



LC35W1000BM, BTS-70U/10U

Asynchronous Silicon Gate 1M (131,072 words × 8 bits) SRAM

Preliminary

Overview

The LC35W1000BM and LC35W1000BTS-70U/10U are asynchronous silicon gate CMOS static RAM devices with a 131,072-word by 8-bit structure. They provide two chip enable pins ($\overline{CE1}$ and $\overline{CE2}$) for device select/deselect control and one output enable pin (\overline{OE}) for output control. They feature high speed, low power, and a wide operating temperature range. This makes them optimal for use in systems that require high speed, low power, and battery backup. They also support easy memory expansion.

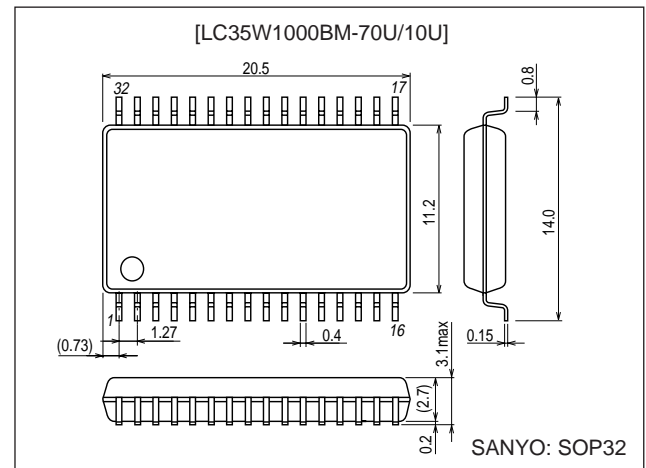
Features

- Low-voltage operation: 2.7 to 3.6 V
- Wide operating temperature range: -40 to $+85^{\circ}\text{C}$
- Access time:
 - 70 ns (maximum):
LC35W1000BM and LC35W1000BTS-70U.
 - 100 ns (maximum):
LC35W1000BM and LC35W1000BTS-10U.
- Low current drain
 - Standby mode: $0.1 \mu\text{A}$ (typical*) at $T_a = +25^{\circ}\text{C}$
 - $10.0 \mu\text{A}$ (maximum) at $T_a = -40$ to $+70^{\circ}\text{C}$
 - $20.0 \mu\text{A}$ (maximum) at $T_a = -40$ to $+85^{\circ}\text{C}$
- Data retention voltage: 2.0 to 3.6 V
- No clock required (fully static circuits)
- Input/output shared function pins, 3-state output pins
- Package
 - 32-pin SOP (525 mil) plastic package:
LC35W1000BM
 - 32-pin TSOP (8 × 14 mm) plastic package (Normal):
LC35W1000BTS

