



CY7C199

32K x 8 Static RAM

Features

- High speed
 - 10 ns
- Fast t_{DOE}
- CMOS for optimum speed/power
- Low active power
 - 467 mW (max, 12 ns “L” version)
- Low standby power
 - 0.275 mW (max, “L” version)
- 2V data retention (“L” version only)
- Easy memory expansion with \overline{CE} and \overline{OE} features
- TTL-compatible inputs and outputs
- Automatic power-down when deselected

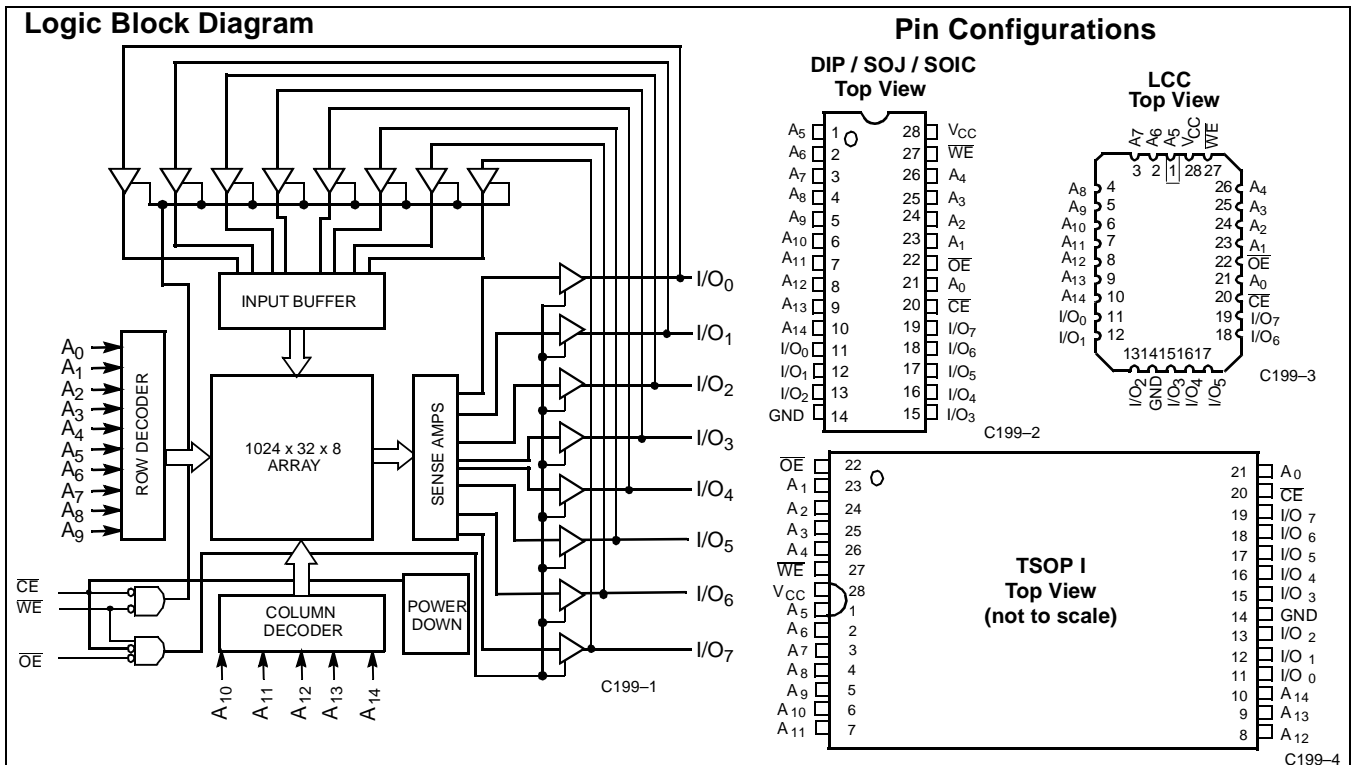
provided by an active LOW chip enable (\overline{CE}) and active LOW output enable (\overline{OE}) and three-state drivers. This device has an automatic power-down feature, reducing the power consumption by 81% when deselected. The CY7C199 is in the standard 300-mil-wide DIP, SOJ, and LCC packages.

An active LOW write enable signal (\overline{WE}) controls the writing/reading operation of the memory. When \overline{CE} and \overline{WE} inputs are both LOW, data on the eight data input/output pins (I/O_0 through I/O_7) is written into the memory location addressed by the address present on the address pins (A_0 through A_{14}). Reading the device is accomplished by selecting the device and enabling the outputs, \overline{CE} and \overline{OE} active LOW, while \overline{WE} remains inactive or HIGH. Under these conditions, the contents of the location addressed by the information on address pins are present on the eight data input/output pins.

The input/output pins remain in a high-impedance state unless the chip is selected, outputs are enabled, and write enable (\overline{WE}) is HIGH. A die coat is used to improve alpha immunity.

Functional Description

The CY7C199 is a high-performance CMOS static RAM organized as 32,768 words by 8 bits. Easy memory expansion is



Selection Guide

	7C199-8	7C199-10	7C199-12	7C199-15	7C199-20	7C199-25	7C199-35	7C199-45
Maximum Access Time (ns)	8	10	12	15	20	25	35	45
Maximum Operating Current (mA)	120	110	160	155	150	150	140	140
	L	90	90	90	90	80	70	
Maximum CMOS Standby Current (mA)	0.5	0.5	10	10	10	10	10	10
	L	0.05	0.05	0.05	0.05	0.05	0.05	

Shaded area contains preliminary information.

Maximum Ratings

(Above which the useful life may be impaired. For user guidelines, not tested.)

