

### FEATURES

- Full CMOS, 6T Cell
- High Speed (Equal Access and Cycle Times)
  - 15/20/25/35 ns (Commercial/Industrial)
  - 15/20/25/35/45 ns (Military)
- Low Power Operation
- Single 5V±10% Power Supply
- Output Enable ( $\overline{OE}$ ) & Chip Enable ( $\overline{CE}_1$  and  $\overline{CE}_2$ ) Control Functions
- Data Retention with 2.0V Supply (P4C1299L)
- Three-State Outputs
- TTL/CMOS Compatible Outputs
- Fully TTL Compatible Inputs
- Standard Pinout (JEDEC Approved)
  - 28-Pin 300 mil DIP, SOJ
  - 28-Pin 350x550 mil LCC



### DESCRIPTION

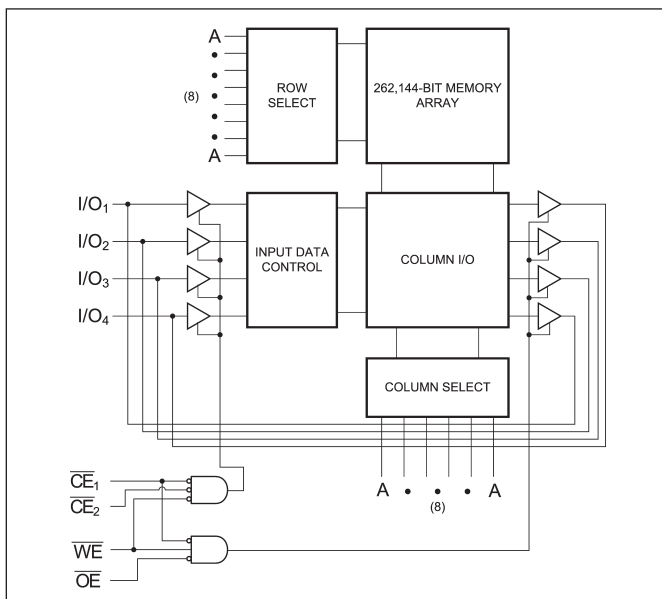
The P4C1299 and P4C1299L are a 262,144-bit ultra high-speed static RAM organized as 64Kx4. The CMOS memory requires no clock or refreshing and has equal access and cycle times. Inputs and outputs are fully TTL-compatible. The RAM operates from a single 5V±10% tolerance power supply. With battery backup (P4C1299L Only), data integrity is maintained for supply voltages down to 2.0V. Current drain is typically 10  $\mu$ A from a 2.0V supply.

Access times as fast as 15 nanoseconds are available, permitting greatly enhanced system speeds. CMOS is utilized to reduce power consumption.

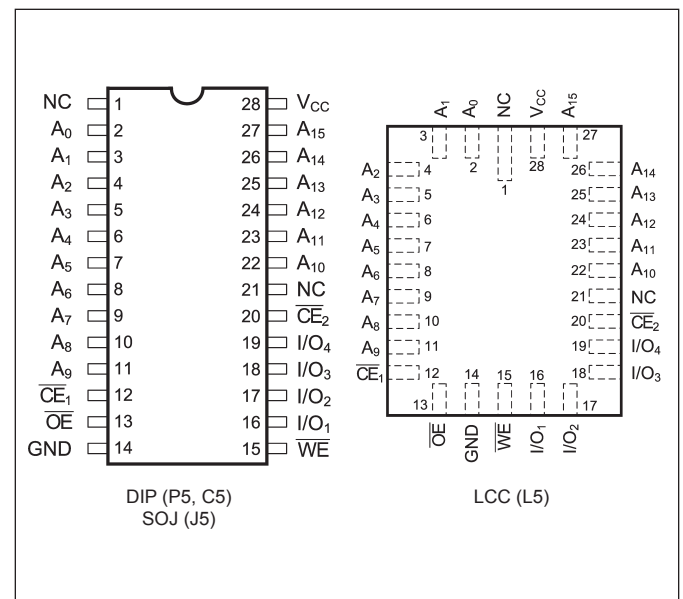
The P4C1299 and P4C1299L are available in a 28-pin 300 mil DIP or SOJ, as well as a 28-pin 350x550 mil LCC package, providing excellent board level densities.



