Integrated Device Technology, Inc.

HIGH-SPEED 1K x 9 DUAL-PORT STATIC RAM WITH BUSY

PRELIMINARY
IDT7010S/L
IDT70104S/L

FEATURES:

- High-speed access
  - — Military: 35/45/55/70ns (max.)
  - — Commercial: 25/35/45/55ns (max.)
- Low-power operation
  - — IDT7010/70104S
    Active: 400mW (typ.)
    Standby: 7mW (typ.)
  - — IDT7010/70104L
    Active: 400mW (typ.)
    Standby: 2mW (typ.)
- Fully asynchronous operation from either port
- Each port has a 9-bit wide data path. The 9th bit could be used as the parity bit.
- MASTER IDT7010 easily expands data bus width to 18 bits or more using SLAVE IDT70104 chip.
- On-chip port arbitration logic (IDT7010 only)
- $\overline{BUSY}$ output flag on MASTER; $\overline{BUSY}$ input on SLAVE
- Battery backup operation — 2V data retention
- TTL compatible, signal 5V (±10%) power supply
- Available in popular hermetic and plastic packages
- Military product compliant to MIL-STD-883, Class B

DESCRIPTION:

The IDT7010/IDT70104 are high-speed 1K X 9 dual-port static RAMs. The IDT7010 is designed to be used as a stand-alone 9-bit dual-port RAM or as a "MASTER" dual-port RAM together with the IDT70104 "SLAVE" dual-port in 18-bit-or-more word width systems. Using the IDT MASTER/SLAVE dual-port RAM approach in 18-bit or wider memory system applications results in full-speed, error-free operation without the need for additional discrete logic.

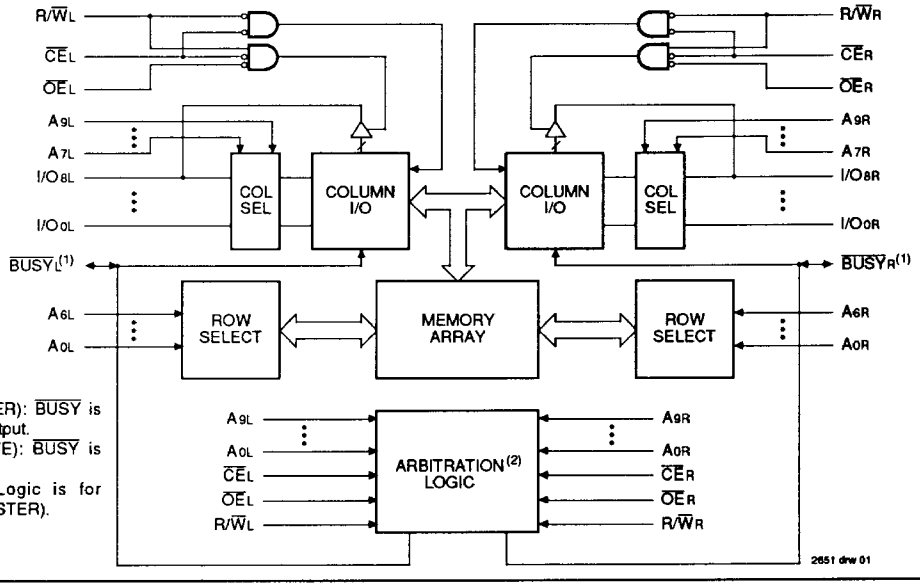
Both devices provide two independent ports with separate control, address and I/O pins that permit independent, asynchronous access for reads or writes to any location in memory. An automatic power down feature controlled by $\overline{CE}$ permits the on-chip circuitry of each port to enter a very low standby power mode.

The devices utilize a 9-bit wide data path to allow for control/data and parity bits at the user's option. This feature is especially useful in data communications applications where it is necessary to use a parity bit for transmission/reception error checking.

Fabricated using IDT's CEMOS™ high-performance technology, these devices typically operate on only 400mW of power at maximum access times as fast as 25ns. Low-power (L) versions offer battery backup data retention capability with each port typically consuming 200µW from a 2V battery.

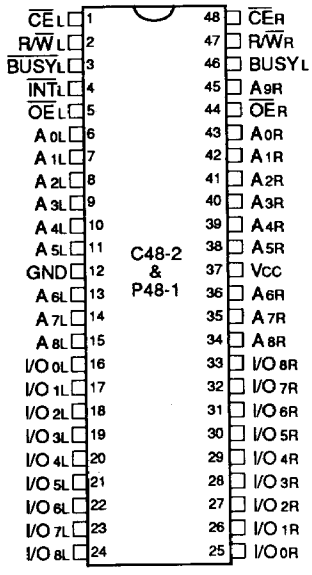
The IDT7010/IDT70104 devices are packaged in 48-pin sidebrazed or plastic DIPs, 48-pin LCCs and 48-pin flatpacks. The military devices are processed 100% in compliance to the test methods of MIL-STD-883, Method 5004.

FUNCTIONAL BLOCK DIAGRAM



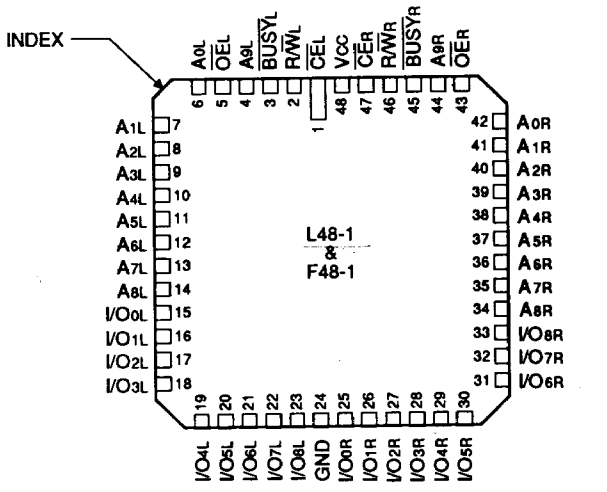
NOTE:
1. 7010 (MASTER): $\overline{BUSY}$ is totem-pole output. 70104 (SLAVE): $\overline{BUSY}$ is input.
2. Arbitration Logic is for IDT7010 (MASTER).

