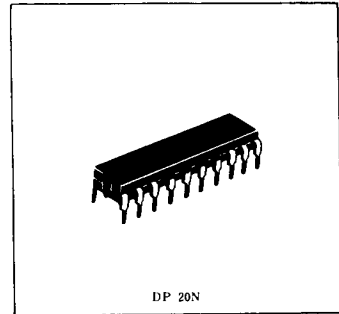


16384-word x 1-bit High Speed CMOS Static RAM

FEATURES

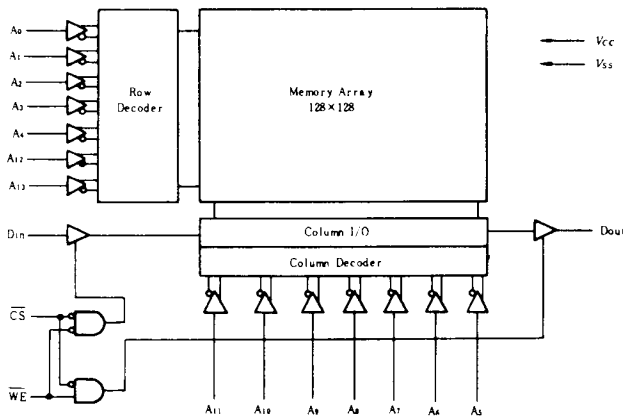
- Single +5V Supply and High Density 20 Pin Package
- Fast Access Time – 85ns/100ns
- Low Power Stand-by and Low Power Operation
Stand-by 100 μ W typ./5 μ W typ. (L-version)
and Operating 150mW typ.
- Completely Static Memory No Clock nor Refresh Required
- Fully TTL Compatible – All Inputs and Output
- Separate Data Input and Output Three State Output
- Pin-Out Compatible with Intel 2167 Series
- Capability of Battery Back Up Operation (L-version)



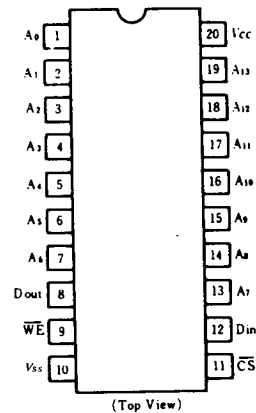
ORDERING INFORMATION

| Type No. | Access Time | Package |
|------------|-------------|-----------------------------|
| HM6167P-6 | 85ns | 300mil 20pin Plastic DIP |
| HM6167P-8 | 100ns | |
| HM6167LP-6 | 85ns | |
| HM6167LP-8 | 100ns | |

BLOCK DIAGRAM



PIN ARRANGEMENT



ABSOLUTE MAXIMUM RATINGS

| Item | Symbol | Rating | Unit |
|-------------------------------------------|-----------------|----------------|------|
| Terminal Voltage with Respect to V_{SS} | V_T | -0.5*1 to +7.0 | V |
| Power Dissipation | P_T | 1.0 | W |
| Operating Temperature | T_{opr} | 0 to +70 | °C |
| Storage Temperature | T_{stg} | -55 to +125 | °C |
| Storage Temperature under bias | $T_{stg(bias)}$ | -10 to +85 | °C |

Note *1. = 3.5V for pulse width \leq 20ns.



RECOMMENDED DC OPERATING CONDITIONS

($0^{\circ}\text{C} \leq T_a \leq 70^{\circ}\text{C}$)

| Item | Symbol | min | typ | max | Unit |
|--------------------|----------|-------------|-----|-----|------|
| Supply Voltage | V_{CC} | 4.5 | 5.0 | 5.5 | V |
| | V_{SS} | 0 | 0 | 0 | V |
| Input High Voltage | V_{IH} | 2.2 | — | 6.0 | V |
| Input Low Voltage | V_{IL} | -0.3^{*1} | — | 0.8 | V |

Note) *1. -3.0V for pulse width $\leq 20\text{ns}$.

