

# P4C174

## HIGH SPEED 8K x 8

### CACHE TAG STATIC RAM



#### FEATURES

- High Speed Address-To-Match - 8 ns Maximum Access Time
- High-Speed Read-Access Time
  - 8/10/12/15/20/25 ns (Commercial)
- Open Drain MATCH Output
- Reset Function
- 8-Bit Tag Comparison Logic
- Automatic Powerdown During Long Cycles
- Data Retention at 2V for Battery Backup Operation
- Advanced CMOS Technology
- Low Power Operation
  - Active: 750 mW Typical at 25 ns
  - Standby: 500  $\mu$ W Typical
- Package Styles Available
  - 28 Pin 300 mil Plastic DIP
  - 28 Pin 300 mil Plastic SOJ
- Single Power Supply
  - 5V $\pm$ 10%



#### DESCRIPTION

The P4C174 is a 65,536 bit high speed cache tag static RAM organized as 8K x 8. The CMOS memory has equal access and cycle times. Inputs are fully TTL-compatible. The cache tag RAMs operate from a single 5V $\pm$ 10% power supply. An 8-bit data comparator with a MATCH output is included for use as an address tag comparator in high speed cache applications. The reset function provides the capability to reset all memory locations to a LOW level.

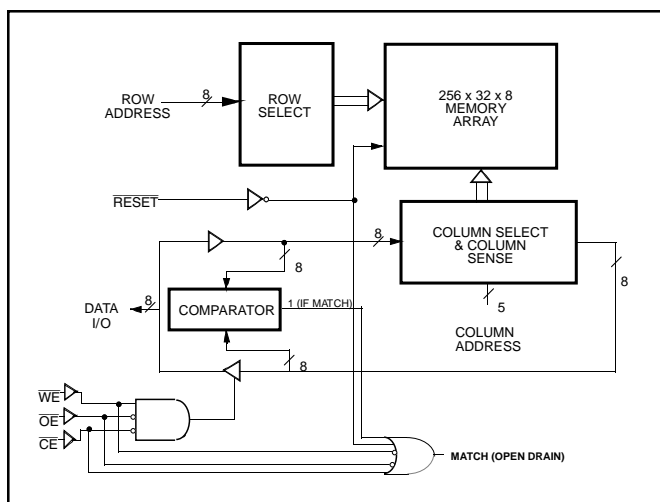
The MATCH output of the P4C174 reflects the comparison result between the 8-bit data on the I/O pins and

the addressed memory location. 8K Cache lines can be mapped into 1M-Byte address spaces by comparing 20 address bits organized as 13-line address bits and 7-page address bits.

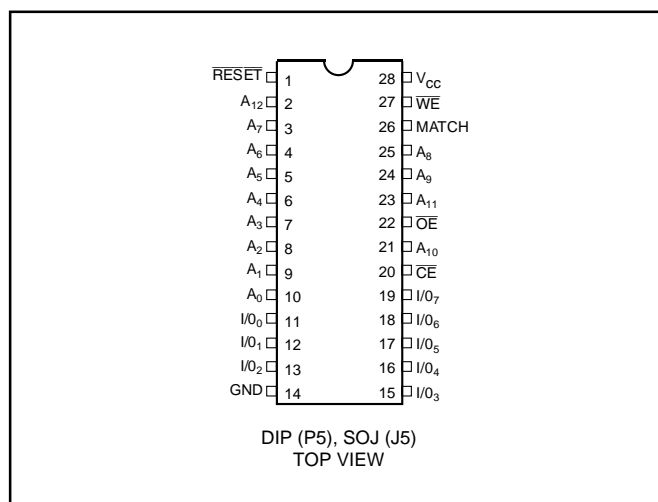
Low power operation of the P4C174 is enhanced by automatic powerdown when the memory is deselected or during long cycle times. Also, data retention is maintained down to  $V_{CC} = 2.0$ . Typical battery backup applications consume only 30  $\mu$ W at  $V_{CC} = 3.0V$ .