PIN CONFIGURATIONS



2651 drw 02

48-PIN DIP
TOP VIEW



2651 drw 03

48-PIN LCC/FLATPACK
TOP VIEW

ABSOLUTE MAXIMUM RATINGS(1)

Symbol	Rating	Com'l.	Mil.	Unit
VTERM	Terminal Voltage with Respect to GND	–0.5 to +7.0	–0.5 to +7.0	V
TA	Operating Temperature	0 to +70	–55 to +125	°C
TBIAS	Temperature Under Bias	–55 to +125	–65 to +135	°C
TSTG	Storage Temperature	–55 to +125	–65 to +150	°C
IOUT	DC Output Current	50	50	mA

2651 tbl 01

NOTE:
1. 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 reliabilty.

RECOMMENDED DC OPERATING CONDITIONS

Symbol	Parameter	Min.	Typ.	Max.	Unit
VCC	Supply Voltage	4.5	5.0	5.5	V
GND	Supply Voltage	0	0	0.0	V
VIH	Input High Votage	2.2	–	6.0	V
VIL	Input Low Voltage	–0.5(1)	–	0.8	V

2651 tbl 02

NOTE:
1. VIL (min.) = –3.0V for pulse width less than 20ns.

RECOMMENDED OPERATING TEMPERATURE AND SUPPLY VOLTAGE

Grade	Ambient Temperature	GND	Vcc
Military	–55°C to +125°C	0V	5.0V ± 10%
Commercial	0°C to +70°C	0V	5.0V ± 10%

2651 tbl 03

7

DC ELECTRICAL CHARACTERISTICS OVER THE OPERATING TEMPERATURE AND SUPPLY VOLTAGE RANGE (V_{CC} = 5.0V ± 10%)

Symbol	Parameter	Test Conditions	7010S 70104S Min.	7010S 70104S Max.	7010L 70104L Min.	7010L 70104L Max.	Unit
$\|I_{LI}\|$	Input Leakage Current	V_{CC} = 5.5V, V_{IN} = 0V to V_{CC}	—	10	—	5	µA
$\|I_{LO}\|$	Output Leakage Current	$\overline{CE}$ = V_{IH}, V_{OUT} = 0V to V_{CC}	—	10	—	5	µA
V_{OL}	Output Low Voltage (I/O_0 – I/O_8), $\overline{BUSY}$	I_{OL} = 4mA	—	0.4	—	0.4	V
V_{OH}	Output High Voltage (I/O_0 – I/O_8), $\overline{BUSY}$	I_{OH} = –4mA	2.4	—	2.4	—	V

2651 tbl 04

DC ELECTRICAL CHARACTERISTICS OVER THE OPERATING TEMPERATURE AND SUPPLY VOLTAGE RANGE[1] (V_{CC} = 5.0V ± 10%)

Symbol	Parameter	Test Condition	Version		7010 x 25[2] 70104 x 25[2] Typ.	7010 x 25[2] 70104 x 25[2] Max.	7010 x 35 70104 x 35 Typ.	7010 x 35 70104 x 35 Max.	7010 x 45 70104 x 45 Typ.	7010 x 45 70104 x 45 Max.	7010 x 55 70104 x 55 Typ.	7010 x 55 70104 x 55 Max.	7010 x 70[3] 70104 x 70[3] Typ.	7010 x 70[3] 70104 x 70[3] Max.	Unit
I_{CC}	Dynamic Operating Current (Both Ports Active)	$\overline{CE} \le V_{IL}$ Outputs Open f = f_{MAX}[4]	Mil.	S	—	—	80	300	75	290	70	285	65	275	mA
				L	—	—	80	220	75	210	70	205	65	200	
			Com'l.	S	75	260	75	250	75	245	70	235	—	—	
				L	75	190	75	180	75	170	70	160	—	—	
I_{SB1}	Standby Current (Both Ports — TTL Level Inputs)	$\overline{CE}_L$ and $\overline{CE}_R \ge V_{IH}$ f = f_{MAX}[4]	Mil.	S	—	—	25	80	25	80	25	80	25	65	mA
				L	—	—	25	60	25	60	25	60	25	55	
			Com'l.	S	25	65	25	65	25	65	25	65	—	—	
				L	25	45	25	45	25	45	25	45	—	—	
I_{SB2}	Standby Current (Both Ports — TTL Level Inputs)	$\overline{CE}_L$ or $\overline{CE}_R \ge V_{IH}$ Active Port Outputs Open, f = f_{MAX}[4]	Mil.	S	—	—	50	190	45	170	40	170	40	165	mA
				L	—	—	50	145	45	140	40	140	40	135	
			Com'l.	S	50	175	46	160	45	150	40	140	—	—	
				L	50	125	46	115	45	105	40	95	—	—	
I_{SB3}	Full Standby Current (Both Ports — All CMOS Level Inputs)	Both Ports $\overline{CE}_L$ and $\overline{CE}_R \ge$ V_{CC} – 0.2V $V_{IN} \ge V_{CC}$ – 0.2V or $V_{IN} \le$ 0.2V, f = 0[5]	Mil.	S	—	—	1.2	30	1.0	30	1.0	30	1.0	30	mA
				L	—	—	0.4	10	0.2	10	0.2	10	0.2	10	
			Com'l.	S	1.2	15	1.0	15	1.0	15	1.0	15	—	—	
				L	0.4	5	0.4	5.0	0.2	5.0	0.2	5.0	—	—	
I_{SB4}	Full Standby Current (One Port — All CMOS Level Inputs)	One Port $\overline{CE}_L$ or $\overline{CE}_R \ge V_{CC}$ – 0.2V, $V_{IN} \ge$ V_{CC} – 0.2V or $V_{IN} \le$ 0.2V Active Port Outputs Open, f = f_{MAX}[4]	Mil.	S	—	—	47	170	45	160	40	155	40	150	mA
				L	—	—	44	130	42	125	35	120	35	115	
			Com'l.	S	50	155	45	142	45	132	45	127	—	—	
				L	46	120	42	110	42	100	42	95	—	—	

