

4496203 HITACHI/ LOGIC/ARRAYS/MEM

04E 12622 D

# HM6264 Series

**Maintenance Only**  
(Substitute HM6264A)

T-46-23-12

**B192-word x 8-bit High Speed CMOS Static RAM**

■ **FEATURES**

- Fast access Time 100ns/120ns/150ns (max.)
- Low Power Standby Standby: 0.1mW (typ.)  
10μW (typ.) L-/LL-version  
Operating: 200mW/MHz (typ.)
- Low Power Operation
- Single +5V Supply
- Completely Static Memory. . . . No clock or Timing Strobe Required
- Equal Access and Cycle Time
- Common Data Input and Output, Three State Output
- Directly TTL Compatible: All Input and Output
- Standard 28pin Package Configuration
- Pin Out Compatible with 64K EPROM HN482764
- Capability of Battery Back Up Operation (L-/LL-version)

■ **ORDERING INFORMATION**

Type No.	Access Time	Package
HM6264P-10	100ns	600 mil 28 pin Plastic DIP
HM6264P-12	120ns	
HM6264P-15	150ns	
HM6264LP-10	100ns	
HM6264LP-12	120ns	
HM6264LP-15	150ns	
HM6264LP-10L	100ns	28 pin Plastic SOP (Note)
HM6264LP-12L	120ns	
HM6264LP-15L	150ns	
HM6264FP-10	100ns	
HM6264FP-12	120ns	
HM6264FP-15	150ns	
HM6264LFP-10	100ns	28 pin Plastic SOP (Note)
HM6264LFP-12	120ns	
HM6264LFP-15	150ns	
HM6264LFP-10L	100ns	
HM6264LFP-12L	120ns	
HM6264LFP-15L	150ns	

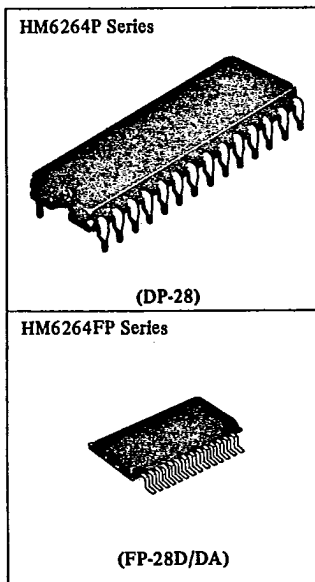
Note) A character T is added to the end of type No. for SOP of 3.00 mm (max.) thickness.

■ **ABSOLUTE MAXIMUM RATINGS**

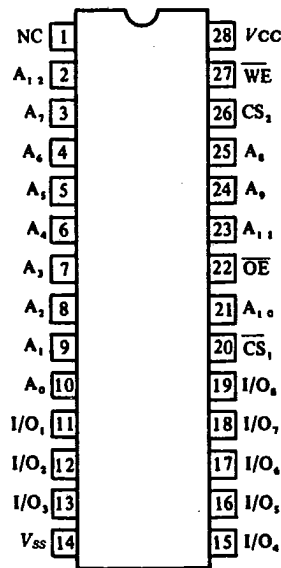
Item	Symbol	Rating	Unit
Terminal Voltage *1	V <sub>T</sub>	-0.5*2 to +7.0	V
Power Dissipation	P <sub>T</sub>	1.0	W
Operating Temperature	T <sub>opr</sub>	0 to +70	°C
Storage Temperature	T <sub>stg</sub>	-55 to +125	°C
Storage Temperature Under Bias	T <sub>bias</sub>	-10 to +85	°C

Notes) \*1. With respect to V<sub>SS</sub>  
\*2. -3.0V for pulse width ≤ 50ns

Note) This device is not available for new application.



