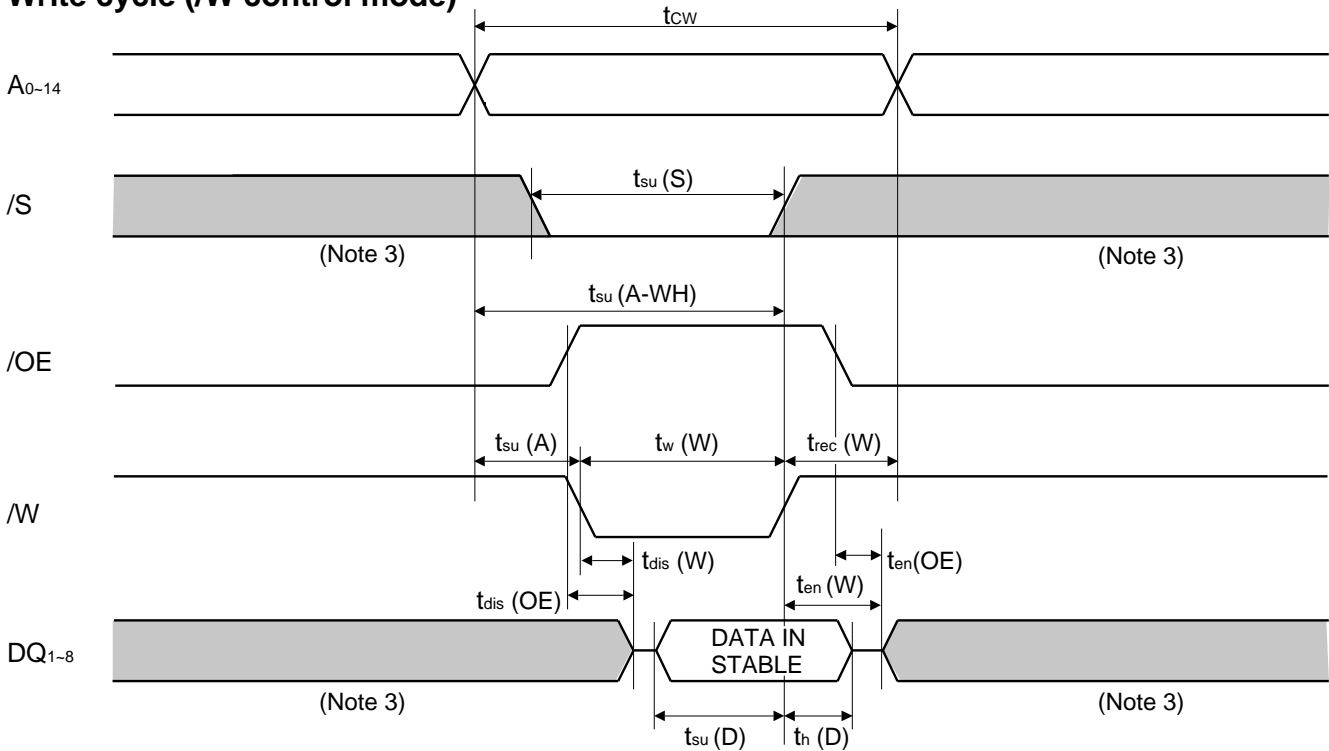
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## (4) TIMING DIAGRAMS

