

## 1024 BIT FULLY DECODED STATIC MOS RANDOM ACCESS MEMORY

- Single +5 Volts Supply Voltage
- Directly TTL Compatible — All Inputs and Output
- Static MOS — No Clocks or Refreshing Required
- Low Power — Typically 150 mW
- Access Time — Typically 500 nsec
- Three-State Output — OR-Tie Capability
- Simple Memory Expansion — Chip Enable Input
- Fully Decoded — On Chip Address Decode
- Inputs Protected — All Inputs Have Protection Against Static Charge
- Low Cost Packaging — 16 Pin Plastic Dual-In-Line Configuration

RAMs

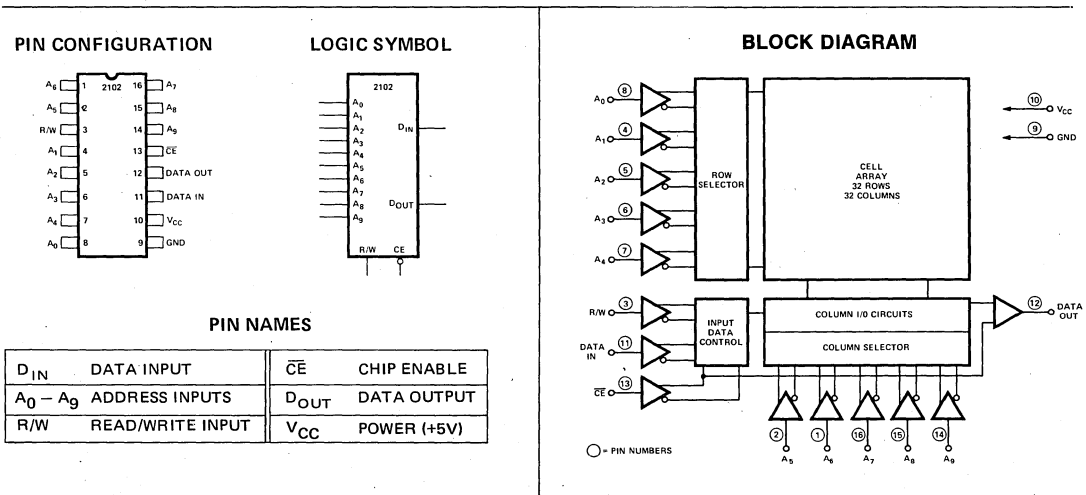
The Intel® 2102 is a 1024 word by one bit static random access memory element using normally off N-channel MOS devices integrated on a monolithic array. It uses fully DC stable (static) circuitry and therefore requires no clocks or refreshing to operate. The data is read out nondestructively and has the same polarity as the input data.

The 2102 is designed for memory applications where high performance, low cost, large bit storage, and simple interfacing are important design objectives.

It is directly TTL compatible in all respects: inputs, output, and a single +5 volt supply. A separate chip enable (CE) lead allows easy selection of an individual package when outputs are OR-tied.

The Intel 2102 is fabricated with N-channel silicon gate technology. This technology allows the design and production of high performance easy to use MOS circuits and provides a higher functional density on a monolithic chip than either conventional MOS technology or P-channel silicon gate technology.

Intel's silicon gate technology also provides excellent protection against contamination. This permits the use of low cost silicone packaging.



## Absolute Maximum Ratings\*

Ambient Temperature Under Bias	0°C to 70°C
Storage Temperature	-65°C to +150°C
Voltage On Any Pin With Respect To Ground	-0.5V to +7V
Power Dissipation	1 Watt

### \*COMMENT:

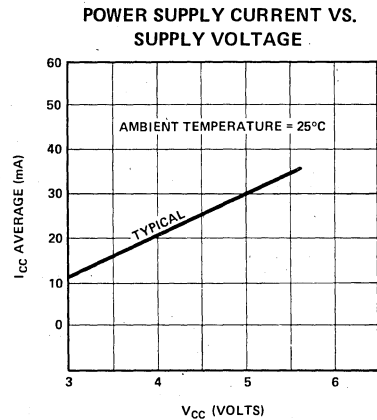
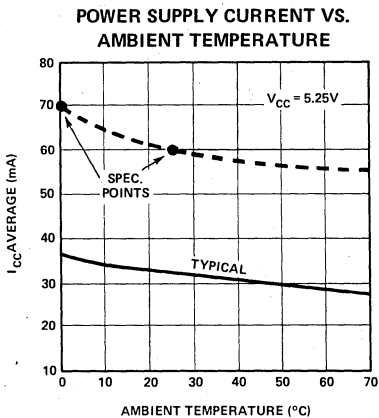
Stresses above those listed under "Absolute Maximum Rating" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or at any other condition above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## D. C. and Operating Characteristics