■ **PIN ARRANGEMENT**



(Top View)



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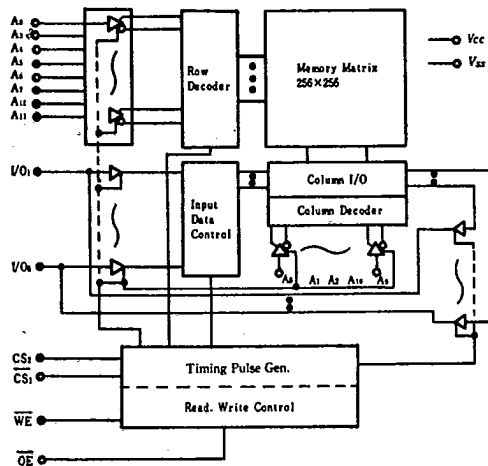
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■ BLOCK DIAGRAM



■ TRUTH TABLE

WE	CS <sub>1</sub>	CS <sub>2</sub>	OE	Mode	I/O Pin	V <sub>CC</sub> Current	Note
X	H	X	X	Not Selected (Power Down)	High Z	I <sub>SB</sub> , I <sub>SB1</sub>	
X	X	L	X	Output Disabled	High Z	I <sub>SB</sub> , I <sub>SB2</sub>	
H	L	H	H	Read	Dout	I <sub>CC</sub> , I <sub>CC1</sub>	
L	L	H	H	Write	Din	I <sub>CC</sub> , I <sub>CC1</sub>	Write Cycle (1)
L	L	H	L		Din	I <sub>CC</sub> , I <sub>CC1</sub>	Write Cycle (2)

X : H or L

■ RECOMMENDED DC OPERATING CONDITIONS (T<sub>a</sub> = 0 to +70°C)

Item	Symbol	min	typ	max	Unit
Supply Voltage	V <sub>CC</sub>	4.5	5.0	5.5	V
	V <sub>SS</sub>	0	0	0	V
Input Voltage	V <sub>IH</sub>	2.2	-	6.0	V
	V <sub>IL</sub>	-0.3*1	-	0.8	V

Note) \*1. -3.0V for pulse width ≤ 50ns

■ DC AND OPERATING CHARACTERISTICS (V<sub>CC</sub> = 5V ± 10%, V<sub>SS</sub> = 0V, T<sub>a</sub> = 0 to +70°C)

Item	Symbol	Test Condition	min	typ*1	max	Unit
Input Leakage Current	I <sub>LI</sub> †	V <sub>in</sub> =V <sub>SS</sub> to V <sub>CC</sub>	-	-	2	μA
Output Leakage Current	I <sub>LO</sub> †	CS <sub>1</sub> =V <sub>IH</sub> or CS <sub>2</sub> =V <sub>IL</sub> or OE=V <sub>IH</sub> or WE=V <sub>IL</sub> , V <sub>I/O</sub> =V <sub>SS</sub> to V <sub>CC</sub>	-	-	2	μA
Operating Power Supply Current	I <sub>CC</sub>	CS <sub>1</sub> =V <sub>IL</sub> , CS <sub>2</sub> =V <sub>IH</sub> , I <sub>I/O</sub> =0mA	-	40	80	mA
Average Operating Current	I <sub>CC1</sub>	Min. cycle, duty=100%, I <sub>I/O</sub> =0mA	-	60	110	mA
	I <sub>SB</sub>	CS <sub>1</sub> =V <sub>IH</sub> or CS <sub>2</sub> =V <sub>IL</sub>	-	1	3	mA
Standby Power Supply Current	I <sub>SB1</sub> *2	CS <sub>1</sub> ≥ V <sub>CC</sub> -0.2V, CS <sub>2</sub> ≥ V <sub>CC</sub> -0.2V or CS <sub>2</sub> ≤ 0.2V	-	0.02	2	mA
			-	2*3	100*3	μA
	I <sub>SB2</sub> *2	CS <sub>2</sub> ≤ 0.2V	-	0.02	2	mA
			-	2*3	100*3	μA
Output Voltage	V <sub>OL</sub>	I <sub>OL</sub> = 2.1mA	-	-	0.4	V
	V <sub>OH</sub>	I <sub>OH</sub> = -1.0 mA	2.4	-	-	V

Notes) \*1. Typical limits are at V<sub>CC</sub>=5.0V, T<sub>a</sub>=25°C and specified loading.

\*2. V<sub>IL</sub> min=-0.3V

\*3. This characteristics is guaranteed only for L-version.

\*4. This characteristics is guaranteed only for LL-version.



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■ CAPACITANCE ( $f = 1\text{MHz}$ ,  $T_a = 25^\circ\text{C}$ )

Item	Symbol	Test Condition	typ	max	Unit
Input Capacitance	$C_{in}$	$V_{in} = 0\text{V}$	-	6	pF
Input/Output Capacitance	$C_{I/O}$	$V_{I/O} = 0\text{V}$	-	8	pF

Note) This parameter is sampled and not 100% tested.