Storage Temperature -65°C to +150°C

Ambient Temperature with Power Applied -55°C to +125°C

Supply Voltage to Ground Potential (Pin 28 to Pin 14) -0.5V to +7.0V

 DC Voltage Applied to Outputs in High Z State^[1] -0.5V to $V_{CC} + 0.5V$

 DC Input Voltage^[1] -0.5V to $V_{CC} + 0.5V$

Output Current into Outputs (LOW) 20 mA

Static Discharge Voltage >2001V (per MIL-STD-883, Method 3015)

Latch-Up Current >200 mA

Operating Range

Range	Ambient Temperature ^[2]	V_{CC}
Commercial	0°C to +70°C	5V ± 10%
Industrial	-40°C to +85°C	5V ± 10%
Military	-55°C to +125°C	5V ± 10%

Electrical Characteristics Over the Operating Range^[3]

Parameter	Description	Test Conditions	7C199-8		7C199-10		7C199-12		7C199-15		Unit
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
V_{OH}	Output HIGH Voltage	$V_{CC} = \text{Min.}, I_{OH} = -4.0 \text{ mA}$	2.4		2.4		2.4		2.4		V
V_{OL}	Output LOW Voltage	$V_{CC} = \text{Min.}, I_{OL} = 8.0 \text{ mA}$		0.4		0.4		0.4		0.4	V
V_{IH}	Input HIGH Voltage		2.2	$V_{CC} + 0.3V$	2.2	$V_{CC} + 0.3V$	2.2	$V_{CC} + 0.3V$	2.2	$V_{CC} + 0.3V$	V
V_{IL}	Input LOW Voltage		-0.5	0.8	-0.5	0.8	-0.5	0.8	-0.5	0.8	V
I_{IX}	Input Load Current	$GND \leq V_I \leq V_{CC}$	-5	+5	-5	+5	-5	+5	-5	+5	μA
I_{OZ}	Output Leakage Current	$GND \leq V_O \leq V_{CC}$, Output Disabled	-5	+5	-5	+5	-5	+5	-5	+5	μA
I_{CC}	V_{CC} Operating Supply Current	$V_{CC} = \text{Max.}, I_{OUT} = 0 \text{ mA}, f = f_{MAX} = 1/t_{RC}$	Com'l	120		110		160		155	mA
			L			85		85		100	mA
			Mil							180	mA
I_{SB1}	Automatic CE Power-Down Current—TTL Inputs	Max. V_{CC} , $\overline{CE} \geq V_{IH}$, $V_{IN} \geq V_{IH}$ or $V_{IN} \leq V_{IL}$, $f = f_{MAX}$	Com'l	5		5		30		30	mA
			L			5		5		5	mA
I_{SB2}	Automatic CE Power-Down Current—CMOS Inputs	Max. V_{CC} , $\overline{CE} \geq V_{CC} - 0.3V$, $V_{IN} \geq V_{CC} - 0.3V$ or $V_{IN} \leq 0.3V$, $f = 0$	Com'l	0.5		0.5		10		10	mA
			L	0.05		0.05		0.05		0.05	mA
			Mil							15	mA

Shaded area contains preliminary information.

Notes:

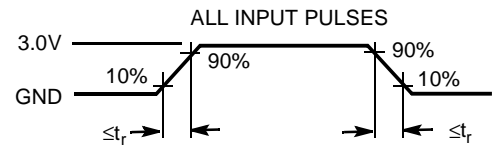
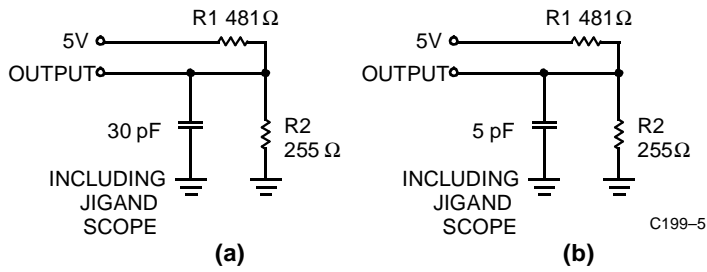
- $V_{IL}(\text{min.}) = -2.0V$ for pulse durations of less than 20 ns.
- T_A is the "instant on" case temperature.
- See the last page of this specification for Group A subgroup testing information.

Electrical Characteristics Over the Operating Range^[3] (continued)

Parameter	Description	Test Conditions	7C199-20		7C199-25		7C199-35		7C199-45		Unit
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
V _{OH}	Output HIGH Voltage	V _{CC} =Min., I _{OH} =-4.0 mA	2.4		2.4		2.4		2.4		V
V _{OL}	Output LOW Voltage	V _{CC} =Min., I _{OL} =8.0 mA		0.4		0.4		0.4		0.4	V
V _{IH}	Input HIGH Voltage		2.2	V _{CC} +0.3V	2.2	V _{CC} +0.3V	2.2	V _{CC} +0.3V	2.2	V _{CC} +0.3V	V
V _{IL}	Input LOW Voltage		-0.5	0.8	-0.5	0.8	-0.5	0.8	-0.5	0.8	V
I _{Ix}	Input Load Current	GND ≤ V _I ≤ V _{CC}	-5	+5	-5	+5	-5	+5	-5	+5	μA
I _{OZ}	Output Leakage Current	GND ≤ V _I ≤ V _{CC} , Output Disabled	-5	+5	-5	+5	-5	+5	-5	+5	μA
I _{CC}	V _{CC} Operating Supply Current	V _{CC} = Max., I _{OUT} = 0 mA, f = f _{MAX} = 1/t _{RC}	Com'l	150		150		140		140	mA
			L	90		80		70		70	mA
			Mil	170		150		150		150	mA
I _{SB1}	Automatic CE Power-Down Current—TTL Inputs	Max. V _{CC} , CE ≥ V _{IH} , V _{IN} ≥ V _{IH} or V _{IN} ≤ V _{IL} , f = f _{MAX}	Com'l	30		30		25		25	mA
			L	5		5		5		5	mA
I _{SB2}	Automatic CE Power-Down Current—CMOS Inputs	Max. V _{CC} , CE ≥ V _{CC} - 0.3V, V _{IN} ≥ V _{CC} - 0.3V or V _{IN} ≤ 0.3V, f=0	Com'l	10		10		10		10	mA
			L	0.05		0.05		0.05		0.05	μA
			Mil	15		15		15		15	mA

