

# MITSUBISHI LSIs

## M5M5256CP,FP,KP,VP,RV-55LL,-55XL,-70LL,-70XL

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

### DESCRIPTION

This M5M5256CP,FP,KP,VP,RV is a 262144-bit CMOS static RAMs organized as 32768-words by 8-bits which is fabricated using high-performance 3 polysilicon CMOS technology. The use of resistive load NMOS cells and CMOS periphery result 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 M5M5256CVP,RV are packaged in a 28-pin thin small outline package. Two types of devices are available, M5M5256CVP (normal lead bend type package) and M5M5256CRV (reverse lead bend type package). Using both type of devices, it becomes very easy to design a printed circuit board.

### FEATURES

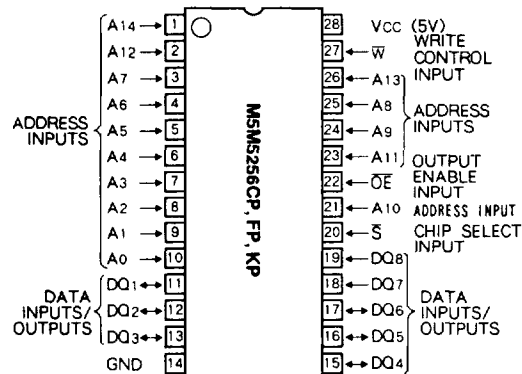
| Type name                      | Access time (max) | Power supply current                                                                 |                                        |
|--------------------------------|-------------------|--------------------------------------------------------------------------------------|----------------------------------------|
|                                |                   | Active (max)                                                                         | Stand-by (max)                         |
| M5M5256CP, FP, KP, VP, RV-55LL | 55ns              | 60mA<br>(V <sub>CC</sub> =5.5V)                                                      | 20 $\mu$ A<br>(V <sub>CC</sub> = 5.5V) |
| M5M5256CP, FP, KP, VP, RV-70LL | 70ns              |                                                                                      |                                        |
| M5M5256CP, FP, KP, VP, RV-55XL | 55ns              | 5 $\mu$ A<br>(V <sub>CC</sub> = 5.5V)<br>0.05 $\mu$ A<br>(V <sub>CC</sub> = 3V, typ) |                                        |
| M5M5256CP, FP, KP, VP, RV-70XL | 70ns              |                                                                                      |                                        |

- Single +5V power supply
- No clocks, no refresh
- Data-hold on +2V power supply
- Directly TTL compatible: All inputs and outputs
- Three-state outputs: OR-tie capability
- Simple memory expansion by  $\bar{S}$
- $\bar{OE}$  prevents data contention in the I/O bus
- Common data I/O
- Low stand-by current..... 0.05  $\mu$ A (typ)
- Package
  - M5M5256CP..... 28 pin 600 mil DIP
  - M5M5256CKP..... 28 pin 300 mil DIP
  - M5M5256CFP..... 28 pin 450 mil SOP
  - M5M5256CVP,RV..... 28pin 8  $\times$  13.4mm<sup>2</sup> TSOP

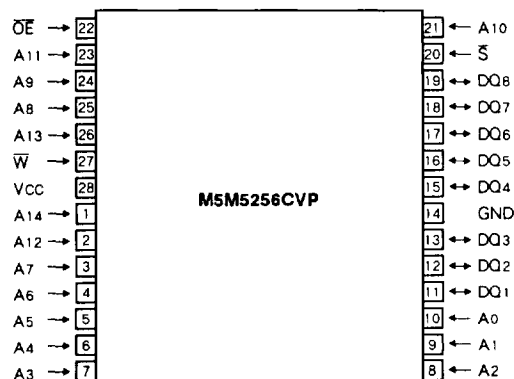
### APPLICATION

Small capacity memory units

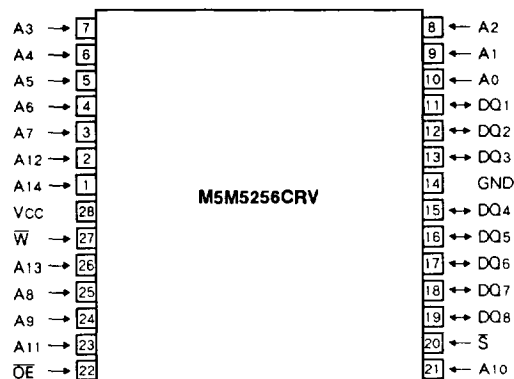
### PIN CONFIGURATION (TOP VIEW)



