

### Features

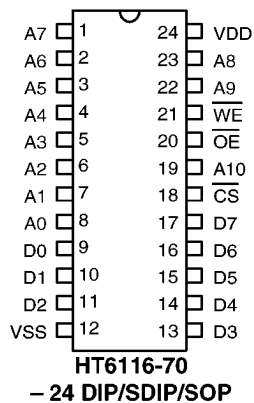
- Single 5V power supply
- Low power consumption
  - Operating: 400mW (Typ.)
  - Standby: 5μW (Typ.)
- 70ns (Max.) high speed access time
- Power down by pin  $\overline{CS}$
- TTL compatible interface levels
- Fully static operation
- Memory expansion by pin  $\overline{OE}$
- Common I/O using tri-state outputs
- Pin-compatible with standard 2K×8 bits of EPROM/MASK ROM
- 24-pin DIP/SDIP/SOP package

### General Description

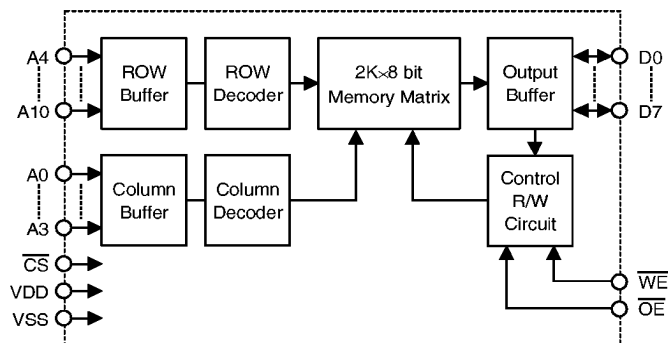
The HT6116-70 is a 16384-bit static random access memory. It is organized with 2048 words of 8 bits in length, and operates with a single 5V power supply. The IC is built with a high performance CMOS 0.8μm process in order to obtain a low standby current and high reliability. The IC contains six-transistor full CMOS mem-

ory cells and TTL compatible inputs and outputs, which are easily interface with common system bus structures. The Data bus of the HT6116-70 is designed as a tri-state type. The IC is in the standby mode if the  $\overline{CS}$  pin is set to "high".

### Pin Assignment



### Block Diagram



**Pin Description**

Pin No.	Pin Name	I/O	Description
8~1, 23, 22, 19	A0~A7 A8, A9, A10	I	Address inputs
9~11 13~17	D0~D2 D3~D7	I/O	Data inputs and outputs
12	VSS	I	Negative power supply, usually connected to the ground
18	$\overline{CS}$	I	Chip select signal pin When this signal is high, the chip is in the standby mode. The chip is in the active mode, if $\overline{CS}$ is low.
20	$\overline{OE}$	I	Output enable signal pin
21	$\overline{WE}$	I	Write enable signal pin
24	VDD	I	Positive power supply

**Absolute Maximum Ratings\***

Supply Voltage .....-0.3V to +7.0V      Storage Temperature.....-50°C to +125°C  
 Input Voltage..... VSS-0.3V to VDD+0.3V      Operating Temperature.....-40°C to +85°C

\*Note: Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only. Functional operation of this device at these or any other conditions above those indicated in the operational sections of this specification is not implied and exposure to absolute maximum rating conditions for extended periods may affect device reliability.

**D.C. Characteristics**

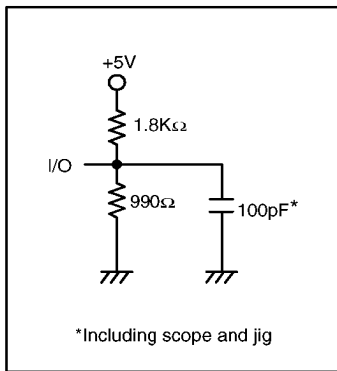
(Ta=25°C)

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		VDD	Conditions				
VDD	Operating Voltage	—	—	4.5	5.0	5.5	V
I <sub>LI</sub>	Input Leakage Current	5V	V <sub>IN</sub> =0 to V <sub>DD</sub>	—	0.1	10	μA
I <sub>LO</sub>	Output Leakage Current	5V	V <sub>O</sub> =0 to V <sub>DD</sub>	—	0.1	10	μA
I <sub>DD</sub>	Operating Current	5V	V <sub>IH</sub> =2.2V, V <sub>IL</sub> =0.8V In write mode, t <sub>WC</sub> =1μs.	—	45	90	mA
		5V	V <sub>IH</sub> =2.2V, V <sub>IL</sub> =0.8V In read mode, t <sub>RC</sub> =1μs.	—	80	90	mA
I <sub>STB</sub>	Standby Current	5V	V <sub>IH</sub> =2.2V, V <sub>IL</sub> =0.8V (TTL Input)	—	0.8	1.5	mA
		5V	V <sub>IH</sub> =4.8V, V <sub>IL</sub> =0.2V (CMOS Input)	—	0.1	3	μA

