



Integrated Device Technology, Inc.

HIGH-SPEED 2K x 8 FourPort™ STATIC RAM

PRELIMINARY
IDT7052S
IDT7052L

FEATURES:

- High-speed access
 - Military: 30/35/45ns (max.)
 - Commercial: 25/30/35/45ns (max.)
- Low-power operation
 - IDT7052S
 - Active: 750mW (typ.)
 - Standby: 10mW (typ.)
 - IDT7052L
 - Active: 750mW (typ.)
 - Standby: 1.5mW (typ.)
- Fully asynchronous operation from each of the four ports: P1, P2, P3, P4
- Versatile control for write-inhibit: separate $\overline{\text{BUSY}}$ input to control write-inhibit for each of the four ports
- Battery backup operation—2V data retention
- TTL-compatible; single 5V ($\pm 10\%$) power supply
- Available in several popular hermetic and plastic packages for both through-hole and surface mount
- Military product compliant to MIL-STD-883, Class B

DESCRIPTION:

The IDT7052 is a high-speed 2K x 8 FourPort static RAM designed to be used in systems where multiple access in a common RAM is required. This FourPort static RAM offers increased system performance in multiprocessed systems that have a need to communicate in real time and also offers

added benefit for high-speed systems in which multiple access is required in the same cycle.

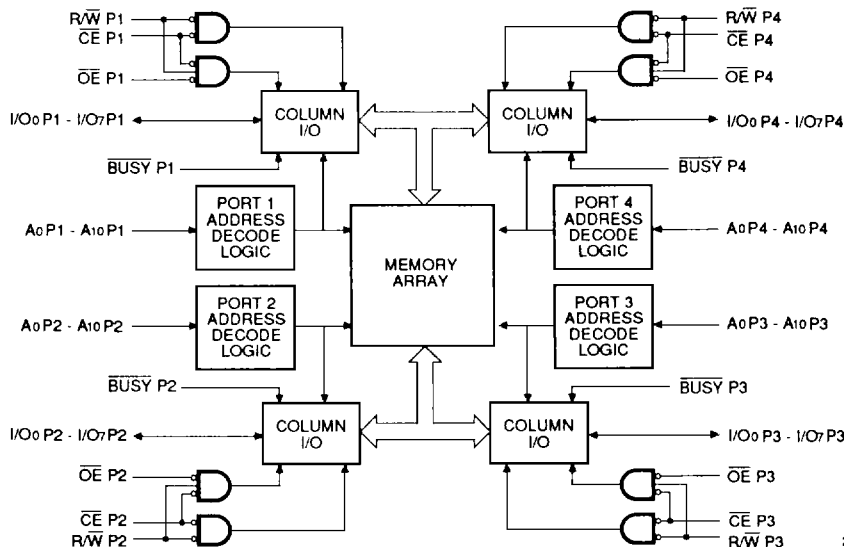
The IDT7052 is also an extremely high-speed 2K x 8 FourPort static RAM designed to be used in systems where on-chip hardware port arbitration is not needed. This part lends itself to those systems which cannot tolerate wait states or are designed to be able to externally arbitrate or withstand contention when all ports simultaneously access the same FourPort RAM location.

The IDT7052 provides four independent ports with separate control, address and I/O pins that permit independent, asynchronous access for reads or writes to any location in memory. It is the user's responsibility to ensure data integrity when simultaneously accessing the same memory location from all ports. An automatic power down feature, controlled by $\overline{\text{CE}}$, permits the on-chip circuitry of each port to enter a very low power standby power mode.

Fabricated using IDT's CEMOS™ high-performance technology, this four port RAM typically operates on only 750mW 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 50 μ W from a 2V battery.

The IDT7052 is packaged in either a ceramic or plastic 108-pin PGA and 132-pin quad flatpack. Military grade product is manufactured in compliance with the latest revision of MIL-STD-883, Class B.

FUNCTIONAL BLOCK DIAGRAM



FourPort is a trademark of Integrated Device Technology, Inc.

