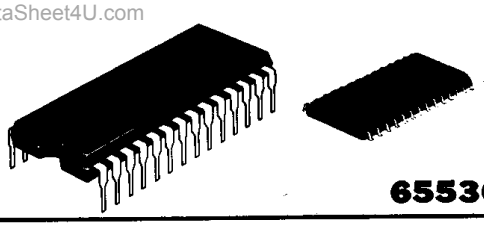


MITSUBISHI LSIs

M5M5165P,FP-70,-10,-12,-15, -70L,-10L,-12L,-15L

65536-BIT (8192-WORD BY 8-BIT) CMOS STATIC RAM

DESCRIPTION

The M5M5165P,FP is a 65536-bit CMOS static RAM organized as 8192 words by 8 bits which is fabricated using high-performance double polysilicon CMOS technology. The use of resistive load NMOS cells and CMOS periphery result in a high-density and low-power static RAM. It is ideal for the memory systems which require simple interface.

The stand-by current is low enough for a battery back-up application.

FEATURES

Type	Access time (max)	Power supply current	
		Active (max)	Stand-by (max)
M5M5165P, FP-70	70ns	50mA	2mA
M5M5165P, FP-10	100ns		
M5M5165P, FP-12	120ns		
M5M5165P, FP-15	150ns		
M5M5165P, FP-70L	70ns		20μA (Vcc=5.5V) 10μA (Vcc=3.0V)
M5M5165P, FP-10L	100ns		
M5M5165P, FP-12L	120ns		
M5M5165P, FP-15L	150ns		

- Single +5V Power Supply
- Fully Static Operation: 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 Expantion by $\overline{S_1}$, S_2
- $\overline{OE}$ Prevents Data Contention in The I/O Bus
- Common Data I/O

APPLICATION

Small Capacity Memory Units.

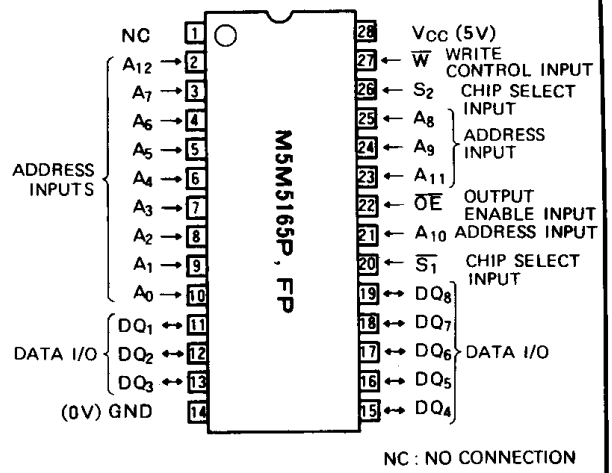
FUNCTION

The operation mode of the M5M5165P, FP is determined by a combination of the device control inputs $\overline{S_1}$, S_2, $\overline{W}$ and $\overline{OE}$. Each mode is summarized in the function table. (see next page)

A write cycle is executed whenever the low level $\overline{W}$ overlaps with the low level $\overline{S_1}$ and the high level S_2. 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 $\overline{W}$, $\overline{S_1}$ or S_2, whichever occurs first, requiring the set-up and hold time relative to these edge to be maintained. The Output enable input $\overline{OE}$ directly controls the output stage. Setting the $\overline{OE}$ 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.

