

Features

- **Low-power consumption**
 - Active: 20mA at 70ns
 - Stand-by: 5 μ A (CMOS input/output)
1 μ A CMOS input/output, L version
- **Single +1.8to 2.2V Power Supply**
- **Equal access and cycle time**
- **70/85/100/150 ns access time**
- **Easy memory expansion with $\overline{CE1}$, CE2 and \overline{OE} inputs**
- **1.0V data retention mode**
- **TTL compatible, Tri-state input/output**
- **Automatic power-down when deselected**

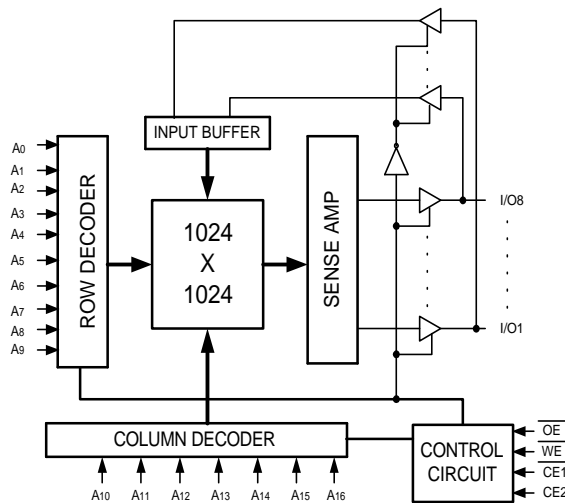
Functional Description

The SD18U128 is a low power CMOS Static RAM organized as 131,072 words by 8 bits. Easy memory expansion is provided by an active LOW $\overline{CE1}$, an active HIGH CE2, an active LOW \overline{OE} , and Tri-state I/O's. This device has an automatic power-down mode feature when deselected.

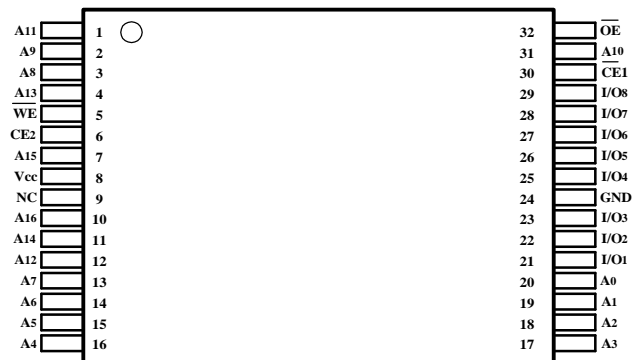
Writing to the device is accomplished by taking Chip Enable 1 ($\overline{CE1}$) with Write Enable (\overline{WE}) LOW, and Chip Enable 2 (CE2) HIGH. Reading from the device is performed by taking Chip Enable 1 ($\overline{CE1}$) with Output Enable (\overline{OE}) LOW while Write Enable (\overline{WE}) and Chip Enable 2 (CE2) is HIGH. The I/O pins are placed in a high-impedance state when the device is deselected: the outputs are disabled during a write cycle.

The SD18U128L comes with a 1V data retention feature and Lower Standby Power. The SD18U128 is available in a 32-pin 8 x 20 mm TSOP1 / STSOP / 48-fpBGA packages.