■ AC CHARACTERISTICS ( $V_{CC} = 5V \pm 10\%$ ,  $T_a = 0$  to  $+70^\circ\text{C}$ )

● AC TEST CONDITIONS

Input Pulse Levels: 0.8 to 2.4V

Input Rise and Fall Times: 10ns

Input and Output Timing Reference Level: 1.5V

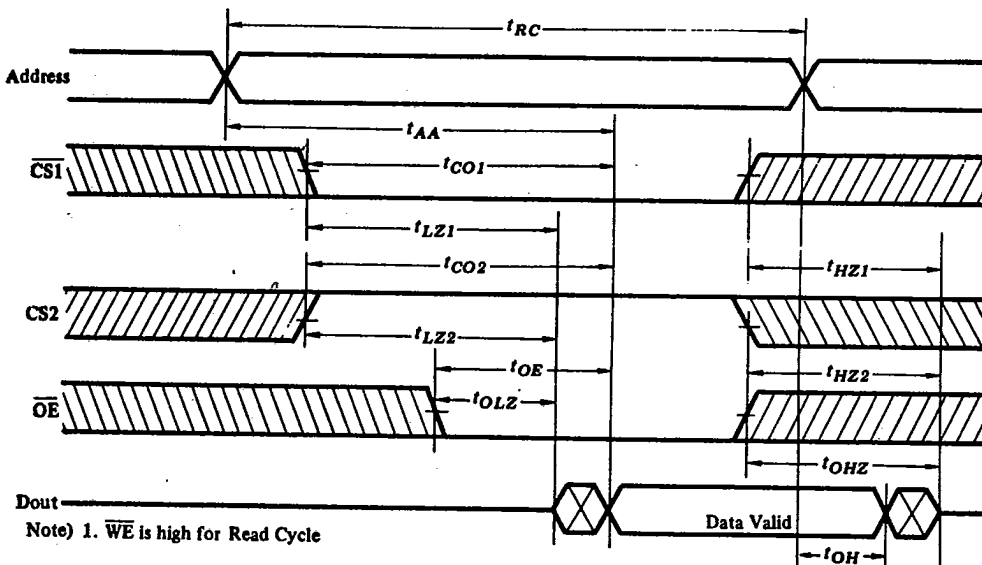
Output Load: 1TTL Gate and  $C_L$  (100pF) (Including scope and jig)

● READ CYCLE

Item	Symbol	HM6264-10		HM6264-12		HM6264-15		Unit	
		min	max	min	max	min	max		
Read Cycle Time	$t_{RC}$	100	-	120	-	150	-	ns	
Address Access Time	$t_{AA}$	-	100	-	120	-	150	ns	
Chip Selection to Output	CS1	$t_{CO1}$	-	100	-	120	-	150	ns
	CS2	$t_{CO2}$	-	100	-	120	-	150	ns
Output Enable to Output Valid	$t_{OE}$	-	50	-	60	-	70	ns	
Chip Selection to Output in Low Z	CS1	$t_{LZ1}$	10	-	10	-	15	-	ns
	CS2	$t_{LZ2}$	10	-	10	-	15	-	ns
Output Enable to Output in Low Z	$t_{OLZ}$	5	-	5	-	5	-	ns	
Chip Deselection to Output in High Z	CS1	$t_{HZ1}$	0	35	0	40	0	50	ns
	CS2	$t_{HZ2}$	0	35	0	40	0	50	ns
Output Disable to Output in High Z	$t_{OHZ}$	0	35	0	40	0	50	ns	
Output Hold from Address Change	$t_{OH}$	10	-	10	-	15	-	ns	

Notes) 1.  $t_{HZ}$  and  $t_{OHZ}$  are defined as the time at which the outputs achieve the open circuit condition and are not referred to output voltage levels.  
 2. At any given temperature and voltage condition,  $t_{HZ}$  max is less than  $t_{LZ}$  min both for a given device and from device to device.

