

# P4C116

## ULTRA HIGH SPEED 2K x 8

## STATIC CMOS RAMS



### FEATURES

- Full CMOS, 6T Cell
- High Speed (Equal Access and Cycle Times)
  - 10/12/15/20/25/35 ns (Commercial)
  - 15/20/25/35 ns (Military)
- Low Power Operation
  - 633/715 mW Active — 15, 20
  - 550/633 mW Active — 25, 35
  - 193/220 mW Standby (TTL Input)
- Output Enable Control Function
- Single  $5V \pm 10\%$  Power Supply
- Common Data I/O
- Fully TTL Compatible Inputs and Outputs
- Produced with PACE II Technology™
- Standard Pinout (JEDEC Approved)
  - 24-Pin 300 mil DIP, SOIC, SOJ
  - 24-Pin Rectangular LCC (300 x 400 mils)
  - 28-Pin Square LCC (450 x 450 mils)



### DESCRIPTION

The P4C116 is a 16,384-bit ultra high-speed static RAMs organized as 2K x 8. 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  $5V \pm 10\%$  tolerance power supply. Current drain is typically 10  $\mu A$  from a 2.0V supply.

Access times as fast as 10 nanoseconds are available,

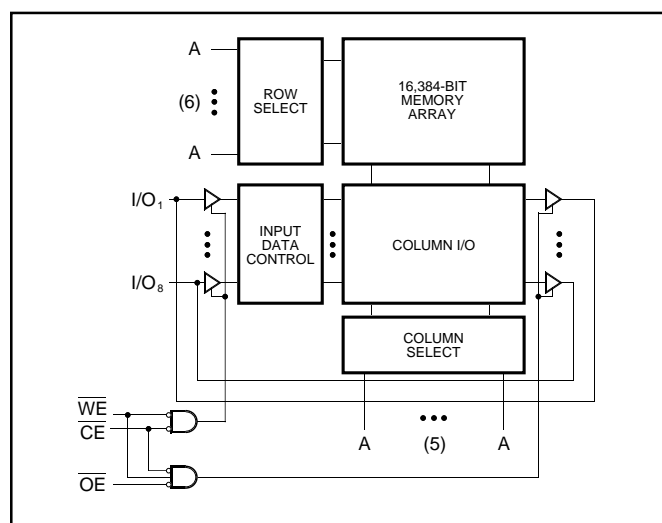
permitting greatly enhanced system operating speeds. CMOS is used to reduce power consumption to a low 633 mW active, 193 mW standby.

The P4C116 is available in 24-pin 300 mil DIP, SOJ and SOIC packages providing excellent board level densities.

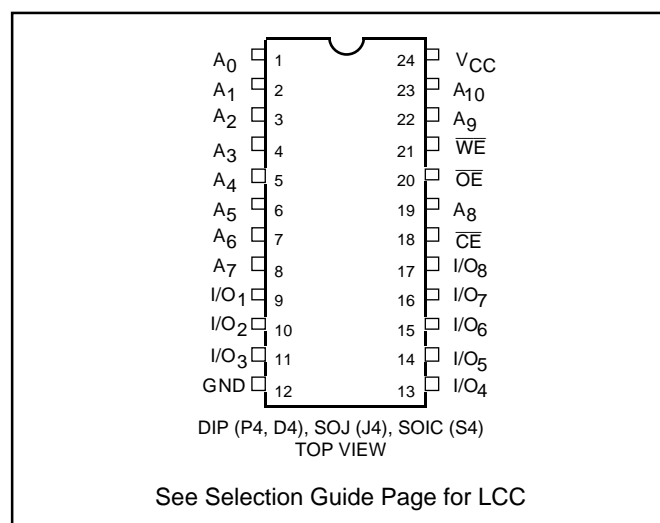
The P4C116 is also available in 24-pin rectangular and 28-pin square LCC packages.