### Read cycle



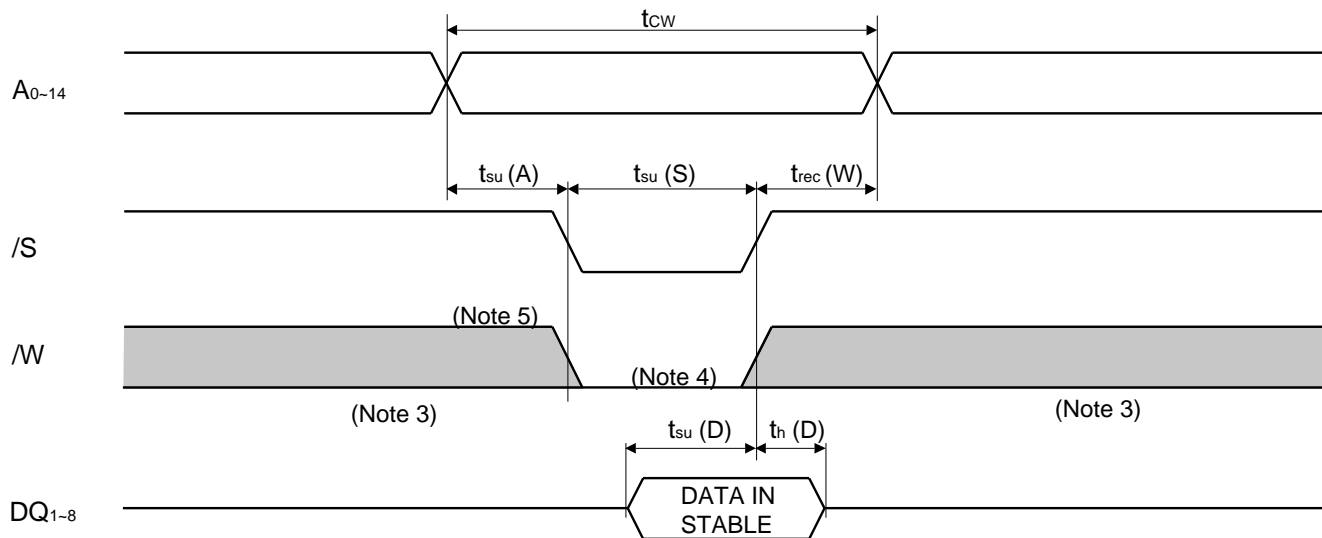
### Write cycle (/W control mode)



**M5M5256DFP,VP,RV -10VLL-I,-12VLL-I,-15VLL-I,  
-10VXL-I,-12VXL-I,-15VXL-I**

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**Write cycle (/S control mode)**



Note 3 : Hatching indicates the state is "don't care".

4 : Writing is executed in overlap of /S and /W low.

5 : If /W goes low simultaneously with or prior to /S, the outputs remain in the high impedance state.

6 : Don't apply inverted phase signal externally when DQ pin is output mode.

7 :  $t_{en}$ ,  $t_{dis}$  are periodically sampled and are not 100% tested.

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## POWER DOWN CHARACTERISTICS

### (1) ELECTRICAL CHARACTERISTICS (Ta = -40~85°C, Vcc=2.7~3.6V, unless otherwise noted)

| Symbol               | Parameter                 | Test conditions   | Limits |      |                | Unit |
|----------------------|---------------------------|---|--------|------|----------------|------|
|                      |                           |   | Min    | Typ  | Max            |      |
| V <sub>CC (PD)</sub> | Power down supply voltage |   | 2      |      |                | V    |
| V <sub>I (/S)</sub>  | Chip select input /S      |   | 2      |      |                | V    |
| I <sub>CC (PD)</sub> | Power down supply current | V <sub>CC</sub> = 3V, /S V <sub>CC</sub> -0.2V,<br>Other inputs=0~V <sub>CC</sub> | -VLL   |      | 20<br>(Note 7) | uA   |
|                      |                           |   | -VXL   | 0.05 | 4<br>(Note 8)  |      |

Note7: I<sub>CC (PD)</sub> = 1uA in case of Ta = 25°C

Note8: I<sub>CC (PD)</sub> = 0.2uA in case of Ta = 25°C

### (2) TIMING REQUIREMENTS (Ta = -40~85°C, Vcc=2.7~3.6V, unless otherwise noted)

| Symbol                | Parameter                | Test conditions | Limits          |     |     | Unit |
|-----------------------|--------------------------|-----------------|-----------------|-----|-----|------|
|                       |                          |                 | Min             | Typ | Max |      |
| t <sub>SU (PD)</sub>  | Power down set up time   |                 | 0               |     |     | ns   |
| t <sub>REC (PD)</sub> | Power down recovery time |                 | t <sub>CR</sub> |     |     | ns   |

### (3) POWER DOWN CHARACTERISTICS

#### /S control mode