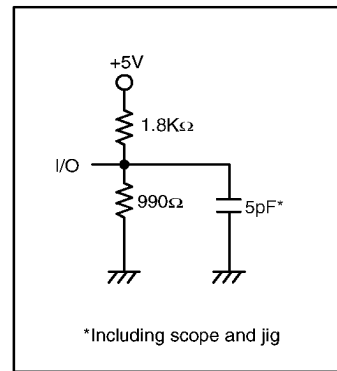
Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V <sub>DD</sub>	Conditions				
V <sub>IH</sub>	Input Voltage	5V	—	2.2	2	5.3	V
V <sub>IL</sub>		5V		-0.3	0.2	0.8	V
I <sub>OH</sub>	Output Source Current	5V	V <sub>OH</sub> =4.5V	-1.2	-6.2	—	mA
I <sub>OL</sub>	Output Sink Current	5V	V <sub>OL</sub> =0.5V	4.8	14.5	—	mA

**A.C. Test Conditions**

Item	Condition
Input pulse high level	V <sub>IH</sub> =3V
Input pulse low level	V <sub>IL</sub> =0V
Input and output reference level	1.5V
Output load	See Figures below



**Output Load**



**Output Load for**  
t<sub>CLZ</sub>, t<sub>OLZ</sub>, t<sub>CHZ</sub>, t<sub>OHZ</sub>, t<sub>WHZ</sub> and t<sub>ow</sub>

**A.C. Characteristics**
**Read cycle**

 (V<sub>DD</sub>=5V±10%, GND=0V, Ta=-40°C to +85°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit
t <sub>RC</sub>	Read Cycle Time	70	36	—	ns
t <sub>AA</sub>	Address Access Time	—	35	70	ns
t <sub>ACS</sub>	Chip Select Access Time	—	35	70	ns
t <sub>OE</sub>	Output Enable to Output Valid	—	12	40	ns
t <sub>OH</sub>	Output Hold from Address Change	10	12	—	ns
t <sub>CLZ</sub>	Chip Enable to Output in Low-Z	10	—	—	ns
t <sub>OLZ</sub>	Output Enable to Output in Low-Z	10	—	—	ns
t <sub>OHZ</sub>	Output Disable to Output in High-Z	0	—	30	ns
t <sub>CHZ</sub>	Chip Disable to Output in High-Z	0	—	30	ns

 Note: 1. A read occurs during the overlap of a low  $\overline{CS}$  and a high  $\overline{WE}$ 

 2. t<sub>CHZ</sub> and t<sub>OHZ</sub> are specified by the time when data out is floating

**Write cycle**

 (V<sub>DD</sub>=5V±10%, GND=0V, Ta=-40°C to +85°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit
t <sub>WC</sub>	Write Cycle Time	70	36	—	ns
t <sub>DW</sub>	Data Set up Time	20	18	—	ns
t <sub>DH</sub>	Data Hold Time from Write Time	5	0	—	ns
t <sub>AW</sub>	Address Valid to End of Write	50	15	—	ns
t <sub>AS</sub>	Address Setup Time	20	14	—	ns
t <sub>WP</sub>	Write Pulse Width	25	0	—	ns
t <sub>WR</sub>	Write Recovery Time	5	—	—	ns
t <sub>CW</sub>	Chip Selection to End of Write	35	—	—	ns
t <sub>OW</sub>	Output Active from End of Write	5	—	—	ns
t <sub>OHZ</sub>	Output Disable to Output in High-Z	0	—	40	ns
t <sub>WHZ</sub>	Write to Output in High-Z	0	—	50	ns

 Note: 1. A write cycle occurs during the overlap of a low  $\overline{CS}$  and a low  $\overline{WE}$ 

 2.  $\overline{OE}$  may be both high and low in a write cycle

 3. t<sub>AS</sub> is specified from  $\overline{CS}$  or  $\overline{WE}$ , whichever occurs last

 4. t<sub>WP</sub> is an overlap time of a low  $\overline{CS}$  and a low  $\overline{WE}$ 