2674 drw 01

MILITARY AND COMMERCIAL TEMPERATURE RANGES

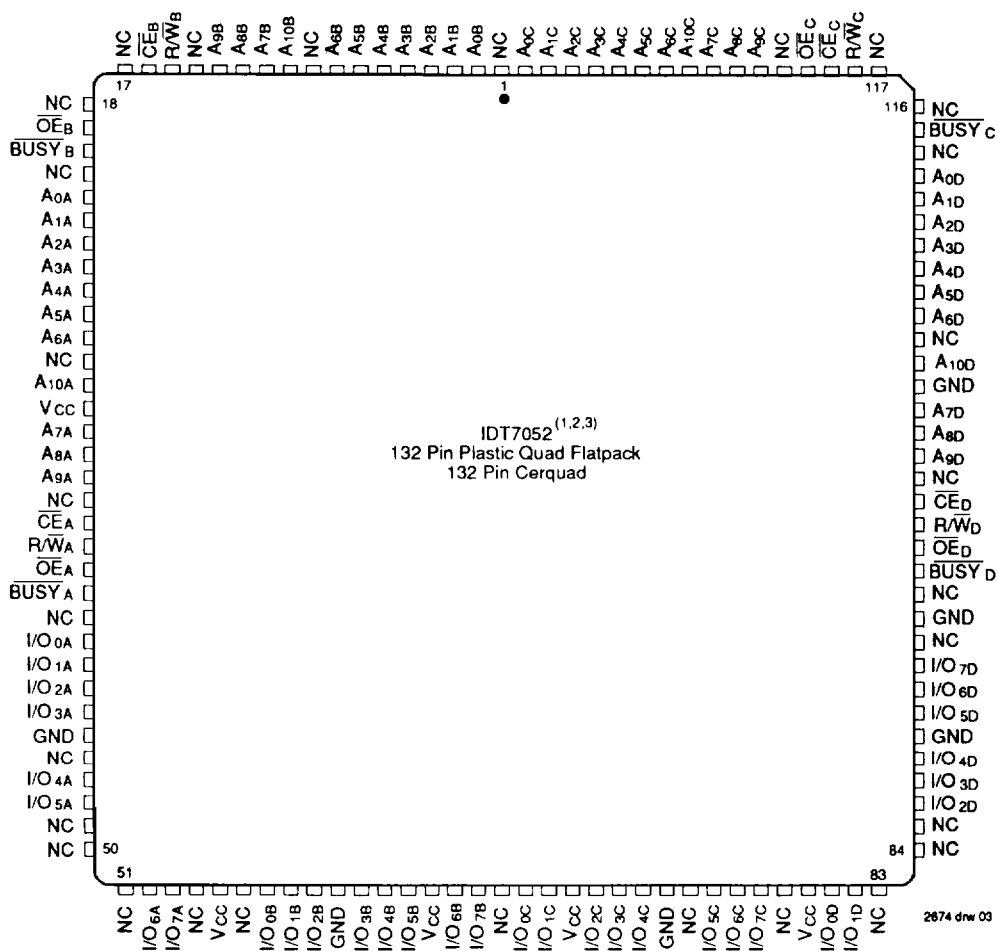
SEPTEMBER 1990

81 R/W P2	80 NC	77 A7 P2	74 A5 P2	72 A3 P2	69 A0 P2	68 A0 P3	65 A3 P3	63 A5 P3	60 A7 P3	57 NC	54 R/W P3	12
84 BUSY P2	83 OE P2	78 A8 P2	76 A10 P2	73 A4 P2	70 A1 P2	67 A1 P3	64 A4 P3	61 A10 P3	59 A8 P3	56 OE P3	53 BUSY P3	11
87 A2 P1	86 A1 P1	82 CE P2	79 A9 P2	75 A6 P2	71 A2 P2	66 A2 P3	62 A6 P3	58 A9 P3	55 CE P3	51 A1 P4	50 A2 P4	10
90 A5 P1	88 A3 P1	85 A0 P1	IDT7052 108-Pin PGA ^(1,2,3) TOP VIEW						52 A0 P4	49 A3 P4	47 A5 P4	09
92 A10 P1	91 A6 P1	89 A4 P1							48 A4 P4	46 A6 P4	45 A10 P4	08
95 A8 P1	94 A7 P1	93 Vcc							44 GND	43 A7 P4	42 A8 P4	07
96 A9 P1	97 NC	98 CE P1							39 CE P4	40 NC	41 A9 P4	06
99 R/W P1	100 OE P1	102 I/O0 P1							35 GND	37 OE P4	38 R/W P4	05
101 BUSY P1	103 I/O1 P1	106 GND							31 GND	34 I/O7 P4	36 BUSY P4	04
104 I/O2 P1	105 I/O3 P1	1 I/O6 P1	4 Vcc	8 GND	12 Vcc	17 Vcc	21 GND	25 Vcc	28 I/O2 P4	32 I/O5 P4	33 I/O6 P4	03
107 I/O4 P1	2 I/O7 P1	5 I/O0 P2	7 I/O2 P2	10 I/O4 P2	13 I/O6 P2	16 I/O1 P3	19 I/O3 P3	22 I/O5 P3	24 I/O7 P3	29 I/O3 P4	30 I/O4 P4	02
108 I/O5 P1	3 NC	6 I/O1 P2	9 I/O3 P2	11 I/O5 P2	14 I/O7 P2	15 I/O0 P3	18 I/O2 P3	20 I/O4 P3	23 I/O6 P3	26 I/O0 P4	27 I/O1 P4	01
A	B	C	D	E	F	G	H	J	K	L	M	

NOTES:

1. All Vcc pins must be connected to the power supply.
2. All GND pins must be connected to the ground supply.
3. NC denotes no-connect pin.

2674 drw 02



NOTES:

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PIN CONFIGURATIONS

Symbol	Pin Name
A ₀ P1 – A ₁₀ P1	Address Lines – Port 1
A ₀ P2 – A ₁₀ P2	Address Lines – Port 2
A ₀ P3 – A ₁₀ P3	Address Lines – Port 3
A ₀ P4 – A ₁₀ P4	Address Lines – Port 4