### FUNCTIONAL BLOCK DIAGRAM



### PIN CONFIGURATIONS





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

Sym	Parameter	Value	Unit
V <sub>CC</sub>	Power Supply Pin with Respect to GND	-0.5 to +7	V
V <sub>TERM</sub>	Terminal Voltage with Respect to GND (up to 7.0V)	-0.5 to V <sub>CC</sub> + 0.5	V
T <sub>A</sub>	Operating Temperature	-55 to +125	°C
T <sub>BIAS</sub>	Temperature Under Bias	-55 to +125	°C
T <sub>STG</sub>	Storage Temperature	-65 to +150	°C
P <sub>T</sub>	Power Dissipation	1.0	W
I <sub>OUT</sub>	DC Output Current	50	mA

### RECOMMENDED OPERATING CONDITIONS

Grade <sup>(2)</sup>	Ambient Temp	GND	V <sub>CC</sub>
Commercial	0°C to 70°C	0V	5.0V ± 10%
Industrial	-40°C to +85°C	0V	5.0V ± 10%
Military	-55°C to +125°C	0V	5.0V ± 10%

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

(V<sub>CC</sub> = 5.0V, T<sub>A</sub> = 25°C, f = 1.0MHz)

Sym	Parameter	Conditions	Typ	Unit
C <sub>IN</sub>	Input Capacitance	V <sub>IN</sub> =0V	5	pF
C <sub>OUT</sub>	Output Capacitance	V <sub>OUT</sub> =0V	7	pF

### DC ELECTRICAL CHARACTERISTICS

(Over Recommended Operating Temperature & Supply Voltage)<sup>(2)</sup>

Sym	Parameter	Test Conditions	P4C1299		P4C1299L		Unit	
			Min	Max	Min	Max		
V <sub>IH</sub>	Input High Voltage		2.2	V <sub>CC</sub> + 0.5	2.2	V <sub>CC</sub> + 0.5	V	
V <sub>IL</sub>	Input Low Voltage		-0.5 <sup>(3)</sup>	0.8	-0.5 <sup>(3)</sup>	0.8	V	
V <sub>HC</sub>	CMOS Input High Voltage		V <sub>CC</sub> - 0.2	V <sub>CC</sub> + 0.5	V <sub>CC</sub> - 0.2	V <sub>CC</sub> + 0.5	V	
V <sub>LC</sub>	CMOS Input Low Voltage		-0.5 <sup>(3)</sup>	0.2	-0.5 <sup>(3)</sup>	0.2	V	
V <sub>CD</sub>	Input Clamp Diode Voltage	V <sub>CC</sub> = Min, I <sub>IN</sub> = 18 mA		-1.2		-1.2	V	
V <sub>OL</sub>	Output Low Voltage (TTL Load)	I <sub>OL</sub> = +8 mA, V <sub>CC</sub> = Min		0.4		0.4	V	
V <sub>OH</sub>	Output High Voltage (TTL Load)	I <sub>OH</sub> = -4 mA, V <sub>CC</sub> = Min	2.4		2.4		V	
I <sub>LI</sub>	Input Leakage Current	V <sub>CC</sub> = Max, V <sub>IN</sub> = GND to V <sub>CC</sub>	MIL	-10	+10	-10	+10	µA
			IND/COM	-5	+5	-5	+5	
I <sub>LO</sub>	Output Leakage Current	V <sub>CC</sub> = Max, V <sub>OUT</sub> = GND to V <sub>CC</sub>	MIL	-10	+10	-10	+10	µA
			IND/COM	-5	+5	-5	+5	
I <sub>SB</sub>	Standby Power Supply Current (TTL Input Levels)	CE <sub>1,2</sub> ≥ V <sub>IN</sub> , V <sub>CC</sub> = Max, f = Max, Outputs Open	MIL	—	40	—	35	mA
			IND/COM	—	30	—	30	
I <sub>SB1</sub>	Standby Power Supply Current (CMOS Input Levels)	CE <sub>1,2</sub> ≥ V <sub>HC</sub> , V <sub>CC</sub> = Max, f = 0, Outputs Open V <sub>IN</sub> ≤ V <sub>LC</sub> or V <sub>IN</sub> ≥ V <sub>HC</sub>	MIL	—	15	—	10	mA
			IND/COM	—	10	—	8	

N/A = Not applicable



### POWER DISSIPATION CHARACTERISTICS VS. SPEED

Sym	Parameter	Temperature Range	-15	-20	-25	-35	-45	Unit
I <sub>CC</sub>	Dynamic Operating Current*	Commercial	160	125	115	110	110	mA
		Industrial	160	135	120	115	115	mA
		Military	160	150	120	120	120	mA

\* V<sub>CC</sub> = 5.5V. Tested with outputs open. f = Max. Switching inputs are 0V and 3V.  $\overline{CE}_{1,2} = V_{IL}$