#### FUNCTIONAL BLOCK DIAGRAM



#### PIN CONFIGURATION



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

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

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

## RECOMMENDED OPERATING TEMPERATURE AND SUPPLY VOLTAGE

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

## CAPACITANCES<sup>(4)</sup>

$V_{CC} = 5.0V$ ,  $T_A = 25^\circ C$ ,  $f = 1.0MHz$

Symbol	Parameter	Conditions	Typ.	Unit
$C_{IN}$	Input Capacitance	$V_{IN} = 0V$	5	pF
$C_{OUT}$	Output Capacitance	$V_{OUT} = 0V$	7	pF

## DC ELECTRICAL CHARACTERISTICS

Over recommended operating temperature and supply voltage<sup>(2)</sup>

Symbol	Parameter	Test Conditions	P4C174		Unit
			Min	Max	
$V_{IH}$	Input High Voltage		2.2	$V_{CC} + 0.5$	V
$V_{IL}$	Input Low Voltage		-0.5 <sup>(3)</sup>	0.8	V
$V_{HC}$	CMOS Input High Voltage		$V_{CC} - 0.2$	$V_{CC} + 0.5$	V
$V_{LC}$	CMOS Input Low Voltage		-0.5 <sup>(3)</sup>	0.2	V
$V_{CD}$	Input Clamp Diode Voltage	$V_{CC} = \text{Min.}, I_{IN} = 18 \text{ mA}$		-1.2	V
$V_{OL}$	Output Low Voltage (TTL Load)	$I_{OL} = +8 \text{ mA}, V_{CC} = \text{Min.}$		0.4	V
$V_{OH}$	Output High Voltage (TTL Load)	$I_{OH} = -4 \text{ mA}, V_{CC} = \text{Min.}$	2.4		V
$I_{LI}$	Input Leakage Current	$V_{CC} = \text{Max.}$ $V_{IN} = \text{GND to } V_{CC}$	-5	+5	µA
$I_{LO}$	Output Leakage Current	$V_{CC} = \text{Max.}, \overline{CE} = V_{IH}$ , $V_{OUT} = \text{GND to } V_{CC}$	-5	+5	µA
$I_{SB}$	Standby Power Supply Current (TTL Input Levels)	$\overline{CE} \geq V_{IH}$ $V_{CC} = \text{Max.}$ , $f = \text{Max.}$ , Outputs Open	—	25	mA
$I_{SB1}$	Standby Power Supply Current (CMOS Input Levels)	$\overline{CE} \geq V_{HC}$ $V_{CC} = \text{Max.}$ , $f = 0$ , Outputs Open $V_{IN} \leq V_{LC}$ or $V_{IN} \geq V_{HC}$	—	5	mA

n/a = Not Applicable

### Notes:

- 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.
- Extended temperature operation guaranteed with 400 linear feet per minute of air flow.
- 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.
- This parameter is sampled and not 100% tested.

**POWER DISSIPATION CHARACTERISTICS VS. SPEED**

Symbol	Parameter	Temperature Range	-8	-10	-12	-15	-20	-25	Unit
$I_{CC}$	Dynamic Operating Current*	Commercial	200	180	170	160	155	150	mA

\* $V_{CC} = 5.5V$ . Tested with outputs open.  $f = \text{Max}$ . Switching inputs are 0V and 3V.  $\overline{CE} = V_{IL}$ ,  $\overline{OE} = V_{IH}$ .