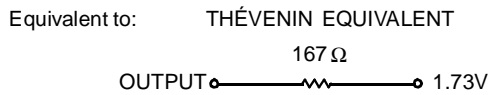
Capacitance^[4]

Parameter	Description	Test Conditions	Max.	Unit
C _{IN}	Input Capacitance	T _A = 25°C, f = 1 MHz, V _{CC} = 5.0V	8	pF
C _{OUT}	Output Capacitance		8	pF

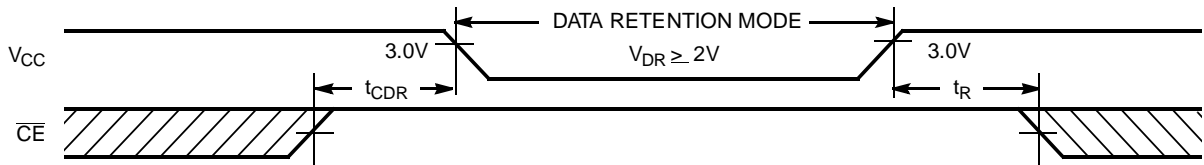
AC Test Loads and Waveforms^[5]


C199-5

C199-6


Data Retention Characteristics Over the Operating Range (L version only)

Parameter	Description	Conditions ^[6]	Min.	Max.	Unit
V_{DR}	V_{CC} for Data Retention		2.0		V
I_{CCDR}	Data Retention Current	Com'I			μA
		Com'I L		10	μA
$t_{CDR}^{[4]}$	Chip Deselect to Data Retention Time	$V_{CC} = V_{DR} = 2.0V$, $CE \geq V_{CC} - 0.3V$, $V_{IN} \geq V_{CC} - 0.3V$ or $V_{IN} \leq 0.3V$	0		ns
$t_R^{[5]}$	Operation Recovery Time		t_{RC}		ns

Data Retention Waveform


C199-7

Notes:

4. Tested initially and after any design or process changes that may affect these parameters.
5. $t_R \leq 3$ ns for the -12 and -15 speeds. $t_R \leq 5$ ns for the -20 and slower speeds.
6. No input may exceed $V_{CC} + 0.5V$.

Switching Characteristics Over the Operating Range^[3, 7]

Parameter	Description	7C199-8		7C199-10		7C199-12		7C199-15		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
READ CYCLE										
t_{RC}	Read Cycle Time	8		10		12		15		ns
t_{AA}	Address to Data Valid		8		10		12		15	ns
t_{OHA}	Data Hold from Address Change	3		3		3		3		ns
t_{ACE}	\overline{CE} LOW to Data Valid		8		10		12		15	ns
t_{DOE}	\overline{OE} LOW to Data Valid		4.5		5		5		7	ns
t_{LZOE}	\overline{OE} LOW to Low Z ^[8]	0		0		0		0		ns
t_{HZOE}	\overline{OE} HIGH to High Z ^[8, 9]		5		5		5		7	ns
t_{LZCE}	\overline{CE} LOW to Low Z ^[8]	3		3		3		3		ns
t_{HZCE}	\overline{CE} HIGH to High Z ^[8, 9]		4		5		5		7	ns
t_{PU}	\overline{CE} LOW to Power-Up	0		0		0		0		ns
t_{PD}	\overline{CE} HIGH to Power-Down		8		10		12		15	ns
WRITE CYCLE ^[10, 11]										
t_{WC}	Write Cycle Time	8		10		12		15		ns
t_{SCE}	\overline{CE} LOW to Write End	7		7		9		10		ns
t_{AW}	Address Set-Up to Write End	7		7		9		10		ns
t_{HA}	Address Hold from Write End	0		0		0		0		ns
t_{SA}	Address Set-Up to Write Start	0		0		0		0		ns
t_{PWE}	\overline{WE} Pulse Width	7		7		8		9		ns
t_{SD}	Data Set-Up to Write End	5		5		8		9		ns
t_{HD}	Data Hold from Write End	0		0		0		0		ns
t_{HZWE}	\overline{WE} LOW to High Z ^[9]		5		6		7		7	ns
t_{LZWE}	\overline{WE} HIGH to Low Z ^[8]	3		3		3		3		ns

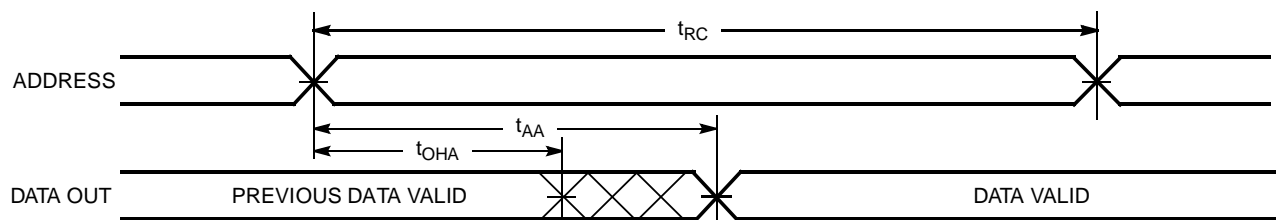
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Notes:

- Test conditions assume signal transition time of 3 ns or less for -12 and -15 speeds and 5 ns or less for -20 and slower speeds, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V, and output loading of the specified I_{OL}/I_{OH} and 30-pF load capacitance.
- At any given temperature and voltage condition, t_{HZCE} is less than t_{LZCE} , t_{HZOE} is less than t_{LZOE} , and t_{HZWE} is less than t_{LZWE} for any given device.
- t_{HZOE} , t_{HZCE} , and t_{HZWE} are specified with $C_L = 5$ pF as in part (b) of AC Test Loads. Transition is measured ± 500 mV from steady-state voltage.
- The internal write time of the memory is defined by the overlap of \overline{CE} LOW and \overline{WE} LOW. Both signals must be LOW to initiate a write and either signal can terminate a write by going HIGH. The data input set-up and hold timing should be referenced to the rising edge of the signal that terminates the write.
- The minimum write cycle time for write cycle #3 (\overline{WE} controlled, \overline{OE} LOW) is the sum of t_{HZWE} and t_{SD} .