### DATA RETENTION CHARACTERISTICS (P4C1299L Only)

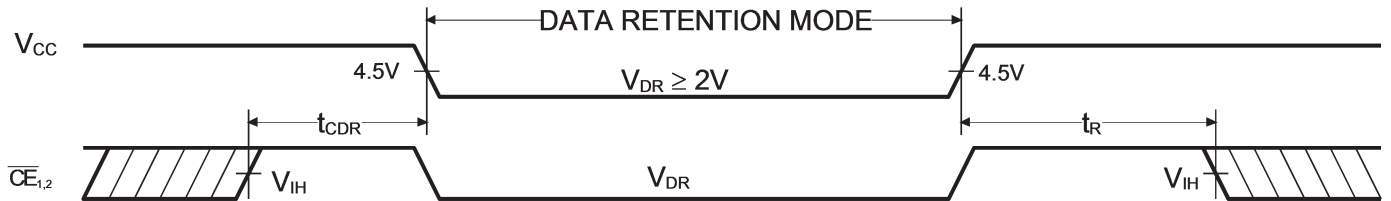
Sym	Parameter	Test Conditions	Min	Typ* V <sub>CC</sub> =		Max V <sub>CC</sub> =		Unit
				2.0V	3.0V	2.0V	3.0V	
V <sub>DR</sub>	V <sub>CC</sub> for Data Retention		2.0					V
I <sub>CCDR</sub>	Data Retention Current	$\overline{CE}_{1,2} \geq V_{CC} - 0.2V$ $V_{IN} \geq V_{CC} - 0.2V$ or $V_{IN} \leq 0.2V$		10	15	1000	2000	μA
t <sub>CDR</sub>	Chip Deselect to Data Retention Time		0					ns
t <sub>R</sub> <sup>†</sup>	Operation Recovery Time		t <sub>RC</sub> <sup>§</sup>					ns

\* T<sub>A</sub> = +25°C

§ t<sub>RC</sub> = Read Cycle Time

† This Parameter is guaranteed but not tested

### DATA RETENTION WAVEFORM

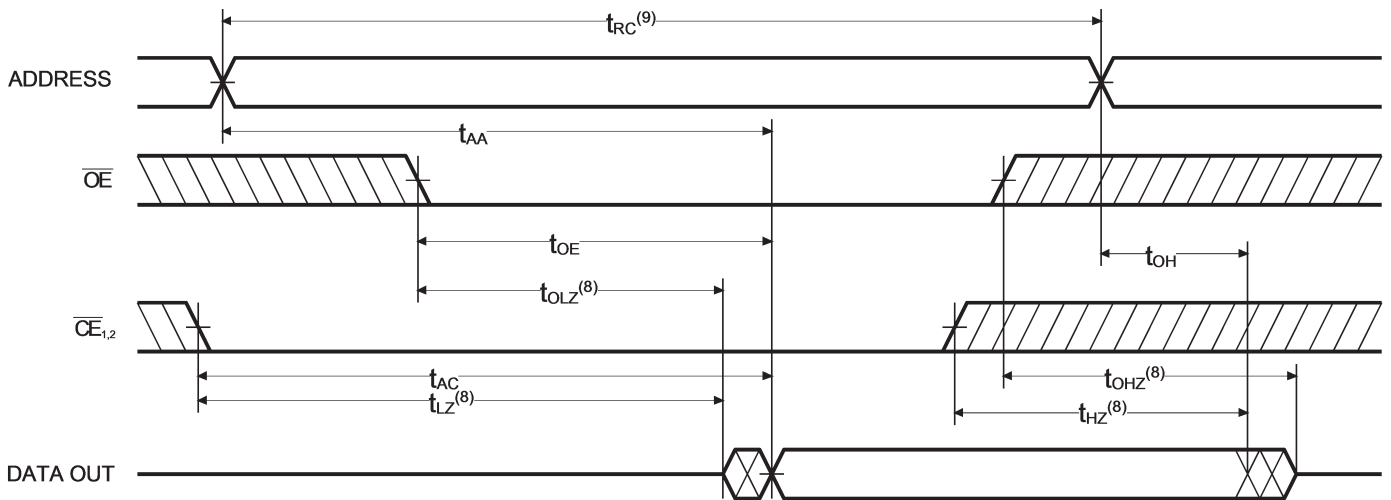


### AC ELECTRICAL CHARACTERISTICS—READ CYCLE

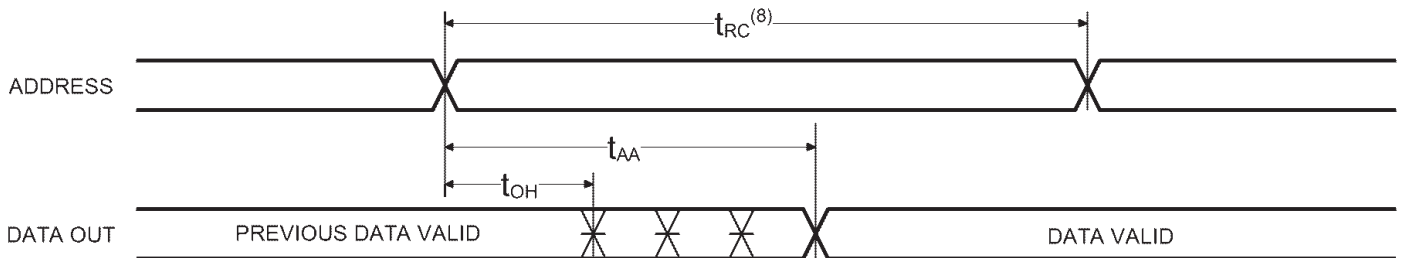
(V<sub>CC</sub> = 5V ± 10%, All Temperature Ranges)<sup>(2)</sup>