Package Dimensions

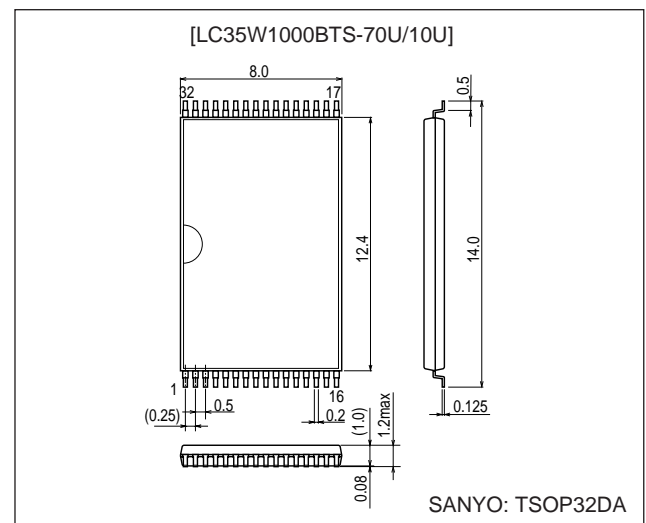
unit: mm

3205A-SOP32



unit: mm

3228A-TSOP32DA



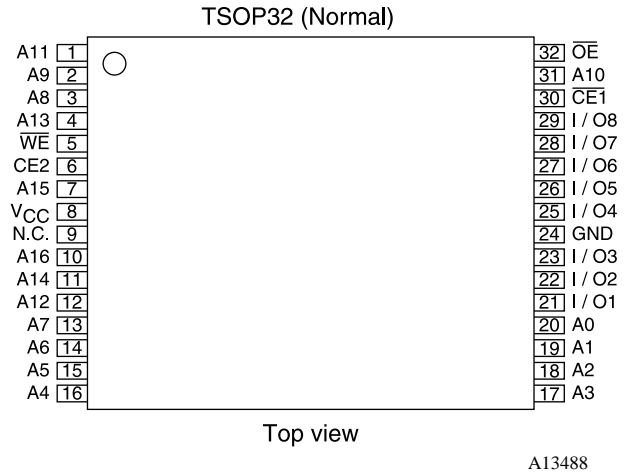
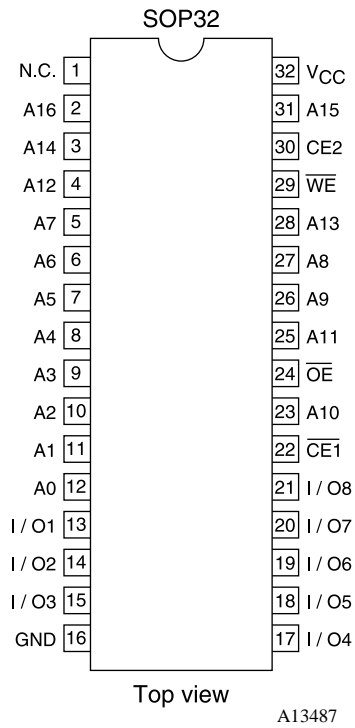
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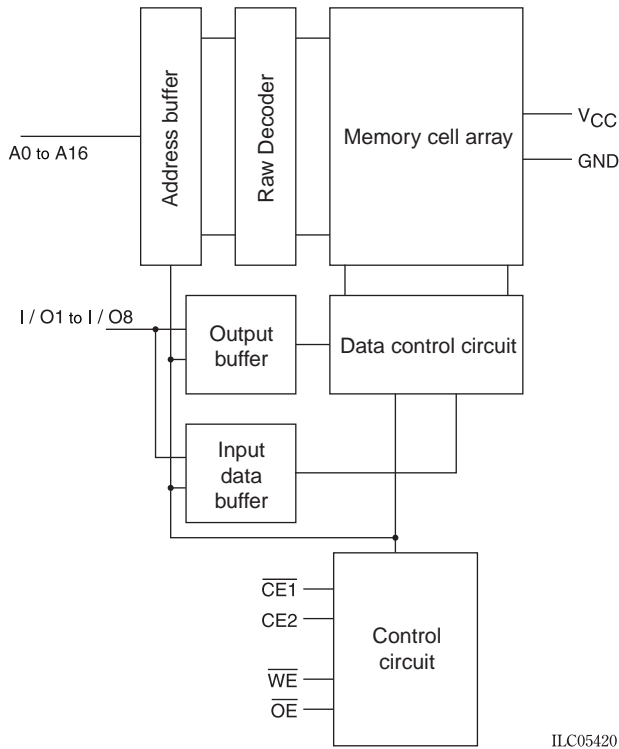
SANYO Electric Co., Ltd. Semiconductor Company

TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

Pin Assignment



Block Diagram



Pin Functions

A0 to A16	Address input
\overline{WE}	Ready/write control input
\overline{OE}	Output enable input
$\overline{CE1}$, $CE2$	Chip enable input
I/O1 to I/O8	Data I/O
V_{CC} , GND	Power supply, ground

Function Table

Mode	$\overline{CE1}$	CE2	\overline{OE}	\overline{WE}	I/O	Supply current
Ready cycle	L	H	L	H	Data output	I_{CCA}
Write cycle	L	H	X	L	Data input	I_{CCA}
Output disable	L	H	H	H	High impedance	I_{CCA}
Unselected	H	X	X	X	High impedance	I_{CCS}
	X	L	X	X	High impedance	I_{CCS}

Note: X indicates H or L.

