



HIGH-SPEED 4K x 8 FourPort™ STATIC RAM

IDT7054S/L

Features

- ♦ **High-speed access**
 - Commercial: 20/25/35ns (max.)
 - Industrial: 25ns (max.)
 - Military: 25/35ns (max.)
- ♦ **Low-power operation**
 - IDT7054S
 - Active: 750mW (typ.)
 - Standby: 7.5mW (typ.)
 - IDT7054L
 - Active: 750mW (typ.)
 - Standby: 1.5mW (typ.)
- ♦ **True FourPort memory cells which allow simultaneous access of the same memory locations**
- ♦ **Fully asynchronous operation from each of the four ports: P1, P2, P3, and P4**

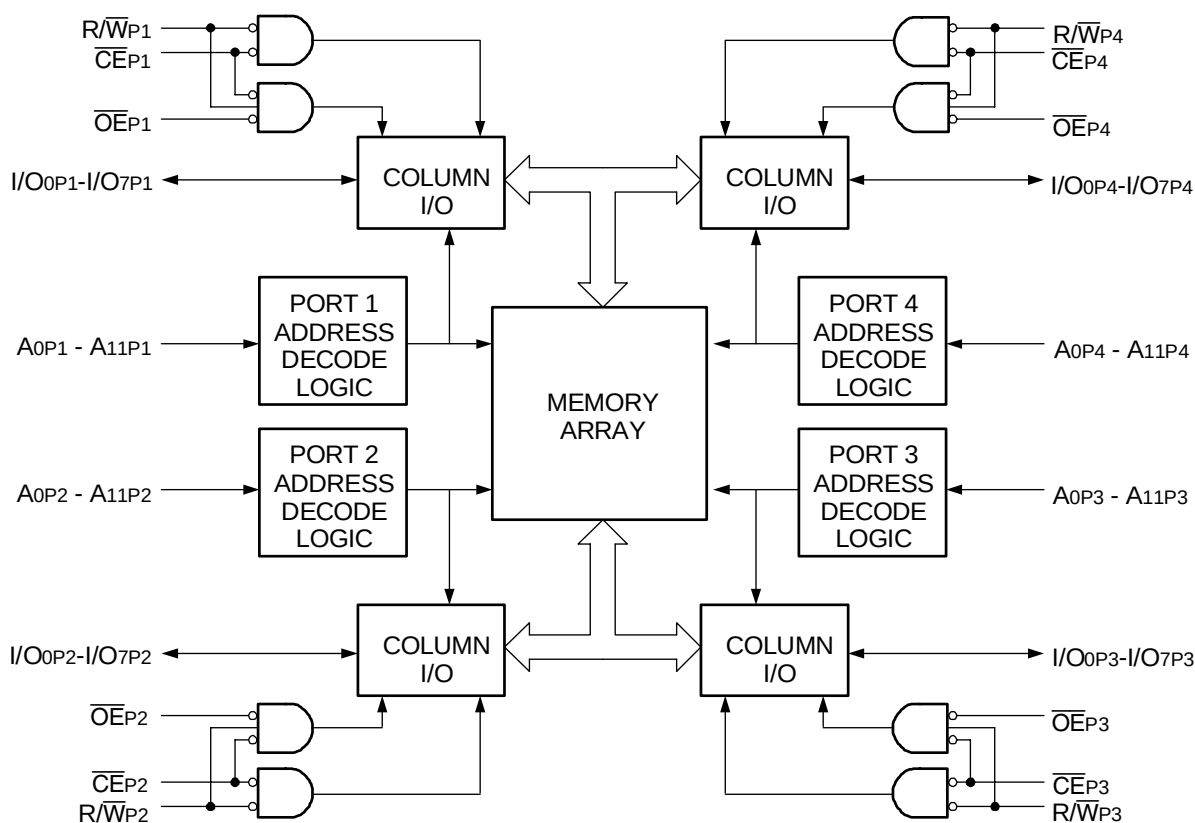
- ♦ TTL-compatible; single 5V ($\pm 10\%$) power supply
- ♦ Available in 128 pin Thin Quad Flatpack and 108 pin PGA packages
- ♦ Industrial temperature range (-40°C to $+85^{\circ}\text{C}$) is available for selected speeds

Description

The IDT7054 is a high-speed 4Kx8 FourPort™ Static RAM designed to be used in systems where multiple access into a common RAM is required. This FourPort Static RAM offers increased system performance in multiprocessor 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 IDT7054 is also 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

Functional Block Diagram



3241 drw 01

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externally arbitrated or withstand contention when all ports simultaneously access the same FourPort RAM location.