I/O ₀ P1 – I/O ₇ P1	Data I/O – Port 1
I/O ₀ P2 – I/O ₇ P2	Data I/O – Port 2
I/O ₀ P3 – I/O ₇ P3	Data I/O – Port 3
I/O ₀ P4 – I/O ₇ P4	Data I/O – Port 4
R/W P1	Read/Write – Port 1
R/W P2	Read/Write – Port 2
R/W P3	Read/Write – Port 3
R/W P4	Read/Write – Port 4
GND	Ground
$\overline{\text{CE}}$ P1	Chip Enable – Port 1
$\overline{\text{CE}}$ P2	Chip Enable – Port 2
$\overline{\text{CE}}$ P3	Chip Enable – Port 3
$\overline{\text{CE}}$ P4	Chip Enable – Port 4
$\overline{\text{OE}}$ P1	Output Enable – Port 1
$\overline{\text{OE}}$ P2	Output Enable – Port 2
$\overline{\text{OE}}$ P3	Output Enable – Port 3
$\overline{\text{OE}}$ P4	Output Enable – Port 4
BUSY P1	Write Disable – Port 1
BUSY P2	Write Disable – Port 2
BUSY P3	Write Disable – Port 3
BUSY P4	Write Disable – Port 4
V _{cc}	Power
GND	Ground

2674 tbl 01

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

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

NOTE:

2674 tbl 02

- 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 (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

NOTE:

2674 tbl 03

- This parameter is determined by device characterization but is not production tested.

RECOMMENDED OPERATING TEMPERATURE AND SUPPLY VOLTAGE

Grade	Ambient Temperature	GND	V _{cc}
Military	-55°C to +125°C	0V	5.0V ± 10%
Commercial	0°C to +70°C	0V	5.0V ± 10%

2674 tbl 04

RECOMMENDED DC OPERATING CONDITIONS

Symbol	Parameter	Min.	Typ.	Max.	Unit
V _{cc}	Supply Voltage	4.5	5.0	5.5	V
GND	Supply Voltage	0	0	0	V
V _{IH}	Input High Voltage	2.2	—	6.0	V
V _{IL}	Input Low Voltage	-0.5 ⁽¹⁾	—	0.8	V

NOTE:

2674 tbl 05

- V_{IL} (min.) = -3.0V for pulse width less than 20ns.

