



Integrated Device Technology, Inc.

**128K x 8  
64K x 8  
CMOS DUAL-PORT  
STATIC RAM MODULE**

**IDT7M1001  
IDT7M1003**

**FEATURES**

- High-density 1M/512K CMOS Dual-Port Static RAM module
- Fast access times:
  - Commercial 35, 40ns
  - Military 40, 50ns
- Fully asynchronous read/write operation from either port
- Full on-chip hardware support of semaphore signaling between ports
- Surface mounted LCC (leadless chip carriers) components on a 64-pin sidebraze DIP (Dual In-line Package)
- Multiple Vcc and GND pins for maximum noise immunity
- Single 5V ( $\pm 10\%$ ) power supply
- Input/outputs directly TTL-compatible

**DESCRIPTION:**

The IDT7M1001/IDT7M1003 is a 128K x 8/64K x 8 high-speed CMOS Dual-Port Static RAM module constructed on a multilayer ceramic substrate using eight IDT7006 (16K x 8) Dual-Port RAMs and two IDT FCT138 decoders or depopulated using only four IDT7006s and two decoders.

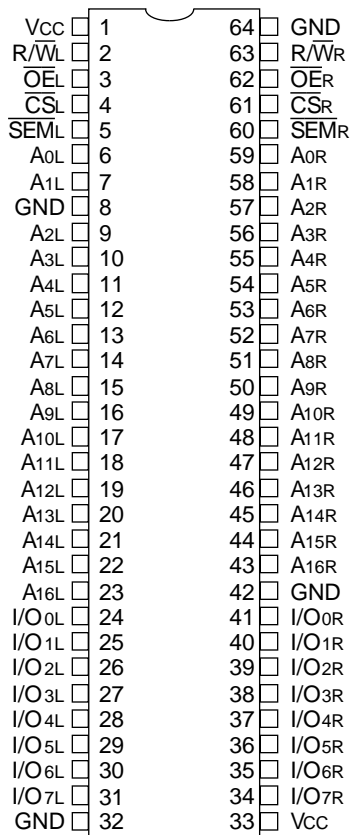
This module provides two independent ports with separate control, address, and I/O pins that permit independent and asynchronous access for reads or writes to any location in memory. System performance is enhanced by facilitating port-to-port communication via semaphore ( $\overline{SEM}$ ) "handshake" signaling. The IDT7M1001/1003 module is designed to be used as stand-alone Dual-Port RAM where on-chip hardware port arbitration is not needed. It is the users responsibility to ensure data integrity when simultaneously accessing the same memory location from both ports.

The IDT7M1001/1003 module is packaged on a multilayer co-fired ceramic 64-pin DIP (Dual In-line Package) with dimensions of only 3.2" x 0.62" x 0.38". Maximum access times as fast as 35ns over the commercial temperature range are available.

All inputs and outputs of the IDT7M1001/1003 are TTL-compatible and operate from a single 5V supply. Fully asynchronous circuitry is used, requiring no clocks or refreshing for operation of the module.

All IDT military module semiconductor components are manufactured in compliance with the latest revision of MIL-STD-883, Class B, making them ideally suited to applications demanding the highest level of performance and reliability.

**PIN CONFIGURATION<sup>(1)</sup>**



2804 drw 01

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**DIP  
TOP VIEW**

**NOTE:**

1. For the IDT7M1003 (64K x 8) version, Pins 23 and 43 must be connected to GND for proper operation of the module.

**PIN NAMES**

Left Port	Right Port	Description
A (0-16)L	A (0-16)R	Address Inputs
I/O (0-7)L	I/O (0-7)R	Data Inputs/Outputs
R/WL	R/WR	Read/Write Enables
CSL	CSR	Chip Select
OEL	OER	Output Enable
SEML	SEMR	Semaphore Control
VCC		Power
GND		Ground