$T_A = 0^\circ\text{C}$  to  $+70^\circ\text{C}$ ,  $V_{CC} = 5V \pm 5\%$  unless otherwise specified

SYMBOL	PARAMETER	LIMITS			UNIT	TEST CONDITIONS
		MIN.	TYP.(1)	MAX.		
$I_{LI}$	INPUT LOAD CURRENT (ALL INPUT PINS)			10	$\mu\text{A}$	$V_{IN} = 0$ to $5.25\text{V}$
$I_{LOH}$	OUTPUT LEAKAGE CURRENT			10	$\mu\text{A}$	$\overline{CE} = 2.2\text{V}$ , $V_{OUT} = 4.0\text{V}$
$I_{LOL}$	OUTPUT LEAKAGE CURRENT			-100	$\mu\text{A}$	$\overline{CE} = 2.2\text{V}$ , $V_{OUT} = 0.45\text{V}$
$I_{CC1}$	POWER SUPPLY CURRENT		30	60	mA	ALL INPUTS = $5.25\text{V}$ DATA OUT OPEN $T_A = 25^\circ\text{C}$
$I_{CC2}$	POWER SUPPLY CURRENT			70	mA	ALL INPUTS = $5.25\text{V}$ DATA OUT OPEN $T_A = 0^\circ\text{C}$
$V_{IL}$	INPUT "LOW" VOLTAGE	-0.5		+0.65	V	
$V_{IH}$	INPUT "HIGH" VOLTAGE	2.2		$V_{CC}$	V	
$V_{OL}$	OUTPUT "LOW" VOLTAGE			+0.45	V	$I_{OL} = 1.9\text{mA}$
$V_{OH}$	OUTPUT "HIGH" VOLTAGE	2.2			V	$I_{OH} = -100\mu\text{A}$

## Typical D.C. Characteristics



NOTE: 1. Typical values are for  $T_A = 25^\circ\text{C}$  and nominal supply voltage.

# SILICON GATE MOS 2102

## A. C. Characteristics $T_A = 0^\circ\text{C}$ to $70^\circ\text{C}$ , $V_{CC} = 5\text{V} \pm 5\%$ unless otherwise specified

SYMBOL	PARAMETER	LIMITS			UNIT
		MIN.	TYP. (1)	MAX.	
<b>READ CYCLE</b>					
$t_{RC}$	READ CYCLE	1000			ns
$t_A$	ACCESS TIME		500	1000	ns
$t_{CO}$	CHIP ENABLE TO OUTPUT TIME			500	ns
$t_{OH1}$	PREVIOUS READ DATA VALID WITH RESPECT TO ADDRESS	50			ns
$t_{OH2}$	PREVIOUS READ DATA VALID WITH RESPECT TO CHIP ENABLE	0			ns
<b>WRITE CYCLE</b>					
$t_{WC}$	WRITE CYCLE	1000			ns
$t_{AW}$	ADDRESS TO WRITE SETUP TIME	200			ns
$t_{WP}$	WRITE PULSE WIDTH	750			ns
$t_{WR}$	WRITE RECOVERY TIME	50			ns
$t_{DW}$	DATA SETUP TIME	800			ns
$t_{DH}$	DATA HOLD TIME	100			ns
$t_{CW}$	CHIP ENABLE TO WRITE SETUP TIME	900			ns

### A. C. CONDITIONS OF TEST

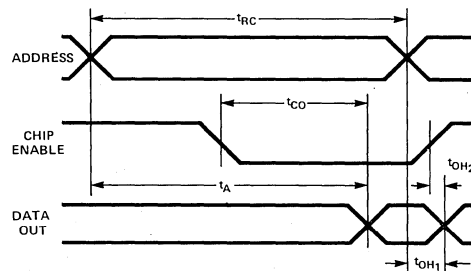
Input Pulse Levels: +0.65 Volt to 2.2 Volt  
 Input Pulse Rise and Fall Times: 20nsec  
 Timing Measurement Reference Level: 1.5 Volt  
 Output Load: 1 TTL Gate and  $C_L = 100 \text{ pF}$