TRUTH TABLE

| $\overline{\text{CS}}$ | $\overline{\text{WE}}$ | Mode | V_{CC} Current | Output Pin | Reference Cycle |
|------------------------|------------------------|--------------|-------------------|------------|------------------|
| H | x | Not Selected | I_{SB}, I_{SB1} | High Z | |
| L | H | Read | I_{CC} | Dout | Read Cycle 1, 2 |
| L | L | Write | I_{CC} | High Z | Write Cycle 1, 2 |

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

| Item | Symbol | Test Conditions | min | typ*1 | max | Unit |
|--------------------------------|------------|-----------------------------------------------------------------|-----|-------|------|---------------|
| Input Leakage Current | $ I_{LI} $ | $V_{CC}=5.5\text{V}$, $V_{IN}=0\text{V} \sim V_{CC}$ | — | — | 2 | μA |
| Output Leakage Current | $ I_{LO} $ | $\overline{\text{CS}}=V_{IH}$, $V_{OUT}=0\text{V} \sim V_{CC}$ | — | — | 2 | μA |
| Operating Power Supply Current | I_{CC} | $\overline{\text{CS}}=V_{IL}$, Output Open | — | 30 | 60 | mA |
| Standby Power Supply Current | I_{SB} | $\overline{\text{CS}}=V_{IH}$ | — | 5 | 20 | mA |
| | | $\overline{\text{CS}}=V_{CC}-0.2\text{V}$ | — | 0.02 | 2 | mA |
| | | $V_{IN} \leq 0.2\text{V}$ or $V_{IN} \geq V_{CC}-0.2\text{V}$ | — | 1*2 | 50*2 | μA |
| Output Low Voltage | V_{OL} | $I_{OL}=8\text{mA}$ | — | — | 0.4 | V |
| Output High Voltage | V_{OH} | $I_{OH}=-4\text{mA}$ | 2.4 | — | — | V |

Notes) *1. Typical limits are at $V_{CC}=5.0\text{V}$, $T_a=25^{\circ}\text{C}$ and specified loading.
*2. This characteristics is guaranteed only for L-version.

CAPACITANCE ($T_a=25^{\circ}\text{C}$, $f=1.0\text{MHz}$)

| Item | Symbol | max | Unit | Conditions |
|--------------------|-----------|-----|------|---------------------|
| Input Capacitance | C_{IN} | 5 | pF | $V_{IN}=0\text{V}$ |
| Output Capacitance | C_{OUT} | 6 | pF | $V_{OUT}=0\text{V}$ |

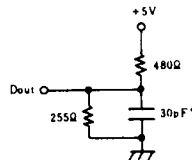
Note) This parameter is sampled and not 100% tested.

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

AC TEST CONDITIONS

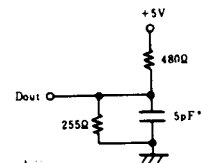
Input pulse levels: V_{SS} to 3.0V
 Input rise and fall times: 5ns
 Input timing reference levels: 1.5V
 Output reference levels: 1.5V
 Output load: See Figure

Output Load A



Output Load B

(for t_{HZ} , t_{LZ} , t_{wz} & t_{ow})



* Including scope and jig.



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● READ CYCLE

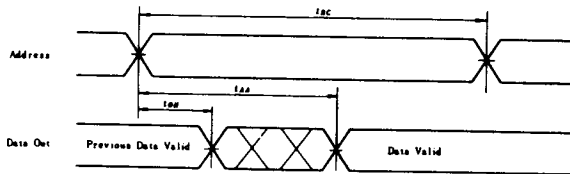
| Item | Symbol | HM6167-6 | | HM6167-8 | | Unit |
|--------------------------------------|-----------|----------|-----|----------|-----|------|
| | | min | max | min | max | |
| Read Cycle Time | t_{RC} | 85 | — | 100 | — | ns |
| Address Access Time | t_{AA} | — | 85 | — | 100 | ns |
| Chip Select Access Time | t_{ACS} | — | 85 | — | 100 | ns |
| Output Hold from Address Change | t_{OH} | 5 | — | 5 | — | ns |
| Chip Selection to Output in Low Z | t_{LZ} | 5 | — | 5 | — | ns |
| Chip Deselection to Output in High Z | t_{HZ} | 0 | 40 | 0 | 40 | ns |
| Chip Selection to Power Up Time | t_{PU} | 0 | — | 0 | — | ns |
| Chip Deselection to Power Down Time | t_{PD} | — | 40 | — | 45 | ns |