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**MILITARY AND COMMERCIAL TEMPERATURE RANGES**

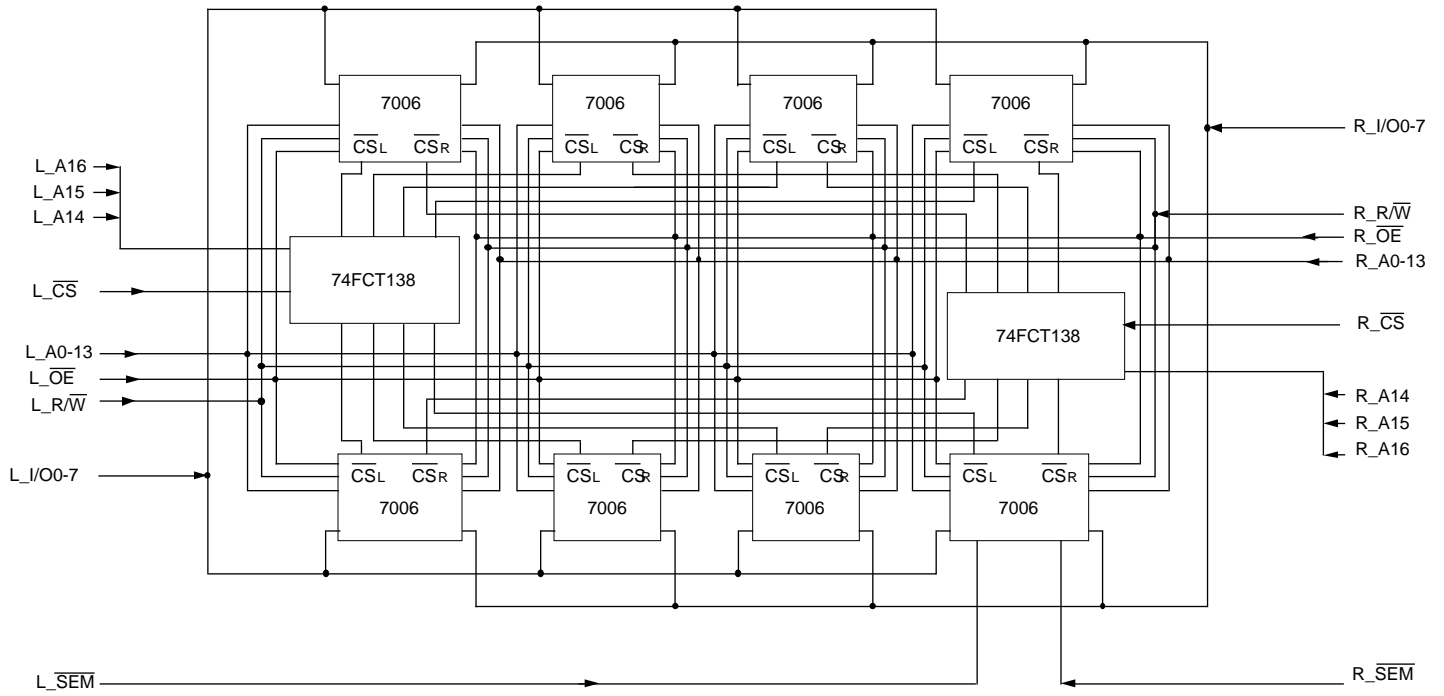
**MARCH 1995**

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DSC-7066/5

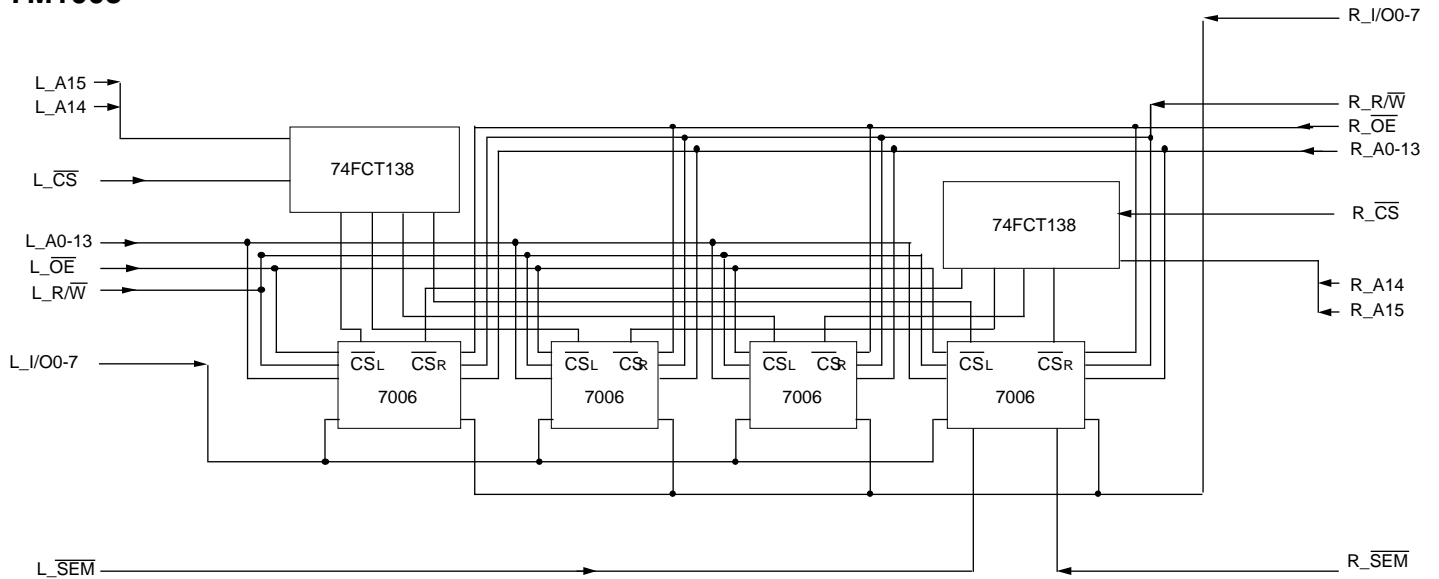
## FUNCTIONAL BLOCK DIAGRAM

### 7M1001



2804 drw 02

### 7M1003



2804 drw 03

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

Symbol	Rating	Commercial	Military	Unit
V <sub>TERM</sub>	Terminal Voltage with Respect to GND	-0.5 to +7.0	-0.5 to +7.0	V
T <sub>A</sub>	Operating Temperature	0 to +70	-55 to +125	°C
T <sub>BIAS</sub>	Temperature Under Bias	-55 to +125	-65 to +135	°C
T <sub>STG</sub>	Storage Temperature	-55 to +125	-65 to +150	°C
I <sub>OUT</sub>	DC Output Current	50	50	mA

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### NOTE:

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

## CAPACITANCE<sup>(1)</sup> (T<sub>A</sub> = +25°C, f = 1.0MHz)

Symbol	Parameter	Test Conditions	Max.	Unit
C <sub>IN1</sub>	Input Capacitance (CS or SEM)	V <sub>IN</sub> = 0V	15	pF
C <sub>IN2</sub>	Input Capacitance (Data, Address, All Other Controls)	V <sub>IN</sub> = 0V	100	pF
C <sub>OUT</sub>	Output Capacitance (Data)	V <sub>OUT</sub> = 0V	100	pF

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### NOTE:

- This parameter is guaranteed by design but not tested.

## DC ELECTRICAL CHARACTERISTICS

(V<sub>CC</sub> = 5V ± 10%, T<sub>A</sub> = -55°C to +125°C or 0°C to +70°C)

Symbol	Parameter	Test Conditions	Commercial			Military			Unit
			Min.	Max. <sup>(1)</sup>	Max. <sup>(2)</sup>	Min.	Max. <sup>(1)</sup>	Max. <sup>(2)</sup>	
I <sub>CC2</sub>	Dynamic Operating Current (Both Ports Active)	V <sub>CC</sub> = Max., $\overline{CS} \leq V_{IL}$ , $\overline{SEM} \geq V_{IH}$ Outputs Open, f = f <sub>MAX</sub>	—	940	660	—	1130	790	mA
I <sub>CC1</sub>	Standby Supply Current (One Port Active)	V <sub>CC</sub> = Max., L <sub>CS</sub> or R <sub>CS</sub> ≥ V <sub>IH</sub> Outputs Open, f = f <sub>MAX</sub>	—	750	470	—	905	565	mA
I <sub>SB1</sub>	Standby Supply Current (TTL Levels)	V <sub>CC</sub> = Max., L <sub>CS</sub> and R <sub>CS</sub> ≥ V <sub>IH</sub> Outputs Open, f = f <sub>MAX</sub> L <sub>SEM</sub> and R <sub>SEM</sub> ≥ V <sub>CC</sub> - 0.2V	—	565	285	—	685	345	mA
I <sub>SB2</sub>	Full Standby Supply Current (CMOS Levels)	L <sub>CS</sub> and R <sub>CS</sub> ≥ V <sub>CC</sub> - 0.2V V <sub>IN</sub> > V <sub>CC</sub> 0.2V or < 0.2V L <sub>SEM</sub> and R <sub>SEM</sub> ≥ V <sub>CC</sub> - 0.2V	—	125	65	—	245	125	mA

### NOTES:

- IDT7M1001 (128K x 8) version only.
- IDT7M1003 (64K x 8) version only.

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## RECOMMENDED OPERATING TEMPERATURE AND SUPPLY VOLTAGE

Grade	Ambient Temperature	GND	V <sub>CC</sub>
Military	-55°C to +125°C	0V	5.0V ± 10%
Commercial	0°C to +70°C	0V	5.0V ± 10%

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## RECOMMENDED DC OPERATING CONDITIONS

Symbol	Parameter	Min.	Typ.	Max.	Unit
V <sub>CC</sub>	Supply Voltage	4.5	5.0	5.5	V
GND	Supply Voltage	0	0	0	V
V <sub>IH</sub>	Input High Voltage	2.2	-	6.0	V
V <sub>IL</sub>	Input Low Voltage	-0.5 <sup>(1)</sup>	-	0.8	V

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### NOTE:

- V<sub>IL</sub> (min.) = -3.0V for pulse width less than 20ns.