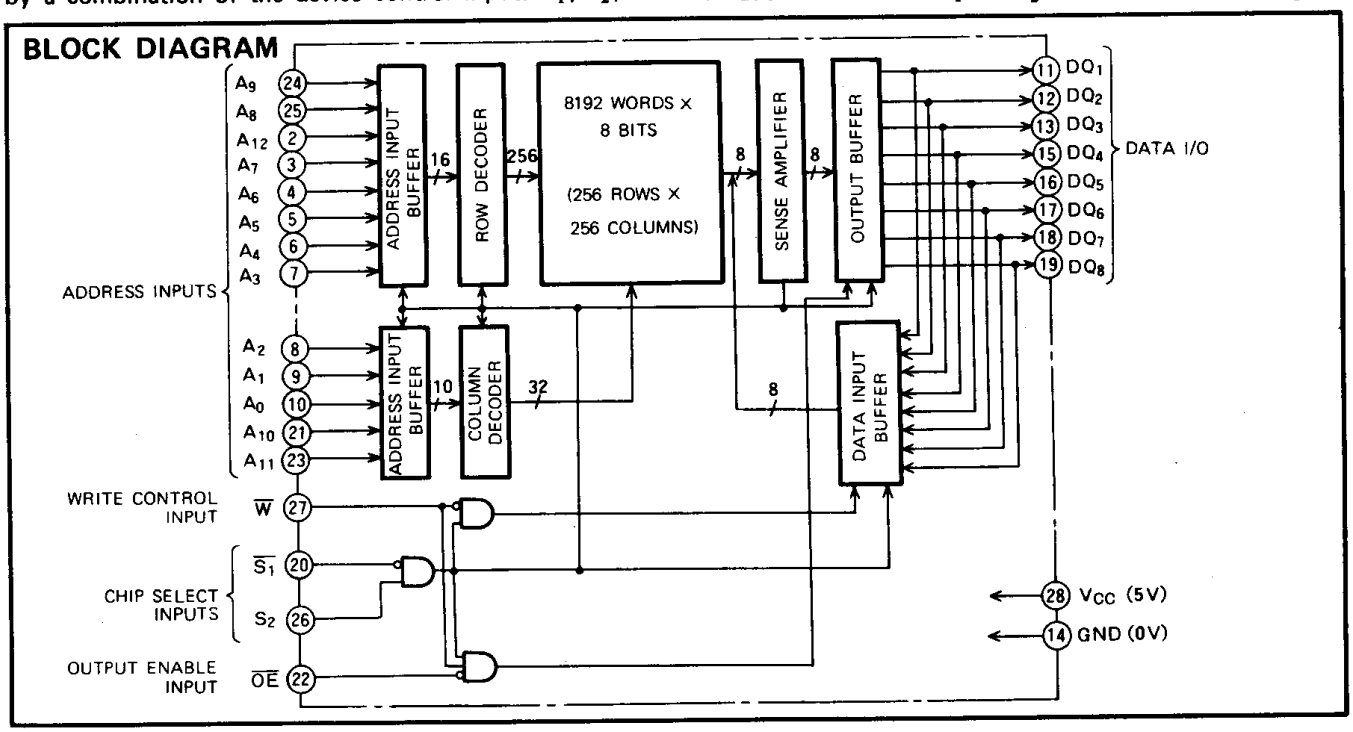
A read cycle is excuted by setting $\overline{W}$ at a high level and $\overline{OE}$ at a low level while $\overline{S_1}$ and S_2 are in an active state ($\overline{S_1}$=L,

PIN CONFIGURATION (TOP VIEW)



Outline 28P4 (DIP)
28P2W-C (SOP)

BLOCK DIAGRAM



M5M5165P, FP-70, -10, -12, -15, -70L, -10L, -12L, -15L

65536-BIT (8192-WORD BY 8-BIT) CMOS STATIC RAM

S_2=H)

When setting $\overline{S_1}$ at a high level or S_2 at a low 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 expantion by $\overline{S_1}$ and S_2. 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 at +2V power supply, enabling battery back-up operation during power failure or power-down operation in the non-selected mode.

FUNCTION TABLE

$\overline{S_1}$	S_2	$\overline{W}$	$\overline{OE}$	Mode	DQ	I_{CC}
X	L	X	X	Non selection	high-impedance	Standby
H	X	X	X	Non selection	high-impedance	Standby
L	H	L	X	Write	D_{IN}	Active
L	H	H	L	Read	D_{OUT}	Active
L	H	H	H		high-impedance	Active

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage	With respect to GND	−0.3 ~ 7	V
V_I	Input voltage		−0.3 ~ V_{CC}+0.3	V
V_O	Output voltage		0 ~ V_{CC}	V
Pd	Power dissipation	Ta=25°C	700	mW
Topr	Operating temperature		0 ~ 70	°C
Tstg	Storage temperature		−65 ~ 150	°C

ELECTRICAL CHARACTERISTICS (Ta=0 ~ 70°C, V_{CC}=5V ±10%, unless otherwise noted)