28P4(P)  
Outline 28P2W-C(FP)  
28P4Y(KP)



Outline 28P2C-A



Outline 28P2C-B

# M5M5256CP,FP,KP,VP,RV-55LL,-55XL,-70LL,-70XL

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

## FUNCTION

The operation mode of the M5M5256CP,FP,KP,VP,RV is determined by a combination of the device control inputs  $\bar{S}$ ,  $\bar{W}$  and  $\bar{OE}$ . Each mode is summarized in the function table.

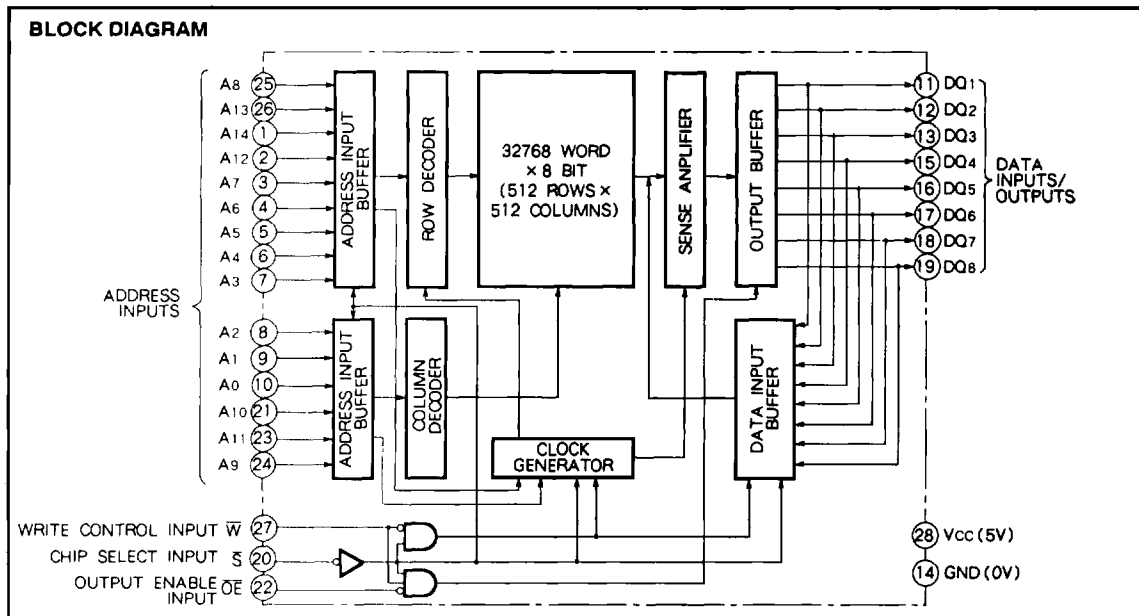
A write cycle is executed whenever the low level  $\bar{W}$  overlaps with the low level  $\bar{S}$ . The address must be set-up before the write cycle and must be stable during the entire cycle. The data is latched into a cell on the trailing edge of  $\bar{W}$ ,  $\bar{S}$ , whichever occurs first, requiring the set-up and hold time relative to these edge to be maintained. The output enable  $\bar{OE}$  directly controls the output stage. Setting the  $\bar{OE}$  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  $\bar{W}$  at a high level and  $\bar{OE}$  at a low level while  $\bar{S}$  are in an active state.

When setting  $\bar{S}$  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  $\bar{S}$ . The power supply current is reduced as low as the stand-by current which is specified as  $I_{CC3}$  or  $I_{CC4}$ , and the memory data can be held +2V power supply, enabling battery back-up operation during power failure or power-down operation in the non-selected mode.

