

# M5M5256DFP,VP -70G,-70GI,-70XG

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

## DESCRIPTION

The M5M5256DFP,VP is 262,144-bit CMOS static RAMs organized as 32,768-words by 8-bits which is fabricated using high-performance 3 poly silicon 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 are packaged in a 28-pin thin small outline package.

## FEATURE

Type	Access time (max)	Operating Temperature	Power supply current	
			Active (max)	Stand-by (max)
M5M5256DFP,VP -70G	70ns	0~70°C	45mA (V <sub>cc</sub> =5.5V)	20µA (V <sub>cc</sub> =5.5V)
M5M5256DFP,VP -70GI	70ns	-40~85°C		40µA (V <sub>cc</sub> =5.5V)
M5M5256DFP,VP -70XG	70ns	0~70°C	25mA (V <sub>cc</sub> =3.6V)	24µA (V <sub>cc</sub> =3.6V)
				5µA (V <sub>cc</sub> =5.5V)
				2.4µA (V <sub>cc</sub> =3.6V)
				0.05µA (V <sub>cc</sub> =3.0V Typical)

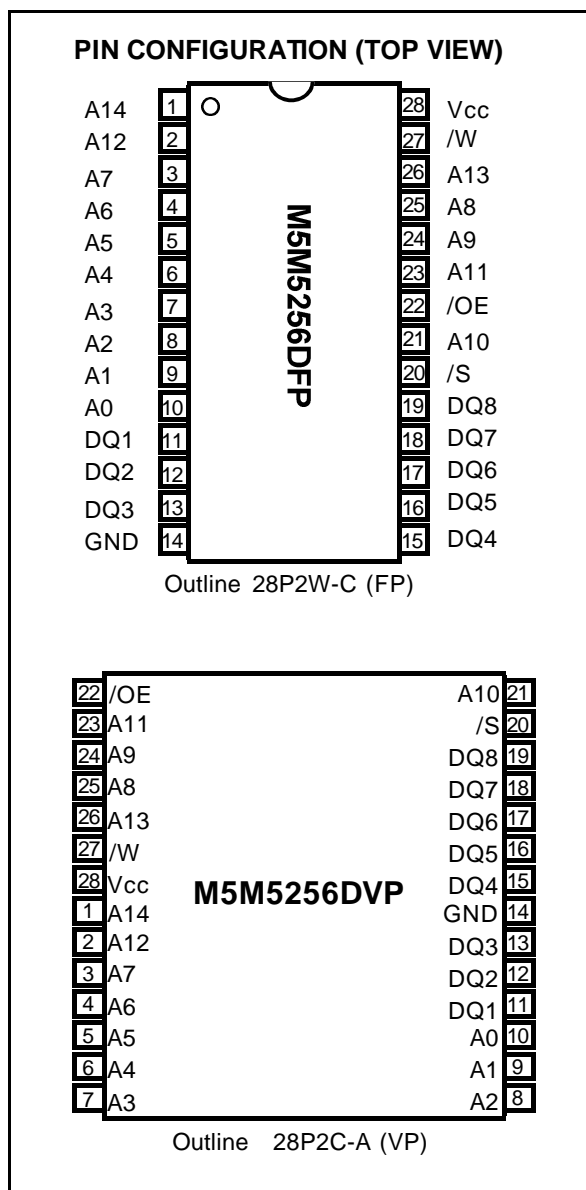
- Single 3.0~5.5V power supply
- No clocks, no refresh
- Data-Hold on +2.0V power supply
- Directly TTL compatible : all inputs and outputs
- Three-state outputs : OR-tie capability
- /OE prevents data contention in the I/O bus
- Common Data I/O
- Battery backup capability
- Low stand-by current ..... 0.05µA(typ.)

## PACKAGE

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

## APPLICATION

Small capacity memory units



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## FUNCTION

The operation mode of the M5M5256DFP,VP 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.