**DATA RETENTION CHARACTERISTICS (P4C174 Military Temperature Only)**

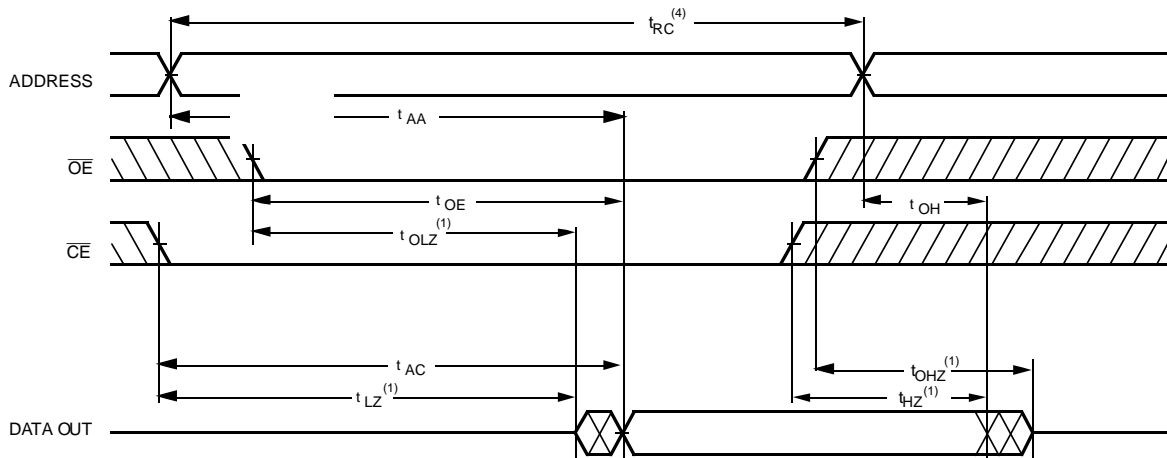
Symbol	Parameter	Test Conditions	Min	Typ.* $V_{CC} =$ 2.0V 3.0V		Max $V_{CC} =$ 2.0V 3.0V		Unit
$V_{DR}$	$V_{CC}$ for Data Retention		2.0					V
$I_{CCDR}$	Data Retention Current	$\overline{CE} \geq V_{CC} - 0.2V$ , $V_{IN} \geq V_{CC} - 0.2V$ or $V_{IN} \leq 0.2V$		10	15	600	900	$\mu A$
$t_{CDR}$	Chip Deselect to Data Retention Time		0					ns
$t_R^\dagger$	Operation Recovery Time		$t_{RC}^\S$					ns

\* $T_A = +25^\circ C$

$t_{RC}^\S$  = Read Cycle Time

$^\dagger$  This parameter is guaranteed but not tested.

**READ CYCLE NO. 1 ( $\overline{OE}$  CONTROLLED)<sup>(2,3)</sup>**



## AC CHARACTERISTICS—READ CYCLE

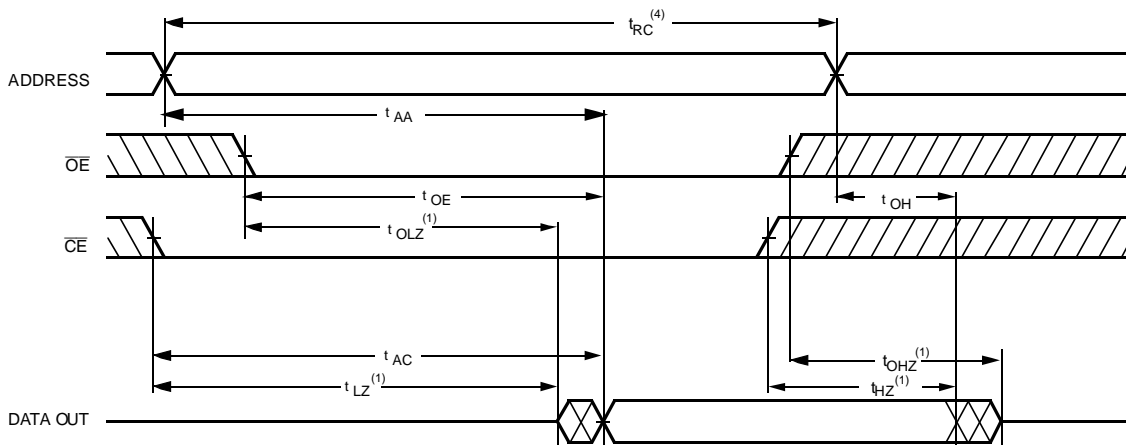
( $V_{CC} = 5V \pm 10\%$ , All Temperature Ranges)<sup>(2)</sup>