## FUNCTION TABLE

| $\bar{S}$ | $\bar{W}$ | $\bar{OE}$ | 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   |



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## ABSOLUTE MAXIMUM RATINGS

| Symbol           | Parameter             | Conditions            | Ratings                      | Unit |
|------------------|-----------------------|-----------------------|------------------------------|------|
| V <sub>CC</sub>  | Supply voltage        |                       | - 0.3~7                      | V    |
| V <sub>I</sub>   | Input voltage         | With respect to GND   | - 0.3*~V <sub>CC</sub> + 0.3 | 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 |                       | 0~70                         | °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> = 0~70°C, V<sub>CC</sub> = 5V ± 10 %, unless otherwise noted)

| Symbol           | Parameter                                | Test conditions                                                                                    | Limits               |     |                      | Unit |
|------------------|------------------------------------------|----------------------------------------------------------------------------------------------------|----------------------|-----|----------------------|------|
|                  |                                          |                                                                                                    | Min                  | Typ | Max                  |      |
| V <sub>IH</sub>  | High-level input voltage                 |                                                                                                    | 2.2                  |     | V <sub>CC</sub> +0.3 | V    |
| V <sub>IL</sub>  | Low-level input voltage                  |                                                                                                    | - 0.3*               |     | 0.8                  | V    |
| V <sub>OH1</sub> | High-level output voltage 1              | I <sub>OH</sub> = - 1mA                                                                            | 2.4                  |     |                      | V    |
| V <sub>OH2</sub> | High-level output voltage 2              | I <sub>OH</sub> = - 0.1mA                                                                          | V <sub>CC</sub> -0.5 |     |                      | V    |
| V <sub>OL</sub>  | Low-level output voltage                 | I <sub>OL</sub> = 2mA                                                                              |                      |     | 0.4                  | V    |
| I <sub>I</sub>   | Input leakage current                    | V <sub>I</sub> = 0~V <sub>CC</sub>                                                                 |                      |     | ± 1                  | μA   |
| I <sub>O</sub>   | Output leakage current                   | $\bar{S} = V_{IH}$ or<br>OE = V <sub>IH</sub> , V <sub>I/O</sub> = 0~V <sub>CC</sub>               |                      |     | ± 1                  | μA   |
| I <sub>CC1</sub> | Active supply current<br>(AC, MOS level) | $\bar{S} \leq 0.2V$<br>Other inputs ≤ 0.2V<br>or ≥ V <sub>CC</sub> - 0.2V<br>Output open Min.cycle | 55ns                 | 35  | 55                   | mA   |
|                  |                                          |                                                                                                    | 70ns                 | 30  | 50                   |      |
| I <sub>CC2</sub> | Active supply current<br>(AC, TTL level) | $\bar{S} = V_{IL}$<br>Other inputs = V <sub>IH</sub> or V <sub>IL</sub><br>Output open Min.cycle   | 55ns                 | 40  | 60                   | mA   |
|                  |                                          |                                                                                                    | 70ns                 | 35  | 55                   |      |
| I <sub>CC3</sub> | Stand-by supply current                  | $\bar{S} \geq V_{CC} - 0.2V$ ,<br>Other inputs = 0~V <sub>CC</sub>                                 | -LL                  |     | 20                   | μA   |
|                  |                                          |                                                                                                    | -XL                  | 0.1 | 5                    |      |
| I <sub>CC4</sub> | Stand-by supply current                  | $\bar{S} = V_{IH}$ , Other inputs = 0~V <sub>CC</sub>                                              |                      |     | 3                    | mA   |

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

## CAPACITANCE (T<sub>a</sub> = 0~70°C, V<sub>CC</sub> = 5V ± 10 %, unless otherwise noted)

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

Note 1. Direction for current flowing into IC is indicated as positive.(no mark)

2. Typical value is V<sub>CC</sub> = 5V, T<sub>a</sub> = 25°C.

3. C<sub>I</sub>, C<sub>O</sub> are periodically sampled and are not 100% tested.

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## AC ELECTRICAL CHARACTERISTICS (Ta = 0~70°C, Vcc = 5V ± 10%, unless otherwise noted)

### (1) MEASUREMENT CONDITIONS

Input pulse level.....V<sub>IH</sub> = 2.4V, V<sub>IL</sub> = 0.6V

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

Reference level.....V<sub>OH</sub> = V<sub>OL</sub> = 1.5V

Transition is measured ± 500mV from steady state voltage.(for t<sub>en</sub>, t<sub>dis</sub>)