### Capacitance <sup>[2]</sup> $T_A = 25^\circ\text{C}$ , $f = 1 \text{ MHz}$

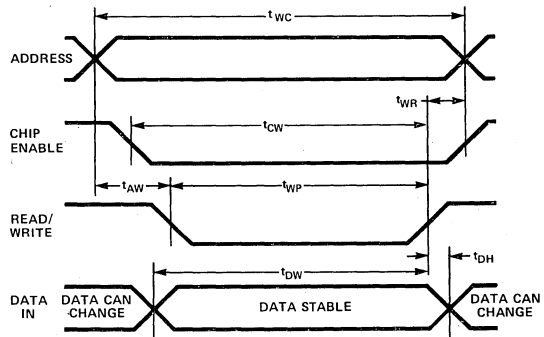
SYMBOL	TEST	LIMITS (pF)	
		TYP. [1]	MAX.
$C_{IN}$	INPUT CAPACITANCE (ALL INPUT PINS) $V_{IN} = 0\text{V}$	3	5
$C_{OUT}$	OUTPUT CAPACITANCE $V_{OUT} = 0\text{V}$	7	10

## Waveforms

### READ CYCLE



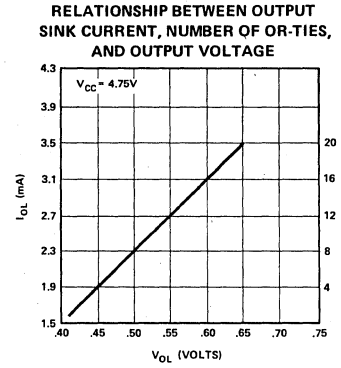
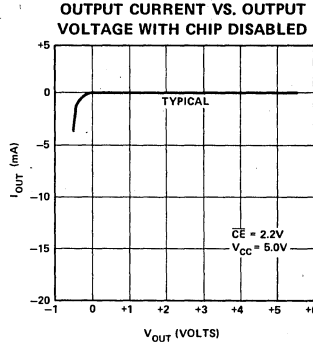
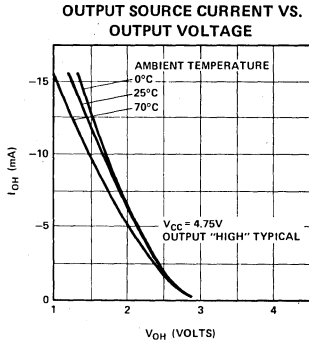
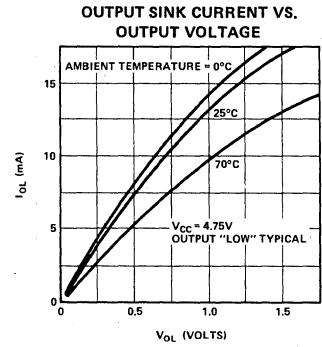
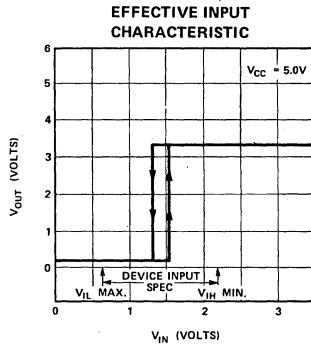
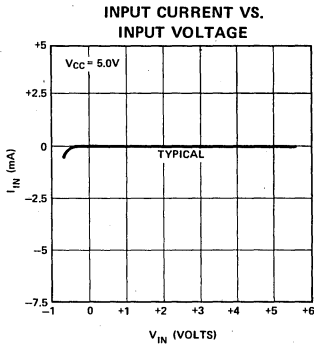
### WRITE CYCLE