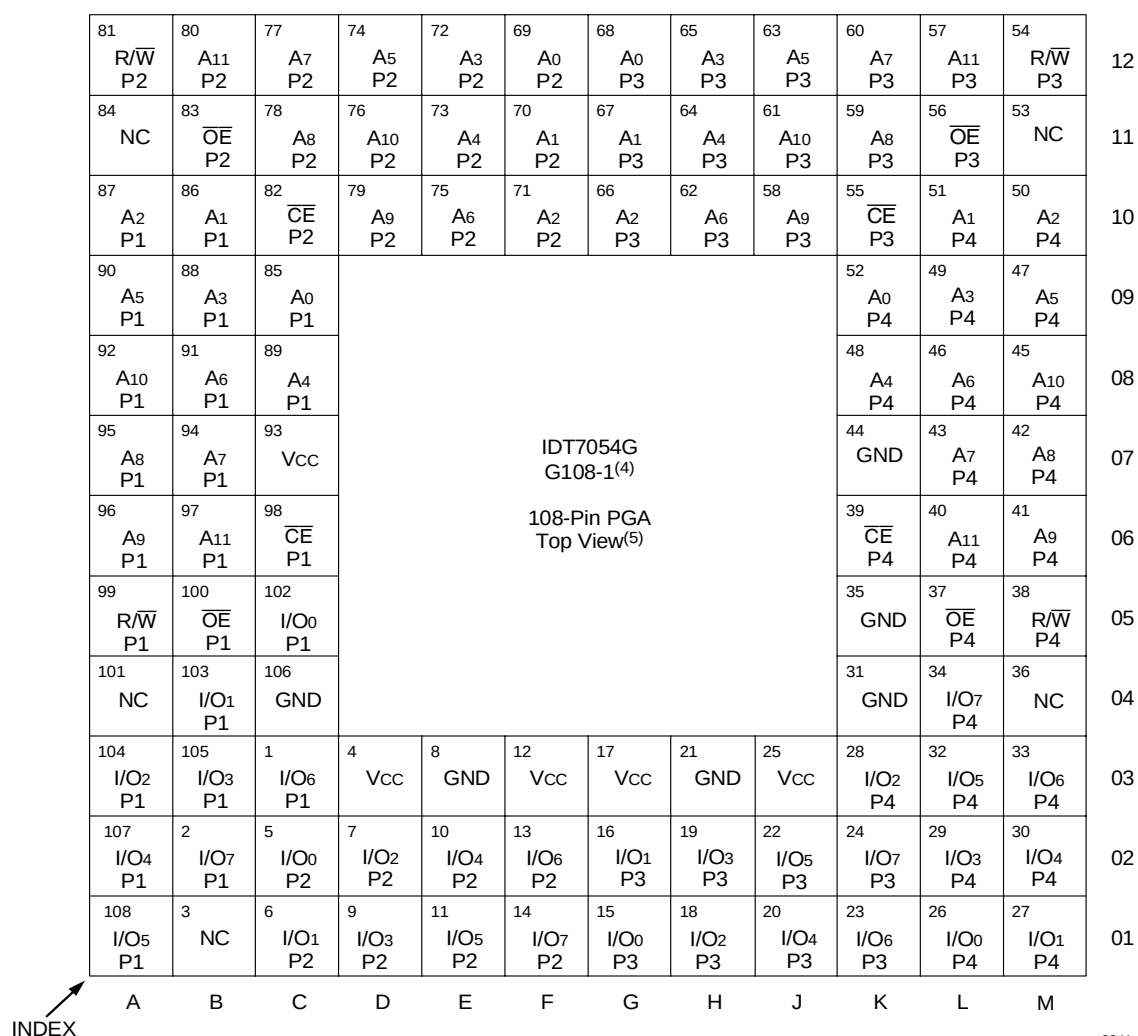
The IDT7054 provides four independent ports with separate control, address, and I/O pins that permit independent, asynchronous access for reads or writes to any location in memory. It is the user's responsibility to ensure data integrity when simultaneously accessing the same memory location from all ports. An automatic power down feature, controlled by $\overline{CE}$, permits the on-chip circuitry of each port to enter a very low power standby power mode.

Fabricated using IDT's CMOS high-performance technology, this FourPort SRAM typically operates on only 750mW of power. Low-power (L) versions offer battery backup data retention capability, with each port typically consuming 50μW from a 2V battery.

The IDT7054 is packaged in a ceramic 108-pin Pin Grid Array (PGA) and a 128-pin Thin Quad Flatpack (TQFP). The military grade product is manufactured in compliance with the latest revision of MIL-PRF-38535 QML, making it ideally suited to military temperature applications demanding the highest level of performance and reliability.