Specifications

Maximum Ratings at $T_a = 25^\circ C$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC \text{ max}}$		4.6	V
Input pin voltage	V_{IN}		-0.3* to $V_{CC} + 0.3$	V
I/O pin voltage	$V_{I/O}$		-0.3 to $V_{CC} + 0.3$	V
Operating temperature	T_{opr}		-40 to +85	$^\circ C$
Storage temperature	T_{stg}		-55 to +125	$^\circ C$

*: For pulse widths under 30 ns: -2.0 V

Note: This chip may be destroyed if any stress in excess of the absolute maximum ratings is applied.

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DC Allowable Operating Range at $T_a = -40$ to $+85^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Supply voltage	V_{CC}		2.7	3.3	3.6	V
High-level input voltage	V_{IH}		$0.8V_{CC}$		$V_{CC} + 0.3$	V
Low-level input voltage	V_{IL}		-0.3^*		$0.2V_{CC}$	V

Note: * The minimum value is -3.0 V for pulse width under 50 ns.

DC Electrical Characteristics at $T_a = -40$ to $+85^\circ\text{C}$, $V_{CC} = 2.7$ to 3.6 V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Input leakage current	I_{LI}	$V_{IN} = 0$ to V_{CC}	-1.0		$+1.0$	μA
I/O leakage current	I_{LO}	$\overline{V_{CE1}} = V_{IH}$ or $V_{CE2} = V_{IL}$ or $\overline{V_{OE}} = V_{IH}$ or $\overline{V_{WE}} = V_{IL}$, $V_{I/O} = 0$ to V_{CC}	-1.0		$+1.0$	μA
Output high-level voltage	V_{OH1}	$V_{OH1} = -2.0$ mA	$V_{CC} - 0.4$			V
	V_{OH2}	$V_{OH2} = -100$ μA	$V_{CC} - 0.1$			V
Output low-level voltage	V_{OL1}	$V_{OL1} = 2.0$ mA			0.4	V
	V_{OL2}	$V_{OL2} = -100$ μA			0.1	V
Operating supply current (CMOS inputs)	I_{CCA2}	$\overline{V_{CE1}} = V_{IL}$, $V_{CE2} = V_{IH}$, $I_{I/O} = 0$ mA, $V_{IN} = V_{IH}$ or V_{IL}			1.2	mA
	I_{CCA3}	$\overline{V_{CE1}} = V_{IL}$, $V_{CE2} = V_{IH}$, $I_{I/O} = 0$ mA, $V_{IN} = V_{IH}$ or V_{IL} , DUTY 100%	min cycle	70 ns	25	mA
				100 ns	20	
Standby mode supply current ($V_{CC} - 0.2$ V/0.2 V inputs) (CMOS inputs)	I_{CCS1}	$V_{CE2} \leq 0.2$ V or $(\overline{V_{CE1}} \geq V_{CC} - 0.2$ V, $V_{CE2} \geq V_{CC} - 0.2$ V)	$T_a \leq 85^\circ\text{C}$		20	μA
			$T_a \leq 70^\circ\text{C}$		10	
			$T_a \leq 25^\circ\text{C}$	0.1		
	I_{CCS2}	$\overline{V_{CE1}} = V_{IH}$ or $V_{CE2} = V_{IL}$, $V_{IN} = 0$ to V_{CC}			0.4	mA

Note: * Reference values when $V_{CC} = 3.0$ V and $T_a = 25^\circ\text{C}$.

I/O Capacitances at $T_a = 25^\circ\text{C}$, $f = 1$ MHz

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Input capacitance	C_{IN}	$V_{IN} = 0$ V		6	10	pF
I/O capacitance	$C_{I/O}$	$V_{I/O} = 0$ V		6	10	pF

Note: These parameters are not measured for all devices, but are sampled values.