Switching Characteristics Over the Operating Range^[3,7] (continued)

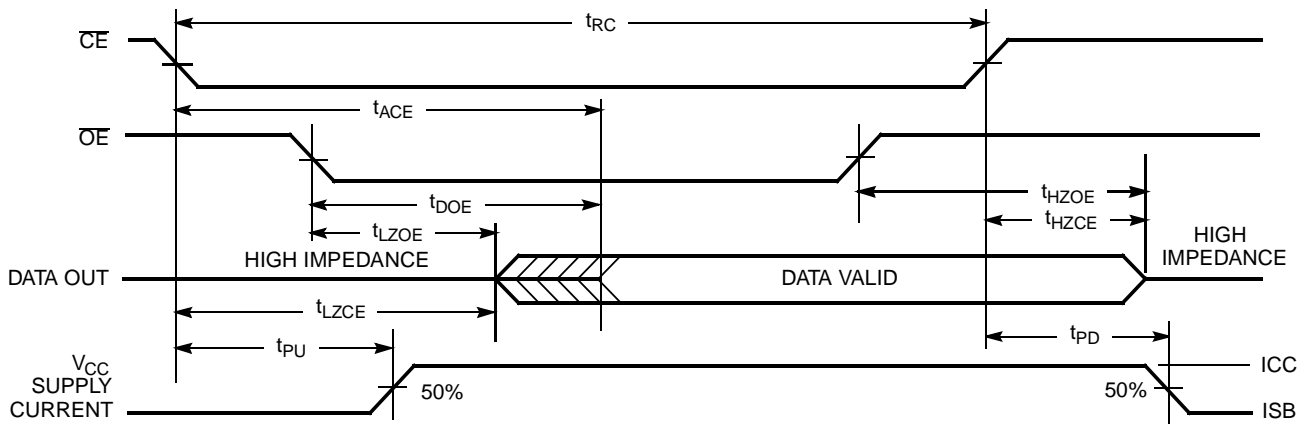
Parameter	Description	7C199-20		7C199-25		7C199-35		7C199-45		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
READ CYCLE										
t_{RC}	Read Cycle Time	20		25		35		45		ns
t_{AA}	Address to Data Valid		20		25		35		45	ns
t_{OHA}	Data Hold from Address Change	3		3		3		3		ns
t_{ACE}	\overline{CE} LOW to Data Valid		20		25		35		45	ns
t_{DOE}	\overline{OE} LOW to Data Valid		9		10		16		16	ns
t_{LZOE}	\overline{OE} LOW to Low Z ^[8]	0		0		0		0		ns
t_{HZOE}	\overline{OE} HIGH to High Z ^[8,9]		9		11		15		15	ns
t_{LZCE}	\overline{CE} LOW to Low Z ^[8]	3		3		3		3		ns
t_{HZCE}	\overline{CE} HIGH to High Z ^[8,9]		9		11		15		15	ns
t_{PU}	\overline{CE} LOW to Power-Up	0		0		0		0		ns
t_{PD}	\overline{CE} HIGH to Power-Down		20		20		20		25	ns
WRITE CYCLE ^[10,11]										
t_{WC}	Write Cycle Time	20		25		35		45		ns
t_{SCE}	\overline{CE} LOW to Write End	15		18		22		22		ns
t_{AW}	Address Set-Up to Write End	15		20		30		40		ns
t_{HA}	Address Hold from Write End	0		0		0		0		ns
t_{SA}	Address Set-Up to Write Start	0		0		0		0		ns
t_{PWE}	\overline{WE} Pulse Width	15		18		22		22		ns
t_{SD}	Data Set-Up to Write End	10		10		15		15		ns
t_{HD}	Data Hold from Write End	0		0		0		0		ns
t_{HZWE}	\overline{WE} LOW to High Z ^[9]		10		11		15		15	ns
t_{LZWE}	\overline{WE} HIGH to Low Z ^[8]	3		3		3		3		ns

Switching Waveforms
Read Cycle No. 1^[12, 13]


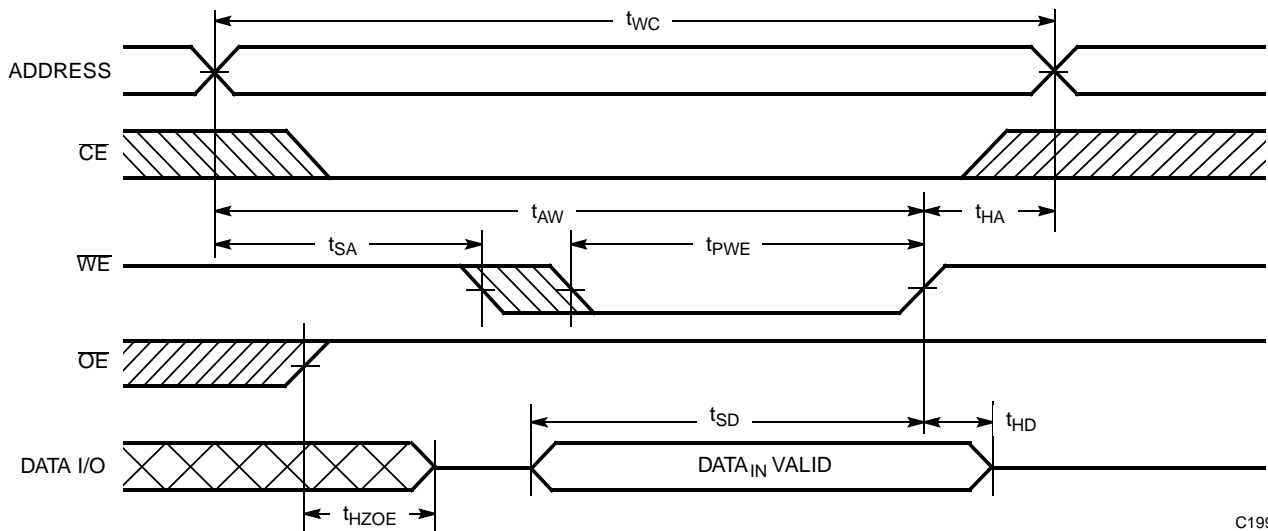
C199-8

Notes:

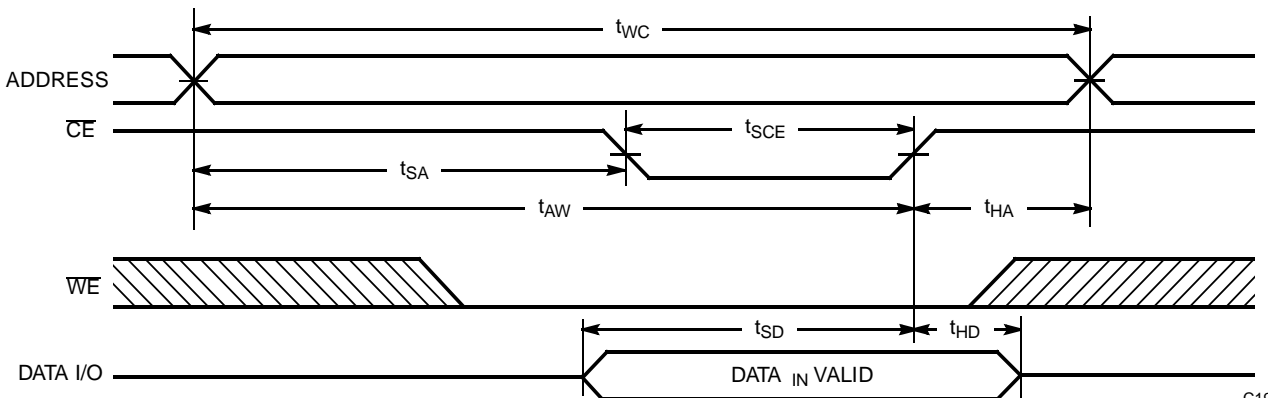
12. Device is continuously selected. $\overline{OE}, \overline{CE} = V_{IL}$.
 13. \overline{WE} is HIGH for read cycle.

Switching Waveforms (continued)
Read Cycle No. 2 [13, 14]


C199-9

Write Cycle No. 1 (WE Controlled) [10, 15, 16]


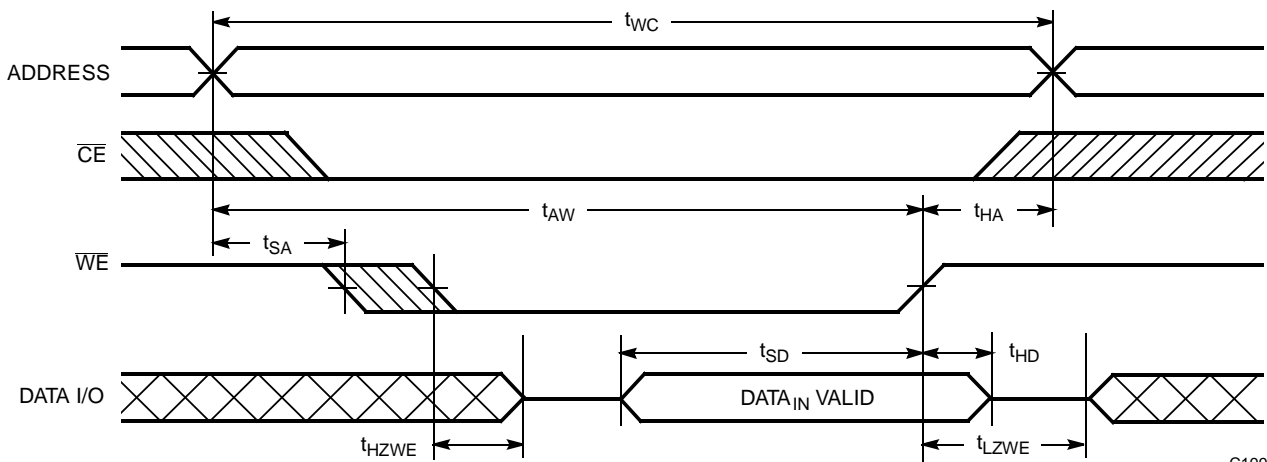
C199-10

Write Cycle No. 2 (CE Controlled) [10, 15, 16]