Pin Configurations^(1,2,3)

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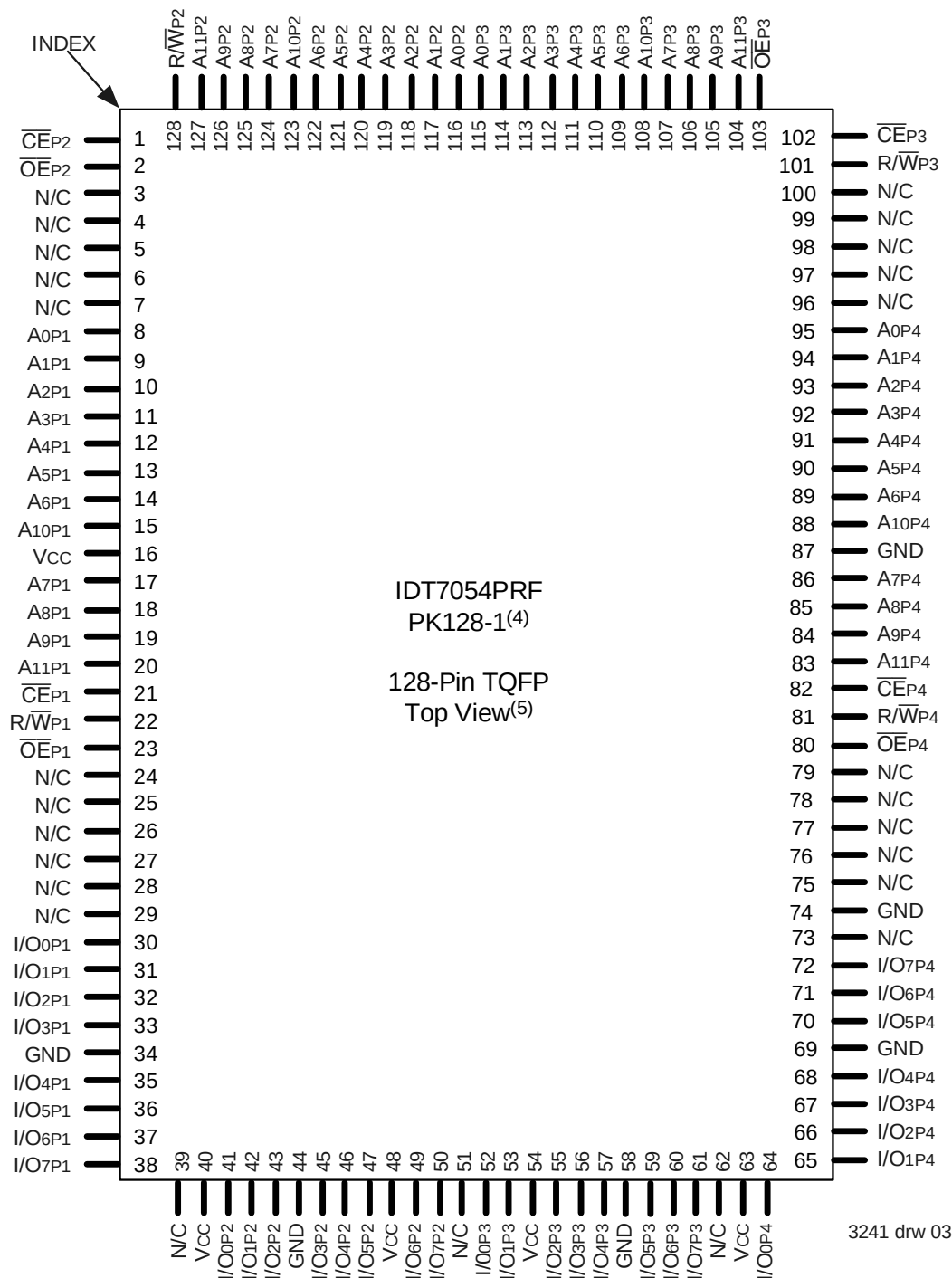


3241 drw 02

NOTES:

1. All Vcc pins must be connected to the power supply.
2. All GND pins must be connected to the ground supply.
3. Package body is approximately 1.21 in x 1.21 in x .16 in.
4. This package code is used to reference the package diagram.
5. This text does not indicate orientation of the actual part-marking.

11/14/01



1. All Vcc pins must be connected to the power supply.
2. All GND pins must be connected to the ground supply.
3. Package body is approximately 14mm x 20mm x 1.4mm.
4. This package code is used to reference the package diagram.
5. This text does not indicate orientation of the actual part-marking.