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AC Electrical Characteristics at $T_a = -40$ to $+85^\circ\text{C}$, $V_{CC} = 2.7$ to 3.6 V

AC test conditions

Input pulse voltage levels: $V_{IL} = 0.2 V_{CC}$, $V_{IH} = 0.8 V_{CC}$

Input rise and fall times: 5 ns

Input and output timing levels: $1/2 V_{CC}$

Output load: 30 pF (including the jig capacitance)

Read cycle

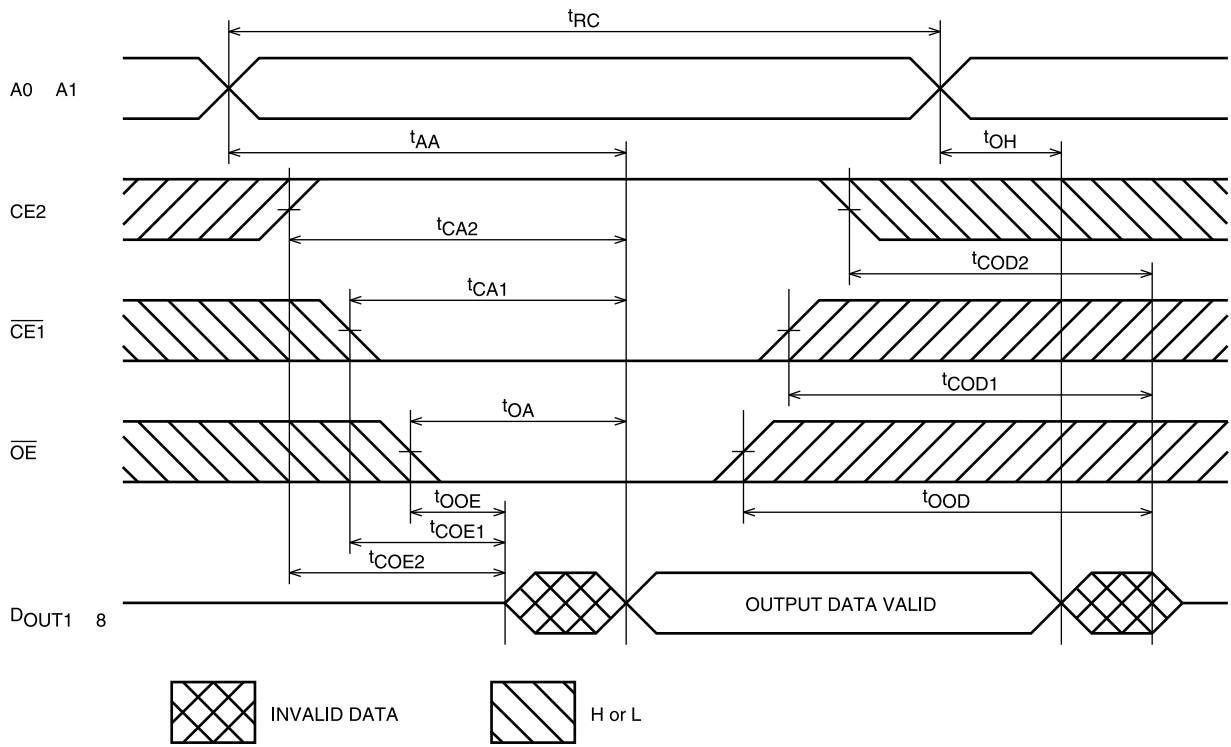
Parameter	Symbol	-70U		-10U		Unit
		min	max	min	max	
Read cycle time	t_{RC}	70		100		ns
Address access time	t_{AA}		70		100	ns
$\overline{CE1}$ access time	t_{CA1}		70		100	ns
CE2 access time	t_{CA2}		70		100	ns
\overline{OE} access time	t_{OA}		50		50	ns
Output hold time	t_{OH}	10		10		ns
$\overline{CE1}$ output enable time	t_{COE1}	10		10		ns
CE2 output enable time	t_{COE2}	10		10		ns
\overline{OE} output enable time	t_{OCE}	5		5		ns
$\overline{CE1}$ output disable time	t_{COD1}		40		35	ns
CE2 output disable time	t_{COD2}		40		35	ns
\overline{OE} output disable time	t_{OOD}		35		30	ns