### DC ELECTRICAL CHARACTERISTICS

( $V_{CC}=5.0V \pm 10\%$ ,  $T_A = -55^{\circ}C$  to  $+125^{\circ}C$  and  $0^{\circ}C$  to  $+70^{\circ}C$ )

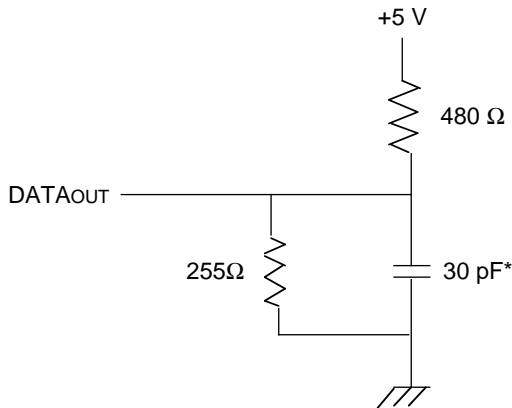
Symbol	Parameter	Test Conditions	IDT7M1001		IDT7M1003		Unit
			Min.	Max.	Min.	Max.	
I <sub>L</sub>	Input Leakage (Address, Data & Other Controls)	$V_{CC} = \text{Max.}$ $V_{IN} = \text{GND to } V_{CC}$	—	80	—	40	$\mu\text{A}$
I <sub>L</sub>	Input Leakage ( $\overline{\text{CS}}$ and $\overline{\text{SEM}}$ )	$V_{CC} = \text{Max.}$ $V_{IN} = \text{GND to } V_{CC}$	—	10	—	10	$\mu\text{A}$
I <sub>LO</sub>	Output Leakage (Data)	$V_{CC} = \text{Max.}$ $\overline{\text{CS}} \geq V_{IH}, V_{OUT} = \text{GND to } V_{CC}$	—	80	—	40	$\mu\text{A}$
V <sub>OL</sub>	Output Low Voltage	$V_{CC} = \text{Min.}$ $I_{OL} = 4\text{mA}$	—	0.4	—	0.4	V
V <sub>OH</sub>	Output High Voltage	$V_{CC} = \text{Min.}$ $I_{OH} = -4\text{mA}$	2.4	—	2.4	—	V

2804 tbl 07

### AC TEST CONDITIONS

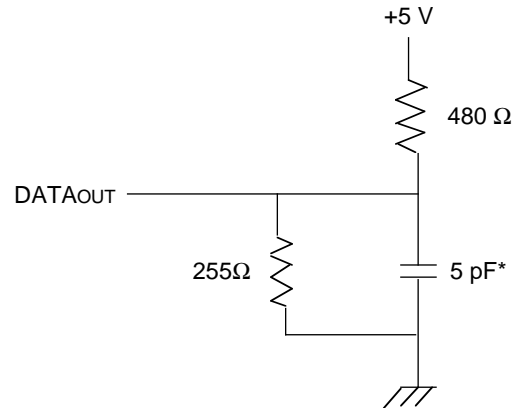
Input Pulse Levels	GND to 3.0V
Input Rise/Fall Times	5ns
Input Timing Reference Levels	1.5V
Output Reference Levels	1.5V
Output Load	See Figures 1 and 2

2804 tbl 08



2804 drw 04

Figure 1. Output Load



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Figure 2. Output Load  
(for t<sub>CLZ</sub>, t<sub>CHZ</sub>, t<sub>OLZ</sub>, t<sub>OHZ</sub>, t<sub>WHZ</sub>, t<sub>OW</sub>)

\*Including scope and jig.

## AC ELECTRICAL CHARACTERISTICS

( $V_{CC} = 5.0V \pm 10\%$ ,  $T_A = -55^\circ C$  to  $+125^\circ C$  and  $0^\circ C$  to  $+70^\circ C$ )

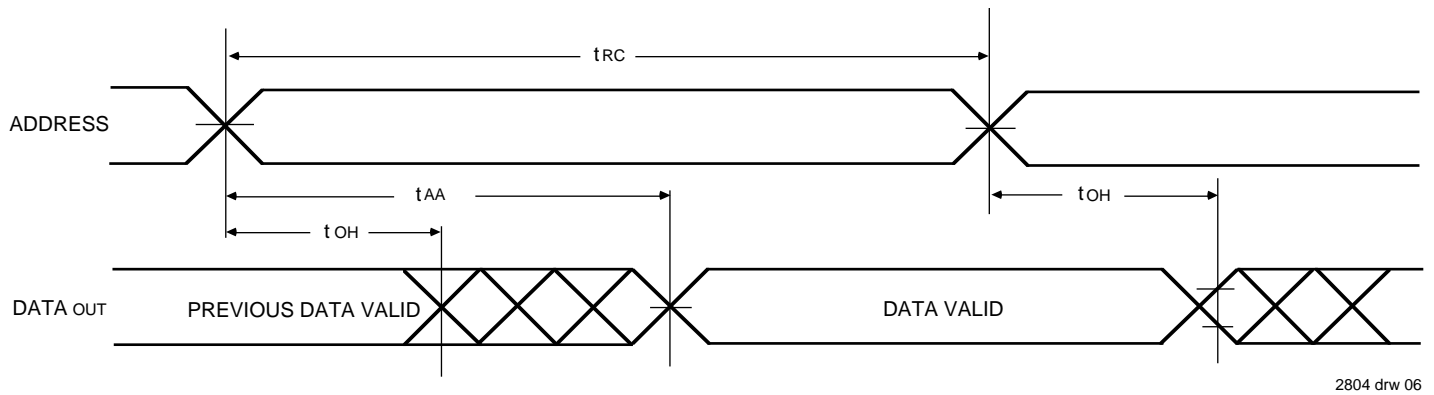
Symbol	Parameter	-35		-40		-50		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
<b>Read Cycle</b>								
t <sub>RC</sub>	Read Cycle Time	35	—	40	—	50	—	ns
t <sub>AA</sub>	Address Access Time	—	35	—	40	—	50	ns
t <sub>ACS</sub> <sup>(2)</sup>	Chip Select Access Time	—	35	—	40	—	50	ns
t <sub>OE</sub>	Output Enable Access Time	—	20	—	25	—	30	ns
t <sub>OH</sub>	Output Hold From Address Change	3	—	3	—	3	—	ns
t <sub>CLZ</sub> <sup>(1)</sup>	Chip Select to Output in Low-Z	3	—	3	—	3	—	ns
t <sub>CHZ</sub> <sup>(1)</sup>	Chip Deselect to Output in High-Z	—	20	—	20	—	25	ns
t <sub>OLZ</sub> <sup>(1)</sup>	Output Enable to Output in Low-Z	3	—	3	—	3	—	ns
t <sub>OHZ</sub> <sup>(1)</sup>	Output Disable to Output in High-Z	—	20	—	20	—	25	ns
t <sub>PU</sub> <sup>(1)</sup>	Chip Select to Power-Up Time	0	—	0	—	0	—	ns
t <sub>PD</sub> <sup>(1)</sup>	Chip Disable to Power-Down Time	—	50	—	50	—	50	ns
t <sub>SOP</sub>	$\overline{SEM}$ Flag Update Pulse ( $\overline{OE}$ or $\overline{SEM}$ )	15	—	15	—	15	—	ns
<b>Write Cycle</b>								
t <sub>WC</sub>	Write Cycle Time	35	—	40	—	50	—	ns
t <sub>CW</sub> <sup>(2)</sup>	Chip Select to End-of-Write	30	—	35	—	40	—	ns
t <sub>AW</sub>	Address Valid to End-of-Write	30	—	35	—	40	—	ns
t <sub>AS1</sub> <sup>(3)</sup>	Address Set-up to Write Pulse Time	5	—	5	—	5	—	ns
t <sub>AS2</sub>	Address Set-up to $\overline{CS}$ Time	0	—	0	—	0	—	ns
t <sub>WP</sub>	Write Pulse Width	30	—	35	—	40	—	ns
t <sub>WR</sub> <sup>(4)</sup>	Write Recovery Time	0	—	0	—	0	—	ns
t <sub>DW</sub>	Data Valid to End-of-Write	25	—	30	—	35	—	ns
t <sub>DH</sub> <sup>(4)</sup>	Data Hold Time	0	—	0	—	0	—	ns
t <sub>OHZ</sub> <sup>(1)</sup>	Output Disable to Output in High-Z	—	20	—	20	—	25	ns
t <sub>WHZ</sub> <sup>(1)</sup>	Write Enable to Output in High-Z	—	20	—	20	—	25	ns
t <sub>OW</sub> <sup>(1, 4)</sup>	Output Active from End-of-Write	0	—	0	—	0	—	ns
t <sub>SWRD</sub>	$\overline{SEM}$ Flag Write to Read Time	15	—	15	—	15	—	ns
t <sub>SPS</sub>	$\overline{SEM}$ Flag Contention Window	15	—	15	—	15	—	ns
<b>Port-to-Port Delay Timing</b>								
t <sub>WDD</sub> <sup>(5)</sup>	Write Pulse to Data Delay	—	60	—	65	—	70	ns
t <sub>DDD</sub> <sup>(5)</sup>	Write Data Valid to Read Data Valid	—	45	—	50	—	55	ns