Pin Configurations^(1,2)

Capacitance⁽¹⁾

(TA = +25°C, f = 1.0MHz) TQFP ONLY

Symbol	Parameter	Conditions ⁽²⁾	Max.	Unit
C _{IN}	Input Capacitance	V _{IN} = 0V	9	pF
C _{OUT}	Output Capacitance	V _{OUT} = 0V	10	pF

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NOTES:

1. This parameter is determined by device characterization but is not production tested.
2. 3dV references the interpolated capacitance when the input and the output signals switch from 0V to 3V or from 3V to 0V.

Maximum Operating Temperature and Supply Voltage⁽¹⁾

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%
Industrial	-40°C to +85°C	0V	5.0V ± 10%

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NOTES:

1. This is the parameter TA. This is the "instant on" case temperature.

NOTES:

1. All V_{CC} pins must be connected to the power supply.
2. All GND pins must be connected to the ground supply.

Recommended DC Operating Conditions

Symbol	Parameter	Min.	Typ.	Max.	Unit
V _{CC}	Supply Voltage	4.5	5.0	5.5	V
GND	Ground	0	0	0	V
V _{IH}	Input High Voltage	2.2	—	6.0 ⁽²⁾	V
V _{IL}	Input Low Voltage	-0.5 ⁽¹⁾	—	0.8	V

3241 tbl 02

NOTES:

1. V_{IL} ≥ -1.5V for pulse width less than 10ns.
2. V_{TERM} must not exceed V_{CC} + 10%.

Absolute Maximum Ratings⁽¹⁾

Symbol	Rating	Commercial & Industrial	Military	Unit
V _{TERM} ⁽²⁾	Terminal Voltage with Respect to GND	-0.5 to +7.0	-0.5 to +7.0	V
T _{BIAS}	Temperature Under Bias	-55 to +125	-65 to +135	°C
T _{STG}	Storage Temperature	-65 to +150	-65 to +150	°C
I _{OUT}	DC Output Current	50	50	mA

3241 tbl 05

NOTES:

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 reliability.
2. V_{TERM} must not exceed V_{CC} + 10% for more than 25% of the cycle time or 10ns maximum, and is limited to ≤ 20mA for the period of V_{TERM} ≥ V_{CC} + 10%.

DC Electrical Characteristics Over the Operating Temperature and Supply Voltage Range^(1,5) (V_{CC} = 5.0V ± 10%)

				7054X20 Com'l Only		7054X25 Com'l, Ind & Military		7054X35 Com'l & Military			
Symbol	Parameter	Condition	Version	TYP. ⁽²⁾	Max.	TYP. ⁽²⁾	Max.	TYP. ⁽²⁾	Max.	Unit	
ICC1	Operating Power Supply Current (All Ports Active)	$\overline{CE} = V_{IL}$ Outputs Disabled $f = 0^{(3)}$	COM'L.	S	150	300	150	300	150	300	mA
				L	150	250	150	250	150	250	
			MIL. & IND.	S	—	—	150	360	150	360	mA
				L	—	—	150	300	150	300	
ICC2	Dynamic Operating Current (All Ports Active)	$\overline{CE} = V_{IL}$ Outputs Disabled $f = f_{MAX}^{(4)}$	COM'L.	S	240	370	225	350	210	335	mA
				L	210	325	195	305	180	290	
			MIL. & IND.	S	—	—	225	400	210	395	mA
				L	—	—	195	340	180	330	
ISB	Standby Current (All Ports - TTL Level Inputs)	$\overline{CE} = V_{IH}$ $f = f_{MAX}^{(4)}$	COM'L.	S	70	95	60	85	40	75	mA
				L	60	80	50	70	35	60	
			MIL. & IND.	S	—	—	60	115	40	110	mA
				L	—	—	50	85	35	80	
ISB1	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 $V_{IN} \leq 0.2V$, $f = 0^{(3)}$	COM'L.	S	1.5	15	1.5	15	1.5	15	mA
				L	0.3	1.5	0.3	1.5	0.3	1.5	
			MIL. & IND.	S	—	—	1.5	30	1.5	30	mA
				L	—	—	0.3	4.5	0.3	4.5	

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NOTES:

- 'X' in part number indicates power rating (S or L).
- V_{CC} = 5V, T_A = +25°C and are not production tested.
- f = 0 means no address or control lines change.
- At f = f_{MAX}, address and control lines (except Output Enable) are cycling at the maximum frequency read cycle of 1/trc, and using "AC Test Conditions" of input levels of GND to 3V.
- For the case of one port, divide the appropriate current above by four.