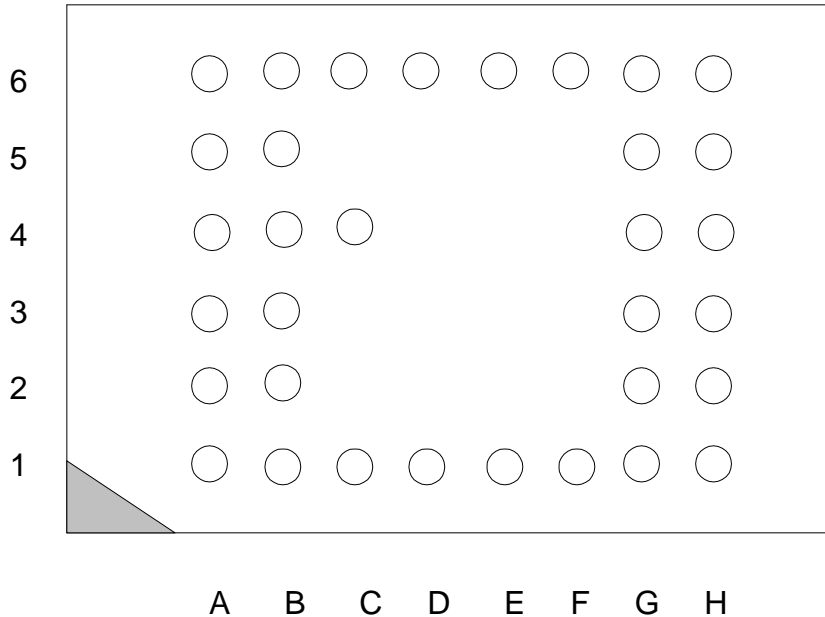
Logic Block Diagram



32-Pin TSOP1 / STSOP (See next page)



Soft Device, Inc. SD28U128B



TOP VIEW

Top View

48-CSP Ball-Grid Array package (shading indicates no ball)

	1	2	3	4	5	6
A	A ₀	A ₁	<u>CE</u> ₂	A ₃	A ₆	A ₈
B	I/O ₄	A ₂	<u>WE</u>	A ₄	A ₇	I/O ₀
C	I/O ₅	NC	NC	A ₅	NC	I/O ₁
D	V _{SS}	NC	NC	NC	NC	V _{DD}
E	V _{DD}	NC	NC	NC	NC	V _{SS}
F	I/O ₆	<u>NC</u>	<u>NC</u>	NC	NC	I/O ₂
G	I/O ₇	<u>OE</u>	<u>CE</u> ₁	A ₁₆	A ₁₅	I/O ₃
H	A ₉	A ₁₀	A ₁₁	A ₁₂	A ₁₃	A ₁₄

Absolute Maximum Ratings *

Parameter	Symbol	Minimum	Maximum	Unit
Voltage on Any Pin Relative to Gnd	Vt	-0.5	4.6	V
Power Dissipation	P _T	–	1.0	W
Storage Temperature (Plastic)	Tstg	-55	+150	°C
Temperature Under Bias	Tbias	-40	+85	°C

* **Note:** Stresses greater than those listed above Absolute 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 conditions outside those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

Truth Table

CE1	CE2	WE	OE	Data	Mode
H	X	X	X	High-Z	Standby
X	L	X	X	High-Z	Standby
L	H	H	L	Data Out	Active, Read
L	H	H	H	High-Z	Active, Output Disable
L	H	L	X	Data In	Active, Write

* **Key:** X = Don't Care, L = Low, H = High

Recommended Operating Conditions (T_A = 0°C to +70°C / -40°C to 85°C)**

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	V _{CC}	1.8	2.0	2.2	V
	Gnd	0.0	0.0	0.0	V
Input Voltage	V _{IH}	1.6	-	V _{CC} + 0.2	V
	V _{IL}	-0.5*	-	0.4	V

* V_{IL} min = -1.0V for pulse width less than t_{RC}/2.

** For Industrial Temperature.

DC Operating Characteristics ($V_{CC} = 1.8$ to $2.2V$, $Gnd = 0V$, $T_A = 0^{\circ}C$ to $+70^{\circ}C$ / $-40^{\circ}C$ to $85^{\circ}C$)