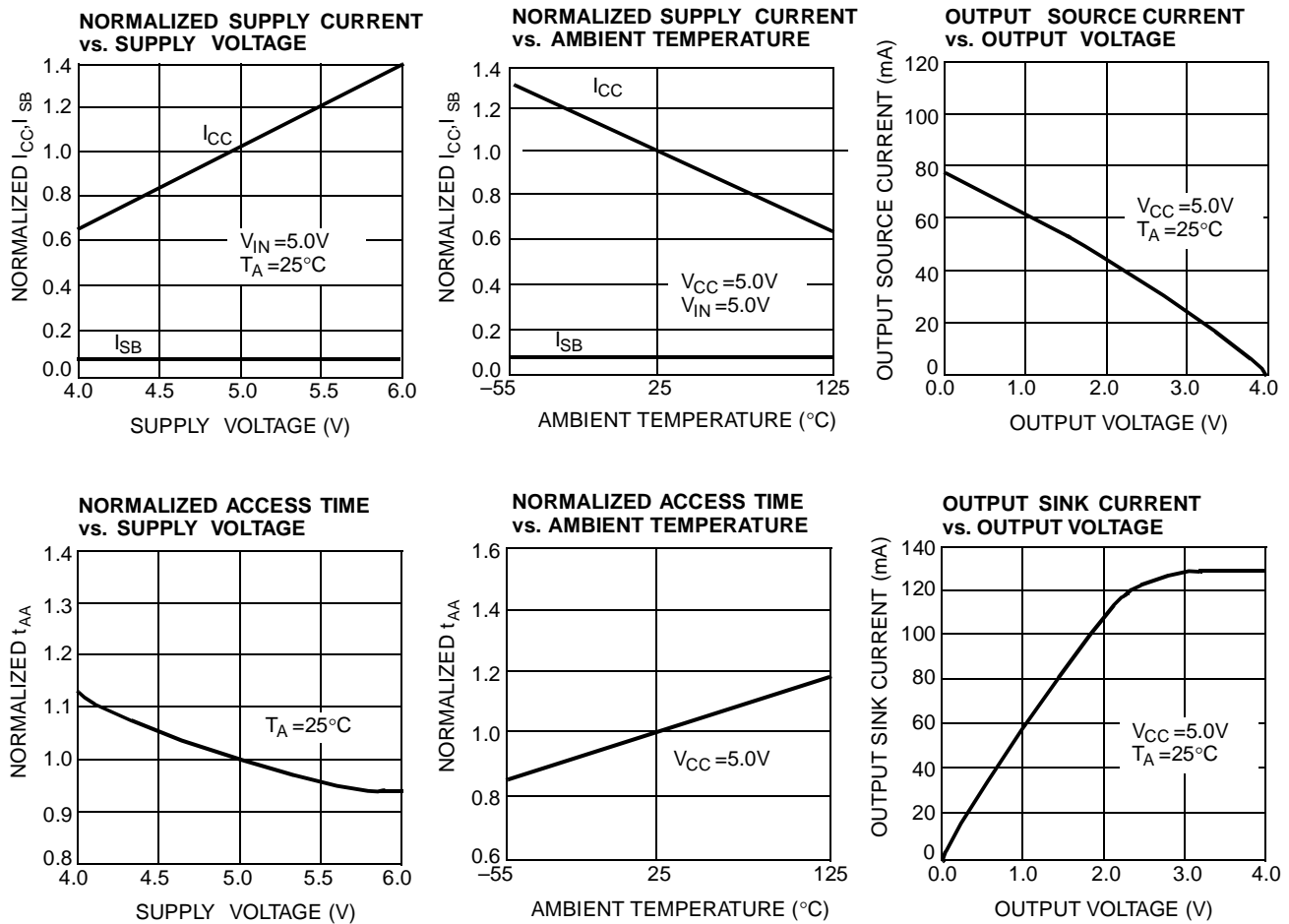
C199-11

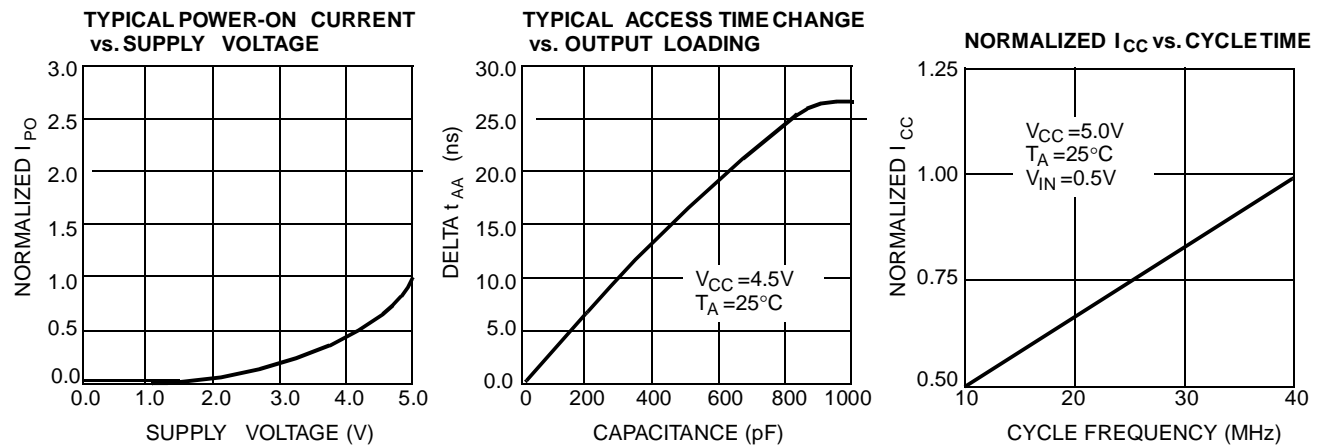
Notes:

14. Address valid prior to or coincident with CE transition LOW.
15. Data I/O is high impedance if OE = V_{IH}.
16. If CE goes HIGH simultaneously with WE HIGH, the output remains in a high-impedance state.

Switching Waveforms (continued)
Write Cycle No. 3 (WE Controlled \overline{OE} LOW)^[11, 16]


C199-12

Typical DC and AC Characteristics


Typical DC and AC Characteristics (continued)

Truth Table

CE	WE	OE	Inputs/Outputs	Mode	Power
H	X	X	High Z	Deselect/Power-Down	Standby (I_{SB})
L	H	L	Data Out	Read	Active (I_{CC})
L	L	X	Data In	Write	Active (I_{CC})
L	H	H	High Z	Deselect, Output Disabled	Active (I_{CC})

Ordering Information

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
8	CY7C199-8VC	V21	28-Lead Molded SOJ	Commercial
	CY7C199-8ZC	Z28	28-Lead Thin Small Outline Package	
	CY7C199L-8VC	V21	28-Lead Molded SOJ	
	CY7C199L-8ZC	Z28	28-Lead Thin Small Outline Package	
10	CY7C199-10VC	V21	28-Lead Molded SOJ	Commercial
	CY7C199-10ZC	Z28	28-Lead Thin Small Outline Package	
	CY7C199L-10VC	V21	28-Lead Molded SOJ	
	CY7C199L-10ZC	Z28	28-Lead Thin Small Outline Package	
	CY7C199-10VI	V21	28-Lead Molded SOJ	Industrial
	CY7C199-10ZI	Z28	28-Lead Thin Small Outline Package	
	CY7C199L-10VI	V21	28-Lead Molded SOJ	
	CY7C199L-10ZI	Z28	28-Lead Thin Small Outline Package	
12	CY7C199-12PC	P21	28-Lead (300-Mil) Molded DIP	Commercial
	CY7C199-12VC	V21	28-Lead Molded SOJ	
	CY7C199-12ZC	Z28	28-Lead Thin Small Outline Package	
	CY7C199L-12PC	P21	28-Lead (300-Mil) Molded DIP	
	CY7C199L-12VC	V21	28-Lead Molded SOJ	Industrial
	CY7C199L-12ZC	Z28	28-Lead Thin Small Outline Package	
	CY7C199-12VI	V21	28-Lead Molded SOJ	
	CY7C199-12ZI	Z28	28-Lead Thin Small Outline Package	
	CY7C199L-12VI	V21	28-Lead Molded SOJ	
	CY7C199L-12ZI	Z28	28-Lead Thin Small Outline Package	