DC Electrical Characteristics Over the Operating Temperature and Supply Voltage Range (V_{CC} = 5.0V ± 10%)

Symbol	Parameter	Test Conditions	7054S		7054L		Unit
			Min.	Max.	Min.	Max.	
I _L	Input Leakage Current ⁽¹⁾	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 tbl 07

NOTE:

- At V_{CC} ≤ 2.0V input leakages are undefined.

AC Test Conditions

Input Pulse Levels	GND to 3.0V
Input Rise/Fall Times	3ns Max.
Input Timing Reference Levels	1.5V
Output Reference Levels	1.5V
Output Load	Figures 1 and 2

3241 tbl 08

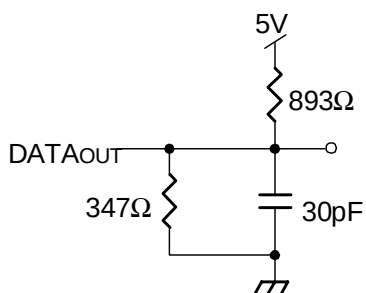
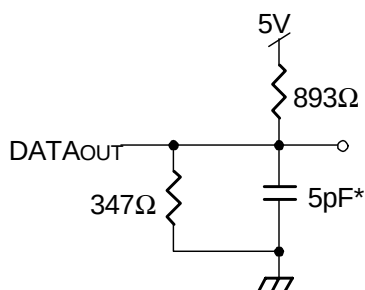


Figure 1. AC Output Test Load

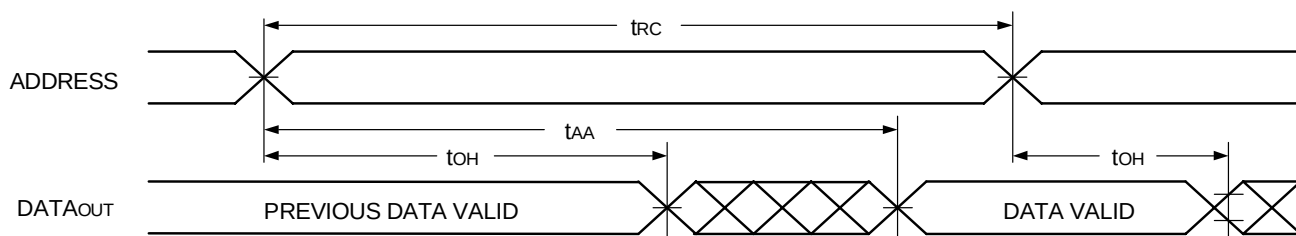


3241 drw 04

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

*Including scope and jig

Timing Waveform of Read Cycle No. 1, Any Port⁽¹⁾



3241 drw 05

NOTE:

1. $\overline{R/\overline{W}} = V_{IH}$, $\overline{OE} = V_{IL}$, and $\overline{CE} = V_{IL}$.

AC Electrical Characteristics Over the Operating Temperature and Supply Voltage⁽³⁾

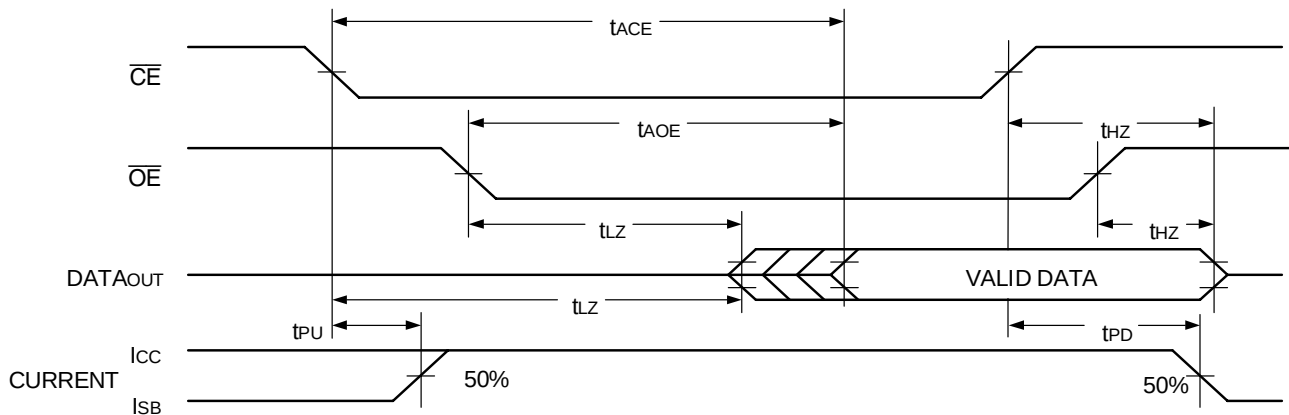
Symbol	Parameter	7054X20 Com'l Only		7054X25 Com'l, Ind & Military		7054X35 Com'l & Military		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
READ CYCLE								
tRC	Read Cycle Time	20	—	25	—	35	—	ns
tAA	Address Access Time	—	20	—	25	—	35	ns
tACE	Chip Enable Access Time	—	20	—	25	—	35	ns
tAOE	Output Enable Access Time	—	10	—	15	—	25	ns
tOH	Output Hold from Address Change	0	—	0	—	0	—	ns
tLZ	Output Low-Z Time ^(1,2)	5	—	5	—	5	—	ns
tHZ	Output High-Z Time ^(1,2)	—	12	—	15	—	15	ns
tPU	Chip Enable to Power Up Time ⁽²⁾	0	—	0	—	0	—	ns
tPD	Chip Disable to Power Down Time ⁽²⁾	—	20	—	25	—	35	ns