### FUNCTIONAL BLOCK DIAGRAM



### PIN CONFIGURATIONS



## 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 CONDITIONS

Grade <sup>(2)</sup>	Ambient Temp	Gnd	Vcc
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	P4C116		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	$V_{CC} = \text{Max.}, \overline{CS} = V_{IH}, V_{OUT} = \text{GND to } V_{CC}$	−5	+5	μA
$I_{CC}$	Dynamic Operating Current – 10, 12	$V_{CC} = \text{Max.}, f = \text{Max.}, \text{Outputs Open}$		130	mA
$I_{CC}$	Dynamic Operating Current – 15, 20	$V_{CC} = \text{Max.}, f = \text{Max.}, \text{Outputs Open}$	—	115	mA
$I_{CC}$	Dynamic Operating Current – 25, 35	$V_{CC} = \text{Max.}, f = \text{Max.}, \text{Outputs Open}$	—	100	mA
$I_{SB}$	Standby Power Supply Current (TTL Input Levels)	$\overline{CE} \geq V_{IH}, V_{CC} = \text{Max.}, f = \text{Max.}, \text{Outputs Open}$	—	35	mA
$I_{SBI}$	Standby Power Supply Current (CMOS Input Levels)	$\overline{CE} \geq V_{HC}, V_{CC} = \text{Max.}, f = 0, \text{Outputs Open}$ $V_{IN} \leq V_{LC} \text{ or } V_{IN} \geq V_{HC}$	—	17	mA

## POWER DISSIPATION CHARACTERISTICS VS. SPEED

Symbol	Parameter	Temperature Range	–10	–12	–15	–20	–25	–35	Unit
$I_{CC}$	Dynamic Operating Current*	Commercial	180	170	160	155	150	140	mA
		Military	N/A	N/A	170	160	155	150	mA

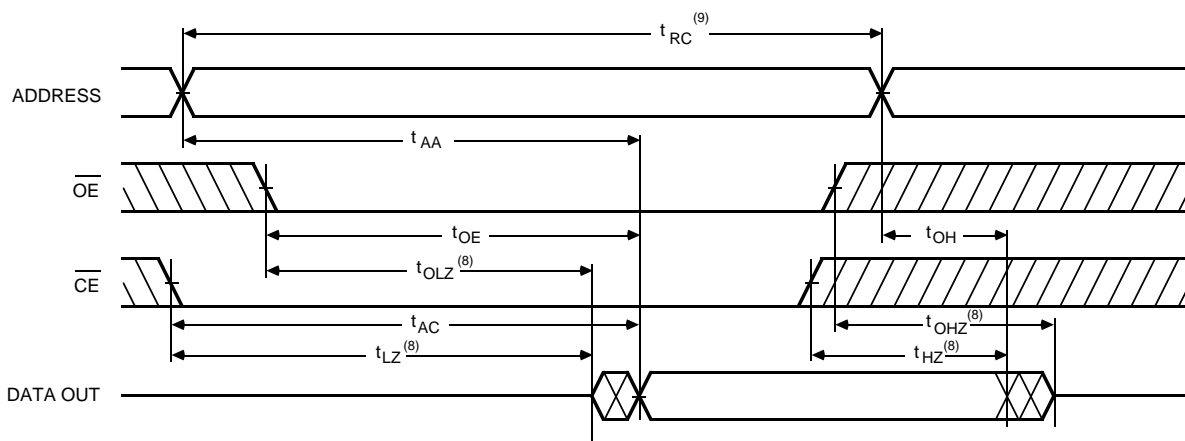
\* $V_{CC} = 5.5V$ . Tested with outputs open.  $f = \text{Max}$ . Switching inputs are 0V and 3V.  $\overline{CE} = V_{IL}$ ,  $\overline{OE} = V_{IH}$ .