**NOTES:**

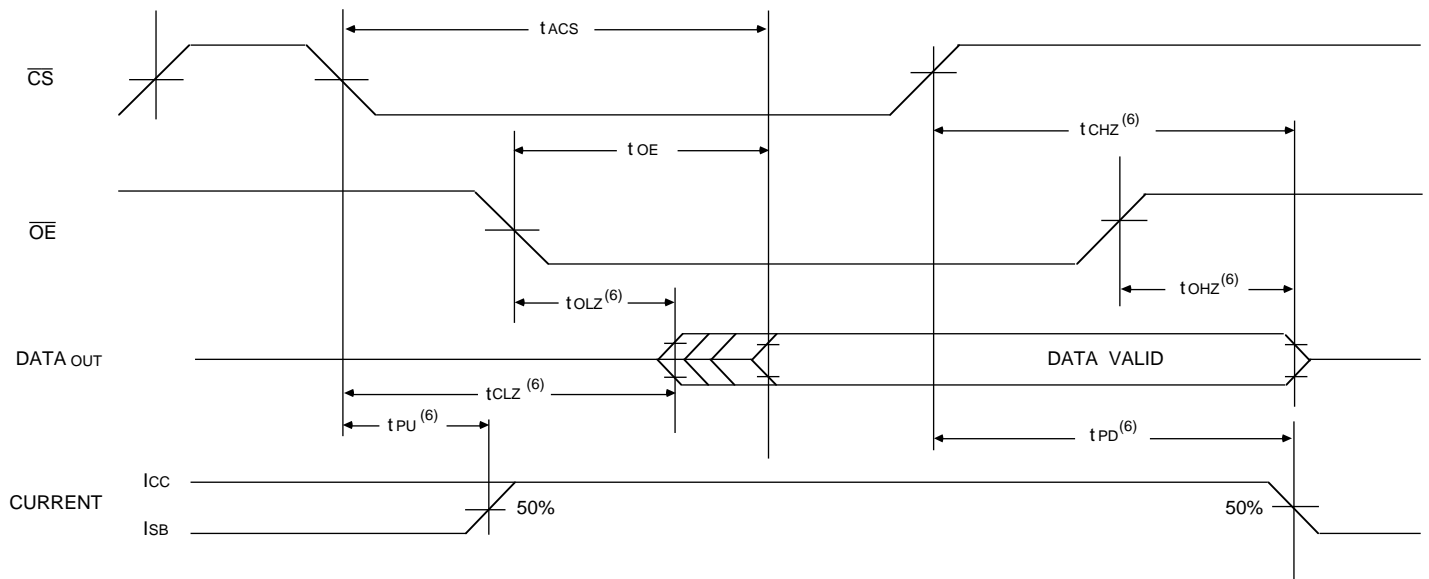
1. This parameter is guaranteed by design but not tested.
2. To access RAM  $\overline{CS} \leq V_{IL}$  and  $\overline{SEM} \geq V_{IH}$ . To access semaphore,  $\overline{CS} \geq V_{IH}$  and  $\overline{SEM} \leq V_{IL}$ .
3. t<sub>AS1</sub>= 0 if R/W is asserted LOW simultaneously with or after the  $\overline{CS}$  LOW transition.
4. For  $\overline{CS}$  controlled write cycles, t<sub>WR</sub>= 5ns, t<sub>DH</sub>= 5ns, t<sub>OW</sub>= 5ns.
5. Port-to-Port delay through the RAM cells from the writing port to the reading port.

