P4C148, P4C149
ULTRA HIGH SPEED 1K x 4
STATIC CMOS RAMS (SCRAMS)

T-46-23-08

FEATURES

- Full CMOS, 6T Cell
- High Speed (Equal Access and Cycle Times)
  - 10/12/15/20/25 ns (Commercial)
- Low Power operation (Commercial)
  - 715 mW Active – 10/12
  - 550 mW Active – 15/20/25
  - 127 mW Standby (TTL Input) P4C148
  - 55 mW Standby (CMOS Input) P4C148
- Single 5V±10% Power Supply
- Two Options
  - P4C148 Low Power Standby Mode
  - P4C149 Fast Chip Select Control
- Common Input/Output Ports
- Three-State Output
- Fully TTL Compatible Inputs and Outputs
- Produced with PACE II Technology™
- Standard Pinout (JEDEC Approved)
  - 18-Pin 300 mil DIP

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DESCRIPTION

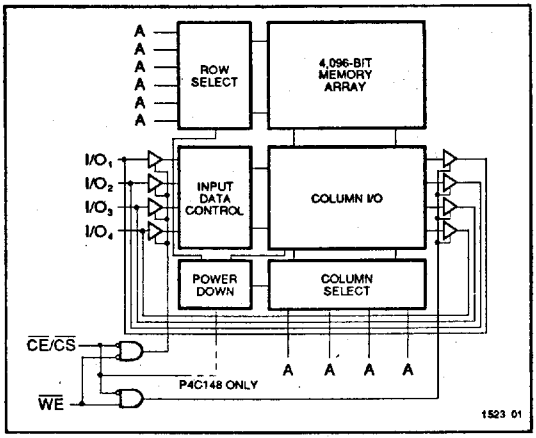
The P4C148 and P4C149 are 4,096-bit ultra high-speed static RAMs organized as 1K x 4. Both devices have common input/output ports. The P4C148 enter the standby mode when the chip enable ($\overline{CE}$) goes HIGH; with CMOS input levels, power consumption is extremely low in this mode. The P4C149 features a fast chip select capability using $\overline{CS}$. The CMOS memories require no clocks or refreshing, and have equal access and cycle times. Inputs are fully TTL-compatible. The RAMs operate from a single 5V ± 10% tolerance power supply.

Access times as fast as 10 nanoseconds are available, permitting greatly enhanced system operating speeds. CMOS is used to reduce power consumption when active; for the P4C148, consumption is further reduced in the standby mode. The P4C148 and P4C149 are members of a family of PACE RAM™ products offering super fast access times never before available at these complexity levels in TTL-compatible bipolar or CMOS technologies. The P4C148 and P4C149 are manufactured with PACE II Technology.

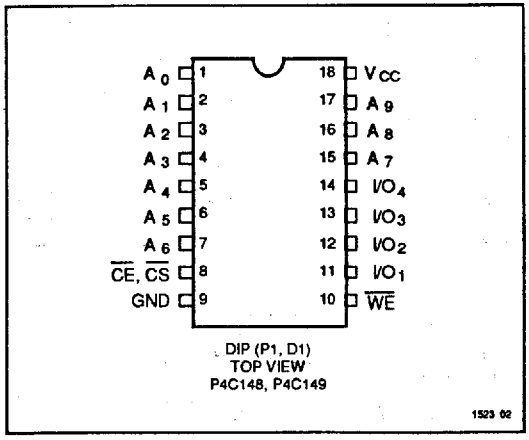
The P4C148 and P4C149 are available in 18-pin 300 mil DIP packages providing excellent board level densities.

*For a fan-in/fan-out of 4 at 85°C junction temperature and 5.0V supply.

FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATIONS



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MAXIMUM RATINGS[1]

Symbol	Parameter	Value	Unit
V_{CC}	Power Supply Pin with Respect to GND	–0.5 to +7	V
V_{TERM}	Terminal Voltage with Respect to GND (up to 7.0V)	–0.5 to V_{CC} +0.5	V
T_A	Operating Temperature	–55 to +125	°C

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Symbol	Parameter	Value	Unit
T_{BIAS}	Temperature Under Bias	–55 to +125	°C
T_{STG}	Storage Temperature	–65 to +150	°C
P_T	Power Dissipation	1.0	W
I_{OUT}	DC Output Current	50	mA

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RECOMMENDED OPERATING TEMPERATURE AND SUPPLY VOLTAGE

Grade[2]	Ambient Temperature	GND	V_{CC}
Commercial	0°C to +70°C	0V	5.0V ± 10%

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DC ELECTRICAL CHARACTERISTICS

Over recommended operating temperature and supply voltage[2]

Symbol	Parameter	Test Conditions	P4C148		P4C149		Unit
			Min	Max	Min	Max	
V_{IH}	Input High Voltage		2.2	V_{CC}+0.5	2.2	V_{CC}+0.5	V
V_{IL}	Input Low Voltage		–0.5[3]	0.8	–0.5[3]	0.8	V
V_{HC}	CMOS Input High Voltage		V_{CC}–0.2	V_{CC}+0.5	V_{CC}–0.2	V_{CC}+0.5	V
V_{LC}	CMOS Input Low Voltage		–0.5[3]	0.2	–0.5[3]	0.2	V
V_{CD}	Input Clamp Diode Voltage	V_{CC} = Min., I_{IN} = –18 mA		–1.2		–1.2	V
V_{OL}	Output Low Voltage (TTL Load)	I_{OL} = +8 mA, V_{CC} = Min.		0.4		0.4	V
V_{OLC}	Output Low Voltage (CMOS Load)	I_{OLC} = +100 µA, V_{CC} = Min.		0.2		0.2	V
V_{OH}	Output High Voltage (TTL Load)	I_{OH} = –4 mA, V_{CC} = Min.	2.4		2.4		V
V_{OHC}	Output High Voltage (CMOS Load)	I_{OHC} = –100 µA, V_{CC} = Min.	V_{CC}–0.2		V_{CC}–0.2		V
I_{LI}	Input Leakage Current	V_{CC} = Max. V_{IN} = GND to V_{CC}	–5	+5	–5	+5	µA
I_{LO}	Output Leakage Current	V_{CC} = Max., $\overline{CE}$ = V_{IH}, V_{OUT} = GND to V_{CC}	–5	+5	–5	+5	µA

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Notes:

1. Stresses greater than those listed under 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 MAXIMUM rating conditions for extended periods may affect reliability.
2. Extended temperature operation guaranteed with 400 linear feet per minute of air flow.
3. Transient inputs with V_{IL} and I_{IL} not more negative than –3.0V and –100mA, respectively, are permissible for pulse widths up to 20ns.

CAPACITANCES[4]

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(V_{CC} = 5.0V, T_A = 25°C, f = 1.0MHz)

Symbol	Parameter	Conditions	Typ.	Unit
C_{IN}	Input Capacitance	V_{IN} = 0V	5	pF

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Symbol	Parameter	Conditions	Typ.	Unit
C_{OUT}	Output Capacitance	V_{OUT} = 0V	7	pF

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Note:
4. This parameter is sampled and not 100% tested.

POWER DISSIPATION CHARACTERISTICS

Over recommended operating temperature and supply voltage[2]

Symbol	Parameter	Test Conditions	P4C148		P4C149		Unit
			Min	Max	Min	Max	
I_{CC}	Dynamic Operating Current – 10, 12	V_{CC} = Max., f = Max., Outputs Open Com'l.	—	130	—	130	mA
I_{CC}	Dynamic Operating Current – 15, 20, 25	V_{CC} = Max., f = Max., Outputs Open Com'l.	—	100	—	100	mA
I_{SB}	Standby Power Supply Current (TTL Input Levels)	$\overline{CE} \geq V_{IH}$, V_{CC} = Max., f = Max., Outputs Open Com'l.	—	23	—	n/a	mA
I_{SB1}	Standby Power Supply Current (CMOS Input Levels)	$\overline{CE} \geq V_{HC}$, V_{CC} = Max., f = 0, Outputs Open, $V_{IN} \leq V_{LC}$ or $V_{IN} \geq V_{HC}$ Com'l.	—	10	—	n/a	mA

n/a = Not Applicable

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AC CHARACTERISTICS—READ CYCLE