Symbol	Parameter	-8		-10		-12		-15		-20		-25		Unit
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
$t_{RC}$	Read Cycle Time	8		10		12		15		20		25		ns
$t_{AA}$	Address Access Time		8		10		12		15		20		25	ns
$t_{OH}$	Address Change to Output Change	3		3		3		3		3		3		ns
$t_{AC}$	Chip Enable LOW to Output Valid		8		10		12		15		20		25	ns
$t_{LZ}$	Chip Enable LOW to Output LOW-Z <sup>(1)</sup>	3		3		3		3		3		3		ns
$t_{HZ}$	Chip Enable HIGH to Output HIGH-Z <sup>(1)</sup>		5		5		5		8		8		10	ns
$t_{OE}$	Output Enable LOW to Output Valid		5		6		6		8		10		12	ns
$t_{OLZ}$	Output Enable LOW to Output LOW-Z <sup>(1)</sup>	0		0		0		0		0		0		ns
$t_{OHZ}$	Output Enable HIGH to Output HIGH-Z <sup>(1)</sup>		5		5		5		5		8		10	ns
$t_{PU}$	Chip Enable LOW or Address Change to Powerup	0		0		0		0		0		0		ns
$t_{PUPD}$	Powerup to Powerdown		20		20		20		20		20		25	ns

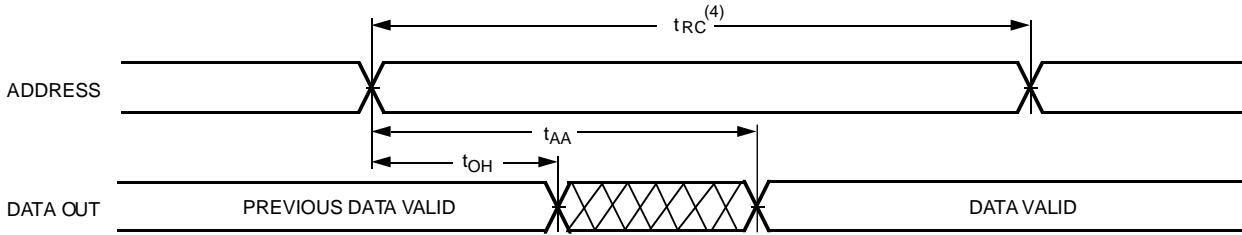
Note:

1. Transition is measured  $\pm 200$  mV from steady state voltage with Output Load B.

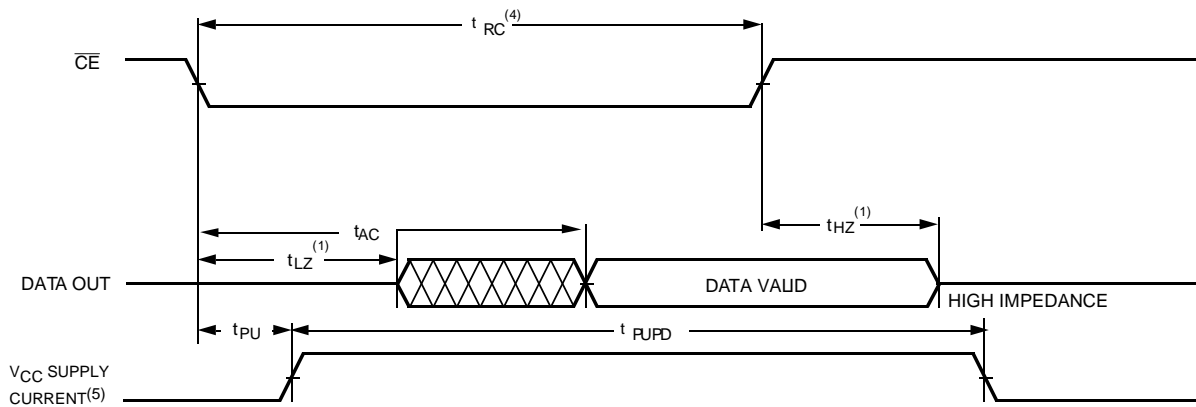
### READ CYCLE NO. 1 (OE CONTROLLED)<sup>(2, 3)</sup>