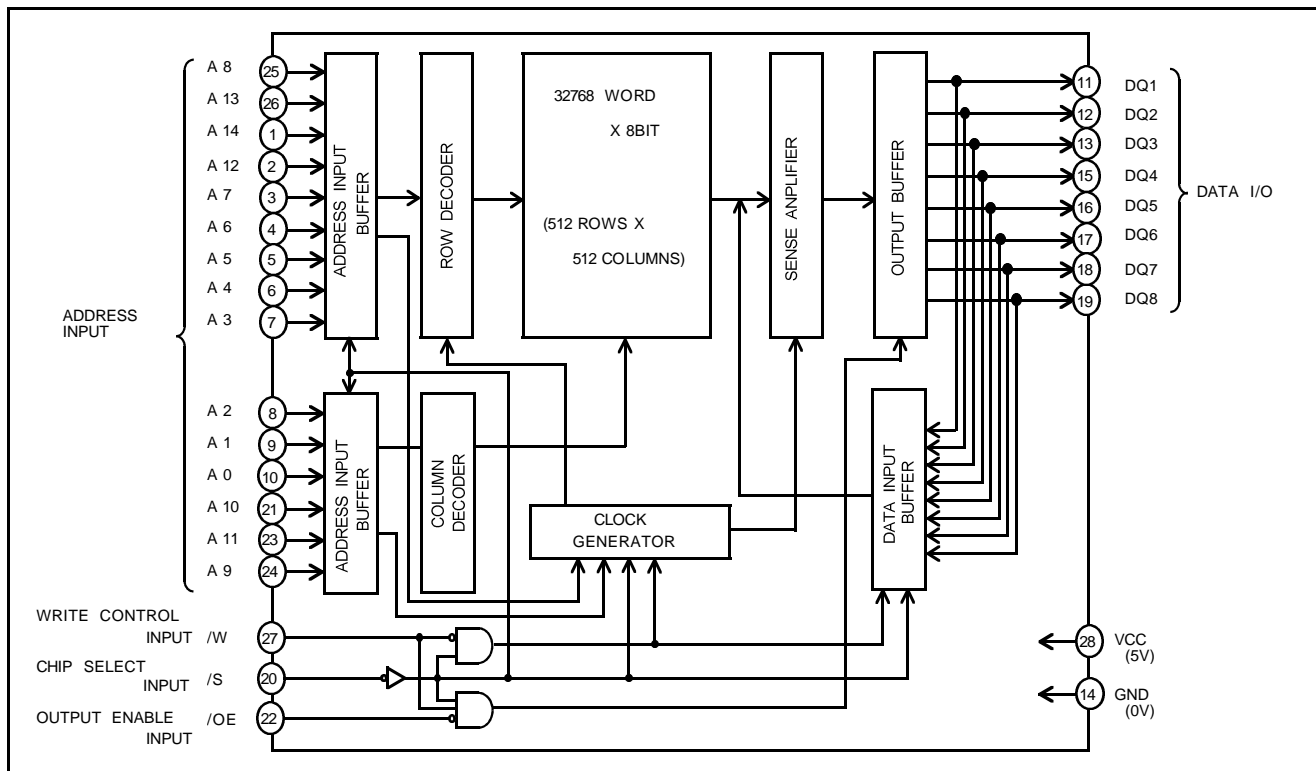
## FUNCTION TABLE

/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

Note • "H" and "L" in this table mean VIH and VIL, respectively.

• "X" in this table should be "H" or "L".

## BLOCK DIAGRAM



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**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Conditions	Ratings	Unit
V <sub>CC</sub>	Supply voltage	With respect to GND	-0.3*~7.0	V
V <sub>I</sub>	Input voltage		-0.3*~V <sub>CC</sub> +0.3 (Max 7.0)	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	-G,-XG	0~70	°C
		-GI	-40~85	
T <sub>stg</sub>	Storage temperature		-65~150	°C