● READ CYCLE



Note) 1.  $\overline{WE}$  is high for Read Cycle



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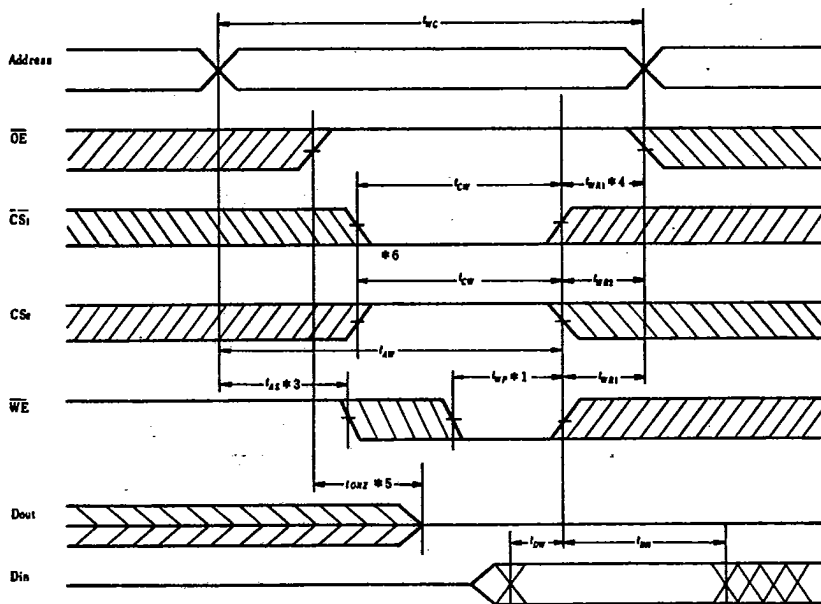
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• WRITE CYCLE

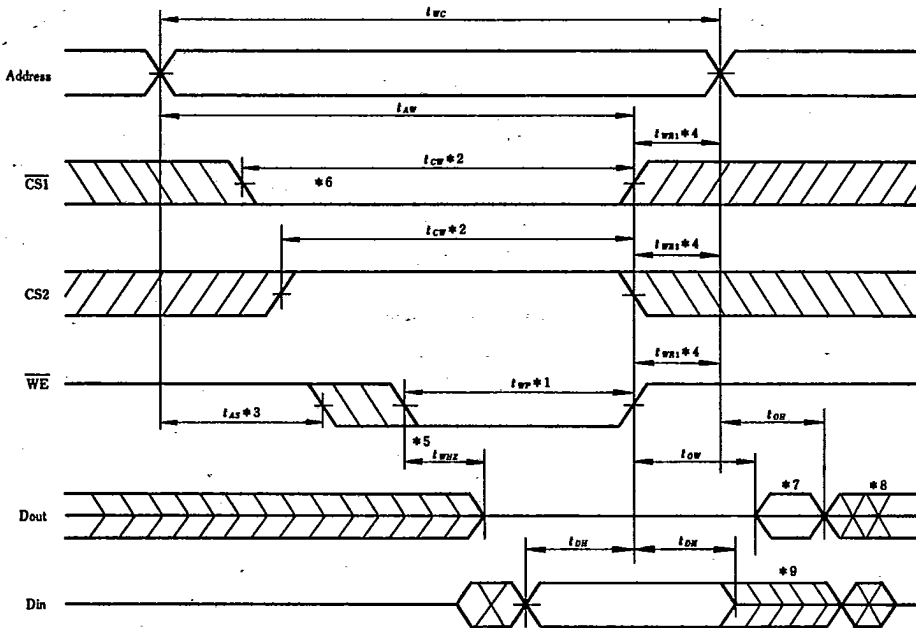
Item	Symbol	HM6264-10		HM6264-12		HM6264-15		Unit	
		min	max	min	max	min	max		
Write Cycle Time	$t_{WC}$	100	-	120	-	150	-	ns	
Chip Selection to End of Write	$t_{CW}$	80	-	85	-	100	-	ns	
Address Setup Time	$t_{AS}$	0	-	0	-	0	-	ns	
Address Valid to End of Write	$t_{AW}$	80	-	85	-	100	-	ns	
Write Pulse Width	$t_{WP}$	60	-	70	-	90	-	ns	
Write Recovery Time	CS1, WE	$t_{WR1}$	5	-	5	-	10	-	ns
	CS2	$t_{WR2}$	15	-	15	-	15	-	ns
Write to Output in High Z	$t_{WHZ}$	0	35	0	40	0	50	ns	
Data to Write Time Overlap	$t_{DW}$	40	-	50	-	60	-	ns	
Data Hold from Write Time	$t_{DH}$	0	-	0	-	0	-	ns	
$\overline{OE}$ to Output in High Z	$t_{OHZ}$	0	35	0	40	0	50	ns	
Output Active from End of Write	$t_{OW}$	5	-	5	-	10	-	ns	