Write cycle

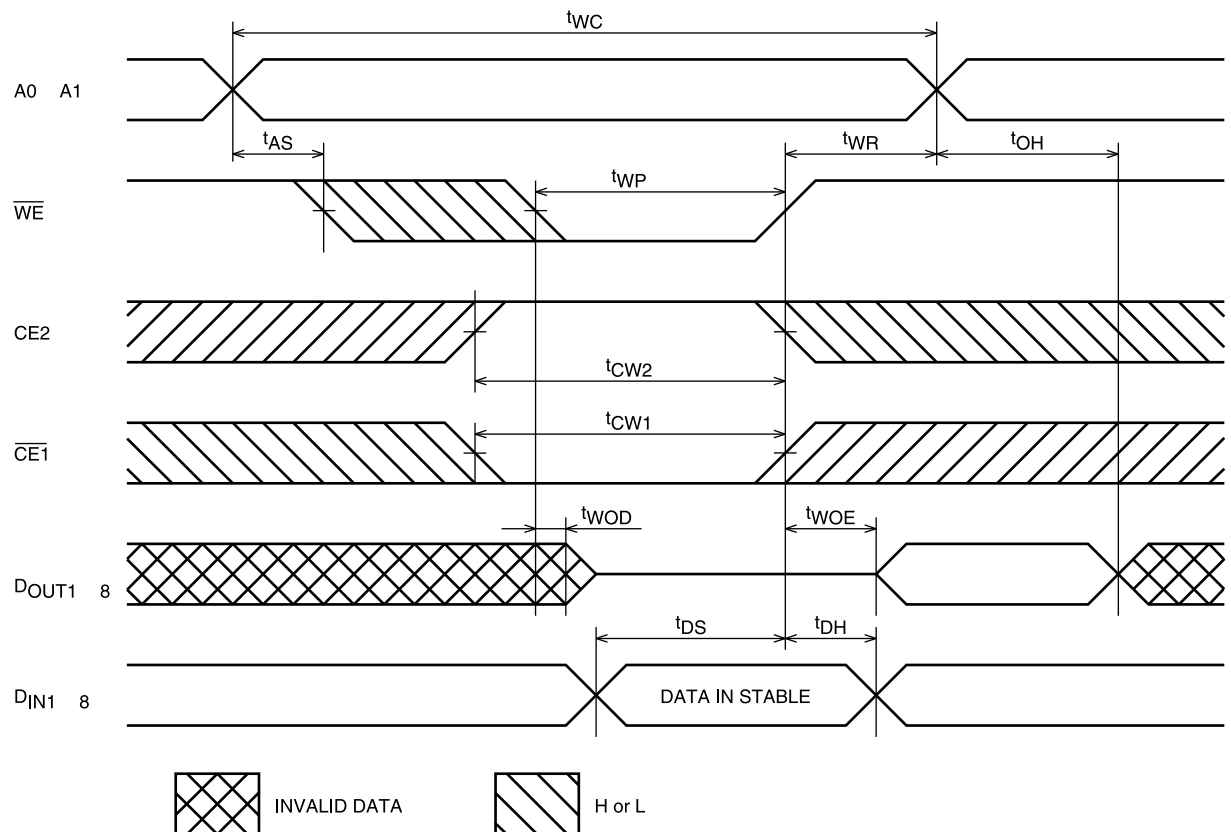
Parameter	Symbol	-70U		-10U		Unit
		min	max	min	max	
Write cycle time	t_{WC}	70		100		ns
Address setup time	t_{AS}	0		0		ns
Write pulse width	t_{WP}	50		70		ns
$\overline{CE1}$ setup time	t_{CW1}	60		90		ns
CE2 setup time	t_{CW2}	60		90		ns
Write recovery time	t_{WR}	0		0		ns
$\overline{CE1}$ write recovery time	t_{WR1}	0		0		ns
CE2 write recovery time	t_{WR2}	0		0		ns
Data setup time	t_{DS}	40		50		ns
Data hold time	t_{DH}	0		0		ns
$\overline{CE1}$ data hold time	t_{DH1}	0		0		ns
CE2 data hold time	t_{DH2}	0		0		ns
\overline{WE} output enable time	t_{WOE}	5		5		ns
\overline{WE} output disable time	t_{WOD}		35		30	ns