Sym	Parameter	-15		-20		-25		-35		-45		Unit
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
t <sub>RC</sub>	Read Cycle Time	15		20		25		35		45		ns
t <sub>AA</sub>	Address Access Time		15		20		25		35		45	ns
t <sub>AC</sub>	Chip Enable Access Time		15		20		25		35		45	ns
t <sub>OH</sub>	Output Hold from Address Change	3		3		3		3		3		ns
t <sub>LZ</sub>	Chip Enable to Output in Low Z	3		3		3		3		3		ns
t <sub>HZ</sub>	Chip Disable to Output in High Z		8		10		15		15		20	ns
t <sub>OE</sub>	Output Enable Low to Data Valid		8		10		15		25		30	ns
t <sub>OLZ</sub>	Output Enable Low to Low Z	0		0		0		0		0		ns
t <sub>OHZ</sub>	Output Enable High to High Z		9		9		15		20		20	ns
t <sub>PU</sub>	Chip Enable to Power Up Time	0		0		0		0		0		ns
t <sub>PD</sub>	Chip Disable to Power Down		15		20		25		35		45	ns

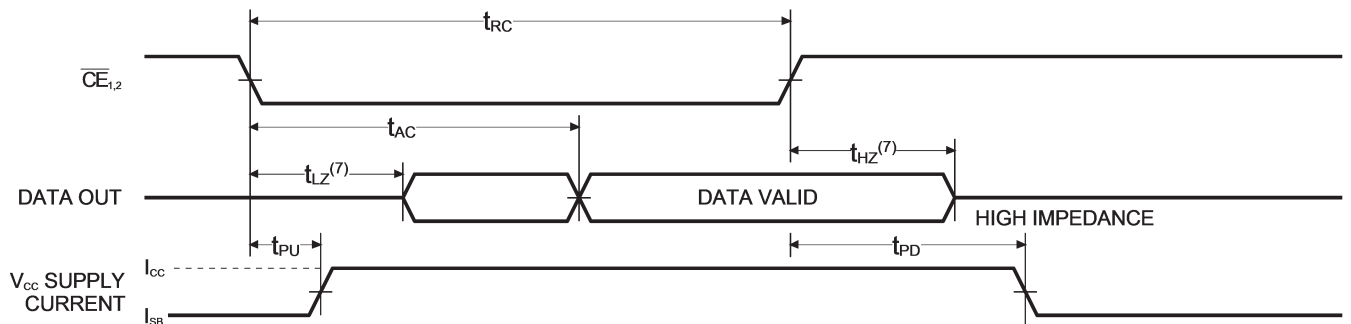
**TIMING WAVEFORM OF READ CYCLE NO. 1 ( $\overline{OE}$  CONTROLLED)<sup>(5)</sup>**



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



**TIMING WAVEFORM OF READ CYCLE NO. 3 ( $\overline{CE}_{1,2}$  CONTROLLED)<sup>(5,6)</sup>**



**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  $V_L$  and  $I_L$  not more negative than  $-3.0V$  and  $-100mA$ , respectively, are permissible for pulse widths up to 20ns.
4. This parameter is sampled and not 100% tested.
5.  $\overline{CE}_1$  and  $\overline{CE}_2$  are LOW and  $\overline{WE}$  is HIGH for READ cycle.
6.  $\overline{WE}$  is HIGH and ADDRESS must be valid prior to, or coincident with  $\overline{CE}_1$  and  $\overline{CE}_2$  transitions LOW.
7. 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.
8. Read Cycle Time is measured from the last valid address to the first transitioning address.