2804 tbl 09

### TIMING WAVEFORM OF READ CYCLE NO. 1 (EITHER SIDE)<sup>(1,2,4)</sup>



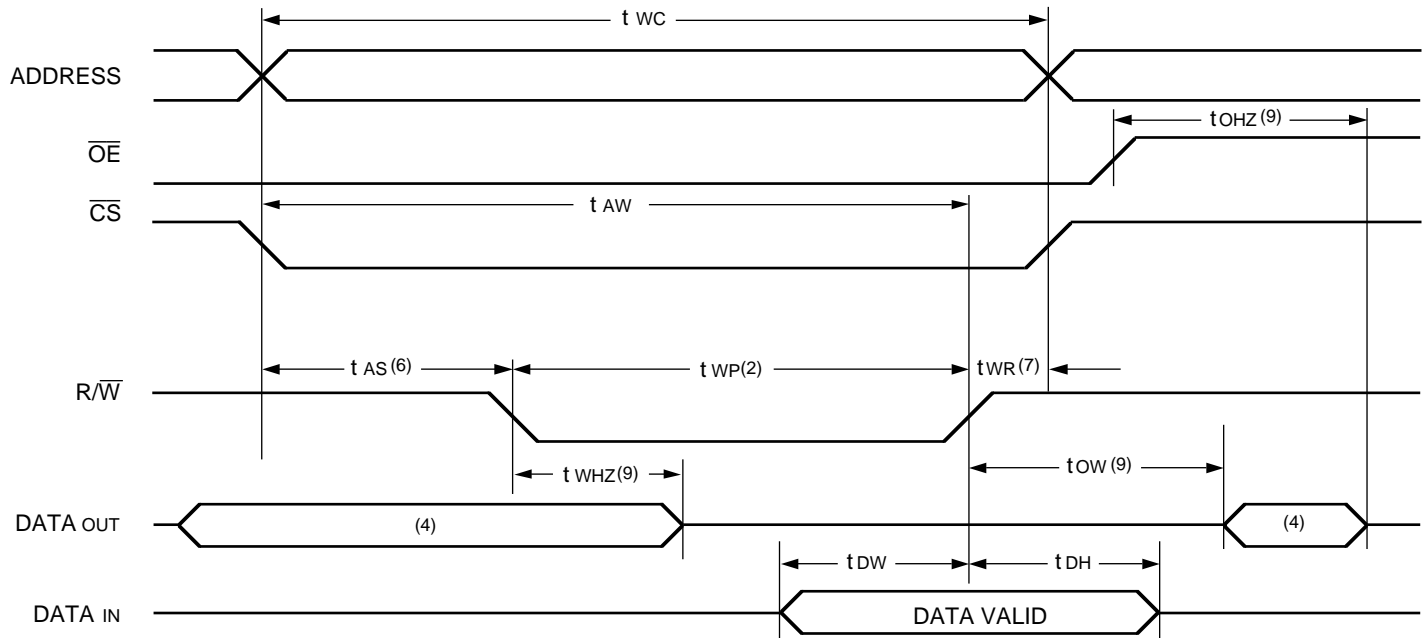
### TIMING WAVEFORM OF READ CYCLE NO. 2 (EITHER SIDE)<sup>(1,3,5)</sup>



**NOTES:**

1.  $R/\overline{W}$  is HIGH for Read Cycles
2. Device is continuously enabled.  $\overline{CS} = \text{LOW}$ . This waveform cannot be used for semaphore reads.
3. Addresses valid prior to or coincident with  $\overline{CS}$  transition LOW.
4.  $\overline{OE} = \text{LOW}$ .
5. To access RAM,  $\overline{CS} = \text{LOW}$ ,  $\overline{SEM} = \text{H}$ . To access semaphore,  $\overline{CS} = \text{HIGH}$  and  $\overline{SEM} = \text{LOW}$ .
6. This parameter is guaranteed by design but not tested.

**TIMING WAVEFORM OF WRITE CYCLE NO. 1 ( $\overline{R/\overline{W}}$  CONTROLLED TIMING)<sup>(1,3,5,8)</sup>**

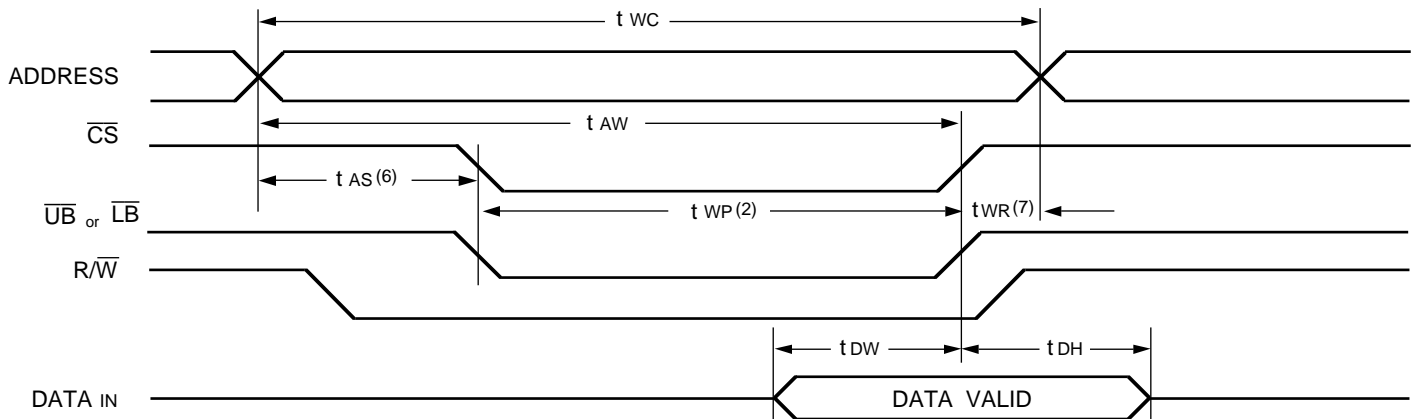


2804 drw 08

**NOTES:**

1.  $\overline{R/\overline{W}}$  is HIGH for Read Cycles
2. Device is continuously enabled.  $\overline{CS} = \text{LOW}$ .  $\overline{UB}$  or  $\overline{LB} = \text{LOW}$ . This waveform cannot be used for semaphore reads.
3. Addresses valid prior to or coincident with  $\overline{CS}$  transition low.
4.  $\overline{OE} = \text{LOW}$ .
5. To access RAM,  $\overline{CS} = \text{LOW}$ ,  $\overline{UB}$  or  $\overline{LB} = \text{LOW}$ ,  $\overline{SEM} = \text{H}$ . To access semaphore,  $\overline{CS} = \text{HIGH}$  and  $\overline{SEM} = \text{LOW}$ .
6. Timing depends on which enable signal is asserted last.
7. Timing depends on which enable signal is de-asserted first.
8. If  $\overline{OE}$  is LOW during a  $\overline{R/\overline{W}}$  controlled write cycle, the write pulse width must be larger of  $t_{WP}$  or  $(t_{WZ} + t_{DW})$  to allow the I/O drivers to turn off and data to be placed on the bus for the required  $t_{DW}$ . If  $\overline{OE}$  is HIGH during a  $\overline{R/\overline{W}}$  controlled write cycle, this requirement does not apply and the write pulse width be as short as the specified  $t_{WP}$ .
9. This parameter is guaranteed by design but not tested.