NOTES:

2651 tbl 05

1. "x" in part numbers indicates power rating (S or L).
2. 0°C to +70°C temperature range only.
3. –55°C to +125°C temperature range only.
4. At f = f_{MAX}, address and data inputs (except Output Enable) are cycling at the maximum frequency of read cycle of 1/t_{RC}, and using "AC TEST CONDITIONS" of input levels of GND to 3V.
5. f = 0 means no address or control lines change. Applies only to inputs at CMOS level standby.

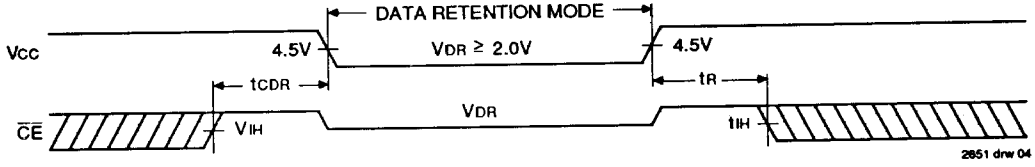
DATA RETENTION CHARACTERISTICS (L Version Only)

Symbol	Parameter	Test Condition		7010L/70104L Min.	Typ.[1]	Max.	Unit
V_{DR}	Vcc for Data Retention	V_{CC} = 2.0V, $\overline{CE} \geq V_{CC} - 0.2V$		2.0	—	—	V
I_{CCDR}	Data Retention Current		Mil.	—	100	4000	µA
			Com'l.	—	100	1500	µA
t_{CDR}[3]	Chip Deselect to Data Retention Time	$V_{IN} \geq V_{CC} - 0.2V$ or $V_{IN} \leq 0.2V$		0	—	—	ns
t_R[3]	Operation Recovery Time			t_{RC}[2]	—	—	ns

2651tbl 06

NOTES:
1. V_{CC} = 2V, T_A = +25°C
2. t_{RC} = Read Cycle Time
3. This parameter is guaranteed but not tested.

DATA RETENTION WAVEFORM



2651 drw 04

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, 2 & 3

2651 tbl 07

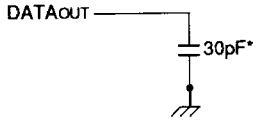
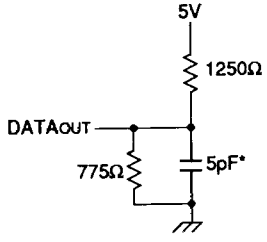


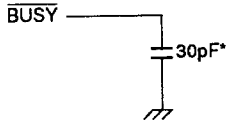
Figure 1. Output Load

2651 drw 05



2651 drw 06

Figure 2. Output Load (for tHZ, tLZ, tWZ, and tOW)



2651 drw 07

Figure 3. $\overline{BUSY}$ Output Load

*Including scope and jig.

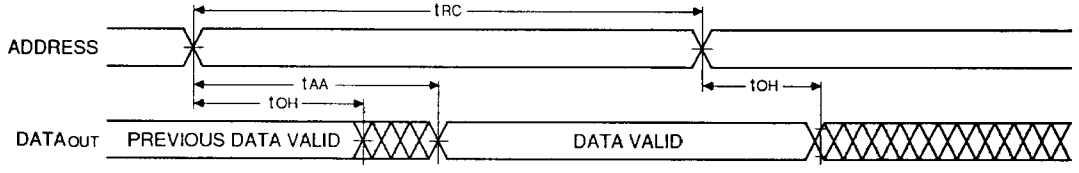
AC ELECTRICAL CHARACTERISTICS OVER THE OPERATING TEMPERATURE AND SUPPLY VOLTAGE RANGE[5]

Symbol	Parameter	7010 x 25[2] 70104 x 25[2]		7010 x 35 70104 x 35		7010 x 45 70104 x 45		7010 x 55 70104 x 55		7010 x 70[3] 70104 x 70[3]		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Read Cycle												
tRC	Read Cycle Time	25	—	35	—	45	—	55	—	70	—	ns
tAA	Address Access Time	—	25	—	35	—	45	—	55	—	70	ns
tACE	Chip Enable Access Time	—	25	—	35	—	45	—	55	—	70	ns
tAOE	Output Enable Access Time	—	12	—	25	—	30	—	35	—	40	ns
tOH	Output Hold From Address Change	0	—	0	—	0	—	0	—	0	—	ns
tLZ	Output Low Z Time[1, 4]	0	—	0	—	0	—	0	—	0	—	ns
tHZ	Output High Z Time[1, 4]	—	10	—	15	—	20	—	30	—	35	ns
tPU	Chip Enable to Power Up Time[4]	0	—	0	—	0	—	0	—	0	—	ns
tPD	Chip Disable to Power Down Time[4]	—	50	—	50	—	50	—	50	—	50	ns