Symbol	Parameter	Test conditions		Limits Min	Limits Typ	Limits Max	Unit
V_{IH}	High input voltage			2.2		V_{CC}+0.3	V
V_{IL}	Low input voltage			−0.3		0.8	V
V_{OH}	High output voltage	I_{OH}=−1mA		2.4			V
V_{OL}	Low output voltage	I_{OL}= 2 mA				0.4	V
I_I	Input current	V_I=0 ~ V_{CC}				±1	μA
I_{OZH}	High level output current in off-state	$\overline{S_1}$=V_{IH} or S_2=V_{IL} or $\overline{OE}$=V_{IH}				1	μA
I_{OZL}	Low level output current in off-state	$V_{I/O}$=0 − V_{CC}				−1	μA
I_{CC1}	Active supply current	$\overline{S_1}$≦0.2, S_2≧V_{CC}−0.2 Outout open Other inputs ≦0.2 or ≧V_{CC}−0.2			30	45	mA
I_{CC2}	Active supply current	$\overline{S_1}$=V_{IL} or S_2=V_{IH} Output open Other inputs =V_{IH}			35	50	mA
I_{CC3}	Stand-by supply current	① S_2≦0.2V, Other inputs = 0 ~ V_{CC} ② $\overline{S_1}$≧V_{CC}−0.2V, S_2≧V_{CC}−0.2V, Other inputs=0 ~ V_{CC}	P, FP			2	mA
			P, FP-L			20	μA
I_{CC4}	Stand-by supply current	S_2=V_{IL}, $\overline{S_1}$=V_{IH}, Other inputs=0 ~ V_{CC}				3	mA
Ci	Input capacitance (Ta=25°C)	V_I=GND, V_i=25mVrms, f=1MHz				6	pF
Co	Output capacitance (Ta=25°C)	V_O=GND, V_O=25mVrms, f=1MHz				8	pF

Note 1 Direction for current flowing into IC is indicated as positive (no mark)
2 Typical value is V_{CC}=5V, Ta=25°C

SWITCHING CHARACTERISTICS ($T_a = 0 \sim 70°C$, $V_{CC} = 5V \pm 10\%$, unless otherwise noted)

Read cycle

Symbol	Parameter	Limits												Unit
		M5M5165P, FP-70 M5M5165P, FP-70L			M5M5165P, FP-10 M5M5165P, FP-10L			M5M5165P, FP-12 M5M5165P, FP-12L			M5M5165P, FP-15 M5M5165P, FP-15L			
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
t_{CR}	Read cycle time	70			100			120			150			ns
$t_{a(A)}$	Address access time			70			100			120			150	ns
$t_{a(S_1)}$	Chip select 1 access time			70			100			120			150	ns
$t_{a(S_2)}$	Chip select 2 access time			70			100			120			150	ns
$t_{a(OE)}$	Output enable access time			35			50			60			70	ns
$t_{dis(S_1)}$	Output disable time after $\overline{S_1}$ high			30			35			40			50	ns
$t_{dis(S_2)}$	Output disable time after S_2 low			30			35			40			50	ns
$t_{dis(OE)}$	Output disable time after $\overline{OE}$ high			30			35			40			50	ns
$t_{en(S_1)}$	Output enable time after $\overline{S_1}$ low	5			10			10			10			ns
$t_{en(S_2)}$	Output enable time after S_2 high	5			10			10			10			ns
$t_{en(OE)}$	Output enable time after $\overline{OE}$ low	5			10			10			10			ns
$t_{v(A)}$	Data valid time after address change	20			20			20			20			ns