Timing Charts

Read cycle (1) : $\overline{CE1} = \overline{OE} = V_{IL}$, $\overline{CE2} = V_{IH}$, $\overline{WE} = V_{IH}$

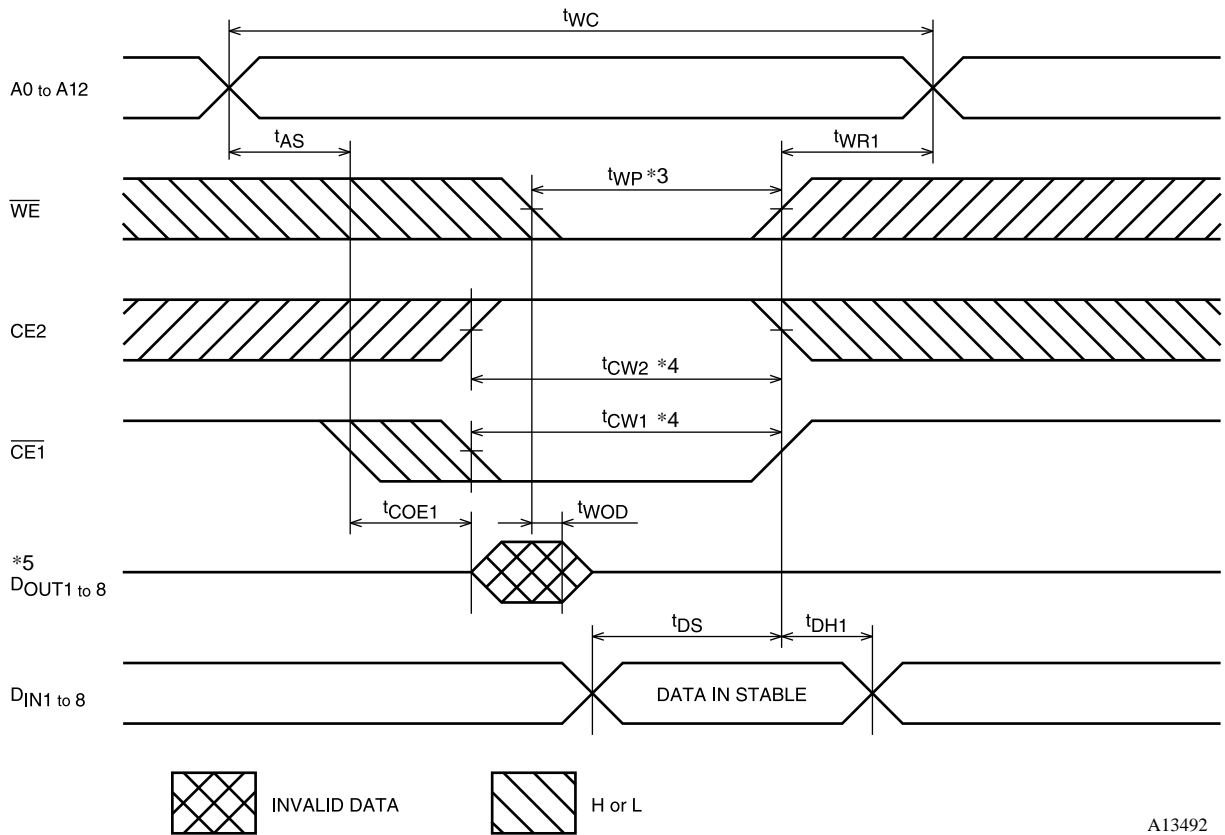