● WRITE CYCLE

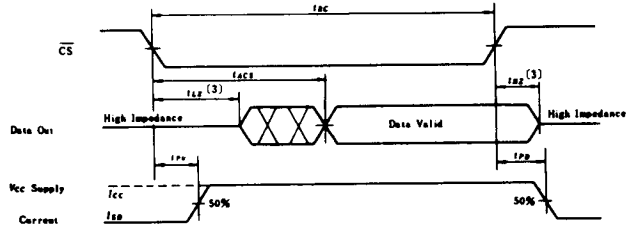
| Item | Symbol | HM6167-6 | | HM6167-8 | | Unit | Notes |
|----------------------------------|----------|----------|-----|----------|-----|------|-------|
| | | min | max | min | max | | |
| Write Cycle Time | t_{WC} | 85 | — | 100 | — | ns | 2 |
| Chip Selection to End of Write | t_{CW} | 65 | — | 80 | — | ns | |
| Address Valid to End of Write | t_{AW} | 65 | — | 80 | — | ns | |
| Address Setup Time | t_{AS} | 0 | — | 0 | — | ns | |
| Write Pulse Width | t_{WP} | 45 | — | 55 | — | ns | |
| Write Recovery Time | t_{WR} | 0 | — | 0 | — | ns | |
| Data Valid to End of Write | t_{DW} | 35 | — | 40 | — | ns | |
| Data Hold Time | t_{DH} | 0 | — | 0 | — | ns | |
| Write Enable to Output in High Z | t_{WZ} | 0 | 40 | 0 | 40 | ns | 3, 4 |
| Output Active from End of Write | t_{OW} | 0 | — | 0 | — | ns | 3, 4 |

- Notes: 1. If CS goes high simultaneously with WE high, the output remains in a high impedance state.
 2. All Write Cycle timings are referenced from the last valid address to the first transitioning address.
 3. Transition is measured ± 500 mV from steady state voltage with specified loading in Load B.
 4. This parameter is sampled and not 100% tested.

● TIMING WAVEFORM OF READ CYCLE NO. 1¹⁾

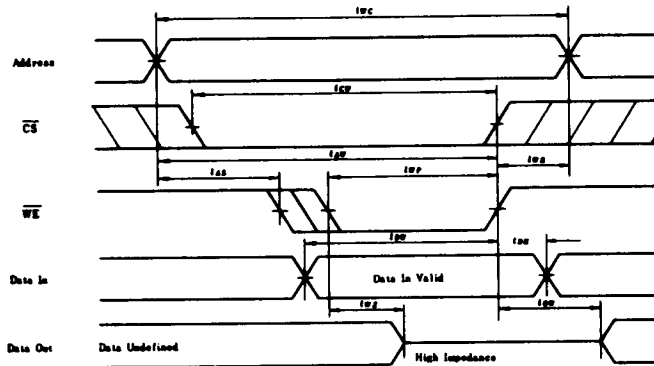


●TIMING WAVEFORM OF READ CYCLE NO.2^{1),3)}

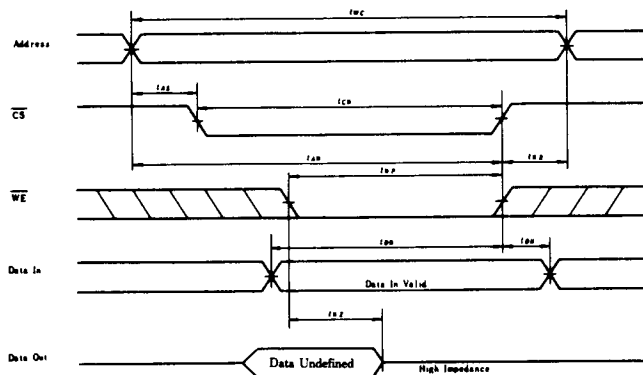


- NOTES: 1. \overline{WE} is high and \overline{CS} is low for READ cycle.
 2. Addresses valid prior to or coincident with \overline{CS} transition low.
 3. Transition is measured ± 500 mV from steady state voltage with specified loading in Load B.