 5. t<sub>WR</sub>, t<sub>DW</sub> and t<sub>DH</sub> is specified from  $\overline{CS}$  or  $\overline{WE}$ , whichever occurs first

 6. t<sub>WHZ</sub> is specified by the time when DATA OUT is floating, not defined by output level

7. When I/O pins are data output mode, don't force inverse signals to those pins

### Functional Description

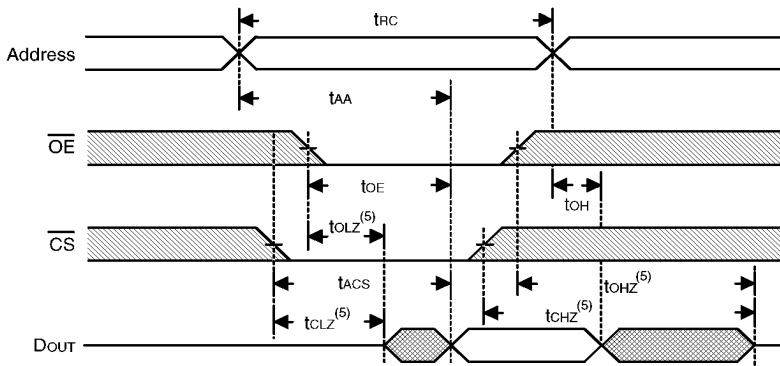
The HT6116-70 is a 2K×8 bit SRAM. When the  $\overline{CS}$  pin of the chip is set to “low”, data can be written in or read from eight data pins; otherwise, the chip is in the standby mode. During a write cycle, the data pins are defined as the input state by setting the  $\overline{WE}$  pin to low. Data should be ready before the rising edge of the  $\overline{WE}$  pin according to the timing of the writing cycle. While in the read cycle, the  $\overline{WE}$  pin is set to high and the  $\overline{OE}$  pin is set to low to define the data pins as the output state. All data pins are defined as a three-state type, controlled by the  $\overline{OE}$  pin. In both cycles (namely, write and read cycles), the locations are defined by the address pins A0~A10. The following table illustrates the relations of  $\overline{WE}$ ,  $\overline{OE}$ ,  $\overline{CS}$  and their corresponding mode.

$\overline{CS}$	$\overline{OE}$	$\overline{WE}$	Mode	D0~D7
H	X	X	Standby	High-Z
L	L	H	Read	Dout
L	H	H	Read	High-Z
L	X	L	Write	Din

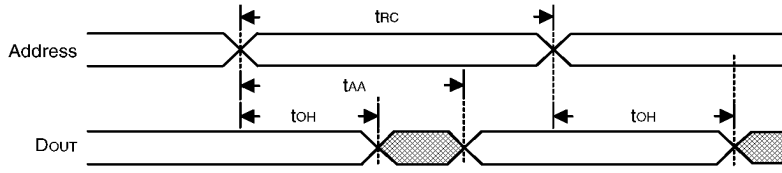
where X stands for “don’t care”.  
 H stands for high level  
 L stands for low level.