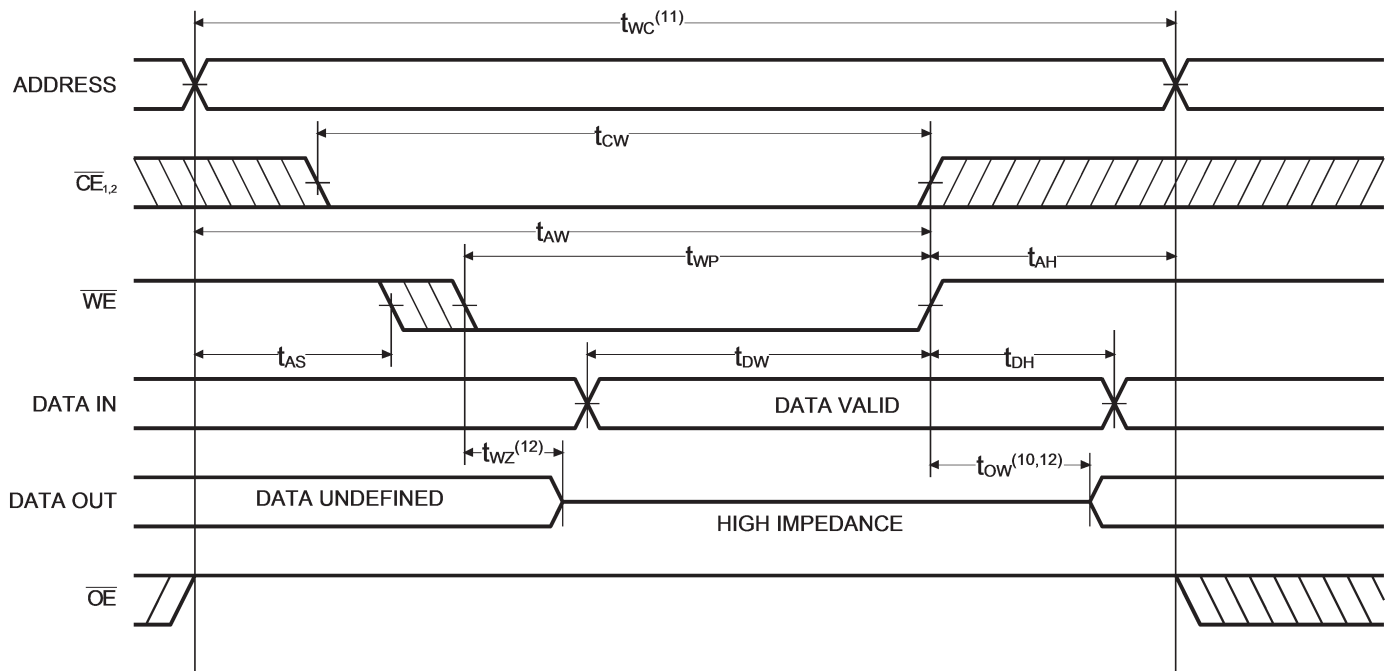


## AC CHARACTERISTICS—WRITE CYCLE

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

Sym	Parameter	-15		-20		-25		-35		-45		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		15		18		ns
$t_{AW}$	Address Valid to End of Write	8		10		12		15		18		ns
$t_{AS}$	Address Setup Time	0		0		0		0		0		ns
$t_{WP}$	Write Pulse Width	8		10		12		15		18		ns
$t_{AH}$	Address Hold Time	0		0		0		0		0		ns
$t_{DW}$	Data Valid to End of Write	7		8		10		12		15		ns
$t_{DH}$	Data Hold Time	0		0		0		0		0		ns
$t_{WZ}$	Write Enable to Output in High Z		6		7		8		10		15	ns
$t_{OW}$	Output Active from End of Write	0		0		0		0		0		ns

### TIMING WAVEFORM OF WRITE CYCLE NO. 1 ( $\overline{WE}$ CONTROLLED)<sup>(9)</sup>



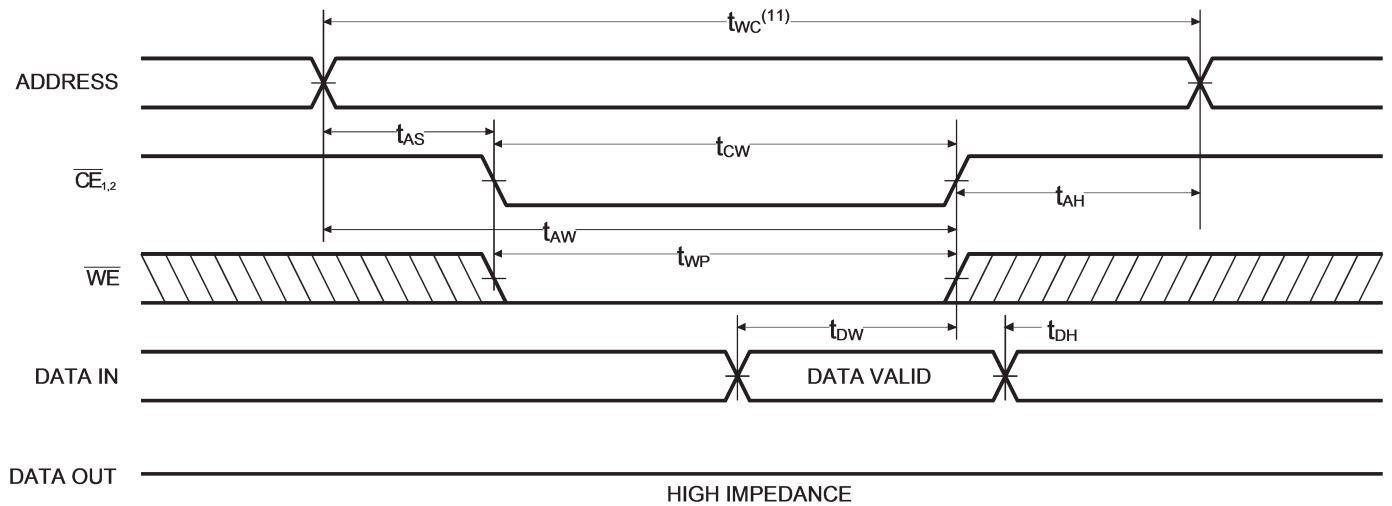
#### Notes:

10.  $\overline{CE}_{1,2}$  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  $\overline{CE}_{1,2}$  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.