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

Symbol	Parameter	Test Conditions	IDT7052S		IDT7052L		Unit
			Min.	Max.	Min.	Max.	
I _{IL}	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	$I_{OL} = 4mA$	—	0.4	—	0.4	V
V _{OH}	Output High Voltage	$I_{OH} = -4mA$	2.4	—	2.4	—	V

2674 lbt 06

DC ELECTRICAL CHARACTERISTICS OVER THE OPERATING TEMPERATURE AND SUPPLY VOLTAGE RANGE^(1, 2, 6) ($V_{CC} = 5.0V \pm 10\%$)

Symbol	Parameter	Test Condition	Version	IDT7052x25 ⁽³⁾		IDT7052x30		IDT7052x35		IDT7052x45		Unit	
				Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Max.		
I _{CC1}	Operating Power Supply Current (All Ports Active)	$\overline{CE} \leq V_{IL}$ Outputs Open $f = 0^{(4)}$	MIL.	S	—	—	150	360	150	360	150	360	mA
				L	—	—	150	300	150	300			
			COM'L.	S	150	300	150	300	150	300	150	300	
				L	150	250	150	250	150	250	150	250	
I _{CC2}	Dynamic Operating Current (All Ports Active)	$\overline{CE} \leq V_{IL}$ Outputs Open $f = f_{MAX}^{(5)}$	MIL.	S	—	—	220	400	210	395	195	390	mA
				L	—	—	190	335	180	330	170	325	
			COM'L.	S	225	350	220	340	210	335	195	330	
				L	195	305	190	295	180	290	170	285	
I _{SB}	Standby Current (All Ports — TTL Level Inputs)	$\overline{CE} \geq V_{IH}$ $f = f_{MAX}^{(5)}$	MIL.	S	—	—	45	115	40	110	35	105	mA
				L	—	—	40	85	35	80	30	75	
			COM'L.	S	60	85	45	80	40	75	35	70	
				L	50	70	40	65	35	60	30	55	
I _{SB1}	Full Standby Current (All Ports — All CMOS Level Inputs)	All Ports $\overline{CE} \geq V_{CC} - 0.2V$ $V_{IN} \geq V_{CC} - 0.2V$ or $V_{IN} \leq 0.2V$, $f = 0^{(4)}$	MIL.	S	—	—	1.5	30	1.5	30	1.5	30	mA
				L	—	—	.3	4.5	.3	4.5	.3	4.5	
			COM'L.	S	1.5	15	1.5	15	1.5	15	1.5	15	
				L	.3	1.5	.3	1.5	.3	1.5	.3	1.5	

NOTES:

- "x" in part number indicates power rating (S or L).
- $V_{CC} = 5V$, $T_A = +25^\circ C$ for Typ.
- $0^\circ C$ to $+70^\circ C$ temperature range only.
- $f = 0$ means no address or control lines change.
- 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.
- For the case of one port, divide the above appropriate current by four.

2674 lbt 07

DATA RETENTION CHARACTERISTICS OVER ALL TEMPERATURE RANGES⁽¹⁾

(L Version Only) $V_{LC} = 0.2V$, $V_{HC} = V_{CC} - 0.2V$

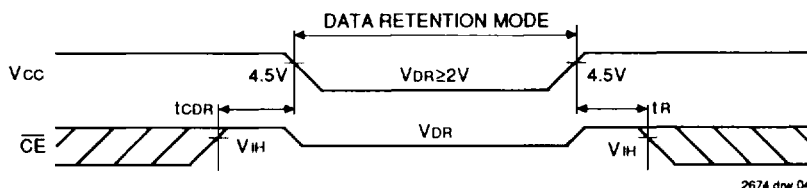
Symbol	Parameter	Test Condition		Min.	Typ. ⁽¹⁾	Max.	Unit
V _{DR}	V _{CC} for Data Retention	V _{CC} = 2V		2.0	—	—	V
I _{CCDR}	Data Retention Current	CE ≥ V _{HC}	MIL.	—	25	1800	μA
		V _{IN} ≥ V _{HC} or ≤ V _{LC}	COM'L.	—	25	600	
t _{CDR} ⁽³⁾	Chip Deselect to Data Retention Time			0	—	—	ns
t _R ⁽³⁾	Operation Recovery Time			t _{RC} ⁽²⁾	—	—	ns