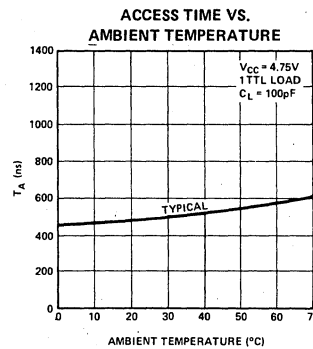
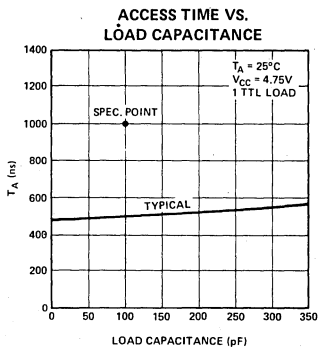
NOTES: 1. Typical values are for  $T_A = 25^\circ\text{C}$  and nominal supply voltage.  
 2. This parameter is periodically sampled and is not 100% tested.

RAMS

## Typical D. C. Characteristics



## Typical A. C. Characteristics



## 1024 BIT FULLY DECODED STATIC MOS RANDOM ACCESS MEMORY

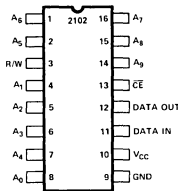
- \*Fast Access Time -- 500 ns max.
- Fast Cycle Time -- 500 ns max.
- N-Channel Silicon Gate

- Maximum Times Apply over Temperature Range and Supply Voltage Variation

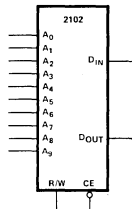
The Intel®2102-1 is the fastest (500ns) version of the standard one microsecond 2102. It has all the same features, pin configuration, and D.C. operating characteristics as the standard 2102. The absolute maximum ratings, pin configuration, and D.C. operating characteristics are repeated below for convenience, while the A.C. characteristics appear on the opposite side.

RAMS

PIN CONFIGURATION



LOGIC SYMBOL



### ABSOLUTE MAXIMUM RATINGS\*

Ambient Temperature Under Bias . . . . . 0°C to 70°C  
 Storage Temperature . . . . . -65°C to +150°C  
 Voltage On Any Pin  
 With Respect to Ground . . . . . -0.5V to +7V  
 Power Dissipation . . . . . 1 Watt

### \*COMMENT

Stresses above those listed under "Absolute Maximum Rating" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or at any other condition above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

### D. C. and Operating Characteristics

$T_A = 0^\circ\text{C}$  to  $+70^\circ\text{C}$ ,  $V_{CC} = 5\text{V} \pm 5\%$  unless otherwise specified

SYMBOL	PARAMETER	LIMITS			UNIT	TEST CONDITIONS
		MIN.	TYP.(1)	MAX.		
$I_{LI}$	INPUT LOAD CURRENT (ALL INPUT PINS)			10	$\mu\text{A}$	$V_{IN} = 0$ to $5.25\text{V}$
$I_{LOH}$	OUTPUT LEAKAGE CURRENT			10	$\mu\text{A}$	$\overline{CE} = 2.2\text{V}$ , $V_{OUT} = 4.0\text{V}$
$I_{LOL}$	OUTPUT LEAKAGE CURRENT			-100	$\mu\text{A}$	$\overline{CE} = 2.2\text{V}$ , $V_{OUT} = 0.45\text{V}$
$I_{CC1}$	POWER SUPPLY CURRENT		30	60	$\text{mA}$	ALL INPUTS = $5.25\text{V}$ DATA OUT OPEN $T_A = 25^\circ\text{C}$
$I_{CC2}$	POWER SUPPLY CURRENT			70	$\text{mA}$	ALL INPUTS = $5.25\text{V}$ DATA OUT OPEN $T_A = 0^\circ\text{C}$
$V_{IL}$	INPUT "LOW" VOLTAGE	-0.5		+0.65	V	
$V_{IH}$	INPUT "HIGH" VOLTAGE	2.2		$V_{CC}$	V	
$V_{OL}$	OUTPUT "LOW" VOLTAGE			+0.45	V	$I_{OL} = 1.9\text{mA}$
$V_{OH}$	OUTPUT "HIGH" VOLTAGE	2.2			V	$I_{OH} = -100\mu\text{A}$

NOTE: 1. Typical values are for  $T_A = 25^\circ\text{C}$  and nominal supply voltage.