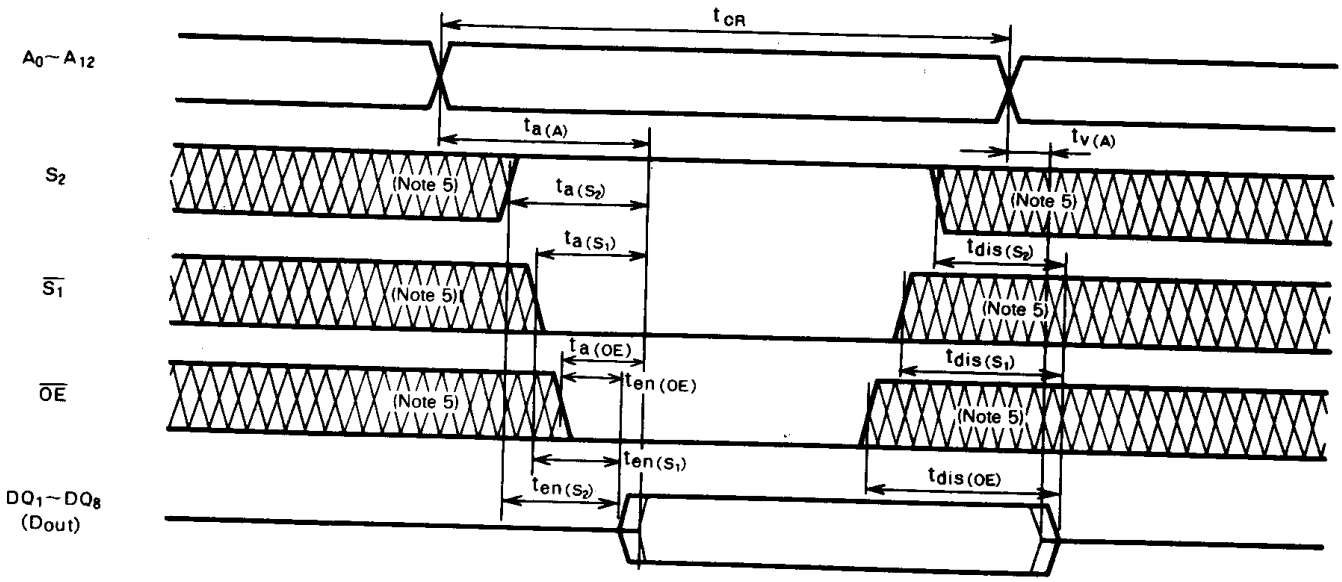
TIMING REQUIREMENTS ($T_a = 0 \sim 70°C$, $V_{CC} = 5V \pm 10\%$, unless otherwise noted)

Write cycle

Symbol	Parameter	Limits												Unit
		M5M5165P, FP-70 M5M5165P, FP-70L			M5M5165P, FP-10 M5M5165P, FP-10L			M5M5165P, FP-12 M5M5165P, FP-12L			M5M5165P, FP-15 M5M5165P, FP-15L			
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
t_{CW}	Write cycle time	70			100			120			150			ns
$t_{w(W)}$	Write pulse width	40			60			70			90			ns
$t_{su(A)}$	Address set up time	0			0			0			0			ns
$t_{su(S)}$	Chip select set up time	65			80			85			100			ns
$t_{su(D)}$	Data set up time	30			35			40			50			ns
$t_{h(D)}$	Data hold time	5			5			5			5			ns
$t_{rec(W)}$	Write recovery time	5			5			10			10			ns
$t_{dis(W)}$	Output disable time after $\overline{W}$ low	0		30			35			40			50	ns
$t_{dis(OE)}$	Output disable time after $\overline{OE}$ high	0		30			35			40			50	ns
$t_{en(W)}$	Output enable time after $\overline{W}$ high	5			10			10			10			ns
$t_{en(OE)}$	Output enable time after $\overline{OE}$ low	5			10			10			10			ns