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

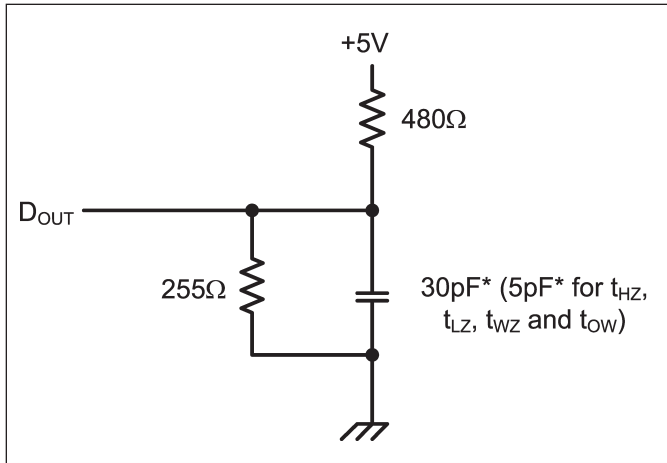


### AC TEST CONDITIONS

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	$\overline{CE}_1$	$CE_2$	$\overline{WE}$	$\overline{OE}$	I/O	Power
Deselect/Power-Down	H	X	X	X	High Z	Standby
	X	H	X	X		
Read	L	L	H	L	Data Out	Active
Write	L	L	L	X	Data In	Active
Deselect	L	L	H	H	High Z	Active

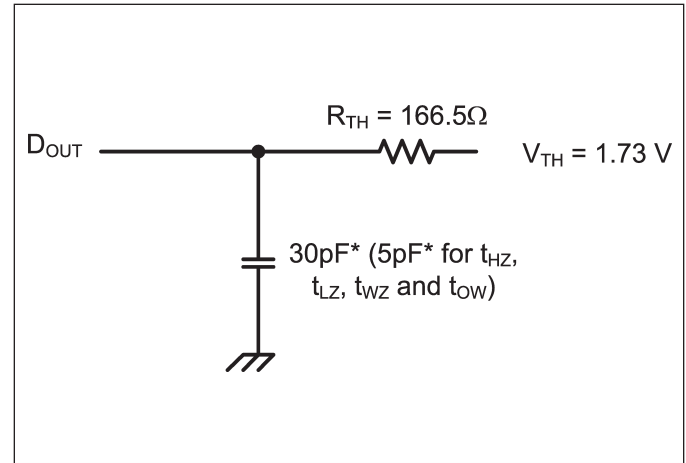


**Figure 1. Output Load**

\* including scope and test fixture.

**Note:**

Because of the ultra-high speed of the P4C1299, 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