## A. C. Characteristics $T_A = 0^\circ\text{C}$ to $70^\circ\text{C}$ , $V_{CC} = 5\text{V} \pm 5\%$ unless otherwise specified

SYMBOL	PARAMETER	LIMITS			UNIT
		MIN.	TYP. <sup>[1]</sup>	MAX.	
<b>READ CYCLE</b>					
$t_{RC}$	READ CYCLE	500			ns
$t_A$	ACCESS TIME			500	ns
$t_{CO}$	CHIP ENABLE TO OUTPUT TIME			350	ns
$t_{OH1}$	PREVIOUS READ DATA VALID WITH RESPECT TO ADDRESS	50			ns
$t_{OH2}$	PREVIOUS READ DATA VALID WITH RESPECT TO CHIP ENABLE	0			ns
<b>WRITE CYCLE</b>					
$t_{WC}$	WRITE CYCLE	500			ns
$t_{AW}$	ADDRESS TO WRITE SETUP TIME	150			ns
$t_{WP}$	WRITE PULSE WIDTH	300			ns
$t_{WR}$	WRITE RECOVERY TIME	50			ns
$t_{DW}$	DATA SETUP TIME	330			ns
$t_{DH}$	DATA HOLD TIME	100			ns
$t_{CW}$	CHIP ENABLE TO WRITE SETUP TIME	400			ns

## Capacitance <sup>[2]</sup> $T_A = 25^\circ\text{C}$ , $f = 1\text{MHz}$

### A. C. CONDITIONS OF TEST

Input Pulse Levels: +0.65 Volt to 2.2 Volt

Input Pulse Rise and Fall Times: 20nsec

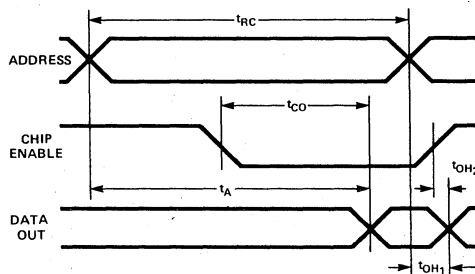
Timing Measurement Reference Level: 1.5 Volt

Output Load: 1 TTL Gate and  $C_L = 100\text{pF}$

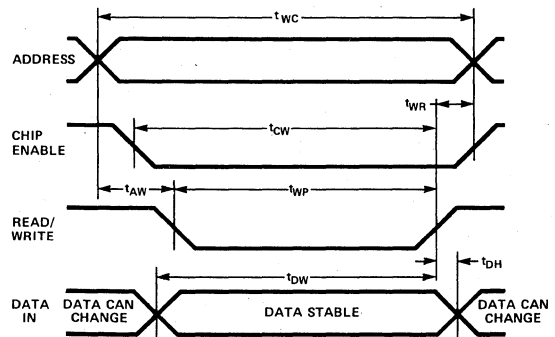
SYMBOL	TEST	LIMITS (pF)	
		TYP. <sup>[1]</sup>	MAX.
$C_{IN}$	INPUT CAPACITANCE (ALL INPUT PINS) $V_{IN} = 0\text{V}$	3	5
$C_{OUT}$	OUTPUT CAPACITANCE $V_{OUT} = 0\text{V}$	7	10

## Waveforms

### READ CYCLE



### WRITE CYCLE



- NOTES: 1. Typical values are for  $T_A = 25^\circ\text{C}$  and nominal supply voltage.  
 2. This parameter is periodically sampled and is not 100% tested.



# Silicon Gate MOS 2102-2

## 1024 BIT FULLY DECODED STATIC MOS RANDOM ACCESS MEMORY

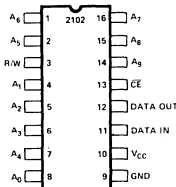
- \* Fast Access Time -- 650 ns max.
- Fast Cycle Time -- 650 ns max.
- N-Channel Silicon Gate

- Maximum Times Apply over Temperature Range and Supply Voltage Variation

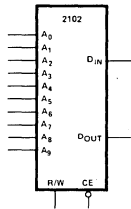
The Intel®2102-2 is a fast (650ns) version of the standard one microsecond 2102. It has all the same features, pin configuration, and D.C. operating characteristics as the standard 2102. The absolute maximum ratings, pin configuration, and D.C. operating characteristics are repeated below for convenience, while the A.C. characteristics appear on the opposite side.