**TIMING WAVEFORM OF WRITE CYCLE NO. 2 ( $\overline{CS}$  CONTROLLED TIMING)<sup>(1,3,5,8)</sup>**

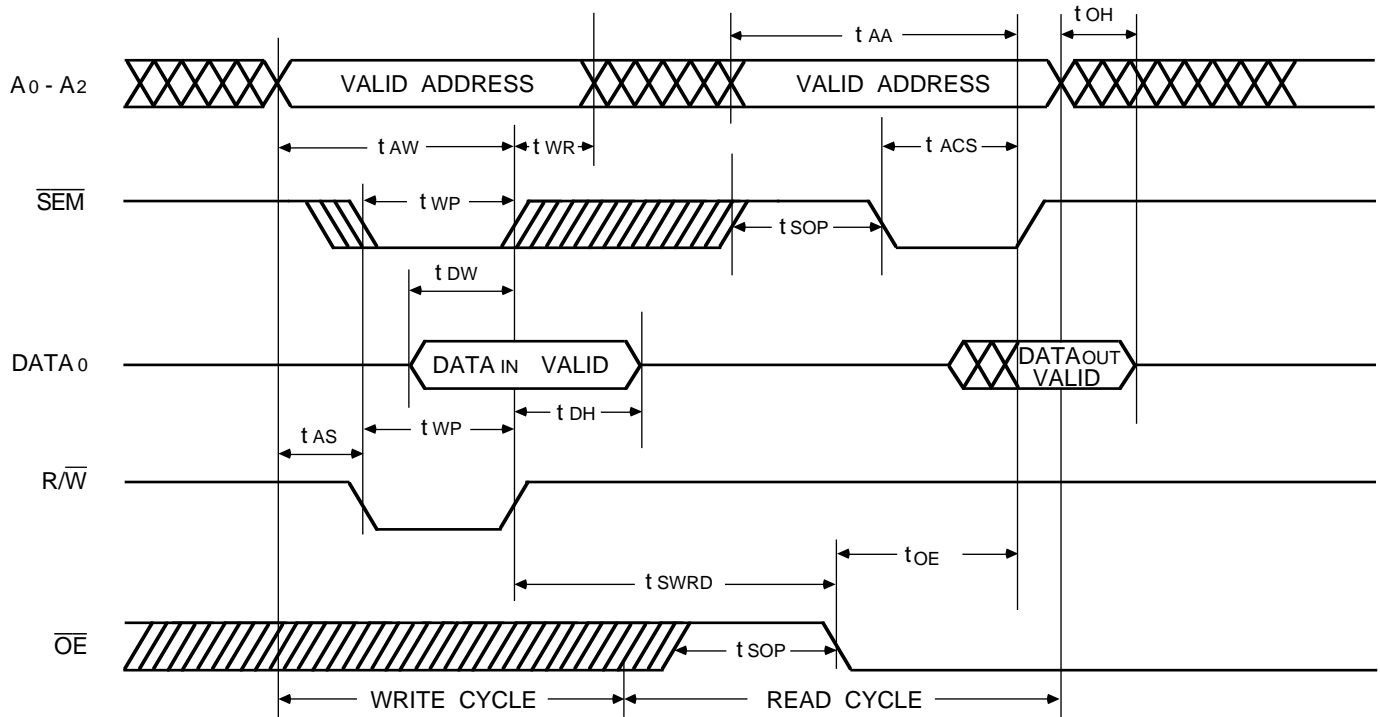


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**NOTES:**

1.  $\overline{R/\overline{W}}$  must be HIGH during all address transitions.
2. A write occurs during the overlap ( $t_{WP}$ ) of a LOW  $\overline{UB}$  or  $\overline{LB}$  and a LOW  $\overline{CS}$  and a LOW  $\overline{R/\overline{W}}$  for memory array writing cycle.
3.  $t_{WR}$  is measured from the earlier of  $\overline{CS}$  or  $\overline{R/\overline{W}}$  (or  $\overline{SEM}$  or  $\overline{R/\overline{W}}$ ) going HIGH to the end of write cycle.
4. During this period, the I/O pins are in the output state and input signals must not be applied.
5. If the  $\overline{CS}$  or  $\overline{SEM}$  LOW transition occurs simultaneously with or after the  $\overline{R/\overline{W}}$  LOW transition, the outputs remain in the high-impedance state.
6. Timing depends on which enable signal is asserted last.
7. Timing depends on which enable signal is de-asserted first.
8. If  $\overline{OE}$  is LOW during a  $\overline{R/\overline{W}}$  controlled write cycle, the write pulse width must be the larger of  $t_{WP}$  or  $(t_{WZ} + t_{DW})$  to allow the I/O drivers to turn off and data to be placed on the bus for the required  $t_{DW}$ . If  $\overline{OE}$  is HIGH during an  $\overline{R/\overline{W}}$  controlled write cycle, this requirement does not apply and the write pulse can be as short as the specified  $t_{WP}$ .
9. This parameter is guaranteed by design but not tested.

### TIMING WAVEFORM OF SEMAPHORE READ AFTER WRITE TIMING (EITHER SIDE)<sup>(1)</sup>

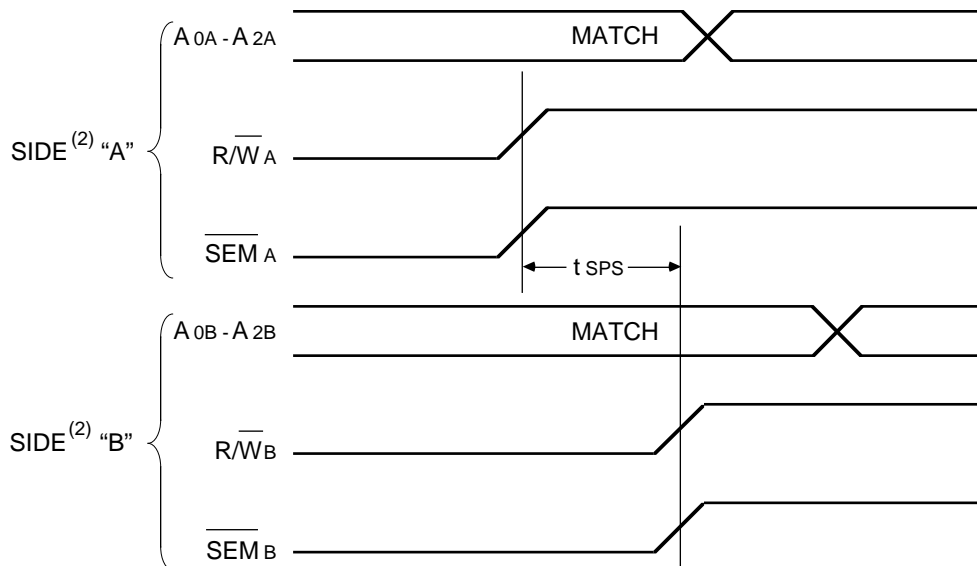


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**NOTE:**

1.  $\overline{CS}$  = HIGH for the duration of the above timing (both write and read cycle).