3241 tbl 09

NOTES:

1. Transition is measured 0mV from Low or High-impedance voltage with the Output Test Load (Figure 2).
2. This parameter is guaranteed by device characterization but is not production tested.
3. 'X' in part number indicates power rating (S or L).

Timing Waveform of Read Cycle No. 2, Any Port^(1, 2)



3241 drw 06

NOTES:

1. $R/\bar{W} = V_{IH}$ for Read Cycles.
2. Addresses valid prior to or coincident with $\overline{CE}$ transition LOW.

AC Electrical Characteristics Over the Operating Temperature and Supply Voltage⁽⁵⁾

Symbol	Parameter	7054X20 Com'l Only		7054X25 Com'l, Ind & Military		7054X35 Com'l & Military		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
WRITE CYCLE								
tWC	Write Cycle Time	20	—	25	—	35	—	ns
tEW	Chip Enable to End-of-Write	15	—	20	—	30	—	ns
tAW	Address Valid to End-of-Write	15	—	20	—	30	—	ns
tAS	Address Set-up Time	0	—	0	—	0	—	ns
tWP	Write Pulse Width ⁽³⁾	15	—	20	—	30	—	ns
tWR	Write Recovery Time	0	—	0	—	0	—	ns
tDW	Data Valid to End-of-Write	15	—	15		20	—	ns
tHZ	Output High-Z Time ^(1,2)	—	15	—	15	—	15	ns
tDH	Data Hold Time	0	—	0	—	0	—	ns
tWZ	Write Enable to Output in High-Z ^(1,2)	—	12	—	15	—	15	ns
tOW	Output Active from End-of-Write ^(1,2)	0	—	0	—	0	—	ns
tWDD	Write Pulse to Data Delay ⁽⁴⁾	—	35	—	45	—	55	ns
tDDD	Write Data Valid to Read Data Delay ⁽⁴⁾	—	30	—	35	—	45	ns

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NOTES:

1. Transition is measured 0mV from Low or High-impedance voltage with the Output Test Load (Figure 2).
2. This parameter is guaranteed by device characterization but is not production tested.
3. If $\overline{OE} = V_{IL}$ during a $R/\overline{W}$ 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 data to be placed on the bus for the required t_{OW}. If $\overline{OE} = V_{IH}$ during an $R/\overline{W}$ controlled write cycle, this requirement does not apply and the write pulse can be as short as the specified t_{WP}. Specified for $\overline{OE} = V_{IH}$ (refer to "Timing Waveform of Write Cycle", Note 8).
4. Port-to-port delay through RAM cells from writing port to reading port, refer to "Timing Waveform of Write with Port-to-Port Read".
5. 'X' in part number indicates power rating.