RAMS

PIN CONFIGURATION



LOGIC SYMBOL



### ABSOLUTE MAXIMUM RATINGS\*

Ambient Temperature Under Bias . . . . . 0°C to 70°C  
 Storage Temperature . . . . . -65°C to +150°C  
 Voltage On Any Pin  
 With Respect to Ground . . . . . -0.5V to +7V  
 Power Dissipation . . . . . 1 Watt

#### \*COMMENT

Stresses above those listed under "Absolute Maximum Rating" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or at any other condition above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

### D. C. and Operating Characteristics

T<sub>A</sub> = 0°C to +70°C, V<sub>CC</sub> = 5V ±5% unless otherwise specified

SYMBOL	PARAMETER	LIMITS			UNIT	TEST CONDITIONS
		MIN.	TYP.(1)	MAX.		
I <sub>LI</sub>	INPUT LOAD CURRENT (ALL INPUT PINS)			10	μA	V <sub>IN</sub> = 0 to 5.25V
I <sub>LOH</sub>	OUTPUT LEAKAGE CURRENT			10	μA	CE = 2.2V, V <sub>OUT</sub> = 4.0V
I <sub>LOL</sub>	OUTPUT LEAKAGE CURRENT			-100	μA	CE = 2.2V, V <sub>OUT</sub> = 0.45V
I <sub>CC1</sub>	POWER SUPPLY CURRENT		30	60	mA	ALL INPUTS = 5.25V DATA OUT OPEN T <sub>A</sub> = 25°C
I <sub>CC2</sub>	POWER SUPPLY CURRENT			70	mA	ALL INPUTS = 5.25V DATA OUT OPEN T <sub>A</sub> = 0°C
V <sub>IL</sub>	INPUT "LOW" VOLTAGE	-0.5		+0.65	V	
V <sub>IH</sub>	INPUT "HIGH" VOLTAGE	2.2		V <sub>CC</sub>	V	
V <sub>OL</sub>	OUTPUT "LOW" VOLTAGE			+0.45	V	I <sub>OL</sub> = 1.9mA
V <sub>OH</sub>	OUTPUT "HIGH" VOLTAGE	2.2			V	I <sub>OH</sub> = -100μA

NOTE: 1. Typical values are for T<sub>A</sub> = 25°C and nominal supply voltage.

## A. C. Characteristics $T_A = 0^\circ\text{C}$ to $70^\circ\text{C}$ , $V_{CC} = 5\text{V} \pm 5\%$ unless otherwise specified

SYMBOL	PARAMETER	LIMITS			UNIT
		MIN.	TYP. <sup>[1]</sup>	MAX.	
<b>READ CYCLE</b>					
$t_{RC}$	READ CYCLE	650			ns
$t_A$	ACCESS TIME			650	ns
$t_{CO}$	CHIP ENABLE TO OUTPUT TIME			400	ns
$t_{OH1}$	PREVIOUS READ DATA VALID WITH RESPECT TO ADDRESS	50			ns
$t_{OH2}$	PREVIOUS READ DATA VALID WITH RESPECT TO CHIP ENABLE	0			ns
<b>WRITE CYCLE</b>					
$t_{WC}$	WRITE CYCLE	650			ns
$t_{AW}$	ADDRESS TO WRITE SETUP TIME	200			ns
$t_{WP}$	WRITE PULSE WIDTH	400			ns
$t_{WR}$	WRITE RECOVERY TIME	50			ns
$t_{DW}$	DATA SETUP TIME	450			ns
$t_{DH}$	DATA HOLD TIME	100			ns
$t_{CW}$	CHIP ENABLE TO WRITE SETUP TIME	550			ns

## Capacitance<sup>[2]</sup> $T_A = 25^\circ\text{C}$ , $f = 1\text{MHz}$

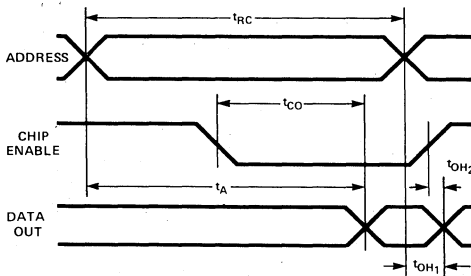
SYMBOL	TEST	LIMITS (pF)	
		TYP. <sup>[1]</sup>	MAX.
$C_{IN}$	INPUT CAPACITANCE (ALL INPUT PINS) $V_{IN} = 0\text{V}$	3	5
$C_{OUT}$	OUTPUT CAPACITANCE $V_{OUT} = 0\text{V}$	7	10