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

**DC ELECTRICAL CHARACTERISTICS**

Symbol	Parameter	Test conditions	Limits1 (V <sub>CC</sub> =3.3±0.3V)			Limits2 (V <sub>CC</sub> =5.0±0.5V)			Unit
			Min	Typ	Max	Min	Typ	Max	
V <sub>IH</sub>	High-level input voltage		2.0		V <sub>CC</sub> +0.3	2.2		V <sub>CC</sub> +0.3	V
V <sub>IL</sub>	Low-level input voltage		-0.3*		0.6	-0.3*		0.8	V
V <sub>OH1</sub>	High-level output voltage 1	I <sub>OH</sub> =-1mA (V <sub>CC</sub> =5.0±0.5V) I <sub>OH</sub> =-0.5mA (V <sub>CC</sub> =3.3±0.3V)	2.4			2.4			V
V <sub>OH2</sub>	High-level output voltage 2	I <sub>OH</sub> =-0.1mA (V <sub>CC</sub> =5.0±0.5V) I <sub>OH</sub> =-0.05mA (V <sub>CC</sub> =3.3±0.3V)	V <sub>CC</sub> -0.5			V <sub>CC</sub> -0.5			V
V <sub>OL</sub>	Low-level output voltage	I <sub>OL</sub> =2mA (V <sub>CC</sub> =5.0±0.5V) I <sub>OL</sub> =1mA (V <sub>CC</sub> =3.3±0.3V)			0.4			0.4	V
I <sub>I</sub>	Input current	V <sub>I</sub> =0~V <sub>CC</sub>			±1			±1	µA
I <sub>O</sub>	Output current in off-state	/S=V <sub>IH</sub> or or /OE=V <sub>IH</sub> , V <sub>I/O</sub> =0~V <sub>CC</sub>			±1			±1	µA
I <sub>CC1</sub>	Active supply current (AC, MOS level)	/S<0.2V, Output-open Other inputs<0.2V or >V <sub>CC</sub> -0.2V	70ns 1MHz	13 1.5	25 3	25 2	40 4		mA
I <sub>CC2</sub>	Active supply current (AC, TTL level)	/S=V <sub>IL</sub> , Output-open other inputs=V <sub>IH</sub> or V <sub>IL</sub>	70ns 1MHz	14 1.5	25 3	25 4	45 8		mA
I <sub>CC3</sub>	Stand-by current	/S>V <sub>CC</sub> -0.2V, other inputs =0~V <sub>CC</sub>	~25°C ~40°C ~70°C ~85°C	-G,-GI -XG -G,-GI -XG -GI	1.2 0.05 0.3 0.8 2.4 24		2 0.1 0.4 1.2 5 40		µA
I <sub>CC4</sub>	Stand-by current	/S=V <sub>IH</sub> , other inputs=0~V <sub>CC</sub>			0.33		3		mA

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

**CAPACITANCE**

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****(1) READ CYCLE**

Symbol	Parameter	Limits1 V <sub>CC</sub> =3.3±0.3V		Limits2 V <sub>CC</sub> =5.0±0.5V		Unit
		Min	Max	Min	Max	
t <sub>CR</sub>	Read cycle time	70		70		ns
t <sub>a(A)</sub>	Address access time		70		70	ns
t <sub>a(S)</sub>	Chip select access time		70		70	ns
t <sub>a(OE)</sub>	Output enable access time		35		35	ns
t <sub>dis(S)</sub>	Output disable time after /S high		25		25	ns
t <sub>dis(OE)</sub>	Output disable time after /OE high		25		25	ns
t <sub>en(S)</sub>	Output enable time after /S low	5		5		ns
t <sub>en(OE)</sub>	Output enable time after /OE low	5		5		ns
t <sub>v(A)</sub>	Data valid time after address	10		10		ns