Output loads.....Fig.1. C<sub>L</sub> = 50pF

C<sub>L</sub> = 5pF (for t<sub>en</sub>, t<sub>dis</sub>)

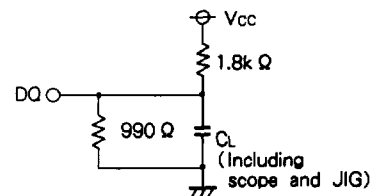


Fig.1 Output load

### (2) READ CYCLE

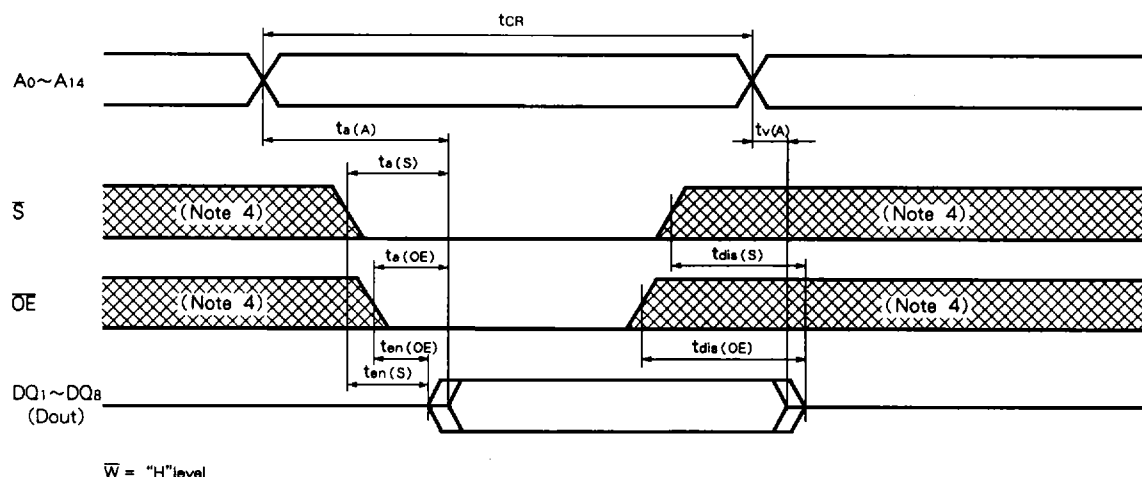
| Symbol                | Parameter                         | Limits                         |     |     |                                |     |     | Unit |
|-----------------------|-----------------------------------|--------------------------------|-----|-----|--------------------------------|-----|-----|------|
|                       |                                   | M5M5256C-55LL<br>M5M5256C-55XL |     |     | M5M5256C-70LL<br>M5M5256C-70XL |     |     |      |
|                       |                                   | Min                            | Typ | Max | Min                            | Typ | Max |      |
| t <sub>CR</sub>       | Read cycle time                   | 55                             |     |     | 70                             |     |     | ns   |
| t <sub>a</sub> (A)    | Address access time               |                                |     | 55  |                                |     | 70  | ns   |
| t <sub>a</sub> (S)    | Chip select access time           |                                |     | 55  |                                |     | 70  | ns   |
| t <sub>a</sub> (OE)   | Output enable access time         |                                |     | 30  |                                |     | 35  | ns   |
| t <sub>dis</sub> (S)  | Output disable time after S high  |                                |     | 20  |                                |     | 25  | ns   |
| t <sub>dis</sub> (OE) | Output disable time after OE high |                                |     | 20  |                                |     | 25  | ns   |
| t <sub>en</sub> (S)   | Output enable time after S low    | 5                              |     |     | 5                              |     |     | ns   |
| t <sub>en</sub> (OE)  | Output enable time after OE low   | 5                              |     |     | 5                              |     |     | ns   |
| t <sub>v</sub> (A)    | Data valid time after address     | 10                             |     |     | 10                             |     |     | ns   |