NOTES:

- $V_{CC} = 2V$, $T_A = +25^\circ C$
- t_{RC} = Read Cycle Time
- This parameter is guaranteed but not tested.

2674 lbt 08

LOW V_{CC} DATA RETENTION WAVEFORM



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

2674 tbl 09

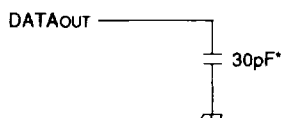


Figure 1. Output Load

*Including scope and jig

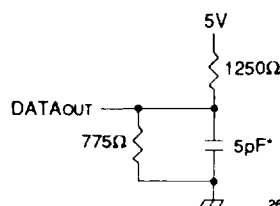


Figure 2. Output Load
(for tLZ, tHZ, tWZ, tOW)

2674 drw 05

AC ELECTRICAL CHARACTERISTICS OVER THE OPERATING TEMPERATURE AND SUPPLY VOLTAGE

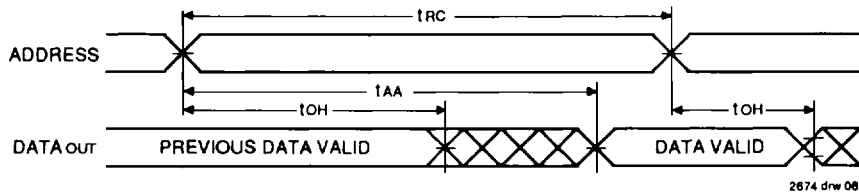
Symbol	Parameter	IDT7052S25 ⁽¹⁾ IDT7052L25 ⁽¹⁾		IDT7052S30 IDT7052L30		IDT7052S35 IDT7052L35		IDT7052S45 IDT7052L45		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
READ CYCLE										
t _{RC}	Read Cycle Time	25	—	30	—	35	—	45	—	ns
t _{AA}	Address Access Time	—	25	—	30	—	35	—	45	ns
t _{ACE}	Chip Enable Access Time	—	25	—	30	—	35	—	45	ns
t _{AOE}	Output Enable Access Time	—	15	—	20	—	25	—	30	ns
t _{OH}	Output Hold from Address Change	0	—	0	—	0	—	0	—	ns
t _{LZ}	Output Low Z Time ^(1, 2)	3	—	3	—	5	—	5	—	ns
t _{HZ}	Output High Z Time ^(1, 2)	—	15	—	15	—	15	—	20	ns
t _{PU}	Chip Enable to Power Up Time ⁽²⁾	0	—	0	—	0	—	0	—	ns
t _{PD}	Chip Disable to Power Down Time ⁽²⁾	—	20	—	30	—	50	—	50	ns

NOTES:

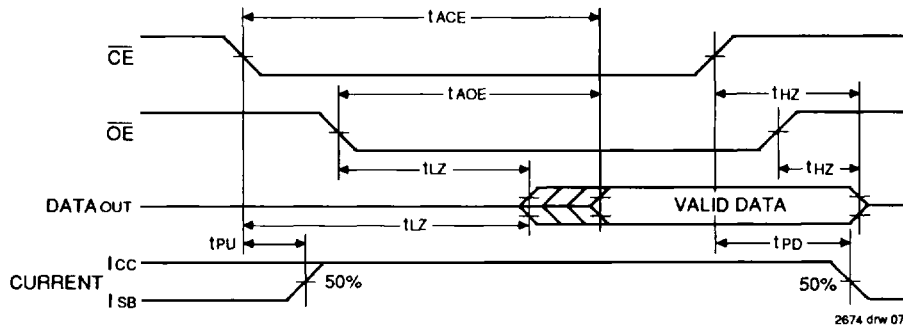
1. Transition is measured ±500mV from low or high impedance voltage with load (Figures 1 and 2).
2. This parameter is guaranteed but not tested.
3. 0°C to +70°C temperature range only.