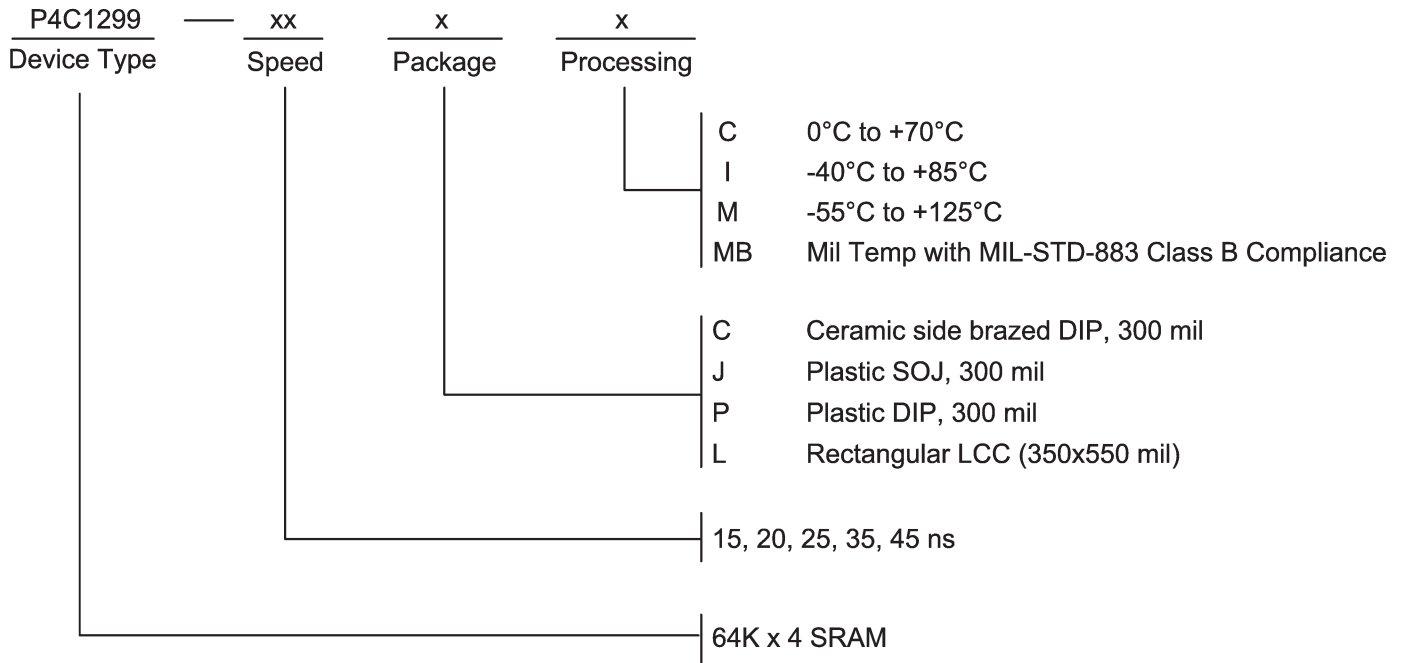


**Figure 2. Thevenin Equivalent**

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

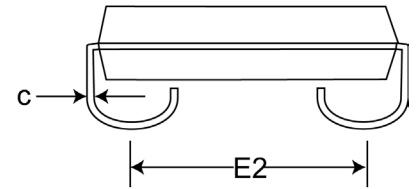
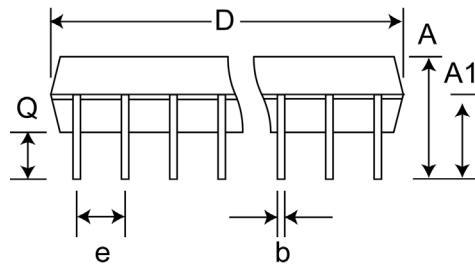
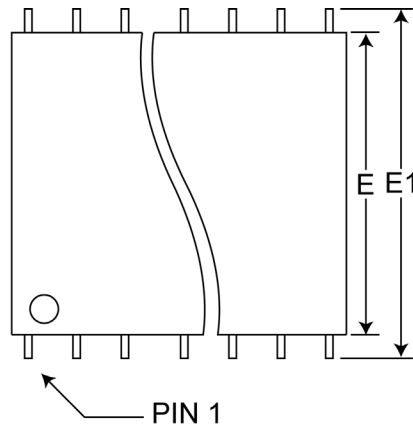






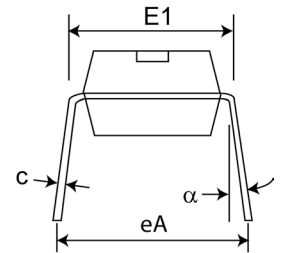
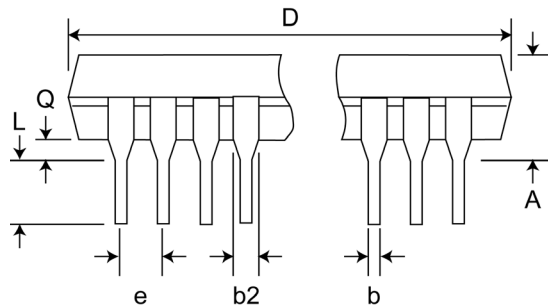
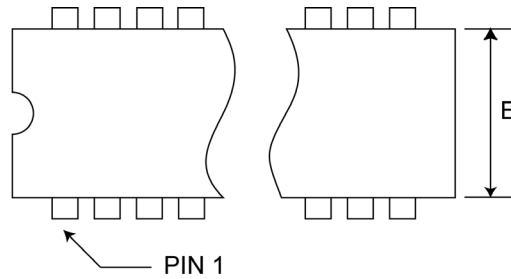
Pkg #	J5	
# Pins	28 (300 mil)	
Symbol	Min	Max
A	0.120	0.148
A1	0.078	-
b	0.014	0.020
C	0.007	0.011
D	0.700	0.730
e	0.050 BSC	
E	0.292	0.300
E1	0.335	0.347
E2	0.262	0.272
Q	0.025	-

**SOJ SMALL OUTLINE IC PACKAGE**



Pkg #	P5	
# Pins	28 (300 mil)	
Symbol	Min	Max
A	-	0.210
A1	-	-
b	0.014	0.023
b2	0.045	0.070
C	0.008	0.014
D	1.345	1.400
E1	0.270	0.300
E	0.300	0.380
e	0.100 BSC	
eB	-	0.430
L	0.115	0.150
$\alpha$	0°	15°