## AC ELECTRICAL CHARACTERISTICS—READ CYCLE

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

Sym.	Parameter	–10		–12		–15		–20		–25		–35		Unit
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
$t_{RC}$	Read Cycle Time	10		12		15		20		25		35		ns
$t_{AA}$	Address Access Time		10		12		15		20		25		35	ns
$t_{AC}$	Chip Enable Access Time		10		12		15		20		25		35	ns
$t_{OH}$	Output Hold from Address Change	2		2		2		2		2		2		ns
$t_{LZ}$	Chip Enable to Output in Low Z	2		2		2		2		3		3		ns
$t_{HZ}$	Chip Disable to Output in High Z		5		6		7		8		10		15	ns
$t_{OE}$	Output Enable Low to Data Valid		6		8		10		10		15		20	ns
$t_{OLZ}$	Output Enable Low to Low Z	0		0		0		0		0		0		ns
$t_{OHZ}$	Output Enable High to High Z		6		7		8		9		12		15	ns
$t_{PU}$	Chip Enable to Power Up Time	0		0		0		0		0		0		ns
$t_{PD}$	Chip Disable to Power Down		10		12		15		20		20		25	ns

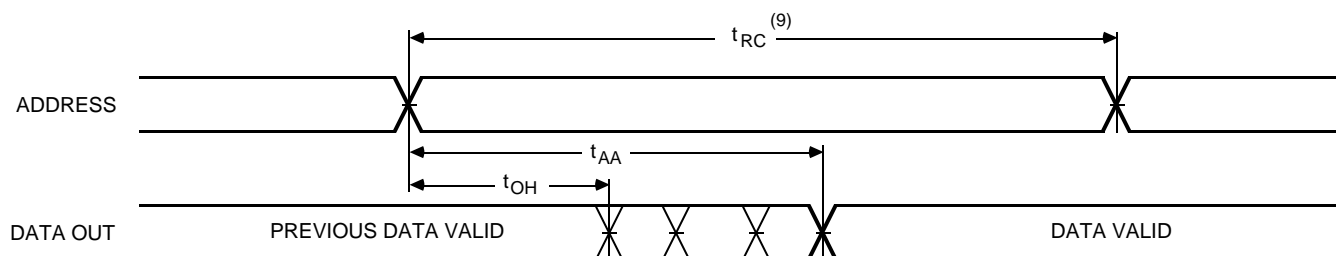
## TIMING WAVEFORM OF READ CYCLE NO. 1 ( $\overline{OE}$ CONTROLLED)<sup>(5)</sup>



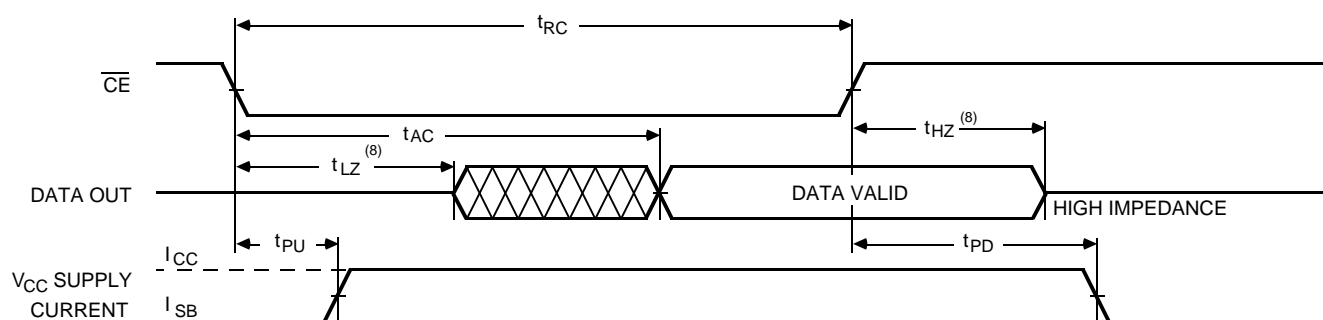
### Notes:

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

## TIMING WAVEFORM OF READ CYCLE NO. 2 (ADDRESS CONTROLLED)<sup>(5,6)</sup>



## TIMING WAVEFORM OF READ CYCLE NO. 3 ( $\overline{CE}$ CONTROLLED)<sup>(5,7)</sup>

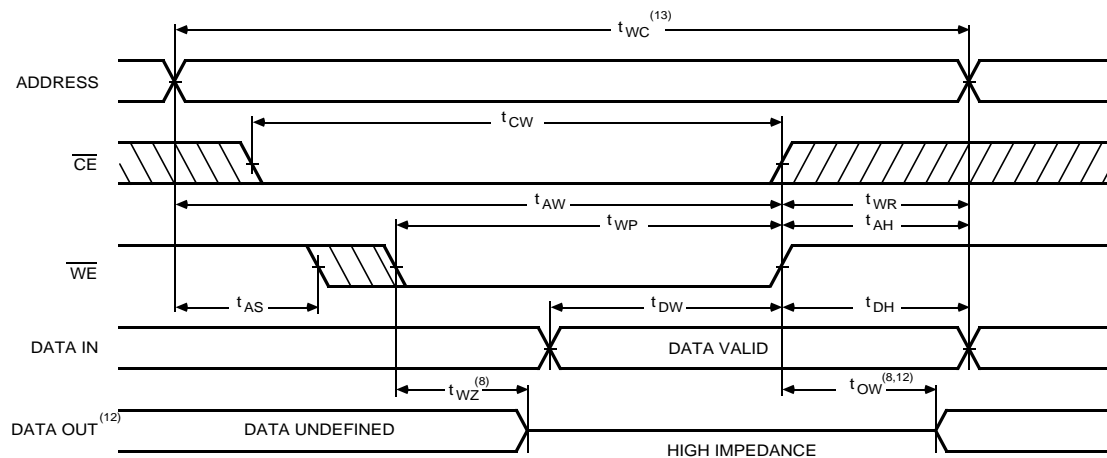


## AC CHARACTERISTICS—WRITE CYCLE

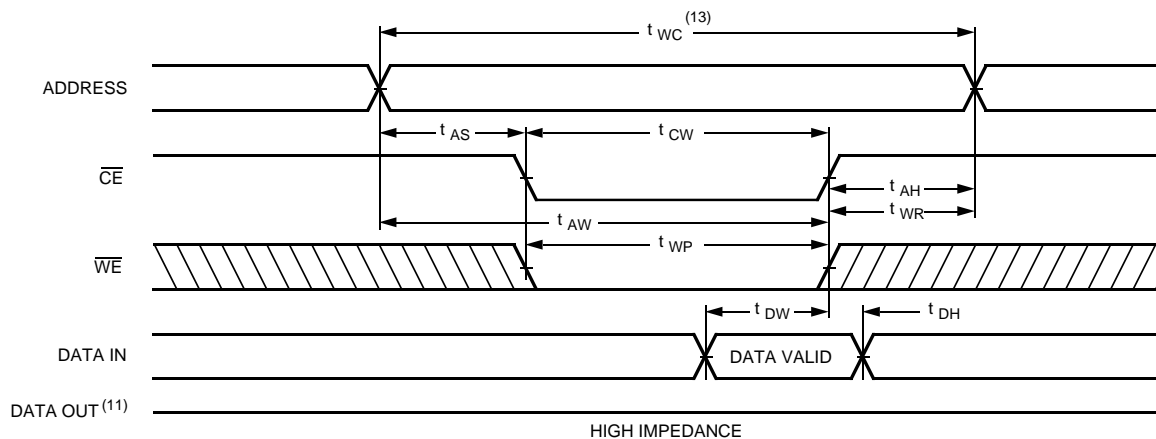
( $V_{CC} = 5V \pm 10\%$ , All Temperature Ranges)<sup>(2)</sup>

Sym.	Parameter	-10		-12		-15		-20		-25		-35		Unit
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
$t_{WC}$	Write Cycle Time	10		12		15		20		25		35		ns
$t_{CW}$	Chip Enable Time to End of Write	8		10		12		15		18		25		ns
$t_{AW}$	Address Valid to End of Write	8		10		12		15		18		25		ns
$t_{AS}$	Address Set-up Time	0		0		0		0		0		0		ns
$t_{WP}$	Write Pulse Width	8		10		12		15		18		20		ns
$t_{AH}$	Address Hold Time	0		0		0		0		0		0		ns
$t_{DW}$	Data Valid to End of Write	7		8		10		12		15		20		ns
$t_{DH}$	Data Hold Time	0		0		0		0		0		0		ns
$t_{WZ}$	Write Enable to Output in High Z		6		7		8		10		15		15	ns
$t_{OW}$	Output Active from End of Write	0		0		0		0		0		0		ns

### TIMING WAVEFORM OF WRITE CYCLE NO. 1 ( $\overline{WE}$ CONTROLLED)<sup>(10,11)</sup>



### TIMING WAVEFORM OF WRITE CYCLE NO. 2 ( $\overline{CE}$ CONTROLLED)<sup>(10)</sup>



#### Notes:

10.  $\overline{CE}$  and  $\overline{WE}$  must be LOW for WRITE cycle.