2651tbl 08

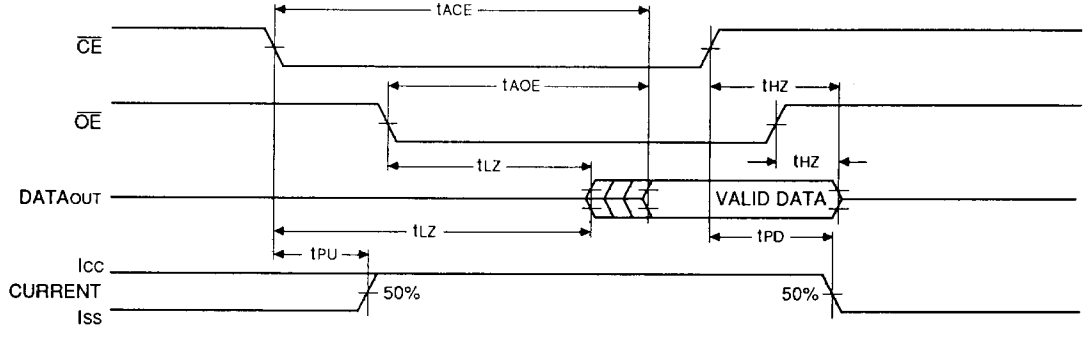
NOTES:
1. Transition is measured ±500mV from low or high impedance voltage with load (Figures 1, 2 and 3).
2. 0°C to +70°C temperature range only.
3. –55°C to +125°C temperature range only.
4. This parameter guaranteed but not tested.
5. "x" in part numbers indicates power rating (S or L).

TIMING WAVEFORM OF READ CYCLE NO. 1, EITHER SIDE[1, 2, 4]



2651 drw 09

TIMING WAVEFORM OF READ CYCLE NO. 2, EITHER SIDE[1, 3]



2651 drw 10

NOTES:
1. R/W is high for Read Cycles.
2. Device is continuously enabled, CE = VIL.
3. Addresses valid prior to or coincident with CE transition low.
4. OE = VIL.

AC ELECTRICAL CHARACTERISTICS OVER THE OPERATING TEMPERATURE AND SUPPLY VOLTAGE RANGE[7]

Symbol	Parameter	7010 x 25[2] 70104 x 25[2]		7010 x 35 70104 x 35		7010 x 45 70104 x 45		7010 x 55 70104 x 55		7010 x 70[3] 70104 x 70[3]		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Write Cycle												
t_{WC}	Write Cycle Time[5]	25	—	35	—	45	—	55	—	70	—	ns
t_{EW}	Chip Enable to End of Write	20	—	30	—	35	—	40	—	50	—	ns
t_{AW}	Address Valid to End of Write	20	—	30	—	35	—	40	—	50	—	ns
t_{AS}	Address Set-up Time	0	—	0	—	0	—	0	—	0	—	ns
t_{WP}	Write Pulse Width[6]	20	—	30	—	35	—	40	—	50	—	ns
t_{WR}	Write Recovery Time	0	—	0	—	0	—	0	—	0	—	ns
t_{DW}	Data Valid to End of Write	12	—	20	—	20	—	20	—	30	—	ns
t_{HZ}	Output High Z Time[1, 4]	—	10	—	15	—	20	—	30	—	35	ns
t_{DH}	Data Hold Time	0	—	0	—	0	—	0	—	0	—	ns
t_{WZ}	Write Enabled to Output in High Z[1, 4]	—	10	—	15	—	20	—	30	—	35	ns
t_{OW}	Output Active From End of Write[1, 4]	0	—	0	—	0	—	0	—	0	—	ns

2651 tbl 09

NOTES:
1. Transition is measured ±500mV from low or high impedance voltage with load (Figures 1, 2 and 3).
2. 0°C to +70°C temperature range only.
3. –55°C to +125°C temperature range only.
4. This parameter guaranteed but not tested.
5. For MASTER/SLAVE combination, $t_{WC} = t_{BAA} + t_{WP}$.
6. Specified for $\overline{OE}$ at high (refer to "Timing Waveform of Write Cycle", Note 7).
7. "x" in part numbers indicates power rating (S or L).

CAPACITANCE (T_A = +25°C, f = 1.0MHz)

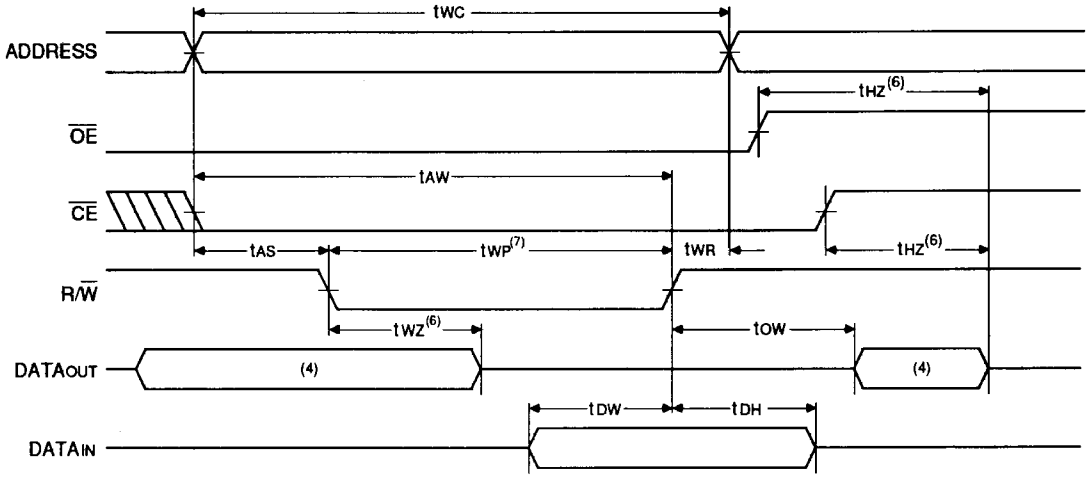
Symbol	Parameter[1]	Conditions	Max.	Unit
C_{IN}	Input Capacitance	V_{IN} = 0V	11	pF
C_{OUT}	Output Capacitance	V_{OUT} = 0V	11	pF

2651 tbl 10

NOTE:
1. This parameter is determined by device characterization but is not production tested.