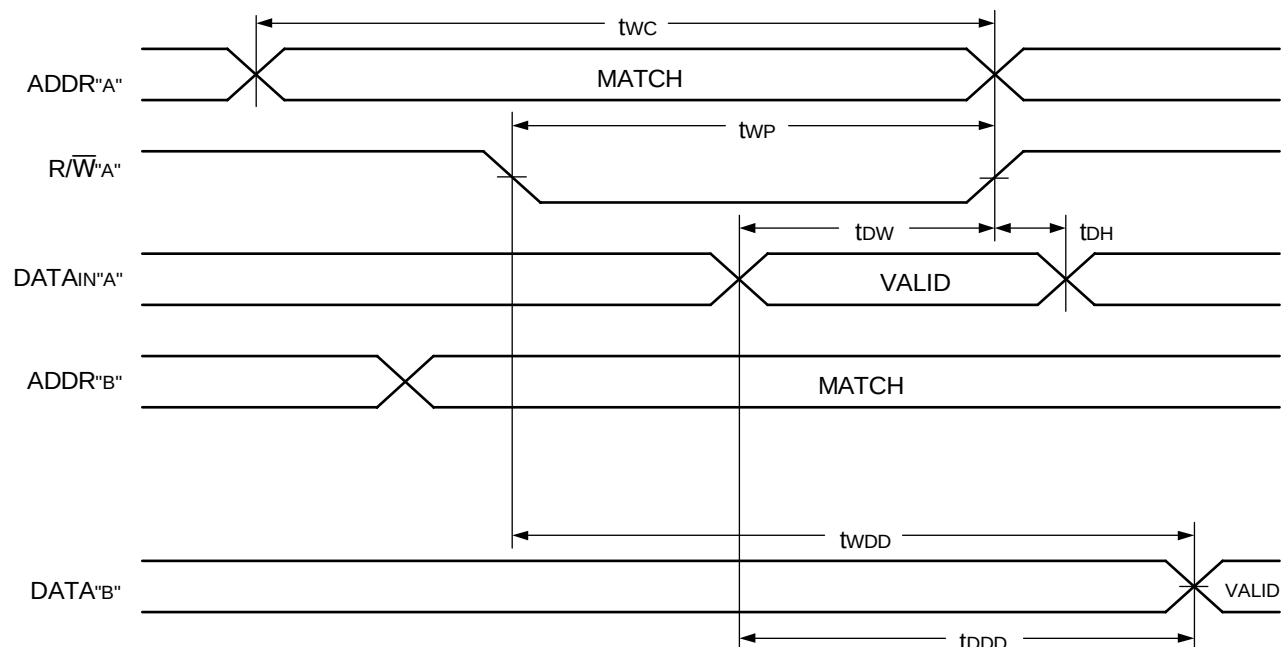
[illegible]

The timing diagram illustrates the relationship between the ADDRESS, $\overline{\text{CE}}$, R/ $\overline{\text{W}}$, and DATAin signals. The signals are shown as digital waveforms. The ADDRESS signal is a high-frequency signal that is sampled by the $\overline{\text{CE}}$ signal. The R/ $\overline{\text{W}}$ signal is a control signal that determines the operation (read or write). The DATAin signal is the data being read from or written to the device. The timing parameters are defined as follows:

- t_{WC} : Address setup time before $\overline{\text{CE}}$ goes low.
- t_{AW} : Address hold time after $\overline{\text{CE}}$ goes high.
- $t_{\text{AS}}^{(6)}$: Address setup time before R/ $\overline{\text{W}}$ goes low.
- $t_{\text{EW}}^{(2)}$: Address hold time after R/ $\overline{\text{W}}$ goes high.
- $t_{\text{WR}}^{(3)}$: Address hold time after R/ $\overline{\text{W}}$ goes high.
- t_{DW} : Data setup time before R/ $\overline{\text{W}}$ goes low.
- t_{DH} : Data hold time after R/ $\overline{\text{W}}$ goes high.

1. $R/\overline{W}$ or $\overline{CE} = V_{IH}$ during all address transitions.
2. A write occurs during the overlap (t_{EW} or t_{WP}) of a $\overline{CE} = V_{IL}$ and a $R/\overline{W} = V_{IL}$.
3. t_{WR} is measured from the earlier of $\overline{CE}$ or $R/\overline{W} = V_{IH}$ 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 $R/\overline{W} = V_{IL}$ transition, the outputs remain in the High-impedance state.
6. Timing depends on which enable signal is asserted last, $\overline{CE}$ or $R/\overline{W}$.
7. Transition is measured 0mV from Low or High-impedance voltage with the Output Test Load (Figure 2). This parameter is guaranteed but is not production tested.
8. If $\overline{OE} = V_{IL}$ during a $R/\overline{W}$ 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 $\overline{OE} = V_{IH}$ during an $R/\overline{W}$ controlled write cycle, this requirement does not apply and the write pulse can be as short as the specified t_{WP} .

Timing Waveform of Write with Port-to-Port Read^(1, 2)



NOTES:

1. $\overline{OE} = V_{IL}$ for the reading ports.
2. All timing is the same for left and right ports. Port "A" may be either of the four ports and Port "B" is any other port.

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Functional Description

The IDT7054 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 ($\overline{CE} = V_{IH}$). 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.