●TIMING WAVEFORM OF WRITE CYCLE NO.1 (\overline{WE} Controlled)



●TIMING WAVEFORM OF WRITE CYCLE No. 2 (\overline{CS} Controlled)



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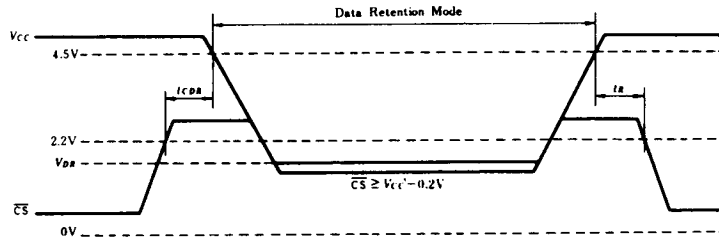
LOW V_{CC} DATA RETENTION CHARACTERISTICS (T_a=0°C to +70°C)

This characteristics is guaranteed only for L-version.

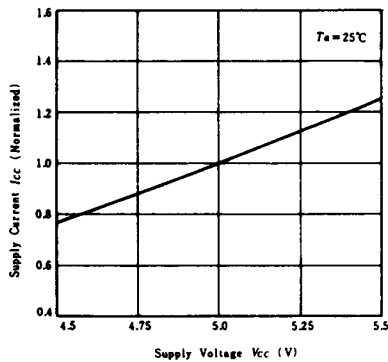
| Parameter | Symbol | Test Condition | min | typ | max | Unit |
|--------------------------------------|-------------------|------------------------------------------------------------------------------------------------------------|--------------------|-----|------|------|
| V _{CC} for Data Retention | V _{DR} | $\overline{CS} \geq V_{CC} - 0.2V$ $V_{\alpha} \geq V_{CC} - 0.2V$ or $0V \leq V_{\alpha} \leq 0.2V$ | 2.0 | — | — | V |
| Data Retention Current | I _{CCDR} | | — | — | 20*2 | μA |
| Chip Deselect to Data Retention Time | t _{CDR} | | 0 | — | — | |
| Operation Recovery Time | t _R | | t _{ac} *1 | — | — | ns |