Parameter	Sym	Test Conditions	-70		-85		-100		-150		Unit
			Min	Max	Min	Max	Min	Max	Min	Max	
Input Leakage Current	I_{LI}	$V_{CC} = \text{Max}$, $V_{in} = \text{Gnd to } V_{CC}$	-	1	-	1	-	1	-	1	μA
Output Leakage Current	I_{LO}	$\overline{CE1} = V_{IH}$ or $CE2 = V_{IL}$ $V_{CC} = \text{Max}$, $V_{OUT} = \text{Gnd to } V_{CC}$	-	1	-	1	-	1	-	1	μA
Operating Power Supply Current	I_{CC}	$\overline{CE1} = V_{IL}$, $CE2 = V_{IH}$ $V_{IN} = V_{IH}$ or V_{IL} , $I_{OUT} = 0mA$	-	3	-	3	-	3	-	3	mA
Average Operating Current	I_{CC1}	$\overline{CE1} = V_{IL}$, $CE2 = V_{IH}$ $I_{OUT} = 0mA$, Min Cycle, 100% Duty	-	25	-	20	-	15	-	15	mA
	I_{CC2}	$\overline{CE1} = 0.2V$, $CE2 = V_{CC} - 0.2V$ $I_{OUT} = 0mA$, Cycle Time=1 μs , 100% Duty	-	3	-	3	-	3	-	3	mA
Standby Power Supply Current (TTL Level)	I_{SB}	$\overline{CE1} = V_{IH}$ or $CE2 = V_{IL}$	-	0.5	-	0.5	-	0.5	-	0.5	mA
Standby Power Supply Current (CMOS Level)	I_{SB1}	$\overline{CE1} \geq V_{CC} - 0.2V$ or $CE2 \leq 0.2V$, $f = 0$ $V_{IN} \leq 0.2V$ or $V_{IN} \geq V_{CC} - 0.2V$	-	5	-	5	-	5	-	5	μA
		L	-	1	-	1	-	1	-	1	μA
Output Low Voltage	V_{OL}	$I_{OL} = 2 mA$	-	0.4	-	0.4	-	0.4	-	0.4	V
Output High Voltage	V_{OH}	$I_{OH} = -1 mA$	1.6	-	1.6	-	1.6	-	1.6	-	V

Capacitance ($f = 1MHz$, $T_A = 25^{\circ}C$)

Parameter*	Symbol	Test Condition	Max	Unit
Input Capacitance	C_{in}	$V_{in} = 0V$	7	pF
I/O Capacitance	$C_{I/O}$	$V_{in} = V_{out} = 0V$	8	pF

* This parameter is guaranteed by device characterization and is not production tested.

AC Test Conditions

Input Pulse Level	0.4V to 1.6V
Input Rise and Fall Time	5ns
Input and Output Timing Reference Level	50% of input level ($V_{IL} + V_{IH}$)/2

Output Load Condition

70ns/85 ns	$C_L = 30pf + 1TTL \text{ Load}$
Load 100ns/150 ns	$C_L = 100pf + 1TTL \text{ Load}$

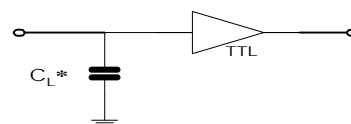


Figure A. * Including Scope and Jig Capacitance

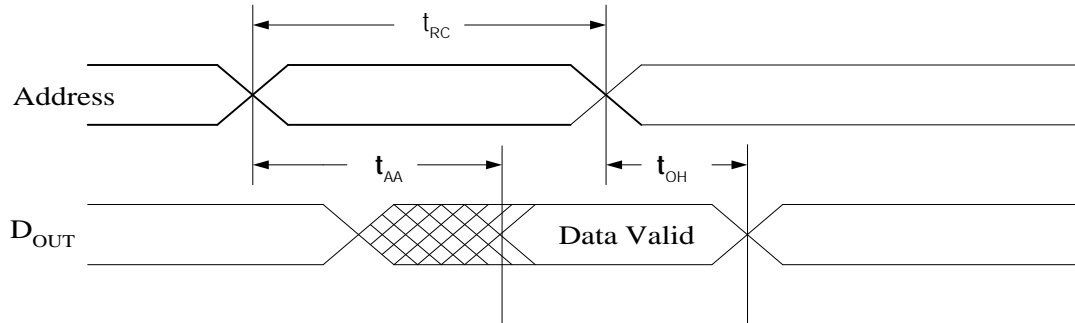
Read Cycle ^(3,9) ($V_{cc} = 1.8$ to $2.2V$, $Gnd = 0V$, $T_A = 0^{\circ}C$ to $+70^{\circ}C$ / $-40^{\circ}C$ to $+85^{\circ}C$)