Read cycle (2) : $\overline{WE} = V_{IH}$

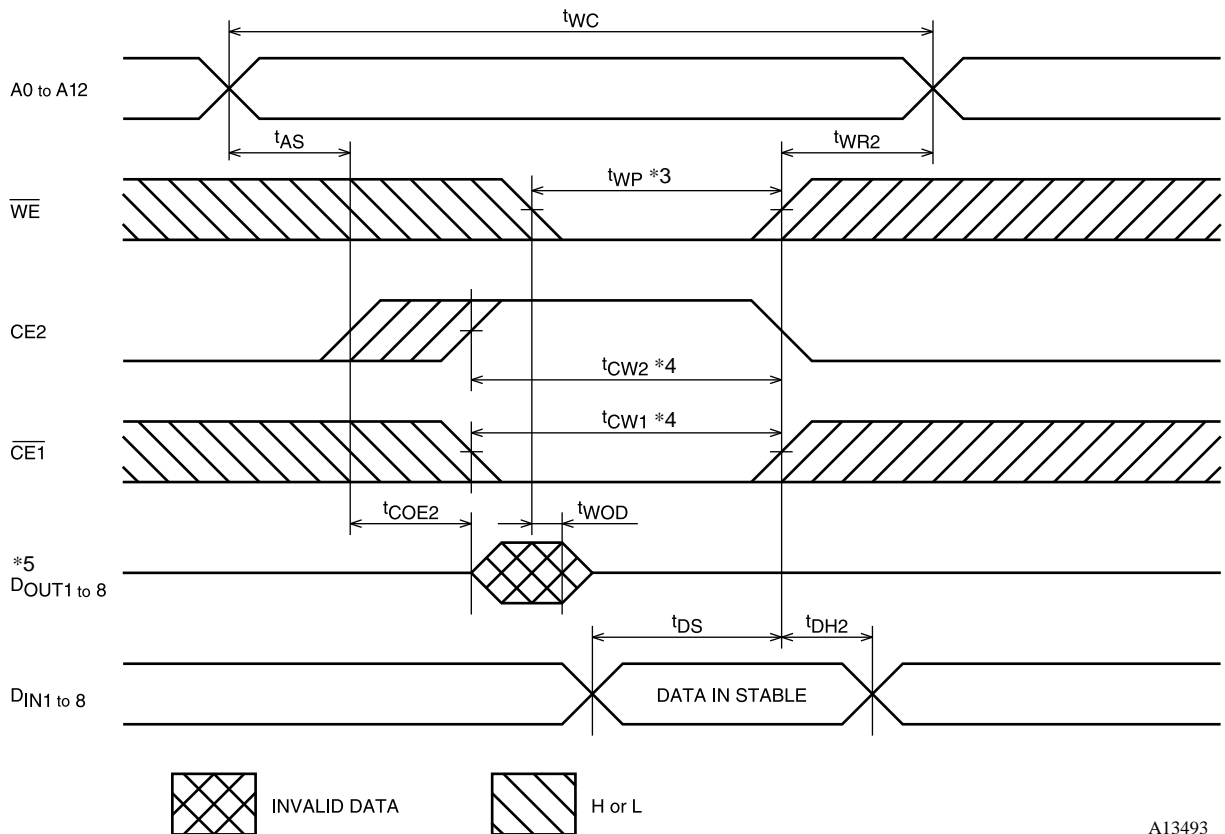


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Write cycle (6) (\overline{WE} = control) *6