### A. C. CONDITIONS OF TEST

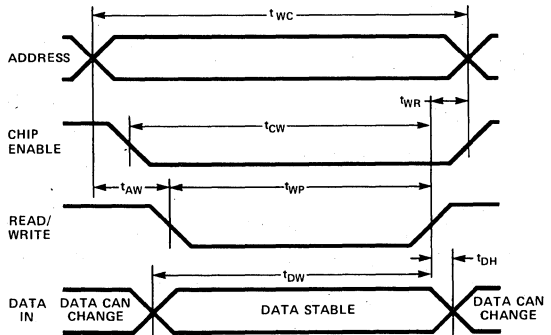
Input Pulse Levels: +0.65 Volt to 2.2 Volt  
 Input Pulse Rise and Fall Times: 20nsec  
 Timing Measurement Reference Level: 1.5 Volt  
 Output Load: 1 TTL Gate and  $C_L = 100\text{ pF}$

## Waveforms

### READ CYCLE



### WRITE CYCLE



NOTES: 1. Typical values are for  $T_A = 25^\circ\text{C}$  and nominal supply voltage.  
 2. This parameter is periodically sampled and is not 100% tested.



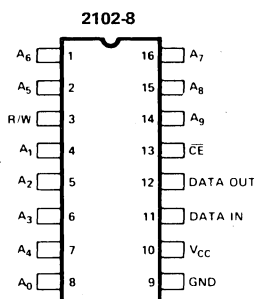
## 1024 BIT FULLY DECODED STATIC MOS RANDOM ACCESS MEMORY

- Access Time--1.5  $\mu$ s max.
- Cycle Time--2.0  $\mu$ s max.
- N-Channel Silicon Gate
- Maximum Times Apply over Temperature Range and Supply Voltage Variation

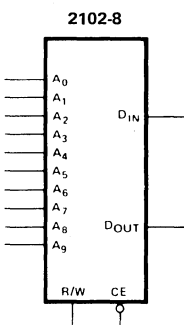
The Intel<sup>®</sup>2102-8 is a 1.5 $\mu$ s version of the standard 2102. It has all the same features, and pin configuration as the standard 2102. The absolute maximum ratings, and pin configuration are repeated below for convenience, while the D.C. operating characteristics and A.C. characteristics appear as follows.

RAMs

### PIN CONFIGURATION



### LOGIC SYMBOL



### ABSOLUTE MAXIMUM RATINGS\*

Ambient Temperature Under Bias . . . . . 15°C to +55°C  
 Storage Temperature . . . . . -65°C to +150°C  
 Voltage On Any Pin  
 With Respect to Ground . . . . . -0.5V to +7V  
 Power Dissipation . . . . . 1 Watt

#### \*COMMENT

Stresses above those listed under "Absolute Maximum Rating" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or at any other condition above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## D. C. and Operating Characteristics

T<sub>A</sub> = 15°C to +55°C, V<sub>CC</sub> = 5V ±5%, unless otherwise specified.

SYMBOL	PARAMETER	LIMITS			UNIT	TEST CONDITIONS
		MIN.	TYP.(1)	MAX.		
I <sub>LI</sub>	INPUT LOAD CURRENT (ALL INPUT PINS)			10	$\mu$ A	V <sub>IN</sub> = 0 to 5.25V
I <sub>LOH</sub>	OUTPUT LEAKAGE CURRENT			10	$\mu$ A	$\overline{CE}$ = 3.0V, V <sub>OUT</sub> = 4.0V
I <sub>LOL</sub>	OUTPUT LEAKAGE CURRENT			-100	$\mu$ A	$\overline{CE}$ = 3.0V, V <sub>OUT</sub> = 0.5V
I <sub>CC1</sub>	POWER SUPPLY CURRENT		30	60	mA	ALL INPUTS = 5.25V DATA OUT OPEN T <sub>A</sub> = 25°C
I <sub>CC2</sub>	POWER SUPPLY CURRENT			70	mA	ALL INPUTS = 5.25V DATA OUT OPEN T <sub>A</sub> = 15°C
V <sub>IL</sub>	INPUT "LOW" VOLTAGE	-0.5		+0.65	V	
V <sub>IH</sub>	INPUT "HIGH" VOLTAGE	3.0		V <sub>CC</sub>	V	
V <sub>OL</sub>	OUTPUT "LOW" VOLTAGE			0.5	V	I <sub>OL</sub> = 1.5mA
V <sub>OH</sub>	OUTPUT "HIGH" VOLTAGE	2.2			V	I <sub>OH</sub> = -50 $\mu$ A