Notes) *1. t_{ac}—Read Cycle Time *2. V_{CC}=2.0V
 *3. V_{CC}=3.0V

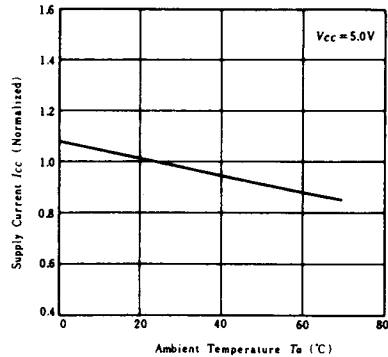
LOW V_{CC} DATA RETENTION WAVEFORM



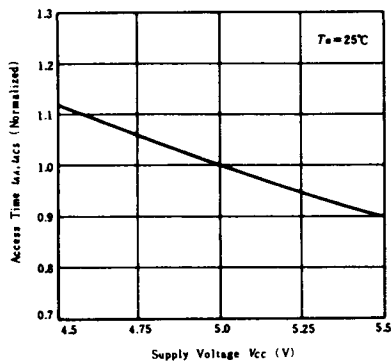
SUPPLY CURRENT vs. SUPPLY VOLTAGE



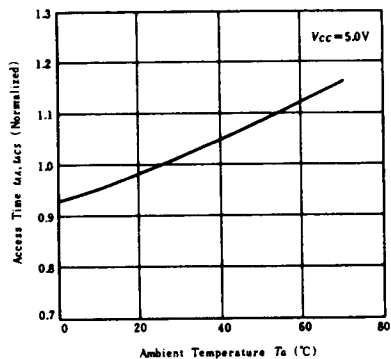
SUPPLY CURRENT vs. AMBIENT TEMPERATURE



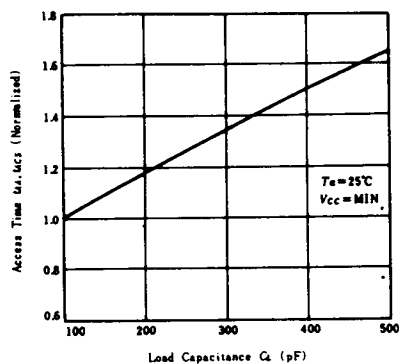
ACCESS TIME vs. SUPPLY VOLTAGE



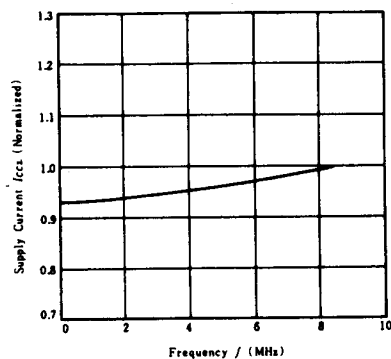
ACCESS TIME vs. AMBIENT TEMPERATURE



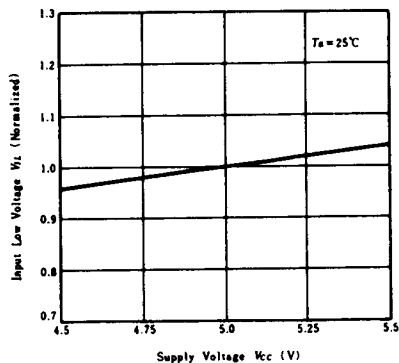
ACCESS TIME vs. LOAD CAPACITANCE



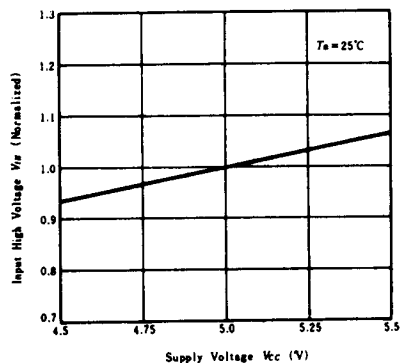
SUPPLY CURRENT vs. FREQUENCY



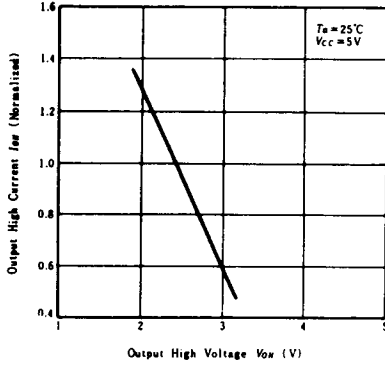
INPUT LOW VOLTAGE vs. SUPPLY VOLTAGE



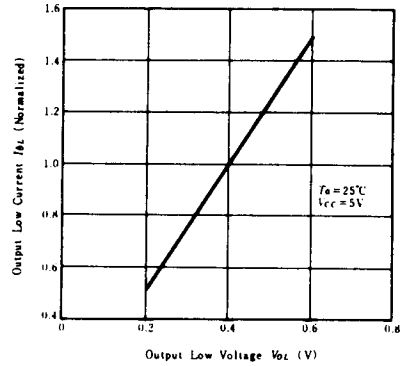
INPUT HIGH VOLTAGE vs. SUPPLY VOLTAGE



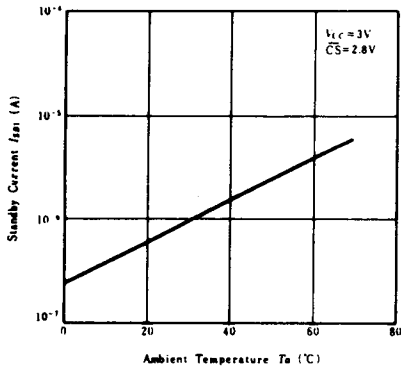
OUTPUT HIGH CURRENT vs. OUTPUT HIGH VOLTAGE



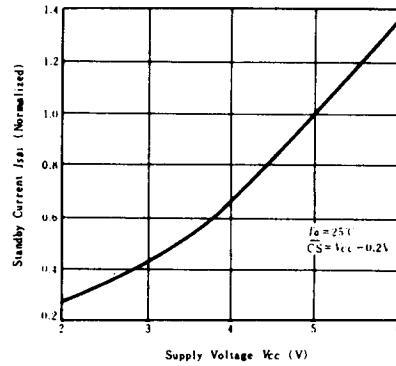
OUTPUT LOW CURRENT vs. OUTPUT LOW VOLTAGE



STANDBY CURRENT vs. AMBIENT TEMPERATURE



STANDBY CURRENT vs. SUPPLY VOLTAGE



STANDBY CURRENT vs. INPUT VOLTAGE