2674 tbl 10

TIMING WAVEFORM OF READ CYCLE NO. 1, ANY PORT^(1, 2, 4)



TIMING WAVEFORM OF READ CYCLE NO. 2, ANY PORT^(1, 3)



NOTES:

1. R/W is high for Read Cycles.
2. Device is continuously enabled, $\overline{CE} = V_{IL}$.
3. Addresses valid prior to or coincident with $\overline{CE}$ transition low.
4. $\overline{OE} = V_{IL}$.

AC ELECTRICAL CHARACTERISTICS OVER THE OPERATING TEMPERATURE AND SUPPLY VOLTAGE

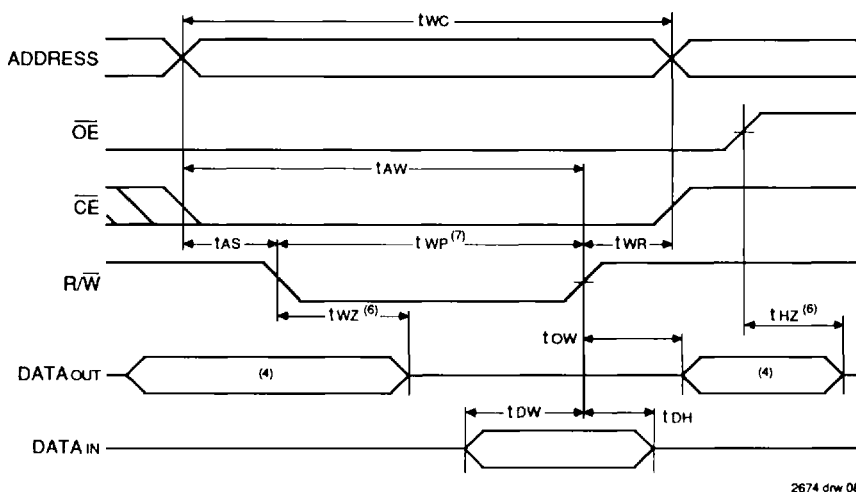
Symbol	Parameter	IDT7052S25 ⁽⁷⁾ IDT7052L25 ⁽⁷⁾		IDT7052S30 IDT7052L30		IDT7052S35 IDT7052L35		IDT7052S45 IDT7052L45		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
WRITE CYCLE										
tWC	Write Cycle Time	25	—	30	—	35	—	45	—	ns
tEW	Chip Enable to End of Write	20	—	25	—	30	—	35	—	ns
tAW	Address Valid to End of Write	20	—	25	—	30	—	35	—	ns
tAS	Address Set-up Time	0	—	0	—	0	—	0	—	ns
tWP	Write Pulse Width ⁽³⁾	20	—	25	—	30	—	35	—	ns
tWR	Write Recovery Time	5	—	5	—	5	—	5	—	ns
tDW	Data Valid to End of Write	15	—	15	—	20	—	20	—	ns
tHZ	Output High Z Time ^(1, 2)	—	15	—	15	—	15	—	20	ns
tDH	Data Hold Time	0	—	0	—	0	—	0	—	ns
twZ	Write Enabled to Output in High Z ^(1, 2)	—	15	—	15	—	15	—	20	ns
tOW	Output Active from End of Write ^(1, 2)	0	—	0	—	0	—	0	—	ns
twDD	Write Pulse to Data Delay ⁽⁴⁾	—	45	—	50	—	55	—	65	ns
tDDO	Write Data Valid to Read Data Delay ⁽⁴⁾	—	35	—	40	—	45	—	55	ns
BUSY INPUT TIMING										
tWB	Write to $\overline{\text{BUSY}}^{(5)}$	0	—	0	—	0	—	0	—	ns
tWH	Write Hold After $\overline{\text{BUSY}}^{(6)}$	15	—	20	—	20	—	20	—	ns