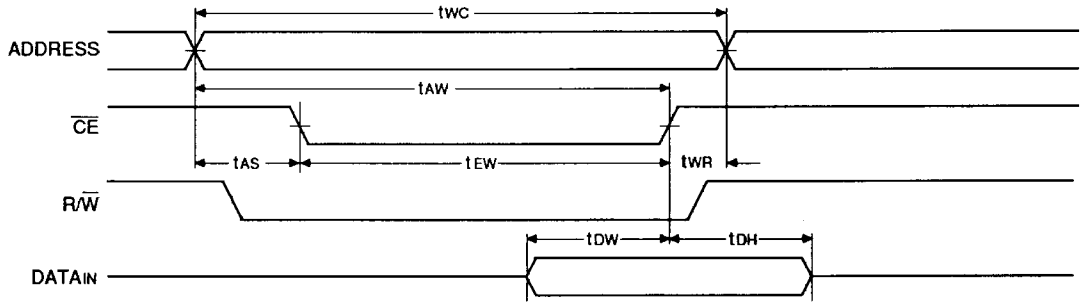
7

TIMING WAVEFORM OF WRITE CYCLE NO. 1, (R/$\overline{W}$ CONTROLLED TIMING)(1, 2, 3, 7)



2651 drw 11

TIMING WAVEFORM OF WRITE CYCLE NO. 2, ($\overline{CE}$ CONTROLLED TIMING)(1, 2, 3, 5)



2651 drw 12

NOTES:
1. R/$\overline{W}$ must be high during all address transitions.
2. A write occurs during the overlap (tEW or tWP) of a low $\overline{CE}$ and a low R/$\overline{W}$.
3. tWR is measured from the earlier of $\overline{CE}$ or R/$\overline{W}$ going high to the end of the 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 $\overline{CE}$ low transition occurs simultaneously with or after the R/$\overline{W}$ low transition, the outputs remain in the high impedance state.
6. Transition is measured ±500mV from steady state with a 5pF load (including scope and jig).
7. If $\overline{OE}$ is low during a R/$\overline{W}$ controlled write cycle, the write pulse width must be the larger of tWP or tWZ + tDW to allow the I/O drivers to turn off and data to be placed on the bus for the required tDW. If $\overline{OE}$ is high during as R/$\overline{W}$ controlled write cycle, this requirement does not apply and the write pulse can be as short as the specified tWP.

AC ELECTRICAL CHARACTERISTICS OVER THE OPERATING TEMPERATURE AND SUPPLY VOLTAGE RANGE[8]

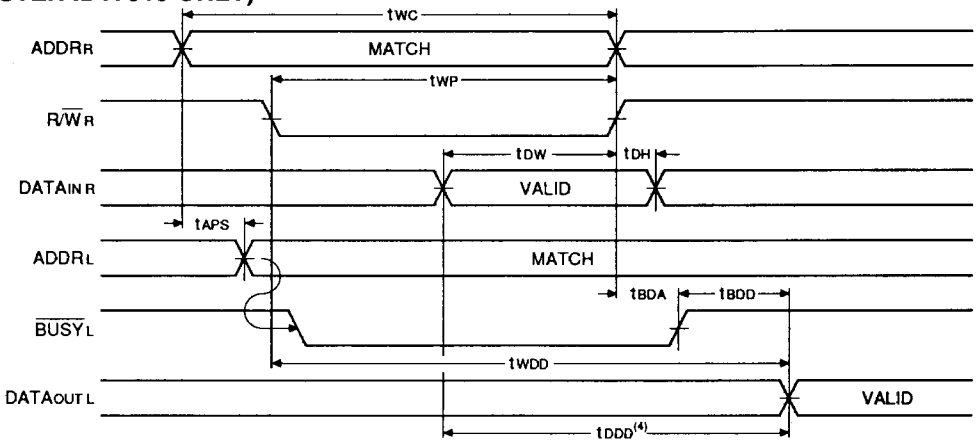
Symbol	Parameter	70101 x 25[1] 70105 x 25[1] Min.	70101 x 25[1] 70105 x 25[1] Max.	70101 x 35 70105 x 35 Min.	70101 x 35 70105 x 35 Max.	70101 x 45 70105 x 45 Min.	70101 x 45 70105 x 45 Max.	70101 x 55 70105 x 55 Min.	70101 x 55 70105 x 55 Max.	70101 x 70[2] 70105 x 70[2] Min.	70101 x 70[2] 70105 x 70[2] Max.	Unit
Busy Timing (For Master IDT7010 Only)												
tBAA	$\overline{BUSY}$ Access Time to Address	—	25	—	35	—	35	—	45	—	45	ns
tBDA	$\overline{BUSY}$ Disable Time to Address	—	20	—	30	—	35	—	40	—	40	ns
tBAC	$\overline{BUSY}$ Access Time to Chip Enable	—	20	—	30	—	30	—	35	—	35	ns
tBDC	$\overline{BUSY}$ Disable Time to Chip Enable	—	20	—	25	—	25	—	30	—	30	ns
tWDD	Write Pulse to Data Delay[3]	—	50	—	60	—	70	—	80	—	95	ns
tDDD	Write Data Valid to Read Data Delay[3]	—	35	—	45	—	55	—	65	—	80	ns
tAPS	Arbitration Priority Set-up Time[4]	5	—	5	—	5	—	5	—	5	—	ns
tBDD	$\overline{BUSY}$ Disable to Valid Data[5]	—	Note 5	—	Note 5	—	Note 5	—	Note 5	—	Note 5	ns
Busy Input Timing (For Slave IDT70104 Only)												
tWB	Write to $\overline{BUSY}$ Input[6]	0	—	0	—	0	—	0	—	0	—	ns
tWH	Write Hold After $\overline{BUSY}$[7]	15	—	20	—	20	—	20	—	20	—	ns
tWDD	Write Pulse to Date Delay[9]	—	50	—	60	—	70	—	80	—	95	ns
tDDD	Write Data Valid to Read Data Delay[9]	—	35	—	45	—	55	—	65	—	80	ns