• WRITE CYCLE (1) ( $\overline{OE}$  clock)



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• WRITE CYCLE (2) ( $\overline{OE}$  Low Fix)



- Notes)
1. A write occurs during the overlap of a low  $\overline{CS1}$ , a high  $CS2$  and a low  $\overline{WE}$ . A write begins at the latest transition among  $\overline{CS1}$  going low,  $CS2$  going high and  $\overline{WE}$  going low. A write ends at the earliest transition among  $\overline{CS1}$  going high,  $CS2$  going low and  $\overline{WE}$  going high.  $t_{wp}$  is measured from the beginning of write to the end of write.
  2.  $t_{cw}$  is measured from the later of  $\overline{CS1}$  going low or  $CS2$  going high to the end of write.
  3.  $t_{as}$  is measured from the address valid to the beginning of write.
  4.  $t_{wr}$  is measured from the end of write to the address change.  
 $t_{wr1}$  applies in case a write ends at  $\overline{CS1}$  or  $\overline{WE}$  going high.  
 $t_{wr2}$  applies in case a write ends at  $CS2$  going low.
  5. During this period, I/O pins are in the output state, therefore the input signals of opposite phase to the outputs must not be applied.
  6. If  $\overline{CS1}$  goes low simultaneously with  $\overline{WE}$  going low or after  $\overline{WE}$  going low, the outputs remain in high impedance state.
  7.  $Dout$  is the same phase of the latest written data in this write cycle.
  8.  $Dout$  is the read data of next address.
  9. If  $\overline{CS1}$  is low and  $CS2$  is high during this period, I/O pins are in the output state. Therefore, the input signals of opposite phase to the outputs must not be applied to them.



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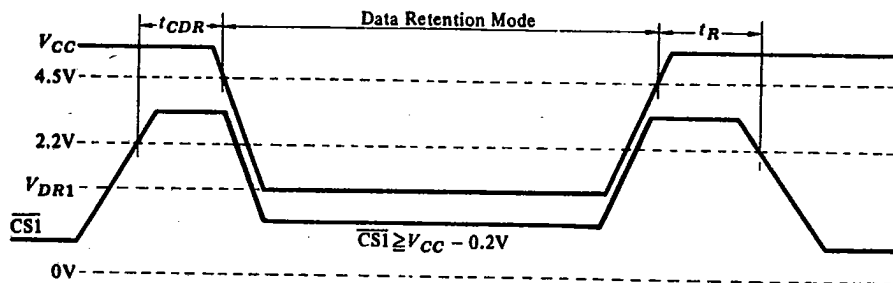
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■ **LOW  $V_{CC}$  DATA RETENTION CHARACTERISTICS** ( $T_a = 0$  to  $+70^\circ\text{C}$ )  
This characteristics is guaranteed only for L/LL-version.

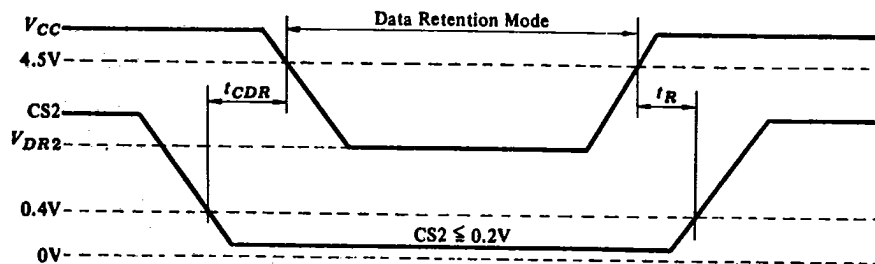
Item	Symbol	Test Condition	min	typ	max	Unit
$V_{CC}$ for Data Retention	$V_{DR1}$	$CS1 \geq V_{CC} - 0.2V$ , $CS2 \geq V_{CC} - 0.2V$ or $CS2 \leq 0.2V$	2.0	-	-	V
	$V_{DR2}$	$CS2 \leq 0.2V$	2.0	-	-	V
Data Retention Current	$I_{CCDR1}$	$V_{CC} = 3.0V$ , $CS1 \geq V_{CC} - 0.2V$	-	1*1	50*1	$\mu\text{A}$
		$CS2 \geq V_{CC} - 0.2V$ or $CS2 \leq 0.2V$	-	1*2	25*2	
	$I_{CCDR2}$	$V_{CC} = 3.0V$ , $CS2 \leq 0.2V$	-	1*1	50*1	$\mu\text{A}$
			-	1*2	25*2	
Chip Deselect to Data Retention Time	$t_{CDR}$	See Retention Waveform	0	-	-	ns
Operation Recovery Time	$t_R$		$t_{RC}$ *3	-	-	ns