Parameter	Symbol	-70		-85		-100		-150		Unit	Note
		Min	Max	Min	Max	Min	Max	Min	Max		
Read Cycle Time	t_{RC}	70	-	85	-	100	-	150	-	ns	
Address Access Time	t_{AA}	-	70	-	85	-	100	-	150	ns	
Chip Enable Access Time	t_{ACE}	-	70	-	85	-	100	-	150	ns	
Output Enable Access Time	t_{OE}	-	40	-	40	-	50	-	70	ns	
Output Hold from Address Change	t_{OH}	10	-	10	-	10	-	10	-	ns	
Chip Enable to Output in Low-Z	t_{CLZ}	10	-	10	-	10	-	10	-	ns	4,5
Chip Disable to Output in High-Z	t_{CHZ}	-	30	-	35	-	40	-	50	ns	4,5
Output Enable to Output in Low-Z	t_{OLZ}	5	-	5	-	5	-	5	-	ns	4,5
Output Disable to Output in High-Z	t_{OHZ}	-	25	-	30	-	35	-	40	ns	4,5
Power-Up Time	t_{PU}	0	-	0	-	0	-	0	-	ns	5
Power-Down Time	t_{PD}	-	70	-	85	-	100	-	150	ns	5

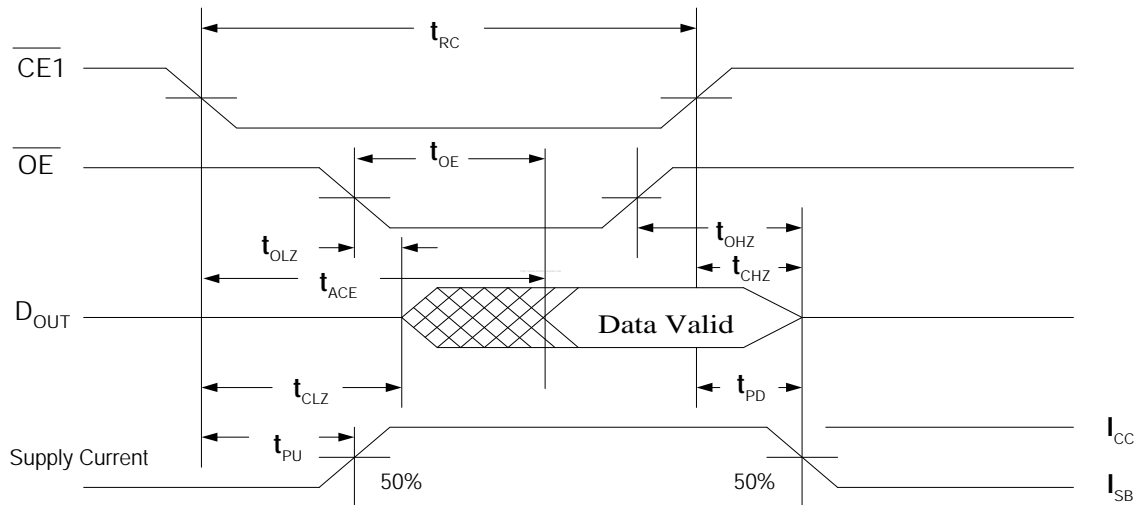
Write Cycle ^(3,11) ($V_{cc} = 1.8$ to $2.2V$, $Gnd = 0V$, $T_A = 0^{\circ}C$ to $+70^{\circ}C$ / $-40^{\circ}C$ to $+85^{\circ}C$)

Parameter	Symbol	-70		-85		-100		-150		Unit	Note
		Min	Max	Min	Max	Min	Max	Min	Max		
Write Cycle Time	t_{WC}	70	-	85	-	100	-	150	-	ns	
Chip Enable to Write End	t_{CW}	60	-	70	-	80	-	120	-	ns	
Address Setup to Write End	t_{AW}	60	-	70	-	80	-	120	-	ns	
Address Setup Time	t_{AS}	0	-	0	-	0	-	0	-	ns	
Write Pulse Width	t_{WP}	50	-	60	-	70	-	100	-	ns	
Write Recovering Time	t_{WR}	0	-	0	-	0	-	0	-	ns	
Data Valid to Write End	t_{DW}	30	-	35	-	40	-	60	-	ns	
Data Hold Time	t_{DH}	0	-	0	-	0	-	0	-	ns	
Write Enable to Output in High-Z	t_{WZ}	-	30	-	35	-	40	-	50	ns	4,5
Output Active from Write End	t_{OW}	5	-	5	-	5	-	5	-	ns	4,5