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(V_{CC} = 5V ± 10%, All Temperature Ranges)[2]

Sym.	Parameter	-10		-12		-15		-20		-25		Unit
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
t_{RC}	Read Cycle Time	10		12		15		20		25		ns
t_{AA}	Address Access Time		10		12		15		20		25	ns
t_{AC}†	Chip Enable Access Time (P4C148)		10		12		15		20		25	ns
t_{AC}*	Chip Select Access Time (P4C149)		8		10		12		14		15	ns
t_{OH}	Output Hold from Address Change	3		3		3		3		3		ns
t_{LZ}*	Chip Enable to Output in Low Z	1		1		1		1		2		ns
t_{HZ}*	Chip Disable to Output in High Z		4		5		6		8		10	ns
t_{RCS}	Read Command Setup Time	0		0		0		0		0		ns
t_{RCH}	Read Command Hold Time	0		0		0		0		0		ns
t_{PU}†	Chip Enable to Power Up Time	0		0		0		0		0		ns
t_{PD}†	Chip Disable to Power Down Time		10		12		15		20		25	ns

† P4C148

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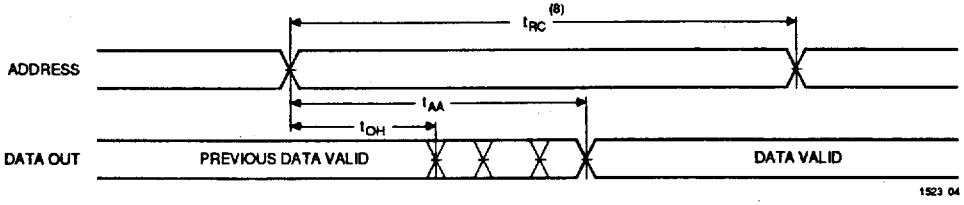
* Chip Select/Deselect for P4C149 only

TIMING WAVEFORM OF READ CYCLE NO. 1 [6]



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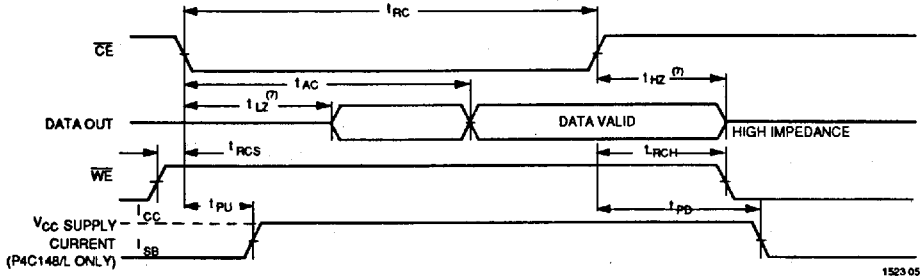
TIMING WAVEFORM OF READ CYCLE NO. 2 [6]



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Notes:

5. $\overline{CE}$ is LOW and $\overline{WE}$ is HIGH for READ cycle.
6. $\overline{WE}$ is HIGH, and address must be valid prior to or coincident with $\overline{CE}$ transition LOW.
7. Transition is measured ±200mV from steady state voltage prior to change with specified loading in Figure 1. This parameter is sampled and not 100% tested.
8. Read Cycle Time is measured from the last valid address to the first transitioning address.