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Ordering Information (continued)

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
15	CY7C199-15PC	P21	28-Lead (300-Mil) Molded DIP	Commercial
	CY7C199-15VC	V21	28-Lead Molded SOJ	
	CY7C199-15ZC	Z28	28-Lead Thin Small Outline Package	
	CY7C199L-15PC	P21	28-Lead (300-Mil) Molded DIP	
	CY7C199L-15VC	V21	28-Lead Molded SOJ	
	CY7C199L-15ZC	Z28	28-Lead Thin Small Outline Package	
	CY7C199-15VI	V21	28-Lead Molded SOJ	Industrial
	CY7C199-15ZI	Z28	28-Lead Thin Small Outline Package	Military
	CY7C199-15DMB	D22	28-Lead (300-Mil) CerDIP	
	CY7C199-15LMB	L54	28-Pin Rectangular Leadless Chip Carrier	
	CY7C199L-15DMB	D22	28-Lead (300-Mil) CerDIP	
	CY7C199L-15LMB	L54	28-Pin Rectangular Leadless Chip Carrier	
20	CY7C199-20PC	P21	28-Lead (300-Mil) Molded DIP	Commercial
	CY7C199-20VC	V21	28-Lead Molded SOJ	
	CY7C199-20ZC	Z28	28-Lead Thin Small Outline Package	
	CY7C199L-20PC	P21	28-Lead (300-Mil) Molded DIP	
	CY7C199L-20VC	V21	28-Lead Molded SOJ	
	CY7C199L-20ZC	Z28	28-Lead Thin Small Outline Package	
	CY7C199-20VI	V21	28-Lead Molded SOJ	Industrial
	CY7C199-20ZI	Z28	28-Lead Thin Small Outline Package	Military
	CY7C199-20DMB	D22	28-Lead (300-Mil) CerDIP	
	CY7C199-20LMB	L54	28-Pin Rectangular Leadless Chip Carrier	
	CY7C199L-20DMB	D22	28-Lead (300-Mil) CerDIP	
	CY7C199L-20LMB	L54	28-Pin Rectangular Leadless Chip Carrier	
25	CY7C199-25PC	P21	28-Lead (300-Mil) Molded DIP	Commercial
	CY7C199-25SC	S21	28-Lead Molded SOIC	
	CY7C199-25VC	V21	28-Lead Molded SOJ	
	CY7C199-25ZC	Z28	28-Lead Thin Small Outline Package	
	CY7C199L-25ZI	Z28	28-Lead Thin Small Outline Package	Industrial
	CY7C199-25DMB	D22	28-Lead (300-Mil) CerDIP	Military
	CY7C199-25LMB	L54	28-Pin Rectangular Leadless Chip Carrier	
35	CY7C199-35PC	P21	28-Lead (300-Mil) Molded DIP	Commercial
	CY7C199-35SC	S21	28-Lead Molded SOIC	
	CY7C199-35VC	V21	28-Lead Molded SOJ	
	CY7C199-35ZC	Z28	28-Lead Thin Small Outline Package	
	CY7C199-35DMB	D22	28-Lead (300-Mil) CerDIP	Military
	CY7C199-35LMB	L54	28-Pin Rectangular Leadless Chip Carrier	
45	CY7C199-45DMB	D22	28-Lead (300-Mil) CerDIP	Military
	CY7C199-45LMB	L54	28-Pin Rectangular Leadless Chip Carrier	

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MILITARY SPECIFICATIONS
Group A Subgroup Testing

DC Characteristics

Parameter	Subgroups
V _{OH}	1, 2, 3
V _{OL}	1, 2, 3
V _{IH}	1, 2, 3
V _{IL Max.}	1, 2, 3
I _{Ix}	1, 2, 3
I _{OZ}	1, 2, 3
I _{CC}	1, 2, 3
I _{SB1}	1, 2, 3
I _{SB2}	1, 2, 3

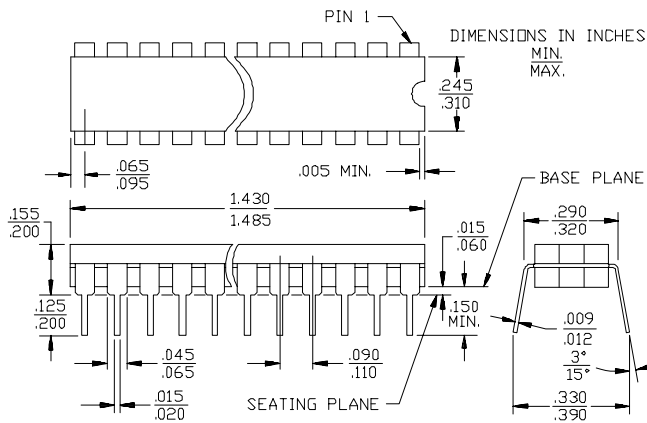
Switching Characteristics

Parameter	Subgroups
READ CYCLE	
t _{RC}	7, 8, 9, 10, 11
t _{AA}	7, 8, 9, 10, 11
t _{OHA}	7, 8, 9, 10, 11
t _{ACE}	7, 8, 9, 10, 11
t _{DOE}	7, 8, 9, 10, 11
WRITE CYCLE	
t _{WC}	7, 8, 9, 10, 11
t _{AA}	7, 8, 9, 10, 11
t _{AW}	7, 8, 9, 10, 11
t _{HA}	7, 8, 9, 10, 11
t _{SA}	7, 8, 9, 10, 11
t _{PWE}	7, 8, 9, 10, 11
t _{SD}	7, 8, 9, 10, 11
t _{HD}	7, 8, 9, 10, 11