2651 tbl 11

NOTES:
1. 0°C to +70°C temperature range only.
2. –55°C to +125°C temperature range only.
3. Port-to-port delay through RAM cells from writing port to reading port, refer to "Timing Waveform of Read With $\overline{BUSY}$ (For MASTER IDT7010 only)".
4. To ensure that the earlier of the two ports wins.
5. tBDD is a calculated parameter and is the greater of 0, tWDD – tWP (actual) or tDDD – tDW (actual).
6. To ensure that a write cycle is inhibited during contention.
7. To ensure that a write cycle is completed after contention.
8. "x" in part numbers indicates power rating (S or L).
9. Port-to-port delay through RAM cells from writing port to reading port, refer to "Timing Waveform of Read With $\overline{BUSY}$ Port-to-port Delay (For SLAVE IDT70104 only)".

7

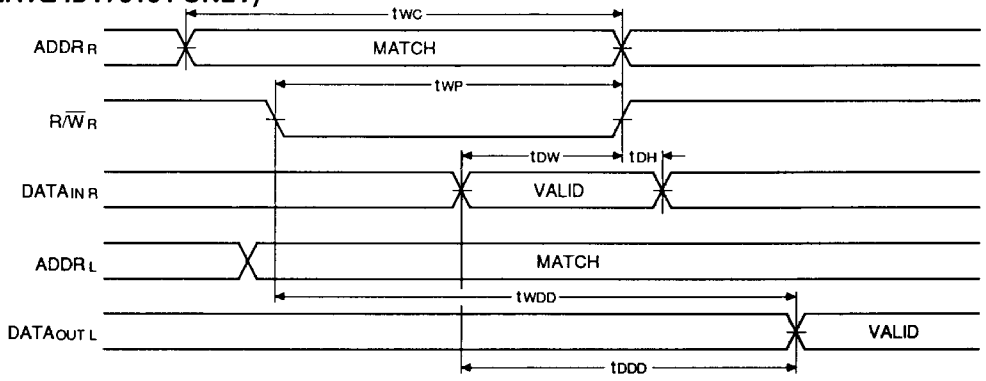
TIMING WAVEFORM OF READ WITH $\overline{BUSY}$[1, 2, 3] (FOR MASTER IDT7010 ONLY)



2651 drw 13

NOTES:
1. To ensure that the earlier of the two ports wins.
2. Write Cycle parameters should be adhered to, in order to ensure proper writing.
3. Device is continuously enabled for both ports.
4. $\overline{OE}$ at LOW for the reading port.

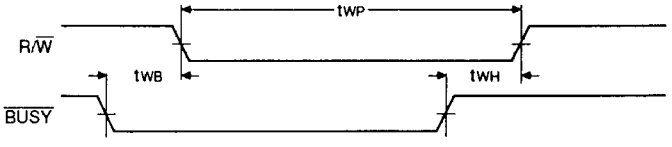
TIMING WAVEFORM OF WRITE WITH PORT-TO-PORT DELAY[1, 2, 3] (FOR SLAVE IDT70104 ONLY)



2651 drw 14

NOTES:
1. Assume $\overline{BUSY}$ input at HIGH for the writing port, and $\overline{OE}$ at LOW for the reading port.
2. Write Cycle parameters should be adhered to, in order to ensure proper writing.
3. Device is continuously enabled for both ports.

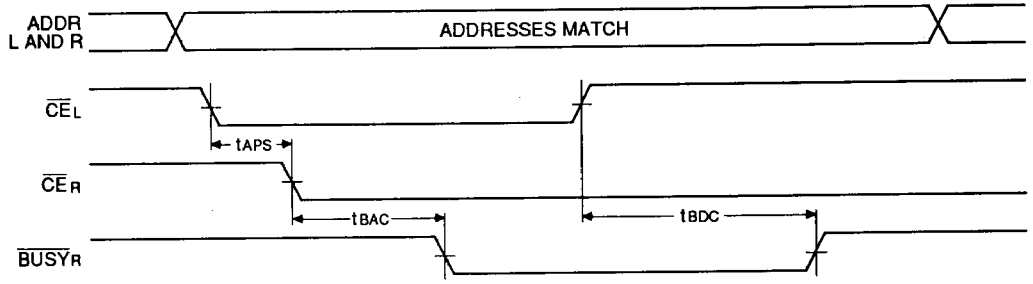
TIMING WAVEFORM OF WRITE WITH $\overline{BUSY}$ INPUT (FOR SLAVE IDT70104 ONLY)



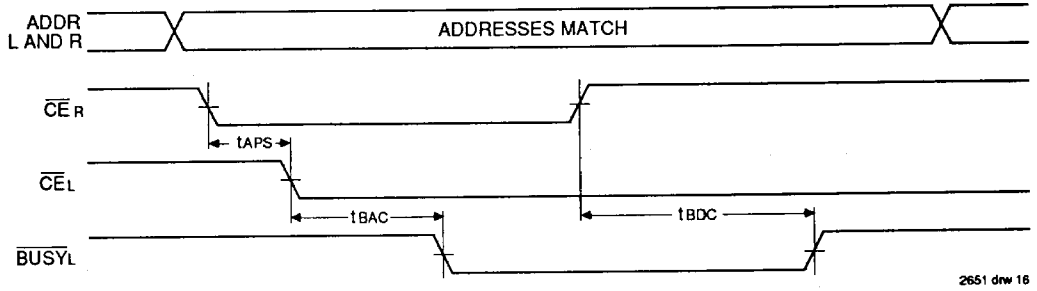
2651 drw 15

TIMING WAVEFORM OF CONTENTION CYCLE NO. 1, $\overline{CE}$ ARBITRATION

$\overline{CE}_L$ Valid First:

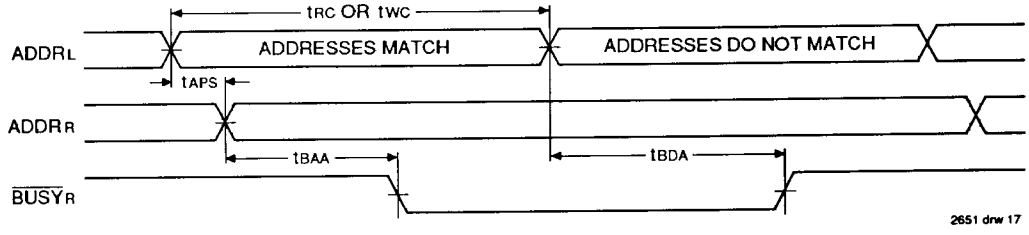


$\overline{CE}_R$ Valid First:

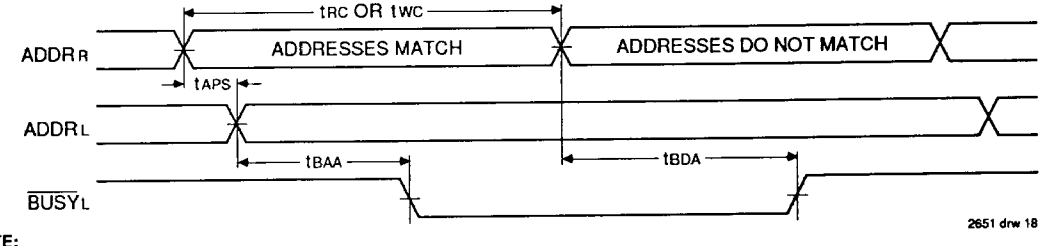


TIMING WAVEFORM OF CONTENTION CYCLE NO. 2, ADDRESS VALID ARBITRATION(1)

Left Address Valid First:



Right Address Valid First:



NOTE:
1. $\overline{CE}_L = \overline{CE}_R = V_{IL}$

FUNCTIONAL DESCRIPTION

The IDT7010/70104 provides two ports with separate control, address and I/O pins that permit independent access for reads or writes to any location in memory. The IDT7010/70104 has an automatic power down feature controlled by $\overline{CE}$. The $\overline{CE}$ controls on-chip power down circuitry that permits the respective port to go into a standby mode when not selected ($\overline{CE}$ high). When a port is enabled, access to the entire memory array is permitted. Each port has its own Output Enable control ($\overline{OE}$). In the read mode, the port's $\overline{OE}$ turns on the output drivers when set LOW. Non-contention READ/WRITE conditions are illustrated in Table I.

ARBITRATION LOGIC, FUNCTIONAL DESCRIPTION

The arbitration logic will resolve an address match or a chip enable match to 5ns minimum and determine which port has access. In all cases, an active $\overline{BUSY}$ flag will be set for the delayed port.

The $\overline{BUSY}$ flags are provided for the situation when both ports simultaneously access the same memory location. When this situation occurs, on-chip arbitration logic will determine which port has access and sets the delayed port's $\overline{BUSY}$ flag. $\overline{BUSY}$ is set at speeds that permit the processor to hold the operation and its respective address and data. It is important to note that the operation is invalid for the port that has $\overline{BUSY}$ set LOW. The delayed port will have access when $\overline{BUSY}$ goes inactive.

Contention occurs when both left and right ports are active and both addresses match. When this situation occurs, the on-chip arbitration logic determines access. Two modes of arbitration are provided: (1) if the addresses match and are valid before $\overline{CE}$, on-chip control logic arbitrates between $\overline{CE}_L$ and $\overline{CE}_R$ for access; or (2) if the $\overline{CE}$s are low before an address match, on-chip control logic arbitrates between the left and right addresses for access (refer to Table II). In either mode of arbitration, the delayed port's $\overline{BUSY}$ flag is set and will reset when the port granted access completes its operation.

DATA BUS WIDTH EXPANSION, MASTER/SLAVE DESCRIPTION

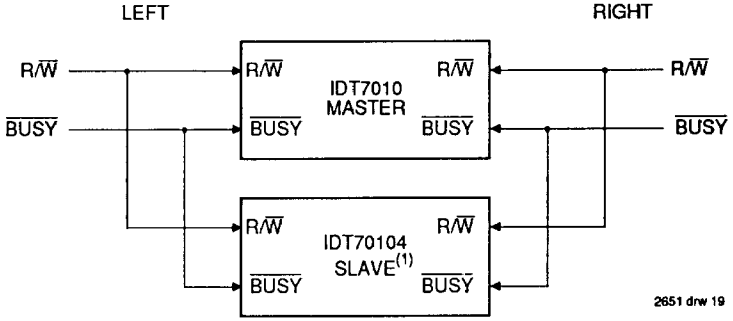
Expanding the data bus width to eighteen-or-more-bits in a dual-port RAM system implies that several chips will be active at the same time. If each chip includes a hardware arbitrator, and the addresses for each chip arrive at the same time, it is possible that one will activate its $\overline{BUSY}_L$ while another activates its $\overline{BUSY}_R$ signal. Both sides are now busy and the CPUs will wait indefinitely for their port to become free.

To avoid this "Busy Lock-Out" problem, IDT has developed a MASTER/SLAVE approach where only one hardware arbitrator, in the MASTER, is used. The SLAVE has $\overline{BUSY}$ inputs which allow an interface to the MASTER with no external components and with a speed advantage over other systems.

When expanding dual-port RAMs in width, the writing of the SLAVE RAMs must be delayed, until after the $\overline{BUSY}$ input has settled. Otherwise, the SLAVE chip may begin a write cycle during a contention situation. Conversely, the write pulse must extend a hold time past $\overline{BUSY}$ to ensure that a write takes place after the contention is resolved. This timing is inherent in all dual-port memory systems where more than than one chip is active at the same time.