Write cycle (2) ($\overline{CE1}$ = control) *6



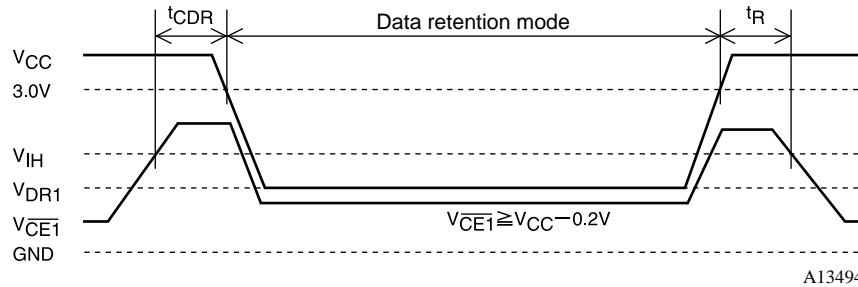
- Notes: 1. The times t_{COD1} , t_{COD2} , t_{OOD} , and t_{WOD} are stipulated as the times until the output reaches the high-impedance state. They are not stipulated by output voltage level.
2. Do not apply reverse phase signals to the data outputs when the data outputs are in the output state.
3. t_{WP} is the period that $\overline{CE1}$ and \overline{WE} are at the low level and CE2 is at the high level, and is defined as the time from the fall of \overline{WE} until the rise of $\overline{CE1}$ or \overline{WE} or the fall of CE2, whichever occurs first.
4. t_{CW1} and t_{CW2} are the period that $\overline{CE1}$ and \overline{WE} are at the low level and CE2 is at the high level, and are defined as the time from the fall of $\overline{CE1}$ or the rise of CE2 to the rise of either $\overline{CE1}$ or \overline{WE} or the fall of CE2, whichever occurs first.
5. The data outputs go to the high-impedance state when any one of the following states hold: \overline{OE} is at the high level, $\overline{CE1}$ is at the high level, CE2 is at the low level, or \overline{WE} is at the low level.
6. If \overline{OE} is at the high level during the write cycle, the data outputs will go to the high-impedance state.

Data Retention Characteristics at Ta = -40 to +85°C

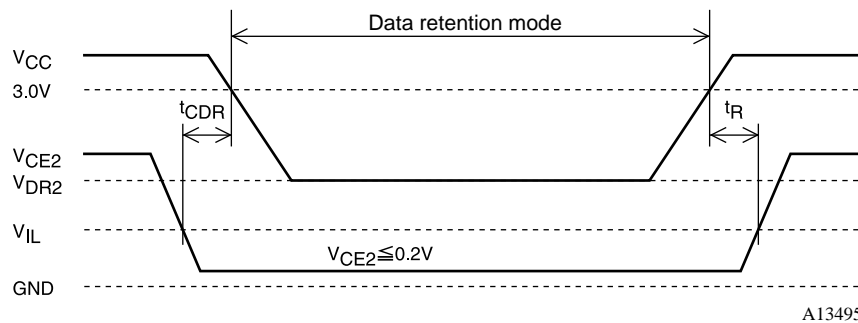
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Data retention supply voltage	V_{DR1}	$V_{\overline{CE1}} \geq V_{CC} - 0.2 \text{ V}$, $V_{CE2} \geq V_{CC} - 0.2 \text{ V}$ or $V_{CE2} \leq 0.2 \text{ V}$	2.0		3.6	V
	V_{DR2}	$V_{CE2} \leq 0.2 \text{ V}$	2.0		3.6	V
Data retention supply current	I_{CCDR1}	$V_{CC} = 3.0 \text{ V}$, $V_{\overline{CE1}} \geq V_{CC} - 0.2 \text{ V}$, $V_{CE2} \geq V_{CC} - 0.2 \text{ V}$, or $V_{CE2} \leq 0.2 \text{ V}$	-40°C to +85°C		16	μA
			-40°C to +70°C		8	
			+25°C	0.1		
Chip enable setup time	t_{CDR}		0			ns
Chip enable hold time	t_R		5			ms

Note: * Ta = +25°C

Data Retention Waveforms (1) ($\overline{CE1}$ control)



Data Retention Waveforms (2) (CE2 control)



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