(1) Typical values are for T<sub>A</sub> = 25°C and nominal supply voltage.

## A. C. Characteristics $T_A = 15^\circ\text{C}$ to $55^\circ\text{C}$ , $V_{CC} = 5\text{V} \pm 5\%$ , unless otherwise specified.

SYMBOL	PARAMETER	LIMITS			UNIT
		MIN.	TYP. <sup>[1]</sup>	MAX.	
<b>READ CYCLE</b>					
$t_{RC}$	READ CYCLE	2000			ns
$t_A$	ACCESS TIME			1500	ns
$t_{CO}$	CHIP ENABLE TO OUTPUT TIME			1500	ns
$t_{OH1}$	PREVIOUS READ DATA VALID WITH RESPECT TO ADDRESS	0			ns
$t_{OH2}$	PREVIOUS READ DATA VALID WITH RESPECT TO CHIP ENABLE	0			ns
<b>WRITE CYCLE</b>					
$t_{WC}$	WRITE CYCLE	2000			ns
$t_{AW}$	ADDRESS TO WRITE SETUP TIME	900			ns
$t_{WP}$	WRITE PULSE WIDTH	1000			ns
$t_{WR}$	WRITE RECOVERY TIME	100			ns
$t_{DW}$	DATA SETUP TIME	1600			ns
$t_{DH}$	DATA HOLD TIME	300			ns
$t_{CW}$	CHIP ENABLE TO WRITE SETUP TIME	1800			ns

### Capacitance <sup>[2]</sup> $T_A = 25^\circ\text{C}$ , $f = 1\text{MHz}$

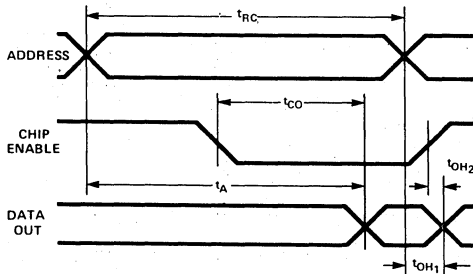
#### A. C. CONDITIONS OF TEST

Input Pulse Levels: +0.65 Volt to 3.0 Volt  
 Input Pulse Rise and Fall Times: 20nsec  
 Timing Measurement Reference Level: 1.5 Volt  
 Output Load: 1 TTL Gate and  $C_L = 100\text{ pF}$

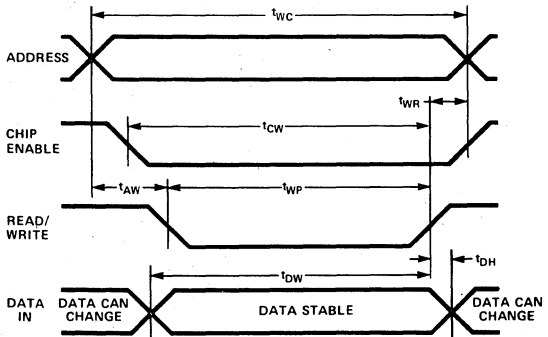
SYMBOL	TEST	LIMITS (pF)	
		TYP. <sup>[1]</sup>	MAX.
$C_{IN}$	INPUT CAPACITANCE (ALL INPUT PINS) $V_{IN} = 0\text{V}$	3	5
$C_{OUT}$	OUTPUT CAPACITANCE $V_{OUT} = 0\text{V}$	7	10

## Waveforms

### READ CYCLE



### WRITE CYCLE



- NOTES: 1. Typical values are for  $T_A = 25^\circ\text{C}$  and nominal supply voltage.  
 2. This parameter is periodically sampled and is not 100% tested.