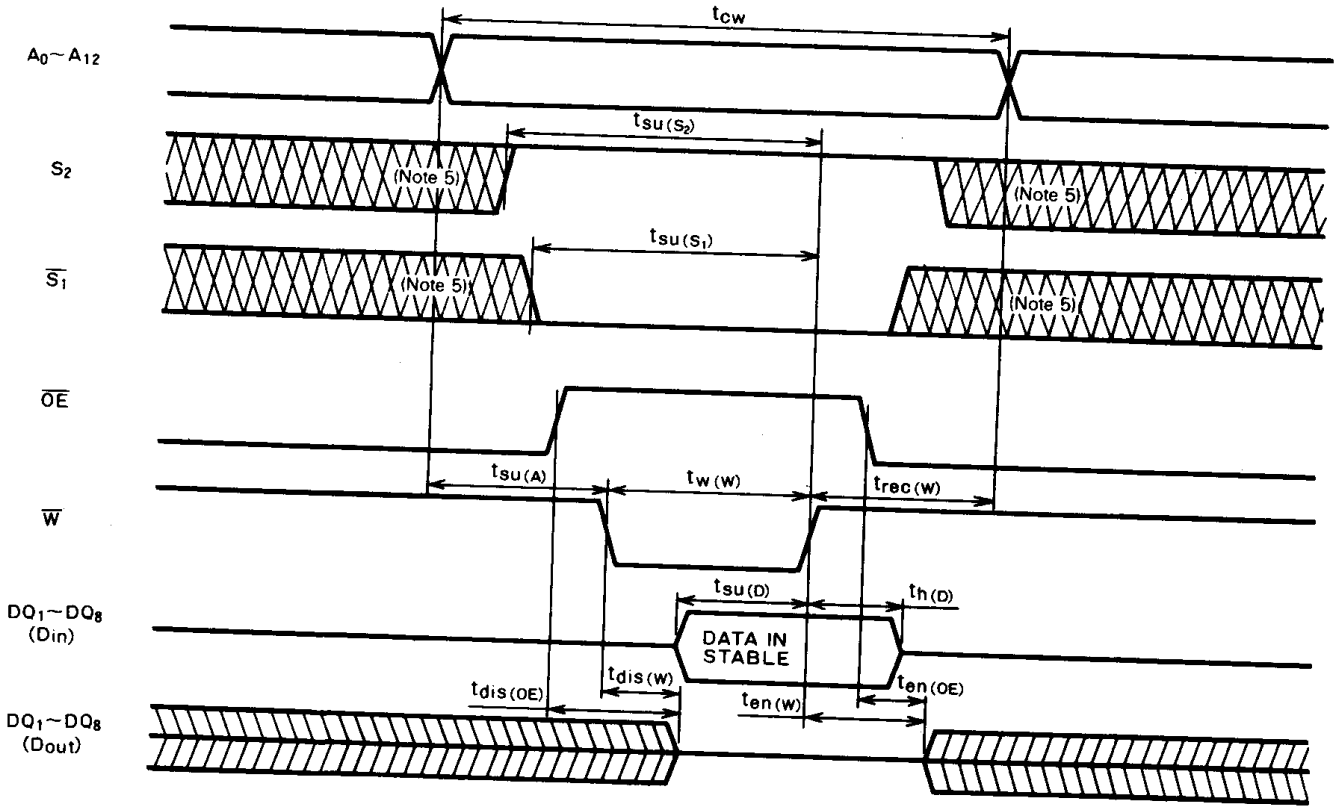
TIMING DIAGRAM

Read cycle

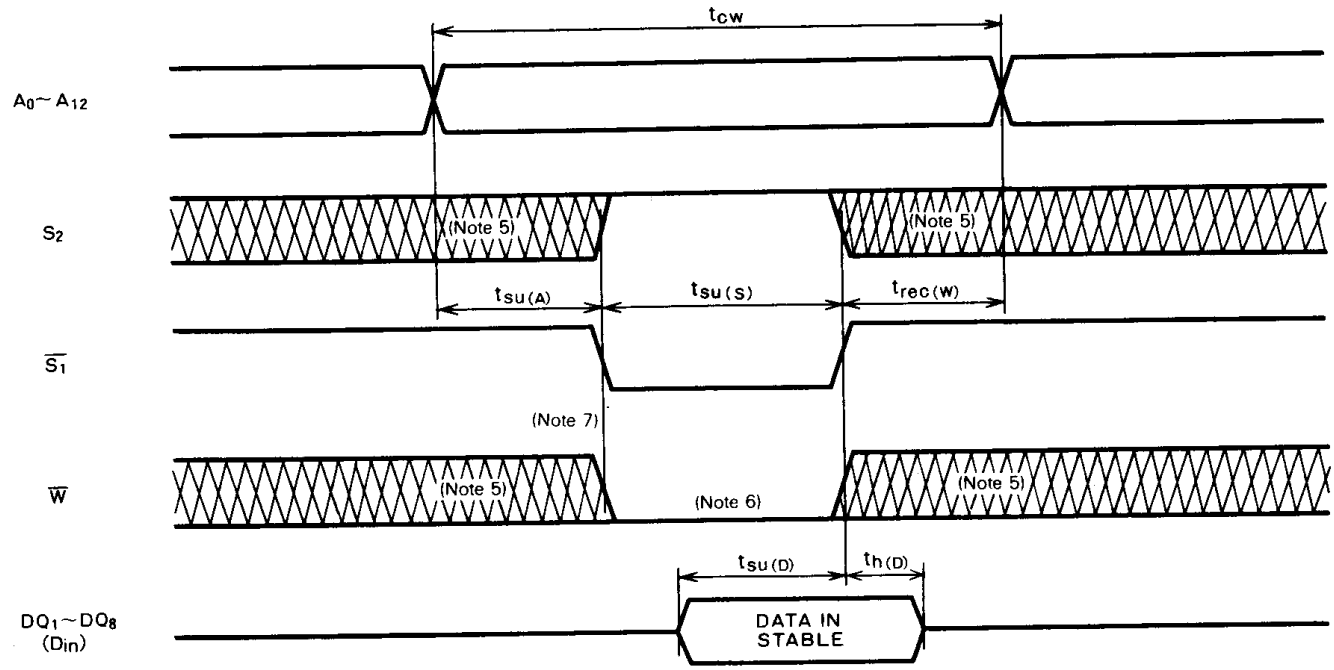


W="H" level

Write cycle (W control)



Write cycle (S control)



Note 4: Test condition

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

Input rise and fall time 10ns

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

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

Output loads . . . . . .Fig. 1, C_L = 100pF (P, FP-10, -12, -15, -10L, -12L, -15L)

C_L = 30pF (P, FP-70, -70L)

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

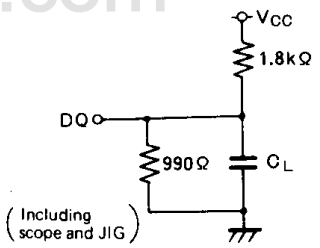


Fig. 1 Output load

Note 5: Hatching indicates the state is don't care.

6: Writing is executed while S_2 high overlaps $\overline{S_1}$ and $\overline{W}$ low.

7: If $\overline{W}$ goes low simultaneously with or prior to $\overline{S_1}$ low or S_2 high, the output remains in the high-impedance state.

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

POWER DOWN CHARACTERISTICS