Notes) \*1.  $V_{IL}$  min =  $-0.3V$ ,  $20\mu\text{A}$  max at  $T_a = 0$  to  $40^\circ\text{C}$ . This characteristics is guaranteed only for L-version.  
\*2.  $V_{IL}$  min =  $-0.3V$ ,  $10\mu\text{A}$  max at  $T_a = 0$  to  $40^\circ\text{C}$ . This characteristics is guaranteed only for LL-version.  
\*3.  $t_{RC}$  = Read Cycle Time

● **LOW  $V_{CC}$  DATA RETENTION WAVEFORM (1) ( $\overline{CS1}$  Controlled)**



● **LOW  $V_{CC}$  DATA RETENTION WAVEFORM (2) ( $CS2$  Controlled)**



NOTE: In Data Retention Mode,  $CS2$  controls the Address,  $\overline{WE}$ ,  $\overline{CS1}$ ,  $\overline{OE}$  and  $Din$  buffer. If  $CS2$  controls data retention mode,  $Vin$  for these inputs can be in the high impedance state. If  $\overline{CS1}$  controls the data retention mode,  $CS2$  must satisfy either  $CS2 > V_{CC} - 0.2V$  or  $CS2 \leq 0.2V$ . The other input levels (address,  $\overline{WE}$ ,  $\overline{OE}$ , I/O) can be in the high impedance state.



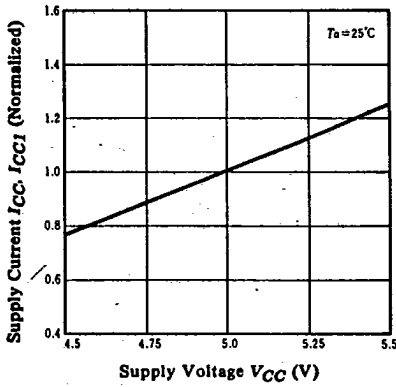
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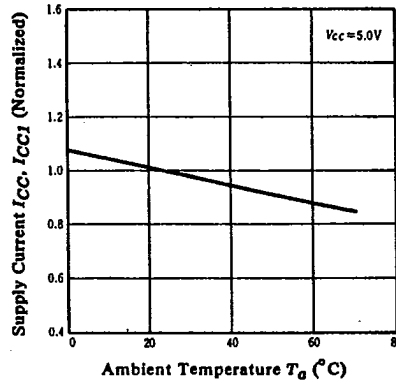
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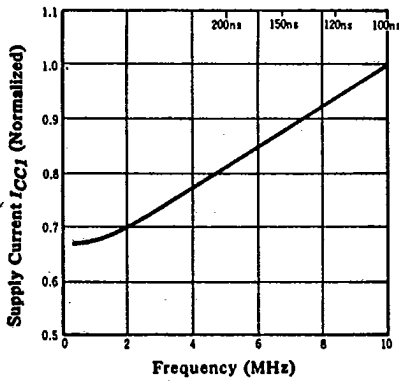
SUPPLY CURRENT vs. SUPPLY VOLTAGE