NOTES:

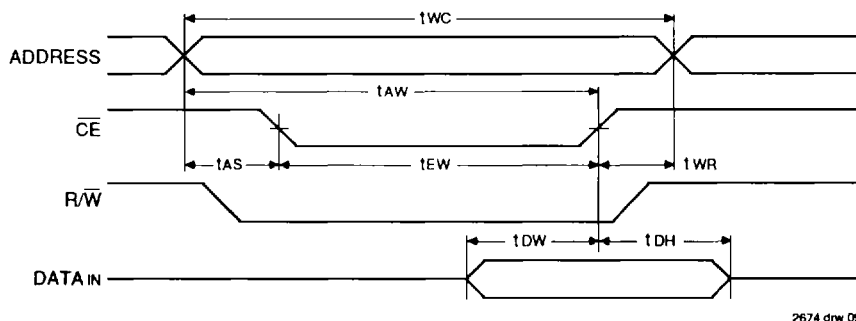
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1. Transition is measured $\pm 500\text{mV}$ from low or high impedance voltage with load (Figures 1 and 2).
2. This parameter is guaranteed but not tested.
3. Specified for $\overline{\text{OE}}$ at high (refer to "Timing Waveform of Write Cycle", Note 7).
4. Port-to-port delay through RAM cells from writing port to reading port, refer to "Timing Waveform of Read with Port-to-Port Delay".
5. To ensure that the write cycle is inhibited during contention.
6. To ensure that a write cycle is completed after contention.
7. 0°C to +70°C temperature range only.

TIMING WAVEFORM OF WRITE CYCLE NO. 1, R/W CONTROLLED TIMING^(1, 2, 3, 7)



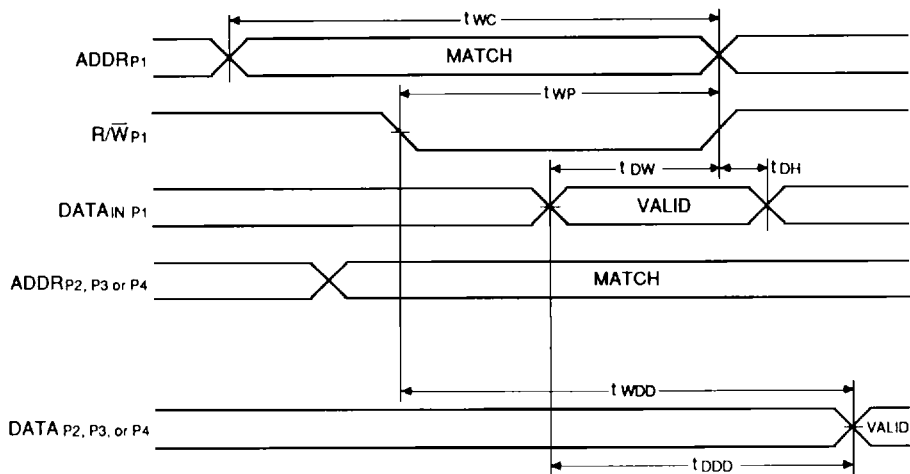
TIMING WAVEFORM OF WRITE CYCLE NO. 2, $\overline{CE}$ CONTROLLED TIMING^(1, 2, 3, 5)



NOTES:

1. $\overline{R/W}$ or $\overline{CE}$ must be high during all address transitions.
2. A write occurs during the overlap (t_{EW} or t_{WP}) of a low $\overline{CE}$ and a low $\overline{R/W}$.
3. t_{WR} is measured from the earlier of $\overline{CE}$ or $\overline{R/W}$ 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 $\overline{CE}$ low transition occurs simultaneously with or after the $\overline{R/W}$ low transition, the outputs remain in the high impedance state.
6. Transition is measured $\pm 500\text{mV}$ from steady state with a 5pF load (including scope and jig). This parameter is sampled and not 100% tested.
7. If $\overline{OE}$ is low during a $\overline{R/W}$ controlled write cycle, the write pulse width must be the larger of t_{WP} or ($t_{WZ} + t_{OW}$) to allow the I/O drivers to turn off data to be placed on the bus for the required t_{OW} . If $\overline{OE}$ is high during an $\overline{R/W}$ controlled write cycle, this requirement does not apply and the write pulse can be as short as the specified t_{WP} .