ELECTRICAL CHARACTERISTICS (Ta = 0 ~ 70°C, unless otherwise noted)

Symbol	Parameter	Test conditions		Limits Min	Limits Typ	Limits Max	Unit
$V_{CC(PD)}$	Power down supply voltage			2			V
$V_{I(\overline{S_1})}$	Chip select input $\overline{S_1}$	$2.2V \leq V_{CC(PD)}$		2.2			V
		$2V \leq V_{CC(PD)} \leq 2.2V$			$V_{CC(PD)}$		
$V_{I(S_2)}$	Chip select input S_2	$4.5V \leq V_{CC(PD)}$				0.8	V
		$V_{CC(PD)} < 4.5V$				0.2	
$I_{CC(PD)}$	Power down supply current	$V_{CC} = 3V$, Other inputs $= 3V$	P, FP			2	mA
			P, FP-L			10 *	μA

Note 3: When $\overline{S_1}$ is operated at 2.2V (V_{IH} min) and the supply voltage is between 4.5V and 2.4V, supply current is defined as I_{CC4}.

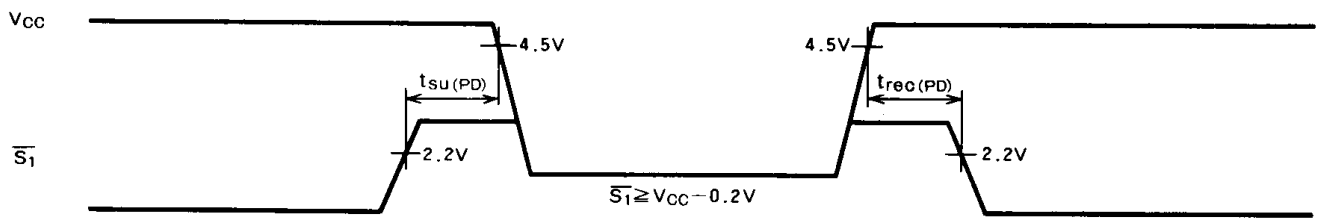
*: $I_{CC}(PD) = 1\mu A$ at $Ta = 25°C$

TIMING REQUIREMENTS (Ta = 0 ~ 70°C, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits Min	Limits Typ	Limits Max	Unit
$t_{su(PD)}$	Power down setup time		0			ns
$t_{rec(PD)}$	Power down recovery time		t_{CR}			ns

POWER DOWN CHARACTERISTICS

$\overline{S_1}$ control



S_2 control