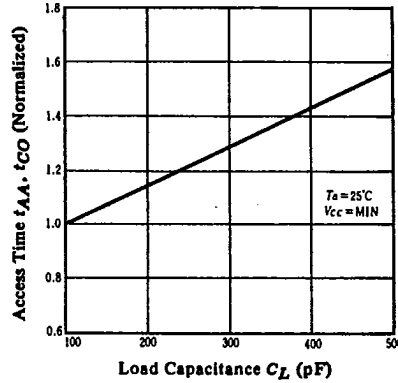
SUPPLY CURRENT vs. AMBIENT TEMPERATURE



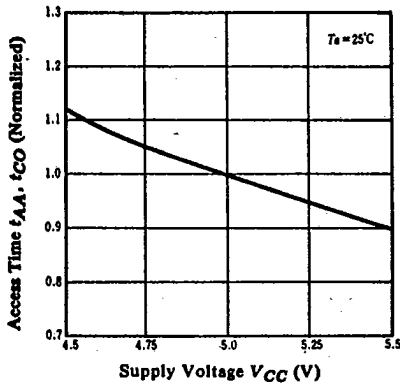
SUPPLY CURRENT vs. FREQUENCY



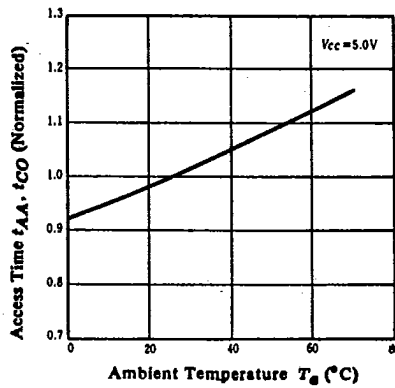
ACCESS TIME vs. LOAD CAPACITANCE



ACCESS TIME vs. SUPPLY VOLTAGE



ACCESS TIME vs. AMBIENT TEMPERATURE

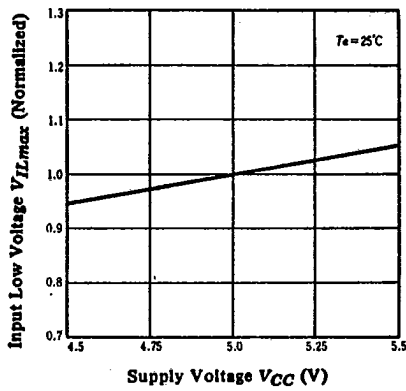


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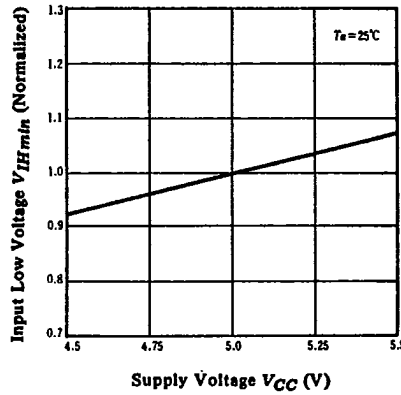
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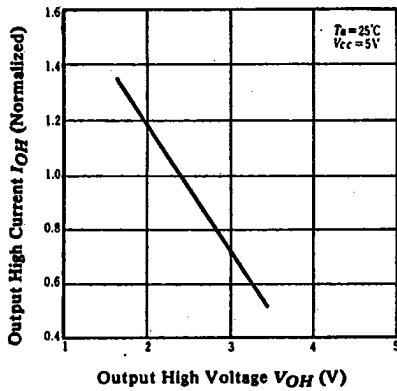
**INPUT LOW VOLTAGE vs. SUPPLY VOLTAGE**



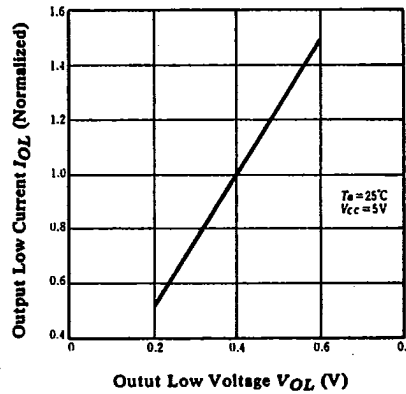
**INPUT HIGH VOLTAGE vs. SUPPLY VOLTAGE**



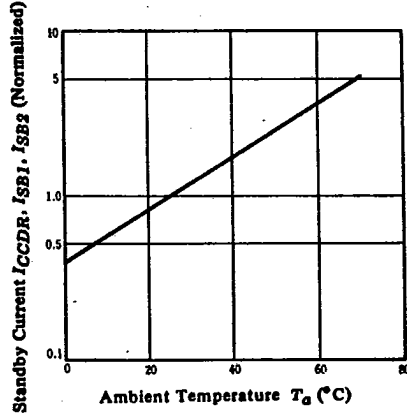
**OUTPUT CURRENT vs. OUTPUT VOLTAGE**



**OUTPUT CURRENT vs. OUTPUT VOLTAGE**



**STANDBY CURRENT vs. AMBIENT TEMPERATURE**



**STANDBY CURRENT vs. SUPPLY VOLTAGE**