**(2) WRITE CYCLE**

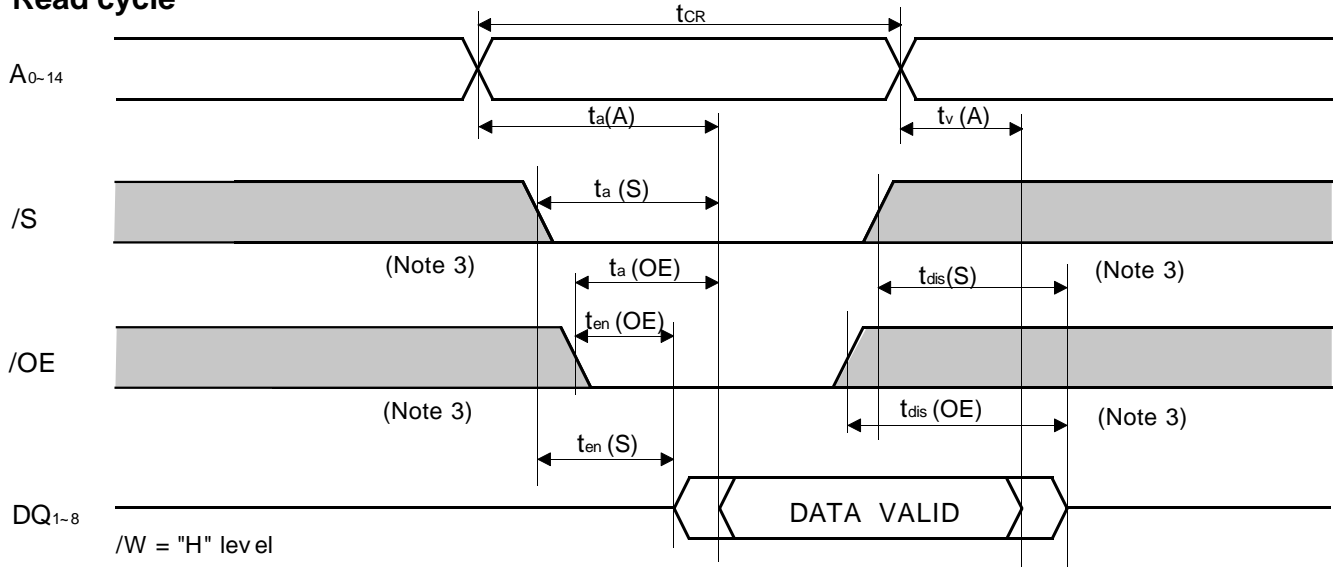
Symbol	Parameter	Limits1 V <sub>CC</sub> =3.3±0.3V		Limits2 V <sub>CC</sub> =5.0±0.5V		Unit
		Min	Max	Min	Max	
t <sub>cw</sub>	Write cycle time	70		70		ns
t <sub>w(W)</sub>	Write pulse width	55		50		ns
t <sub>su(A)</sub>	Address setup time	0		0		ns
t <sub>su(A-WH)</sub>	Address setup time with respect to /W high	65		65		ns
t <sub>su(S)</sub>	Chip select setup time	65		65		ns
t <sub>su(D)</sub>	Data setup time	30		30		ns
t <sub>h(D)</sub>	Data hold time	0		0		ns
t <sub>rec(W)</sub>	Write recovery time	0		0		ns
t <sub>dis(W)</sub>	Output disable time from /W low		25		25	ns
t <sub>dis(OE)</sub>	Output disable time from /OE high		25		25	ns
t <sub>en(W)</sub>	Output enable time from /W high	5		5		ns
t <sub>en(OE)</sub>	Output enable time from /OE low	5		5		ns