**READ CYCLE NO. 2 (ADDRESS CONTROLLED)<sup>(2)</sup>**



**READ CYCLE NO. 3 ( $\overline{CE}$  CONTROLLED)<sup>(2, 3)</sup>**



**Notes:**

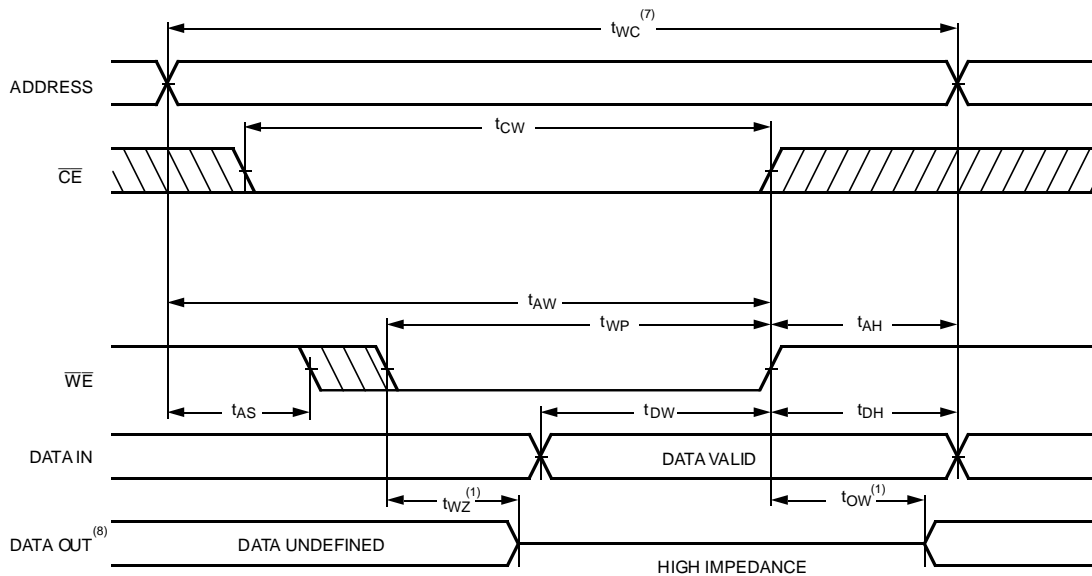
1. Transition is measured  $\pm 200$  mV from steady state voltage with Output Load B. This parameter is sampled, not 100% tested.
2.  $\overline{CE}$  is LOW,  $\overline{OE}$  is LOW,  $\overline{WE}$  is HIGH for READ cycle.  $\overline{CE}$  or  $\overline{WE}$  must be HIGH during address transitions.
3. All address lines are valid no later than the transition of  $\overline{CE}$  to LOW.
4. READ cycle time is measured from the last valid address to the first transitioning address.
5. Powerup occurs as a result of any of the following conditions:
  - a) Falling edge of  $\overline{CE}$ .
  - b) Falling edge of  $\overline{WE}$  ( $\overline{CE}$  active).
  - c) Any address line transition ( $\overline{CE}$  active).
  - d) Any Data line transition ( $\overline{CE}$  and  $\overline{WE}$  active).
 This device automatically powers down after  $T_{PUPD}$  has elapsed from any of the prior conditions. Power dissipation is therefore a function of cycle rate, not  $\overline{CE}$  pulse width.
6.  $\overline{CE}$  is LOW,  $\overline{WE}$  is LOW for WRITE cycle.  $\overline{CE}$  or  $\overline{WE}$  must be HIGH during address transitions.
7. WRITE cycle time is measured from the last valid address to the first transitioning address.
8.  $\overline{OE}$  is LOW for this WRITE cycle to show  $T_{WZ}$  and  $T_{OW}$ .