TIMING WAVEFORM OF READ WITH PORT-TO-PORT DELAY^(1, 2, 3)

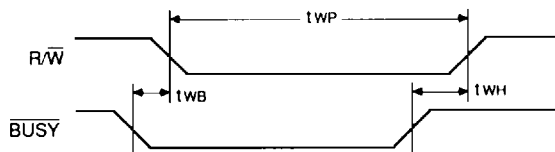


NOTES:

1. Assume $\overline{\text{BUSY}}$ input at HI and $\overline{\text{CE}}$ at LO for the writing port.
2. Write cycle parameters should be adhered to in order to ensure proper writing.
3. Device is continuously enabled for any of the reading ports which has its $\overline{\text{OE}}$ at LO.

2698 drw 10

TIMING WAVEFORM OF WRITE WITH $\overline{\text{BUSY}}$ INPUT



2674 drw 11

FUNCTIONAL DESCRIPTION

The IDT7052 provides four ports with separate control, address and I/O pins that permit independent access for reads or writes to any location in memory. These devices have 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 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. READ/WRITE conditions are illustrated in the table below.

TABLE I – READ/WRITE CONTROL

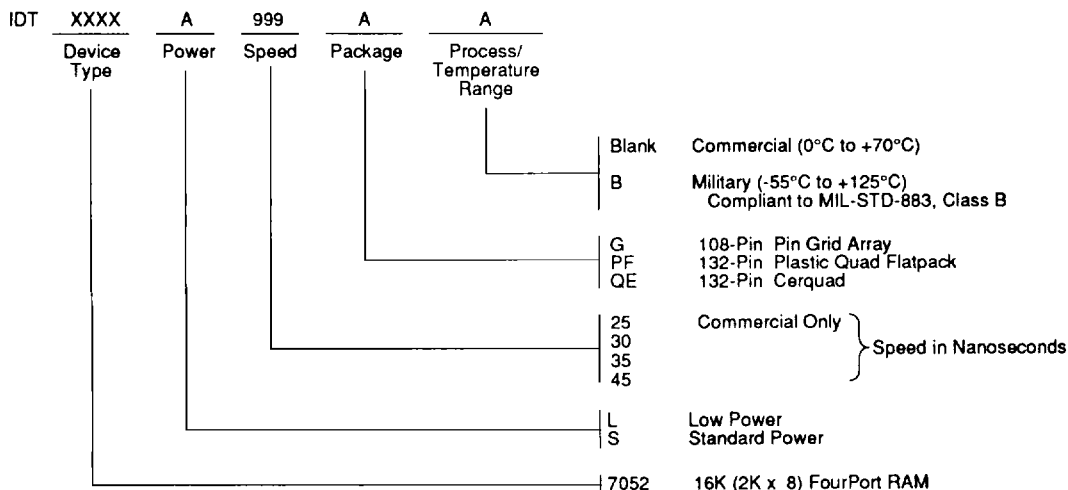
Any Port ⁽¹⁾				Function
R/W	$\overline{CE}$	$\overline{OE}$	D0-7	
X	H	X	Z	Port Disabled and in Power Down Mode
X	H	X	Z	$\overline{CEP1} = \overline{CEP2} = \overline{CEP3} = \overline{CEP4} =$ H Power Down Mode, LSB or LSB1
L	L	X	DATAin	Data on port written into memory ^(2,3)
H	L	L	DATAout	Data in memory output on port
X	X	H	Z	High impedance outputs

NOTES:

1. H = HIGH, L = LOW, X = Don't Care, Z = High Impedance
2. If $\overline{BUSY}$ = LOW, data is not written.
3. For valid write operation, no more than one port can write to the same address location at the same time.

2698 tbl 12

ORDERING INFORMATION



2674 drw 12