Table I – Read/Write Control

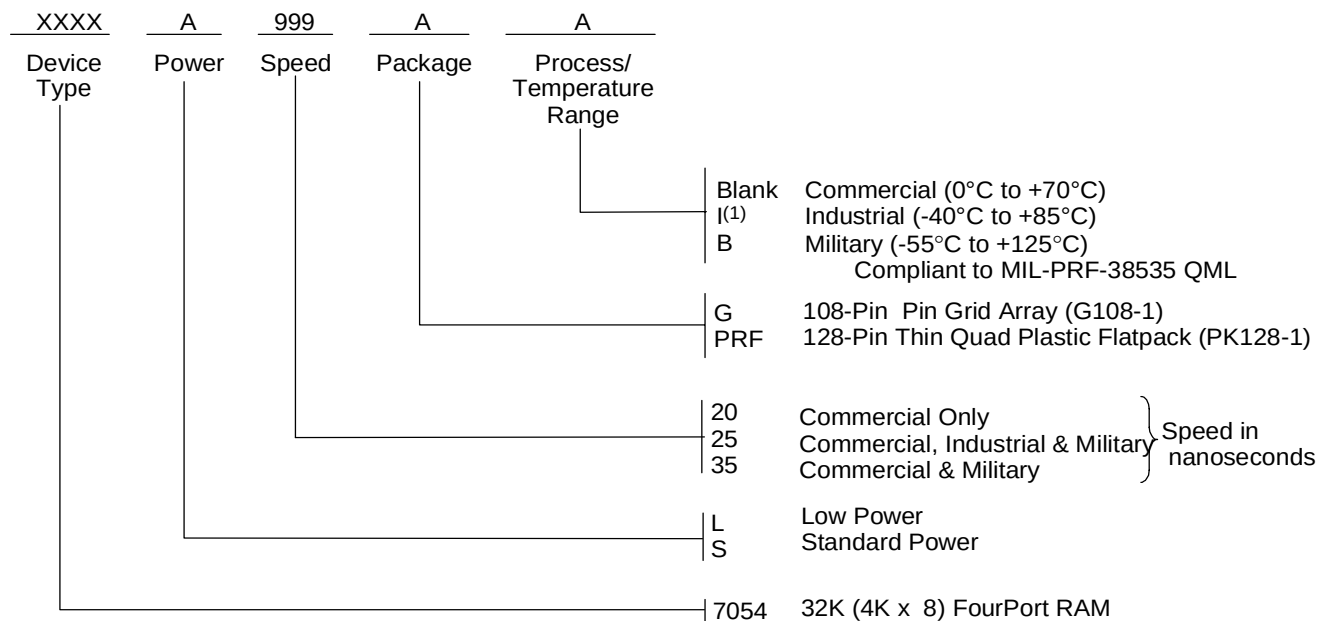
Any Port ⁽¹⁾				Function
R/W	$\overline{CE}$	$\overline{OE}$	D0-7	
X	H	X	Z	Port Deselected: Power-Down
X	H	X	Z	$\overline{CEP1}=\overline{CEP2}=\overline{CEP3}=\overline{CEP4}=V_{IH}$ Power Down Mode ISB or ISB1
L	L	X	DATAin	Data on port written into memory ⁽²⁾
H	L	L	DATAout	Data in memory output on port
X	X	H	Z	Outputs Disabled

3241 tbl 11

NOTES:

1. "H" = V_{IH} , "L" = V_{IL} , "X" = Don't Care, "Z" = High Impedance
2. For valid write operation, no more than one port can write to the same address location at the same time.

Ordering Information



NOTE:

1. Industrial temperature range is available.
 For other speeds, packages and powers contact your sales office.

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Datasheet Document History

1/18/99:	Initiated datasheet document history Converted to new format Cosmetic typographical corrections Added additional notes to pin configurations
6/4/99:	Changed drawing format Page 1 Corrected DSC number
9/1/99:	Removed Preliminary
11/10/99:	Replaced IDT logo
5/23/00:	Page 4 Increased storage temperature parameter Clarified TA parameter Page 5 DC Electrical parameters—changed wording from "open" to "disabled" Changed ±200mV to 0mV in notes
10/22/01:	Page 2 & 3 Added date revision for pin configurations Page 5, 7 & 8 Added Industrial temp to column heading for 25ns speed to DC & AC Electrical Characteristics Page 11 Added Industrial temp offering to 25ns ordering information Page 4, 5, 7 & 8 Removed Industrial temp footnote from all tables Page 6 Changed 5ns to 3ns in AC Test Conditions table Page 1 & 11 Replace ™ logo with ® logo
01/29/09:	Page 11 Removed "IDT" from orderable part number



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