11.  $\overline{OE}$  is LOW for this WRITE cycle to show  $t_{WZ}$  and  $t_{OW}$ .

12. If  $\overline{CE}$  goes HIGH simultaneously with  $\overline{WE}$  HIGH, the output remains

in a high impedance state

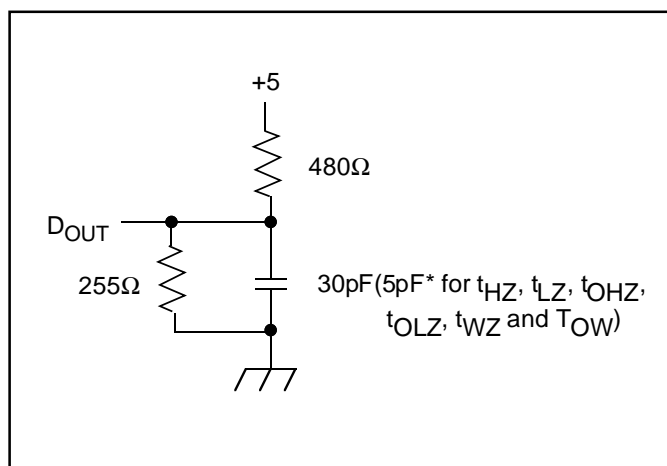
13. Write Cycle Time is measured from the last valid address to the first transitioning address.

## 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

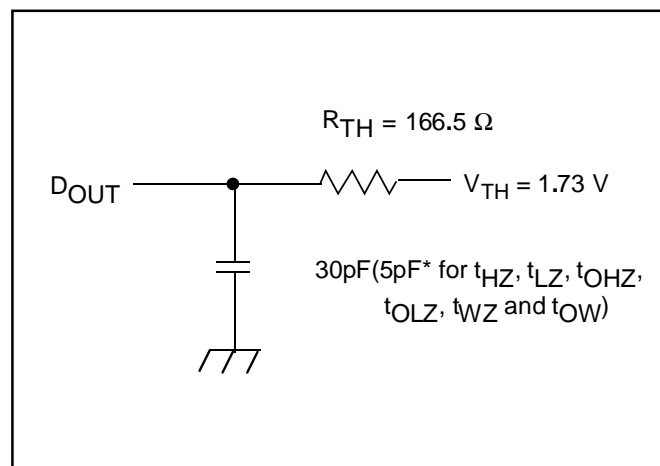
## TRUTH TABLE

Mode	$\overline{CE}$	$\overline{OE}$	$\overline{WE}$	I/O	Power
Standby	H	X	X	High Z	Standby
D <sub>OUT</sub> Disabled	L	H	H	High Z	Active
Read	L	L	H	D <sub>OUT</sub>	Active
Write	L	X	L	High Z	Active



**Figure 1. Output Load**

\* including scope and test fixture.