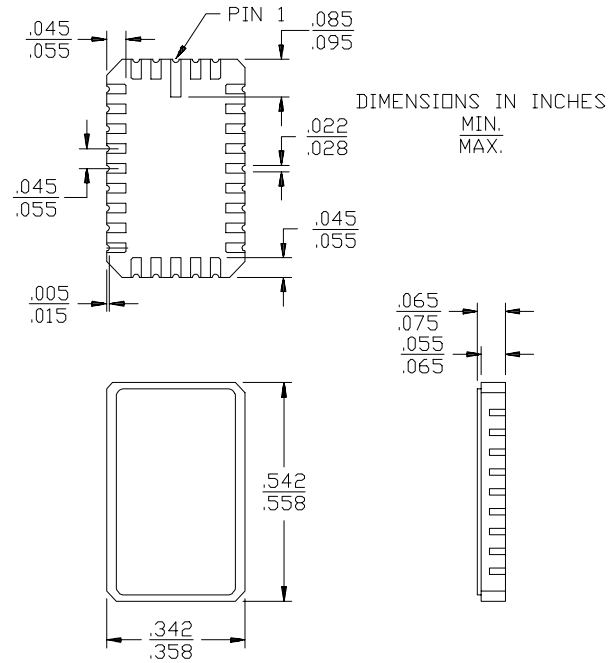
Document #: 38-00239-E

Package Diagrams

28-Lead (300-Mil) CerDIP D22
MIL-STD-1835 D-15 Config.A

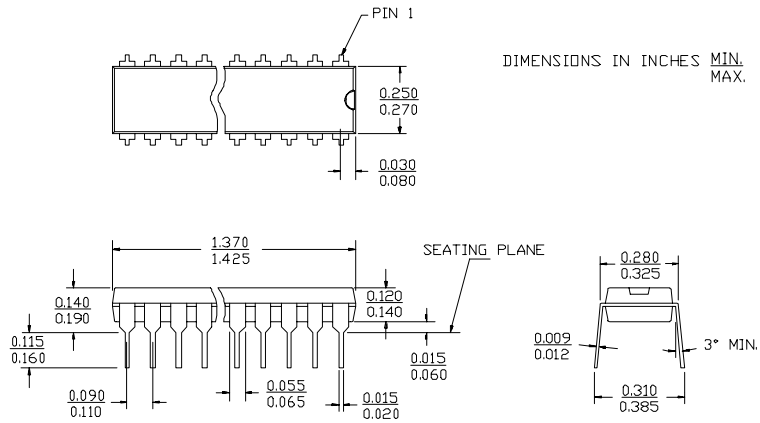


28-Pin Rectangular Leadless Chip Carrier L54
MIL-STD-1835 C-11A

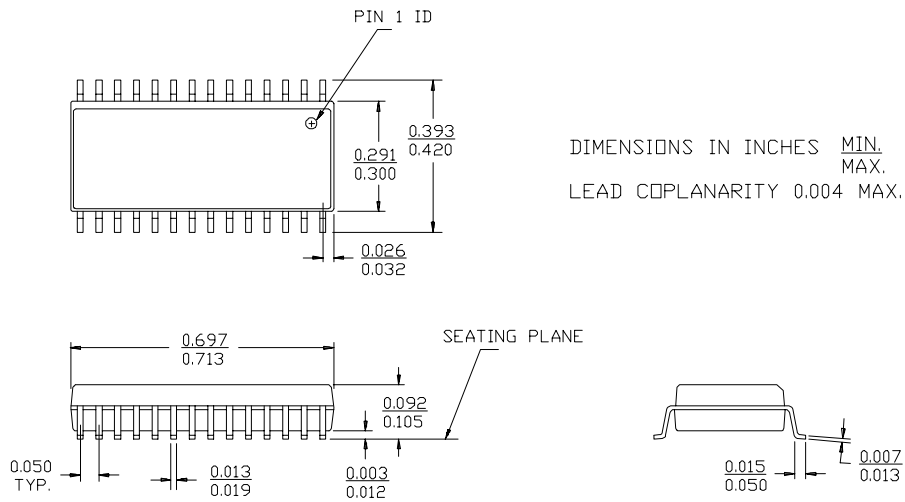


Package Diagrams (continued)

28-Lead (300-Mil) Molded DIP P21

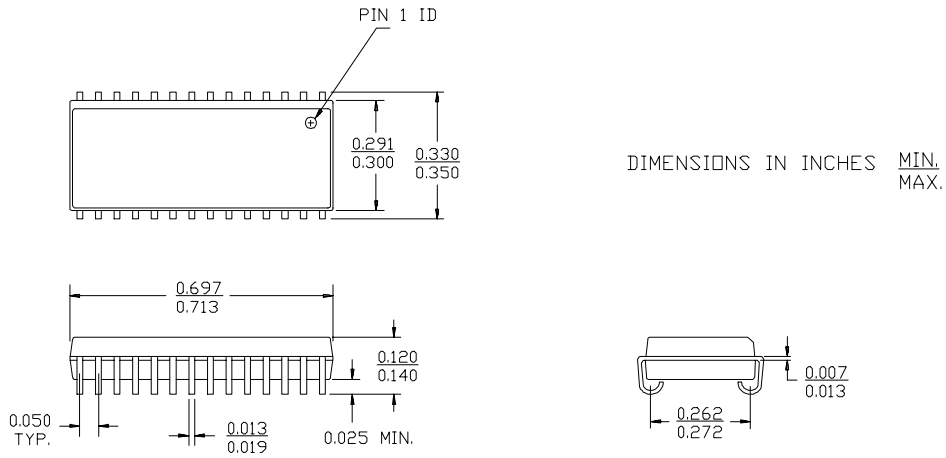


28-Lead (300-Mil) Molded SOIC S21



Package Diagrams (continued)

28-Lead (300-Mil) Molded SOJ V21



28-Lead Thin Small Outline Package Z28

DIMENSION IN MM (INCH)