# M5M5256DFP,VP -70G,-70GI,-70XG

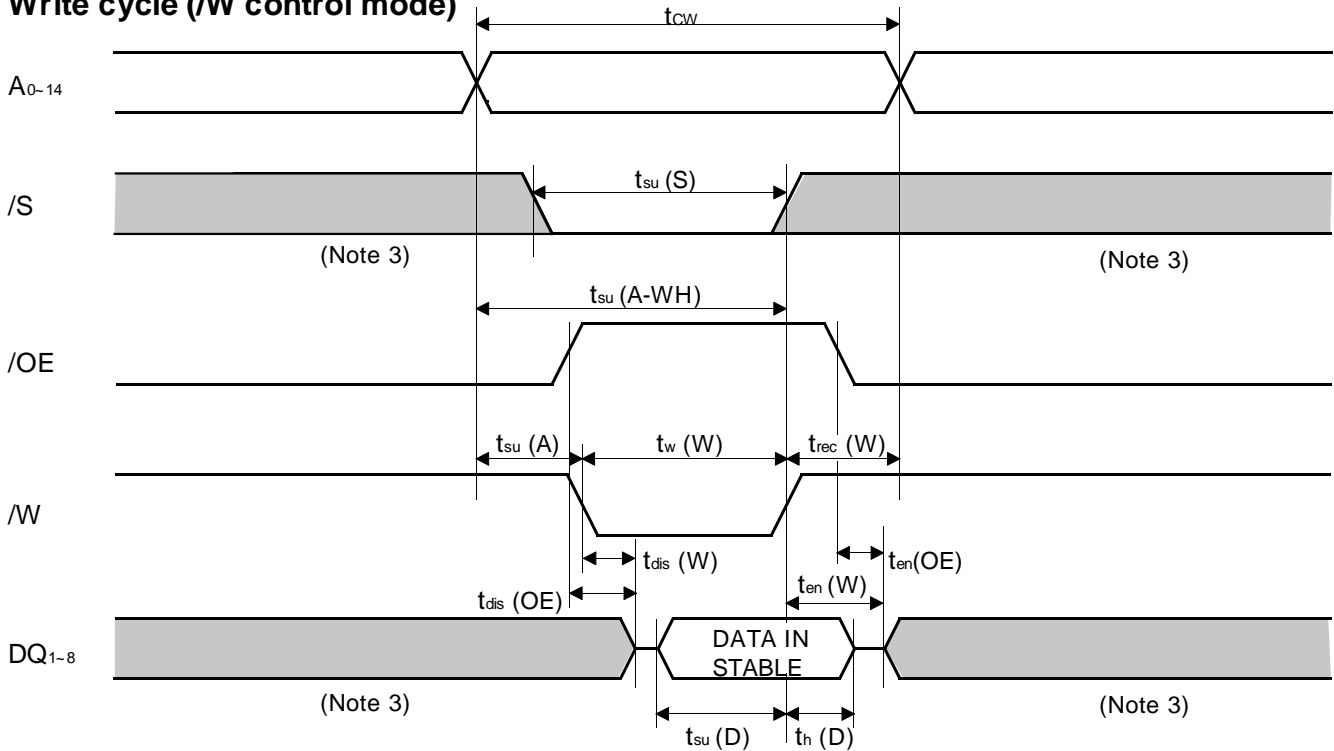
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## (3) TIMING DIAGRAMS

### Read cycle



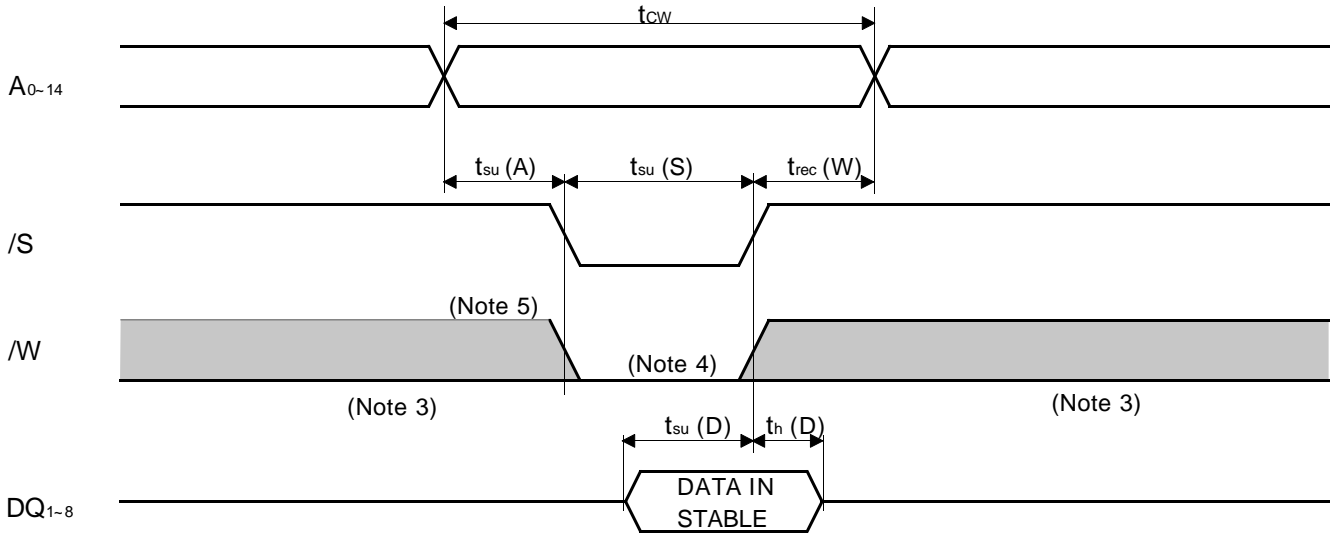
### Write cycle (/W control mode)