AC CHARACTERISTICS—WRITE CYCLE

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(V_{CC} = 5V ± 10%, All Temperature Ranges)[2]

Sym.	Parameter	-10		-12		-15		-20		-25		Unit
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
t_{WC}	Write Cycle Time	10		12		15		20		25		ns
t_{CW}	Chip Enable Time to End of Write	8		10		12		16		20		ns
t_{AW}	Address Valid to End of Write	8		10		12		16		20		ns
t_{AS}	Address Set-up Time	0		0		0		0		0		ns
t_{WP}	Write Pulse Width	8		10		12		16		20		ns
t_{AH}	Address Hold Time from End of Write	0		0		0		0		0		ns
t_{DW}	Data Valid to End of Write	5		6		7		9		12		ns
t_{DH}	Data Hold Time	0		0		0		0		0		ns
t_{WZ}	Write Enable to Output in High Z		5		6		7		7		8	ns
t_{OW}	Output Active from End of Write	0		0		0		0		0		ns

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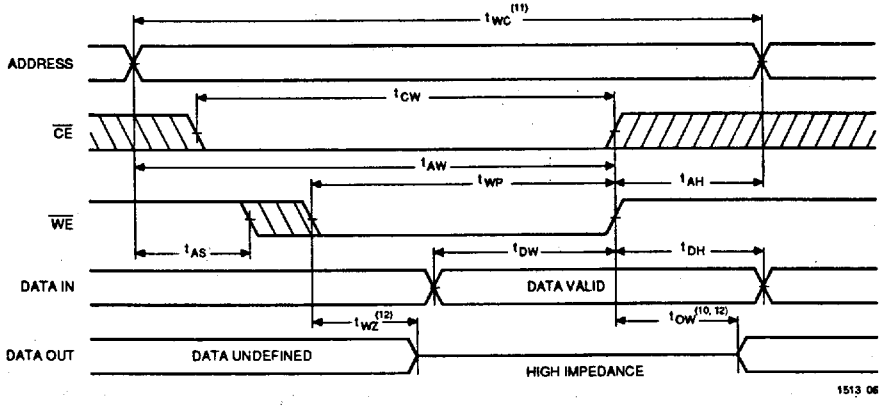
TIMING WAVEFORM OF WRITE CYCLE NO. 1 ($\overline{WE}$ CONTROLLED) [9]



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Notes:

9. $\overline{CE}$ and $\overline{WE}$ must be LOW for WRITE cycle.
10. If $\overline{CE}$ goes HIGH simultaneously with $\overline{WE}$ HIGH, the output remains in a high impedance state.
11. Write Cycle Time is measured from the last valid address to the first transition address.
12. Transition is measured ±200mV from steady state voltage prior to change with specified loading in Figure 1. This parameter is sampled and not 100% tested.

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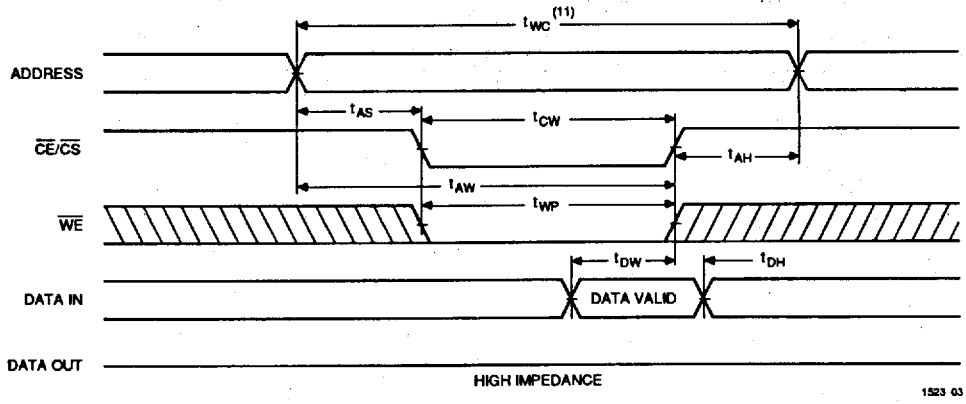
TIMING WAVEFORM OF WRITE CYCLE NO. 2 ($\overline{CE}/\overline{CS}$ CONTROLLED) [9]



AC TEST CONDITIONS

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

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TRUTH TABLE

P4C148 (P4C149)

Mode	$\overline{CE}/\overline{CS}$	$\overline{WE}$	Output	Power
Standby*	H	X	High Z	Standby*
Read	L	H	D_{OUT}	Active
Write	L	L	High Z	Active