## AC CHARACTERISTICS - WRITE CYCLE

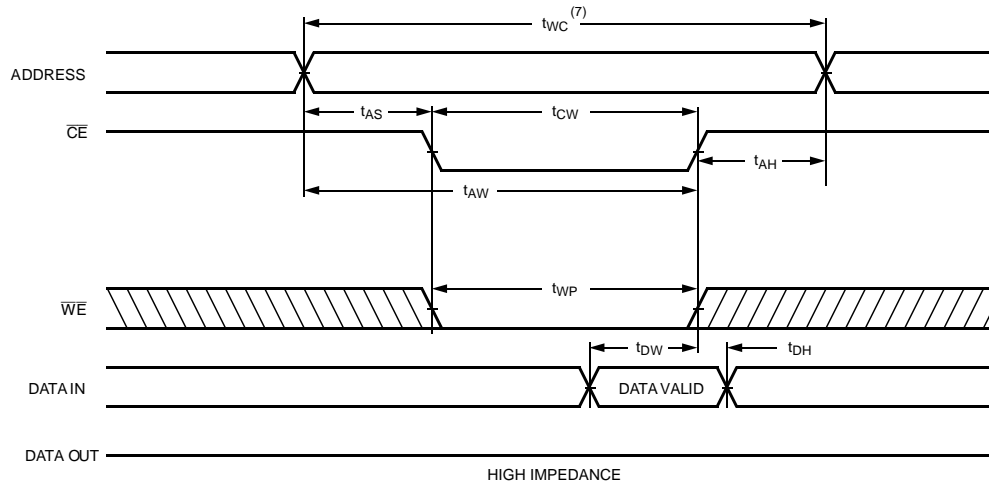
( $V_{CC} = 5V \pm 10\%$ ,  $0^\circ C$  to  $+70^\circ C$ )

Symbol	Parameter	-8		-10		-12		-15		-20		-25		Unit
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
$t_{WC}$	Write Cycle Time	8		10		12		15		20		20		ns
$t_{CW}$	Chip Enable LOW to End of Write	7		9		10		12		15		15		ns
$t_{AS}$	Address Valid to Beginning of Write	0		0		0		0		0		0		ns
$t_{AW}$	Address Valid to End of Write	7		9		10		12		15		15		ns
$t_{AH}$	End of Write to Address Change	0		0		0		0		0		0		ns
$t_{WP}$	Write Pulse Width	7		9		10		12		15		15		ns
$t_{DW}$	Data Valid to End of Write	6		6		6		7		10		10		ns
$t_{DH}$	End of Write to Data Change	0		0		0		0		0		0		ns
$t_{OW}$	Write Enable HIGH to Output LOW-Z <sup>(1)</sup>	0		0		0		0		0		0		ns
$t_{WZ}$	Write Enable LOW to Output HIGH-Z <sup>(1)</sup>		4		4		4		5		7		7	ns