# M5M5256DFP,VP -70G,-70GI,-70XG

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## Write cycle (/S control mode)



## (4) MEASUREMENT CONDITIONS

Limits1: Vcc=3.3±0.3V

Input pulse level .....  $V_{IH}=2.4V, V_{IL}=0.4V$

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

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

Output load ..... Fig.1,  $CL=30pF$

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

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

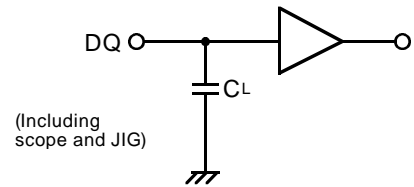


Fig.1 Output load

Limits2: Vcc=5.0±0.5V

Input pulse level .....  $V_{IH}=2.4V, V_{IL}=0.6V$

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

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

Output load ..... Fig.2,  $CL=100pF$

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

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

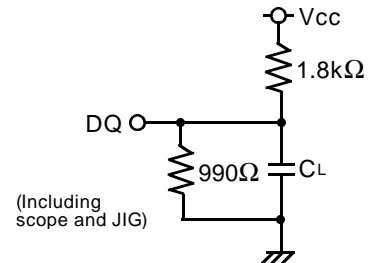


Fig.2 Output load

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

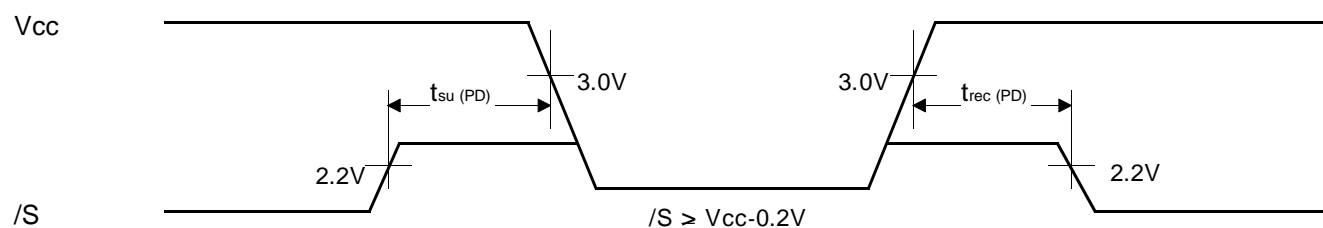
Symbol	Parameter	Test conditions	Limits			Unit	
			Min	Typ	Max		
$V_{CC(PD)}$	Power down supply voltage		2			V	
$V_I (/S)$	Chip select input /S	$2.2V \leq V_{CC(PD)}$	2.2			V	
		$2V \leq V_{CC(PD)} \leq 2.2V$		$V_{CC(PD)}$		V	
$I_{CC(PD)}$	Power down supply current	$V_{CC} = 3V, /S \geq V_{CC}-0.2V,$ Other inputs=0~ $V_{CC}$	~25°C	-G,-GI		1	$\mu A$
				-XG	0.05	0.2	
			~40°C	-G,-GI		3	
				-XG		0.6	
			~70°C	-G,-GI		10	
				-XG		2	
~85°C	-GI		20				

### (2) TIMING REQUIREMENTS

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		tCR			ns

### (3) POWER DOWN CHARACTERISTICS

#### /S control mode



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