### Timing Diagrams

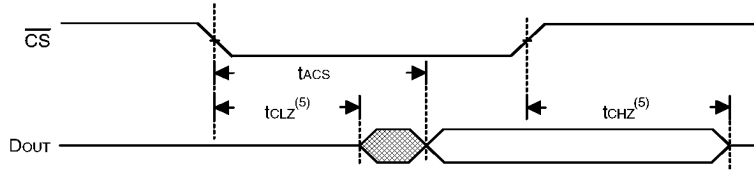
#### Read cycle <sup>(1)</sup>



**Read cycle (1, 2, 4)**

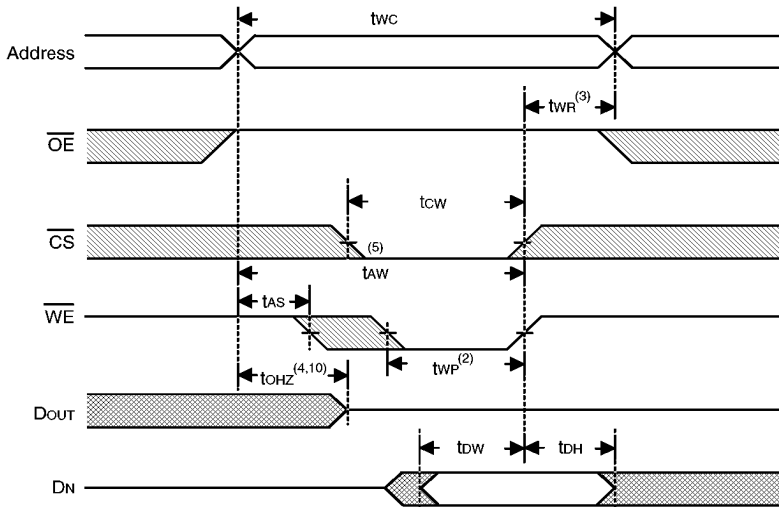


**Read cycle (1, 3, 4)**

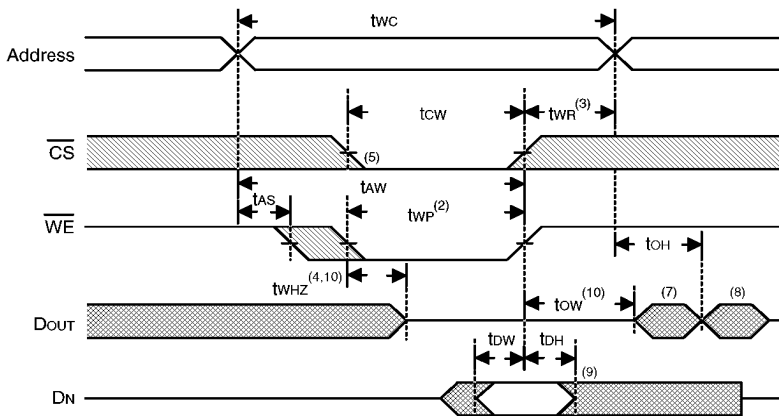


- Notes:
- (1)  $\overline{WE}$  is high during the Read cycle
  - (2) Device is continuously enabled,  $\overline{CS}=V_{IL}$
  - (3) Address is valid prior to or coincident with the  $\overline{CS}$  transition low.
  - (4)  $\overline{OE}=V_{IL}$
  - (5) Transition is measured  $\pm 500mV$  from the steady state.

Write cycle 1 <sup>(1)</sup>



Write cycle 2 <sup>(1, 6)</sup>



- Notes:
- (1)  $\overline{WE}$  must be high during all address transitions.
  - (2) A write occurs during the overlap ( $t_{WP}$ ) of a low  $\overline{CS}$  and a low  $\overline{WE}$ .
  - (3)  $t_{WR}$  is measured from the earlier of  $\overline{CS}$  or  $\overline{WE}$  going high to the end of the write cycle.
  - (4) During this period, I/O pins are in the output state, so the input signals of the opposite phase to the outputs must not be applied.
  - (5) If the  $\overline{CS}$  low transition occurs simultaneously with the  $\overline{WE}$  low transitions or after the  $\overline{WE}$  transition, outputs remain in a high impedance state.

- (6)  $\overline{OE}$  is continuously low ( $\overline{OE}=V_{IL}$ ).
- (7)  $D_{OUT}$  is at the same phase of the write data of this write cycle.
- (8)  $D_{OUT}$  is the read data of the next address.
- (9) If  $\overline{CS}$  is low during this period, I/O pins are in the output state; then the data input signals of the opposite phase to the outputs must not be applied to them.
- (10) Transition is measured  $\pm 500mV$  from the steady state.

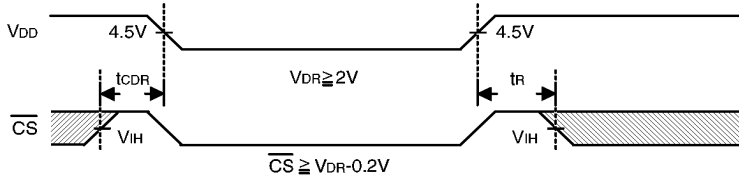
**Data Retention Characteristics**

( $T_a = -40^\circ C$  to  $+85^\circ C$ )

Symbol	Parameter	Conditions	Min.	Max.	Unit
$V_{DR}$	$V_{DD}$ for Data Retention	$\overline{CS} \geq V_{DD}-0.2V$	2	5.5	V
$I_{CCDR}$	Data Retention Current	$V_{DD}=3V, \overline{CS} \geq V_{DD}-0.2V$ $V_{IN} \geq V_{DD}-0.2V$ or $V_{IN} \leq 0.2V$	—	50	$\mu A$
$t_{CDR}$	Chip Disable Data Retention Time	See Retention Timing	0	—	ns
$t_R$	Operation Recovery Time	See Retention Timing	$t_{RC}^*$	—	ns

\* $t_{RC}$ =Read Cycle Time

**Low  $V_{DD}$  Data Retention Timing**





Characteristic Curves