The write pulse to the SLAVE should be delayed by the maximum arbitration time of the MASTER. If, then, a contention occurs, the write to the SLAVE will be inherited due to $\overline{BUSY}$ from the MASTER.

18-BIT MASTER/SLAVE DUAL-PORT MEMORY SYSTEMS



NOTE:
1. No arbitration in IDT70104 (SLAVE). $\overline{BUSY}$-IN inhibits write in IDT70104 (SLAVE).

TRUTH TABLES

TABLE I. NON-CONTENTION READ/WRITE CONTROL[4]

Left or Right Port[1]				Function
R/$\overline{W}$	$\overline{CE}$	$\overline{OE}$	D_{0-8}	
X	H	X	Z	Port Disabled and in Power Down Mode, I_{SB2} or I_{SB4}
X	H	X	Z	$\overline{CE}_R = \overline{CE}_L$ = H, Power Down Mode, I_{SB1} or I_{SB3}
L	L	X	DATAIN	Data on Port Written Into Memory[2]
H	L	L	DATAOUT	Data in Memory Output on Port[3]
H	L	H	Z	High Impedance Outputs

2651 tbl 12

NOTES:
1. $A_{0L} - A_{9L} \neq A_{0R} - A_{9R}$
2. If $\overline{BUSY}$ = L, data is not written.
3. If $\overline{BUSY}$ = L, data may not be valid, see t_{WDD} and t_{DDD} timing.
4. H = HIGH, L = LOW, X = DON'T CARE, Z = HIGH IMPEDANCE

TABLE II. ARBITRATION[1]

Left Port		Right Port		Flags		Function
$\overline{CE}_L$	$A_{0L} - A_{9L}$	$\overline{CE}_R$	$A_{0R} - A_{9R}$	$\overline{BUSY}_L$	$\overline{BUSY}_R$	
H	X	H	X	H	H	No Contention
L	Any	H	X	H	H	No Contention
H	X	L	Any	H	H	No Contention
L	$\neq A_{0R} - A_{9R}$	L	$\neq A_{0L} - A_{9L}$	H	H	No Contention
Address Arbitration With $\overline{CE}$ Low Before Address Match						
L	LV5R	L	LV5R	H	L	L-Port Wins
L	RV5L	L	RV5L	L	H	R-Port Wins
L	Same	L	Same	H	L	Arbitration Resolved
L	Same	L	Same	L	H	Arbitration Resolved
$\overline{CE}$ Arbitration With Address Match Before $\overline{CE}$						
LL5R	= $A_{0R} - A_{9R}$	LL5R	= $A_{0L} - A_{9L}$	H	L	L-Port Wins
RL5L	= $A_{0R} - A_{9R}$	RL5L	= $A_{0L} - A_{9L}$	L	H	R-Port Wins
LW5R	= $A_{0R} - A_{9R}$	LW5R	= $A_{0L} - A_{9L}$	H	L	Arbitration Resolved
LW5R	= $A_{0R} - A_{9R}$	LW5R	= $A_{0L} - A_{9L}$	L	H	Arbitration Resolved

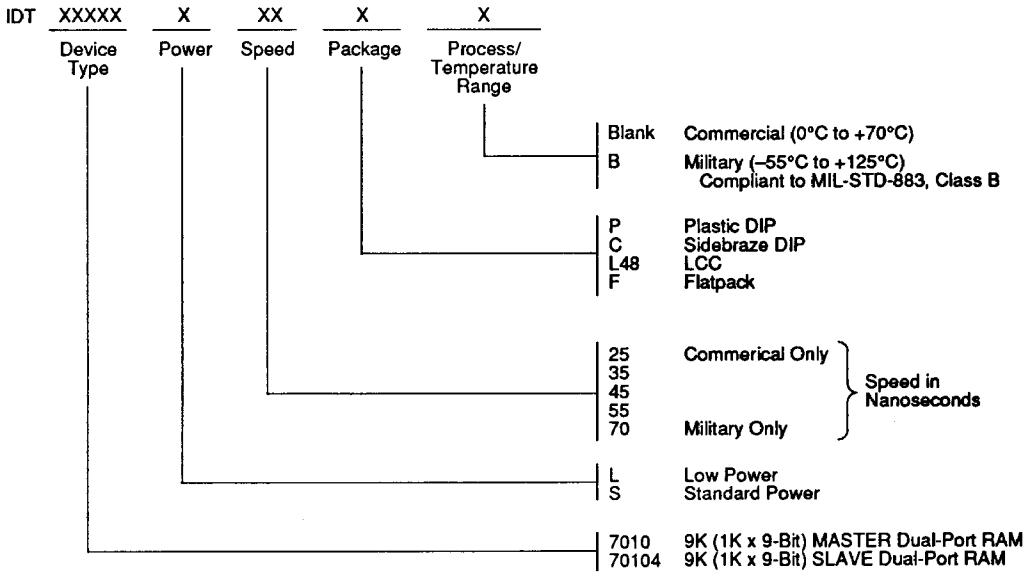
2651 tbl 13

NOTES:
1. X = DON'T CARE, L = LOW, H = HIGH
   LV5R = Left Address Valid ≥ 5ns before right address.
   RV5L = Right Address Valid ≥ 5ns before left address.

Same = Left and Right Addresses match within 5ns of each other.
LL5R = Left $\overline{CE}$ = LOW > 5ns before Right $\overline{CE}$.
RL5L = Right $\overline{CE}$ = LOW ≥ 5ns before Left $\overline{CE}$.
LW5R = Left and right $\overline{CE}$ = LOW within 5ns of each other.

7

ORDERING INFORMATION



2651 drw 20