### WRITE CYCLE NO. 1 ( $\overline{WE}$ CONTROLLED)<sup>(6)</sup>



### WRITE CYCLE NO. 2 ( $\overline{CE}$ CONTROLLED)<sup>(6)</sup>

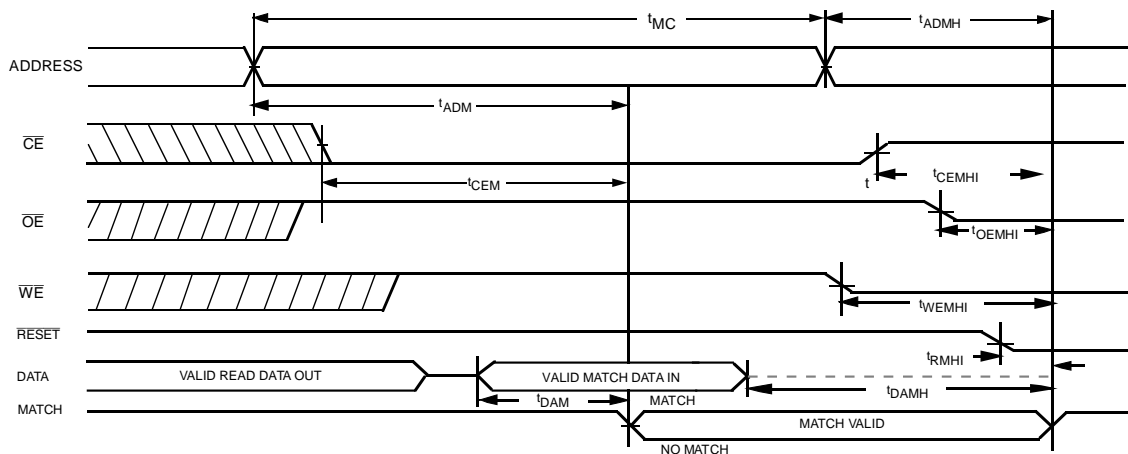


### AC CHARACTERISTICS - MARCH CYCLE

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

Symbol	Parameter	-8		-10		-12		-15		-20		-25		Unit
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
$t_{MC}$	Match Cycle Time	8		10		12		15		20		25		ns
$t_{ADM}$	Address Valid to MATCH Valid		8		10		12		15		20		25	ns
$t_{ADMH}$	Address Change to MATCH Change	3		3		3		3		3		3		ns
$t_{CEM}$	Chip Enable LOW to MATCH Valid		7		8		8		10		10		15	ns
$t_{CEMHI}$	Chip Enable HIGH to MATCH HIGH		7		8		8		10		10		15	ns
$t_{OEMHI}$	Output Enable LOW to MATCH HIGH		7		9		10		12		15		20	ns
$t_{WEMHI}$	Write Enable LOW to MATCH HIGH		7		9		10		12		15		20	ns
$t_{DAM}$	Data Valid to MATCH Valid		7		9		10		13		15		15	ns
$t_{DAMH}$	Data Change to MATCH Change	0		0		0		0		0		0		ns

### MATCH TIMING

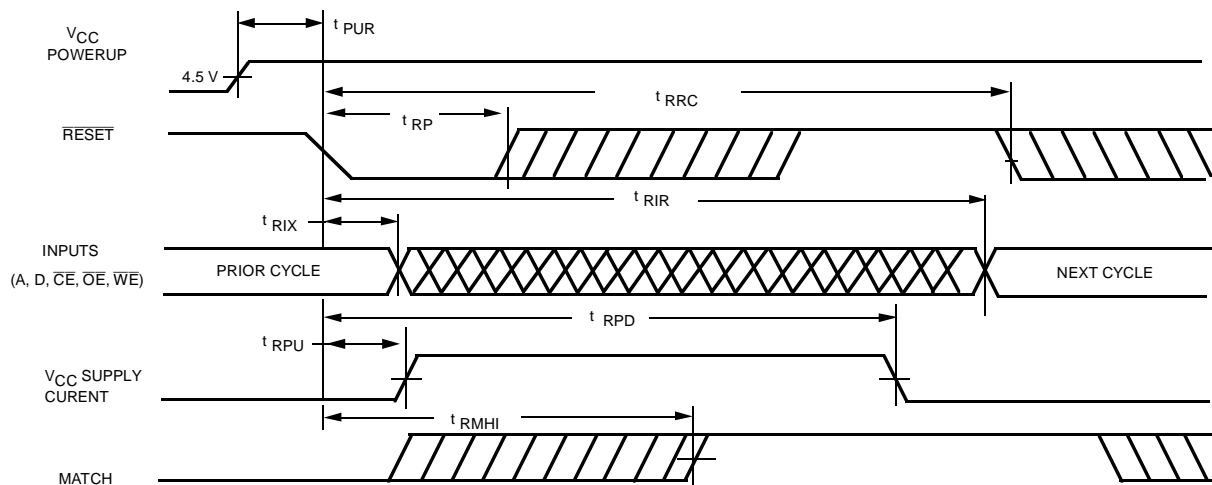


## AC CHARACTERISTICS - RESET CYCLE

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

Symbol	Parameter	-8		-10		-12		-15		-20		-25		Unit
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
$t_{RRC}$	Reset Cycle Time	35		40		45		50		50		60		ns
$t_{RP}$	Reset Pulse Width	8		10		12		12		15		15		ns
$t_{RPU}$	Reset LOW to Powerup	0		0		0		0		0		0		ns
$t_{RPD}$	Reset LOW to Powerdown		35		40		45		50		50		60	ns
$t_{RMHI}$	Reset LOW to MATCH HIGH	0	8	0	10	0	10	0	12	0	15	0	20	ns
$t_{RIX}$	Reset LOW to Inputs Ignored	0		0		0		0		0		0		ns
$t_{RIR}$	Reset LOW to inputs Recognized		35		40		45		50		50		60	ns
$t_{PUR}$	Powerup to RESET LOW	8		10		12		15		20		25		ns