### (3) WRITE CYCLE

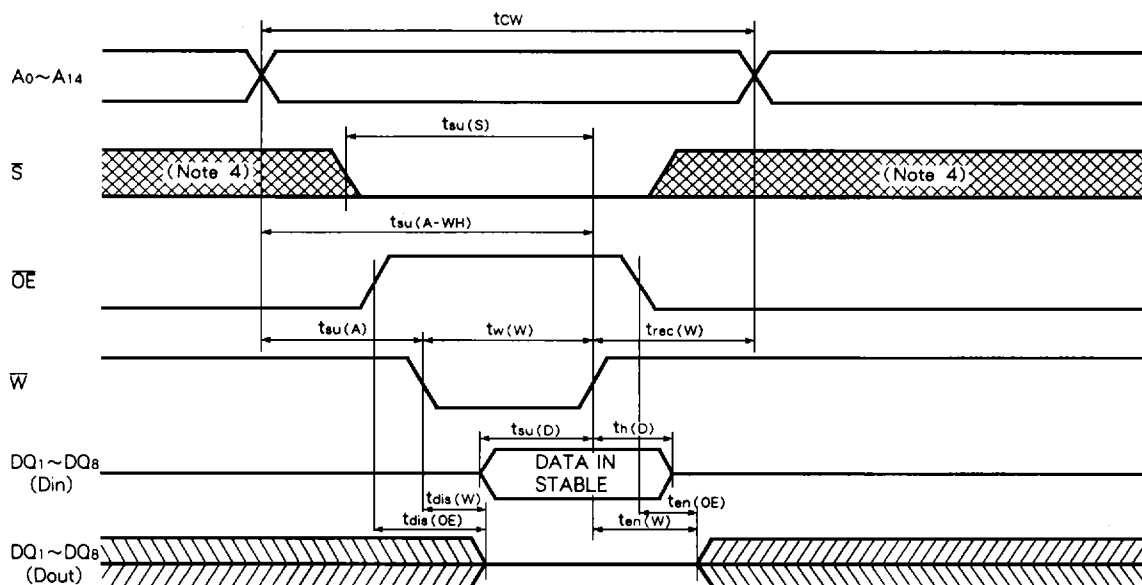
| Symbol                 | Parameter                                               | Limits                         |     |     |                                |     |     | Unit |
|------------------------|---------------------------------------------------------|--------------------------------|-----|-----|--------------------------------|-----|-----|------|
|                        |                                                         | M5M5256C-55LL<br>M5M5256C-55XL |     |     | M5M5256C-70LL<br>M5M5256C-70XL |     |     |      |
|                        |                                                         | Min                            | Typ | Max | Min                            | Typ | Max |      |
| t <sub>OW</sub>        | Write cycle time                                        | 55                             |     |     | 70                             |     |     | ns   |
| t <sub>w</sub> (W)     | Write pulse width                                       | 45                             |     |     | 55                             |     |     | ns   |
| t <sub>su</sub> (A)    | Address set up time                                     | 0                              |     |     | 0                              |     |     | ns   |
| t <sub>su</sub> (A-WH) | Address set up time with respect to $\overline{W}$ high | 50                             |     |     | 65                             |     |     | ns   |
| t <sub>su</sub> (S)    | Chip select set up time                                 | 50                             |     |     | 65                             |     |     | ns   |
| t <sub>su</sub> (D)    | Data set up time                                        | 25                             |     |     | 30                             |     |     | ns   |
| t <sub>h</sub> (D)     | Data hold time                                          | 0                              |     |     | 0                              |     |     | ns   |
| t <sub>rec</sub> (W)   | Write recovery time                                     | 0                              |     |     | 0                              |     |     | ns   |
| t <sub>dis</sub> (W)   | Output disable time after $\overline{W}$ low            |                                |     | 20  |                                |     | 25  | ns   |
| t <sub>dis</sub> (OE)  | Output disable time after $\overline{OE}$ high          |                                |     | 20  |                                |     | 25  | ns   |
| t <sub>en</sub> (W)    | Output enable time after $\overline{W}$ high            | 5                              |     |     | 5                              |     |     | ns   |
| t <sub>en</sub> (OE)   | Output enable time after $\overline{OE}$ low            | 5                              |     |     | 5                              |     |     | ns   |