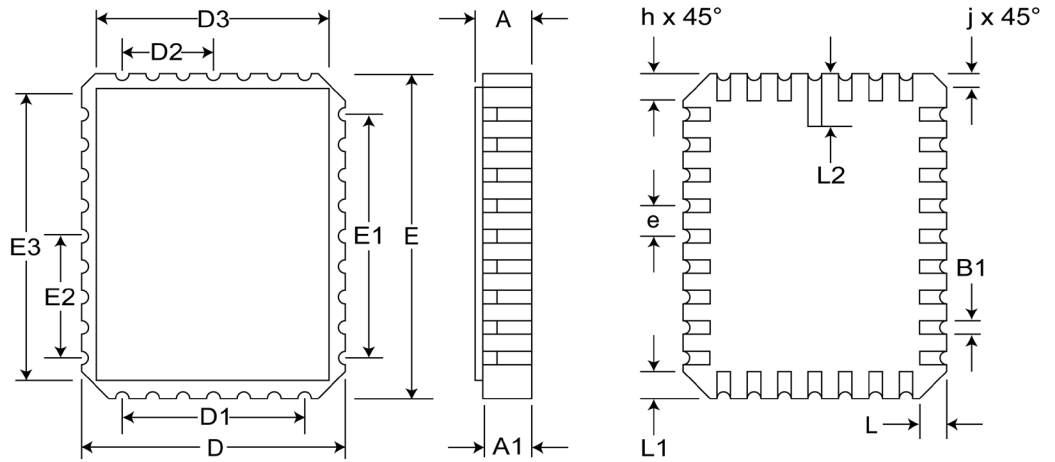
**PLASTIC DUAL IN-LINE PACKAGE**





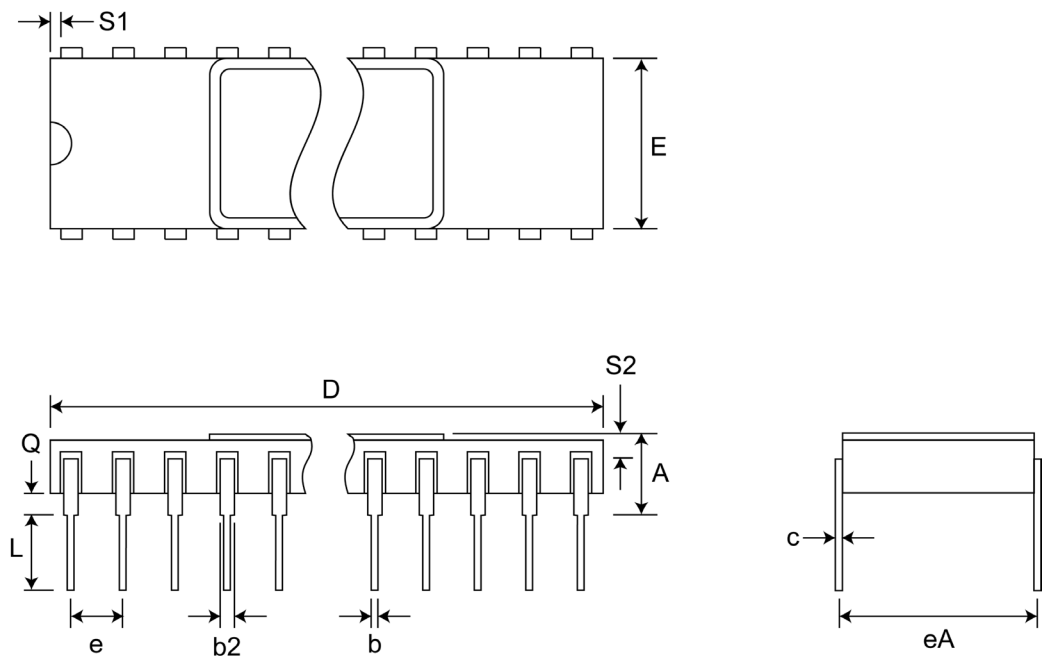
### RECTANGULAR LEADLESS CHIP CARRIER

Pkg #	<b>L5</b>	
# Pins	28	
Symbol	Min	Max
A	0.060	0.075
A1	0.050	0.065
B1	0.022	0.028
D	0.342	0.358
D1	0.200 BSC	
D2	0.100 BSC	
D3	-	0.358
E	0.540	0.560
E1	0.400 BSC	
E2	0.200 BSC	
E3	-	0.558
e	0.050 BSC	
h	0.040 REF	
j	0.020 REF	
L	0.045	0.055
L1	0.045	0.055
L2	0.075	0.095
ND	5	
NE	9	



Pkg #	<b>C5</b>	
# Pins	28 (300 mil)	
Symbol	Min	Max
A	-	0.225
b	0.014	0.026
b2	0.045	0.065
C	0.008	0.018
D	-	1.485
E	0.240	0.310
eA	0.300 BSC	
e	0.100 BSC	
L	0.125	0.200
Q	0.015	0.070
S1	0.005	-
S2	0.005	-

### SIDEBRAZED DUAL IN-LINE PACKAGE





## REVISIONS

<b>DOCUMENT NUMBER</b>	SRAM 144
<b>DOCUMENT TITLE</b>	P4C1299/P4C1299L - ULTRA HIGH SPEED 64K x 4 STATIC CMOS RAM

<b>REV</b>	<b>ISSUE DATE</b>	<b>ORIGINATOR</b>	<b>DESCRIPTION OF CHANGE</b>
OR	Nov-2012	JDB	New Data Sheet