## RESET TIMING



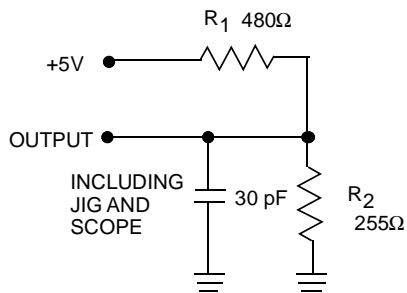
## AC TEST CONDITIONS

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	Outputs Loads A, B & C

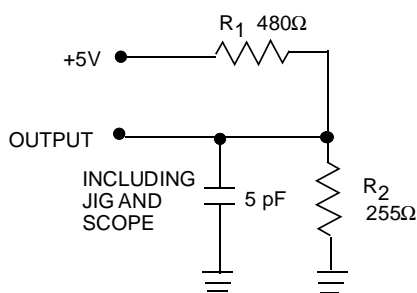
## TRUTH TABLE

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

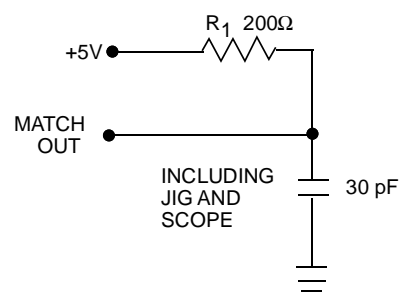




OUTPUT LOAD A



OUTPUT LOAD B



OUTPUT LOAD C

**PACKAGE SUFFIX**

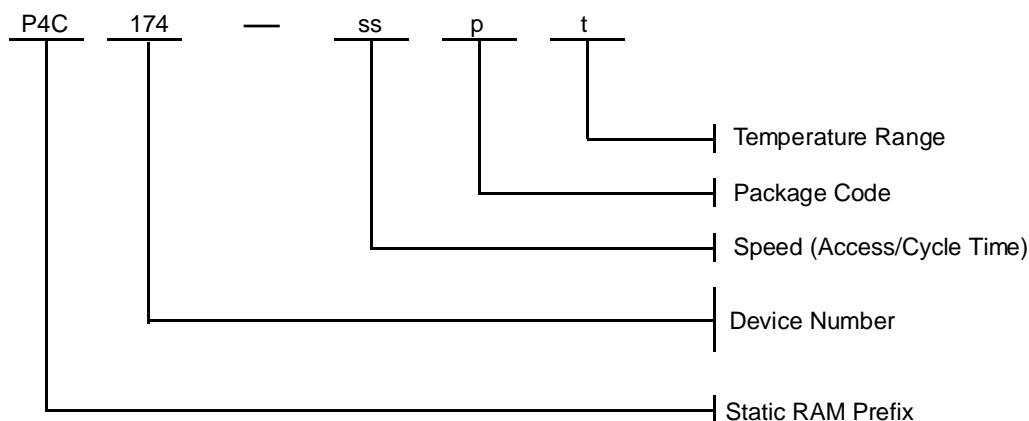
Package Suffix	Description
P	Plastic DIP, 300 mil wide standard
J	Plastic SOJ, 300 mil wide standard

**TEMPERATURE RANGE SUFFIX**

Temperature Range Suffix	Description
C	Commercial Temp. Range, 0°C to +70°C.

**ORDERING INFORMATION**

Performance Semiconductor's part numbering scheme is as follows:



SS = Speed (access/cycle time in ns), e.g., 10, 12, 15

P = Package code, i.e., P, J.

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

**SELECTION GUIDE**

The P4C174 is available in the following temperature, speed and package options.

Temperature Range	Speed (ns)						
	Package	8	10	12	15	20	25
Commercial	Plastic DIP (300 mil)	-8PC	-10PC	-12PC	-15PC	-20PC	-25PC
	Plastic SOJ (300 mil)	-8JC	-10JC	-12JC	-15JC	-20JC	-25JC