(4) TIMING DIAGRAMS

Read Cycle



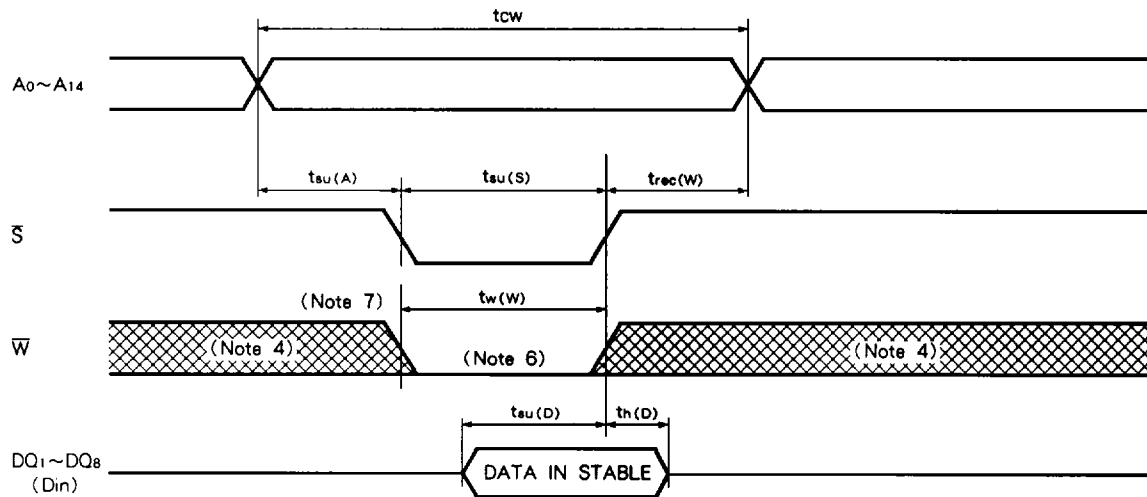
Write cycle ( $\bar{W}$  control mode)



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## Write cycle ( $\bar{S}$ control mode)



Note 4. Hatching indicates the state is don't care.

5. Writing is executed in overlap of  $\bar{S}$  and  $\bar{W}$  low.

6. If  $\bar{W}$  goes low simultaneously with or prior to  $\bar{S}$ , the output remains in the high-impedance state.

7. Don't apply inverted phase signal externally when DQ pin is in output mode.

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

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## POWER DOWN CHARACTERISTICS

(1) ELECTRICAL CHARACTERISTICS ( $T_a = 0 \sim 70^\circ\text{C}$ ,  $V_{cc} = 5V \pm 10\%$ , unless otherwise noted)

| Symbol         | Parameter                   | Test conditions                | Limits |              |     | Unit    |
|----------------|-----------------------------|--------------------------------|--------|--------------|-----|---------|
|                |                             |                                | Min    | Typ          | Max |         |
| $V_{cc(PD)}$   | Power down supply voltage   |                                | 2      |              |     | V       |
| $V_i(\bar{S})$ | Chip select input $\bar{S}$ | $2.2V \leq V_{cc(PD)}$         | 2.2    |              |     | V       |
|                |                             | $2V \leq V_{cc(PD)} \leq 2.2V$ |        | $V_{cc(PD)}$ |     |         |
| $I_{cc(PD)}$   | Power down supply current   | $V_{cc} = 3V$                  | -LL    |              | 10* | $\mu A$ |
|                |                             | Other inputs = 3V              | -XL    | 0.05         | 2** | $\mu A$ |

\*  $T_a = 25^\circ\text{C}$ ,  $I_{cc(PD)} = 1 \mu A$ 

\*\*  $T_a = 25^\circ\text{C}$ ,  $I_{cc(PD)} = 0.2 \mu A$ 

(2) TIMING REQUIREMENTS ( $T_a = 0 \sim 70^\circ\text{C}$ ,  $V_{cc} = 5V \pm 10\%$ , unless otherwise noted)

| Symbol        | Parameter                | Test conditions | Limits   |     |     | Unit |
|---------------|--------------------------|-----------------|----------|-----|-----|------|
|               |                          |                 | Min      | Typ | Max |      |
| $t_{su(PD)}$  | Power down set up time   |                 | 0        |     |     | ns   |
| $t_{rec(PD)}$ | Power down recovery time |                 | $t_{cr}$ |     |     | ns   |

## (3) POWER COWN CHARACTERISTICS

 $\bar{S}$  control mode