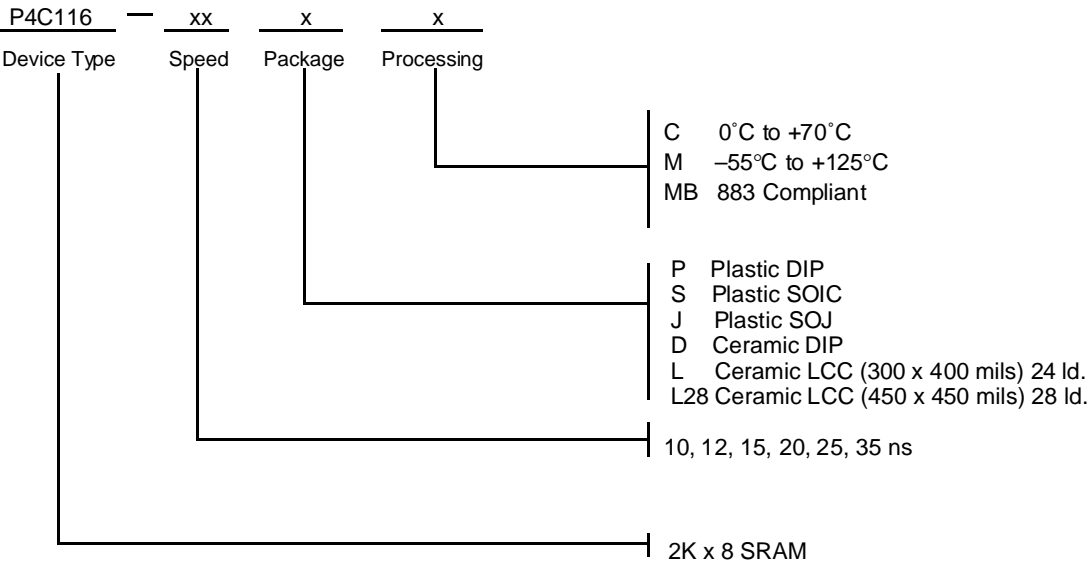
**Figure 2. Thevenin Equivalent**

### Note:

Because of the ultra-high speed of the P4C116/L, care must be taken when testing this device; 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  $\mu$ F high frequency

capacitor is also required between  $V_{CC}$  and ground. To avoid signal reflections, proper termination must be used; for example, a 50 $\Omega$  test environment should be terminated into a 50 $\Omega$  load with 1.73V (Thevenin Voltage) at the comparator input, and a 116 $\Omega$  resistor must be used in series with D<sub>OUT</sub> to match 166 $\Omega$  (Thevenin Resistance).

# ORDERING INFORMATION



The P4C116 is also available to SMD-5962-89690 & 5962-84036

## SELECTION GUIDE

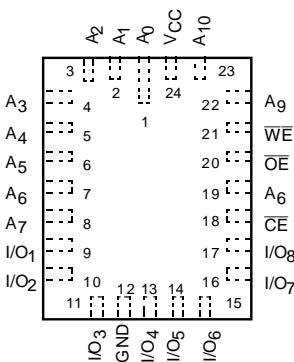
The P4C116 is available in the following temperature, speed and package options.

Temperature Range	Package \ Speed (ns)	10	12	15	20	25	35
Commercial	Plastic DIP	-10PC	-12PC	-15PC	-20PC	-25PC	-35PC
	Plastic SOIC	-10SC	-12SC	-15SC	-20SC	-25SC	-35SC
	Plastic SOJ	-10JC	-12JC	-15JC	-20JC	-25JC	-35JC
Military Temp.	CERDIP (300 mil)	N/A	N/A	-15DM	-20DM	-25DM	-35DM
	LCC (rectangular)	N/A	N/A	-15LM	-20LM	-25LM	-35LM
	LCC (square)	N/A	N/A	-15L28M	-20L28M	-25L28M	-35L28M
Military Processed*	CERDIP (300 mil)	N/A	N/A	-15DMB	-20DMB	-25DMB	-35DMB
	LCC (rectangular)	N/A	N/A	-15LMB	-20LMB	-25LMB	-35LMB
	LCC (square)	N/A	N/A	-15L28MB	-20L28MB	-25L28MB	-35L28MB

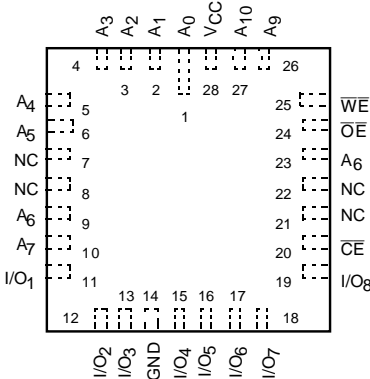
\* Military temperature range with MIL-STD-883, Class B processing.

N/A = Not Available

## LCC PIN CONFIGURATIONS



LCC (L8)  
TOP VIEW



LCC (L5-1)  
TOP VIEW