### TIMING WAVEFORM OF SEMAPHORE CONTENTION<sup>(1,3,4)</sup>



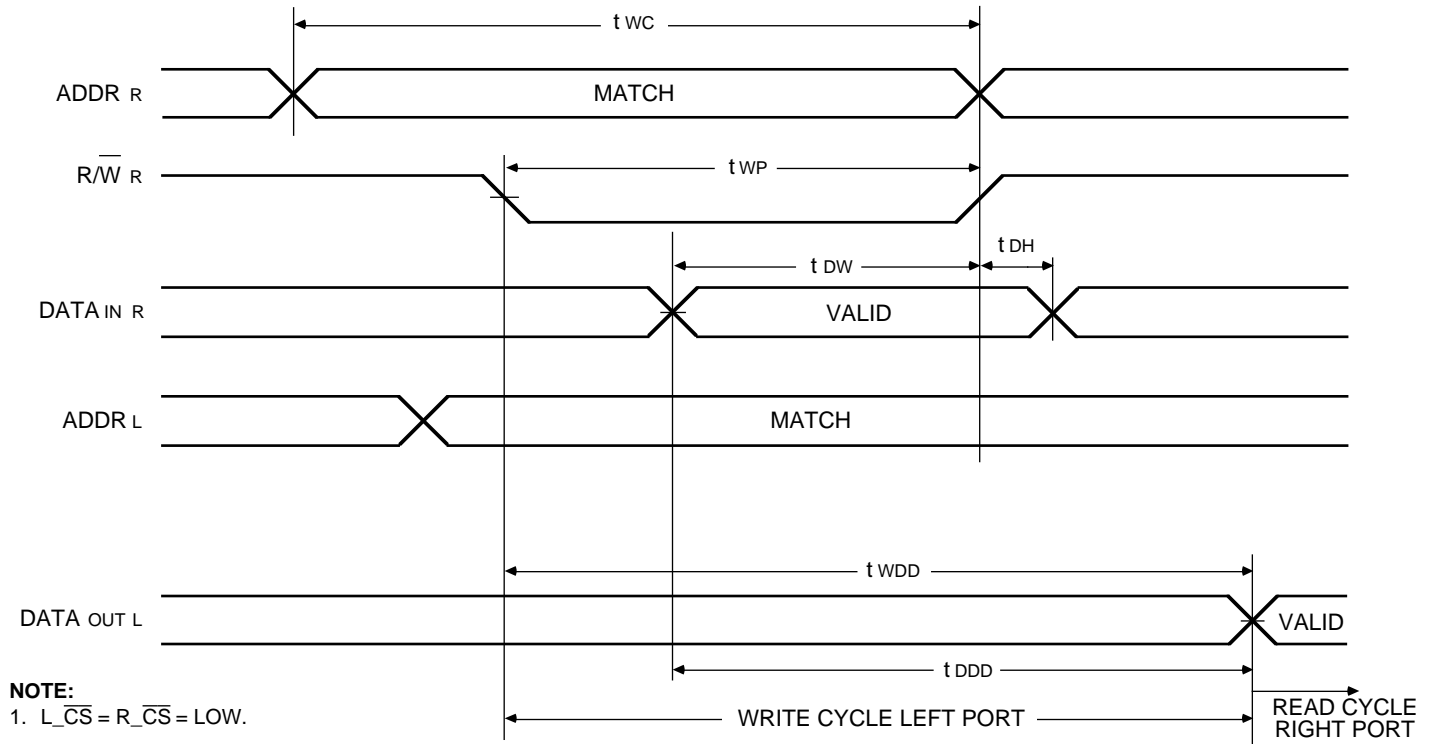
2804 drw 11

**NOTES:**

1.  $D_{0R} = D_{0L} = \text{LOW}$ ,  $L_{\overline{CS}} = R_{\overline{CS}} = \text{HIGH}$ . Semaphore Flag is released from both sides (reads as ones from both sides) at cycle start.
2. "A" may be either left or right port. "B" is the opposite port from "A".
3. This parameter is measured from  $R/\overline{W}_A$  or  $\overline{SEM}_A$  going HIGH to  $R/\overline{W}_B$  or  $\overline{SEM}_B$  going HIGH.
4. If tSPS is violated, the semaphore will fall positively to one side or the other, but there is no guarantee which side will obtain the flag.



### TIMING WAVEFORM OF WRITE WITH PORT-TO-PORT DELAY<sup>(1)</sup>



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### TRUTH TABLES

**TABLE I: NON-CONTENTION READ/WRITE CONTROL<sup>(1)</sup>**

Inputs <sup>(1)</sup>				Outputs	Mode
$\overline{CS}$	R/ $\overline{W}$	$\overline{OE}$	$\overline{SEM}$	I/O <sub>0</sub> - I/O <sub>7</sub>	
H	X	X	H	High-Z	Deselected: Power Down
L	L	X	H	DATA <sub>IN</sub>	Write to Both Bytes
L	H	L	H	DATA <sub>OUT</sub>	Read Both Bytes
X	X	H	X	High-Z	Outputs Disabled

**NOTE:**

1. A<sub>0L</sub> — A<sub>12</sub> ≠ A<sub>0R</sub> — A<sub>12R</sub>

2804 tbl 10

**TABLE II: SEMAPHORE READ/WRITE CONTROL<sup>(1)</sup>**

Inputs				Outputs	Mode
$\overline{CS}$	R/ $\overline{W}$	$\overline{OE}$	$\overline{SEM}$	I/O <sub>0</sub> - I/O <sub>7</sub>	
H	H	L	L	DATA <sub>OUT</sub>	Read Data in Semaphore Flag
X	$\uparrow$	X	L	DATA <sub>IN</sub>	Write D <sub>IN0</sub> into Semaphore Flag
L	X	X	L	—	Not Allowed