* For the P4C149, Power is Active in Deselect Mode. 1523 TBI 09

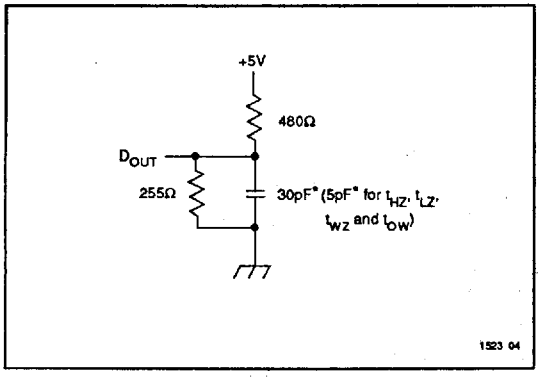

Figure 1. Output Load

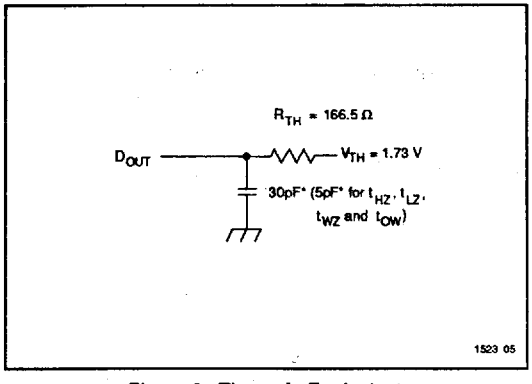

Figure 2. Thevenin Equivalent

* including scope and test fixture.

Note:
Because of the ultra-high speed of the P4C148 and P4C149, care must be taken when testing these devices; an inadequate setup can cause a normal functioning part to be rejected as faulty. Long high-inductance leads that cause supply bounce must be avoided by bringing the V_{cc} and ground planes directly up to the contactor fingers. A 0.01 µF high frequency capacitor is also required between V_{cc} and ground. To avoid signal reflections, proper termination must be used; for example, a 50Ω test environment should be terminated into a 50Ω load with 1.73V (Thevenin Voltage) at the comparator input, and a 116Ω resistor must be used in series with D_{OUT} to match 166Ω (Thevenin Resistance).

ORDERING INFORMATION

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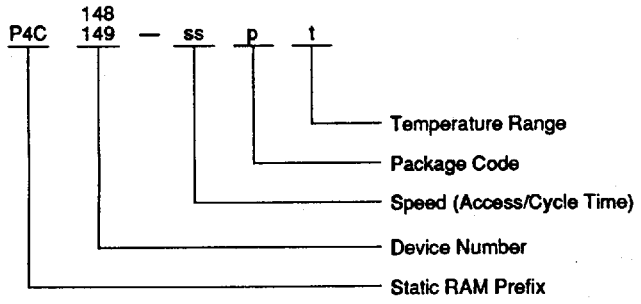

ss = Speed (access/cycle time in ns), e.g., 10, 15

p = Package code, i.e., P, D.

t = Temperature range, i.e., C.

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PACKAGE SUFFIX

Package Suffix	Description
P	Plastic DIP, 300 mil wide standard
D	CERDIP, 300 mil wide standard

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TEMPERATURE RANGE SUFFIX

Temperature Range Suffix	Description
C	Commercial Temperature Range, 0°C to +70°C.
M	Military Temperature Range, –55°C to +125°C.
MB	Mil. Temp. with MIL-STD-883D Class B compliance

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SELECTION GUIDE

The P4C148 and P4C149 are available in the following temperature, speed and package options.

Temperature Range	Speed (ns) / Package	10	12	15	20	25
Commercial	Plastic DIP	-10PC	-12PC	-15PC	-20PC	-25PC
	CERDIP	N/A	-12DC	-15DC	-20DC	-25DC
Military Temp.	CERDIP	N/A	N/A	N/A	N/A	N/A
Military Processed*	CERDIP	N/A	N/A	N/A	N/A	N/A

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* Military temperature range with MIL-STD-883 Revision D, Class B processing.
N/A = Not available