**NOTE:**

1. A<sub>0L</sub> — A<sub>12</sub> ≠ A<sub>0R</sub> — A<sub>12R</sub>

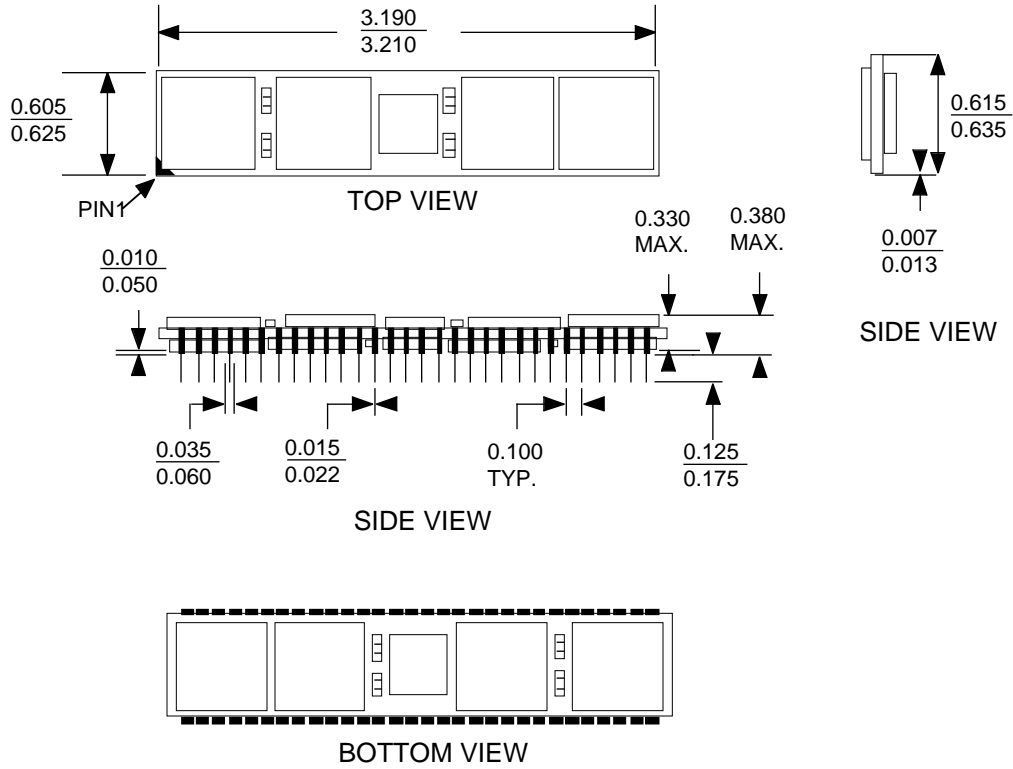
2804 tbl 11

### SEMAPHORE OPERATION

For more details regarding semaphores & semaphore operations, please consult the IDT7006 datasheet.

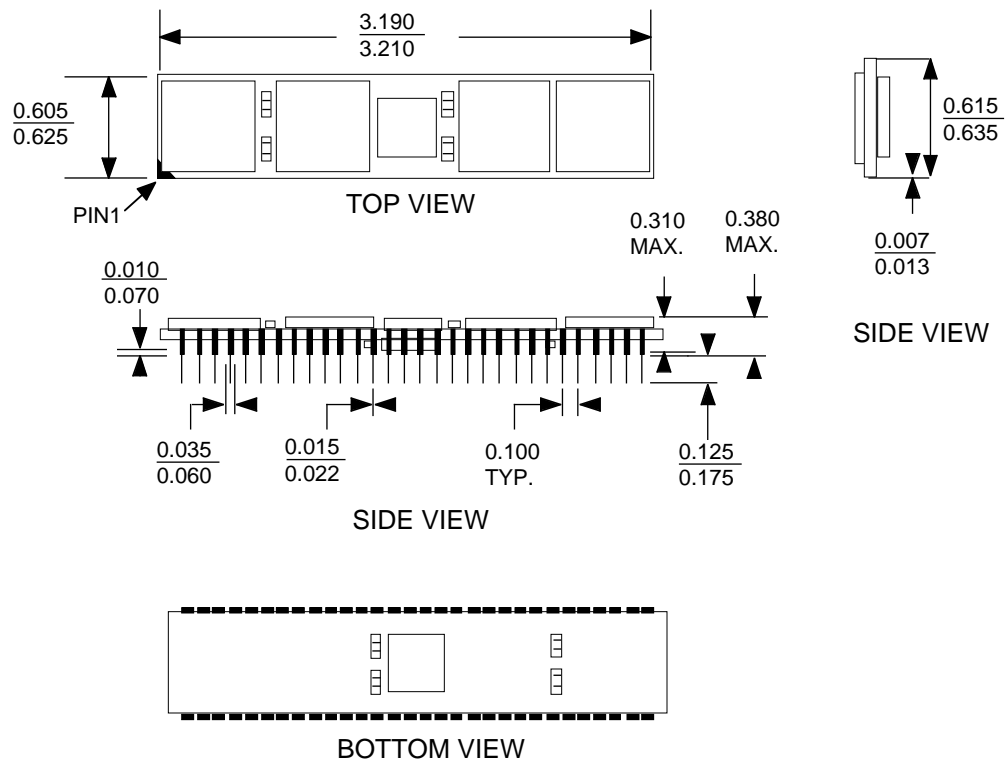
**PACKAGE DIMENSIONS**

**7M1001**



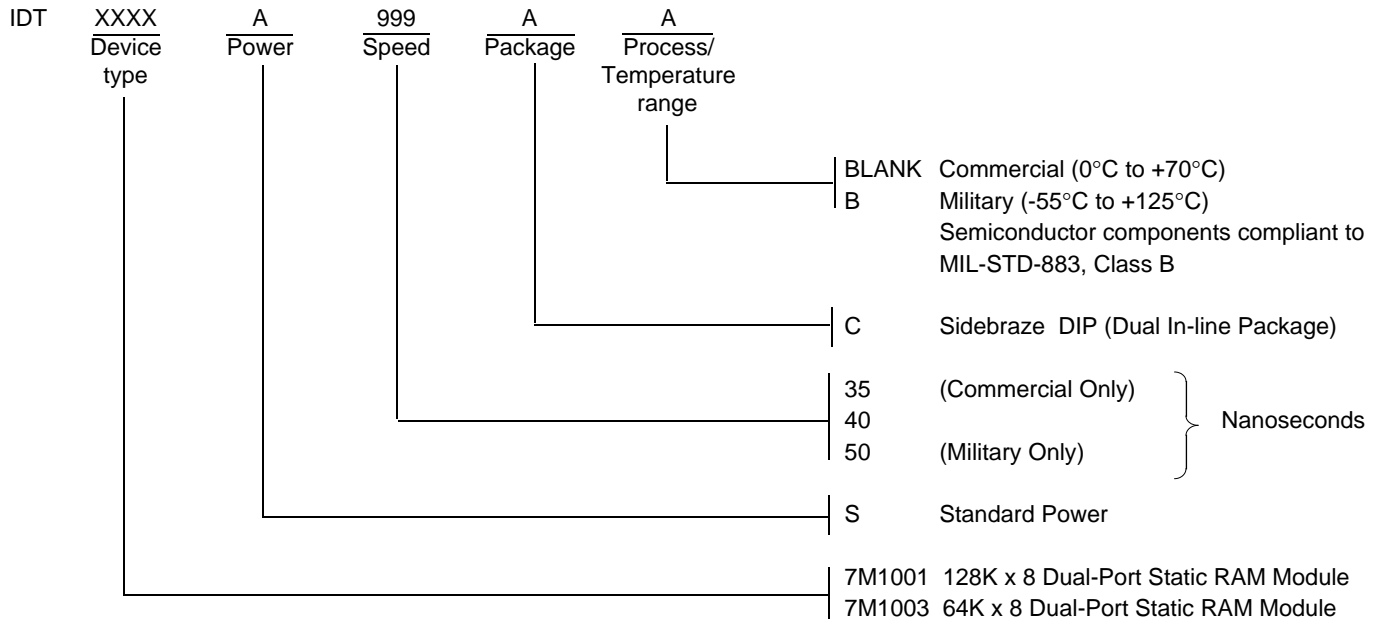
2804 drw 13

**7M1003**



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**ORDERING INFORMATION**



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