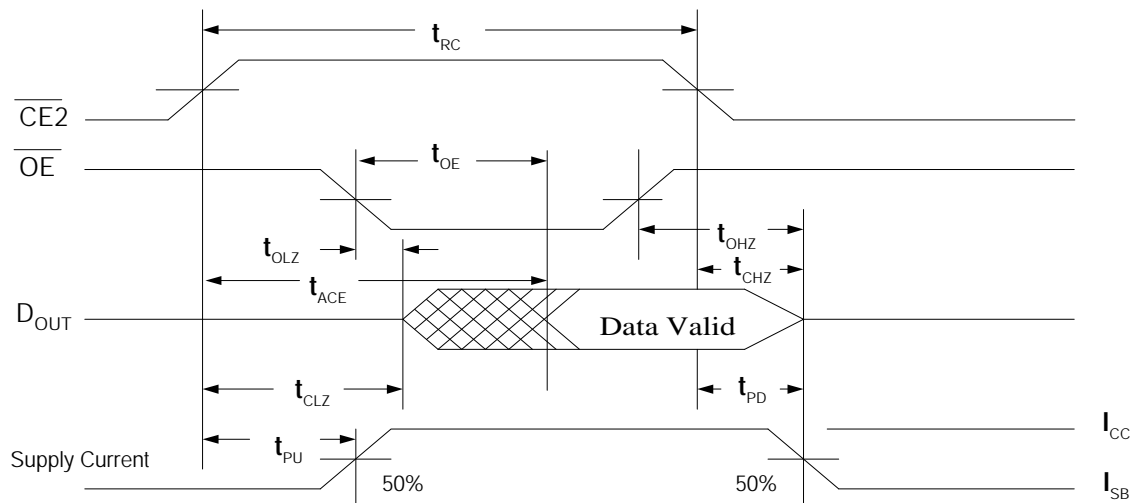
Timing Waveform of Read Cycle 1 ^(3,6,7,9) (Address Controlled)



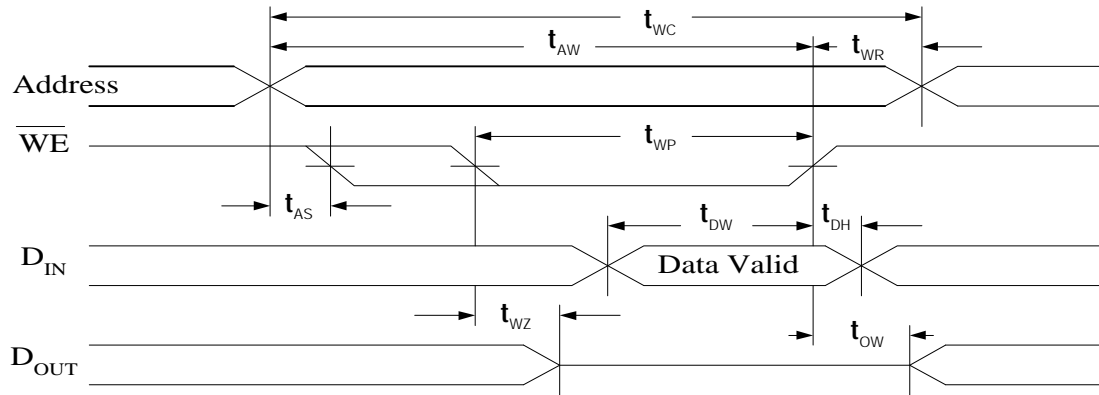
Timing Waveform of Read Cycle 2 ^(5,6,8,9) ($\overline{CE1}$ Controlled)



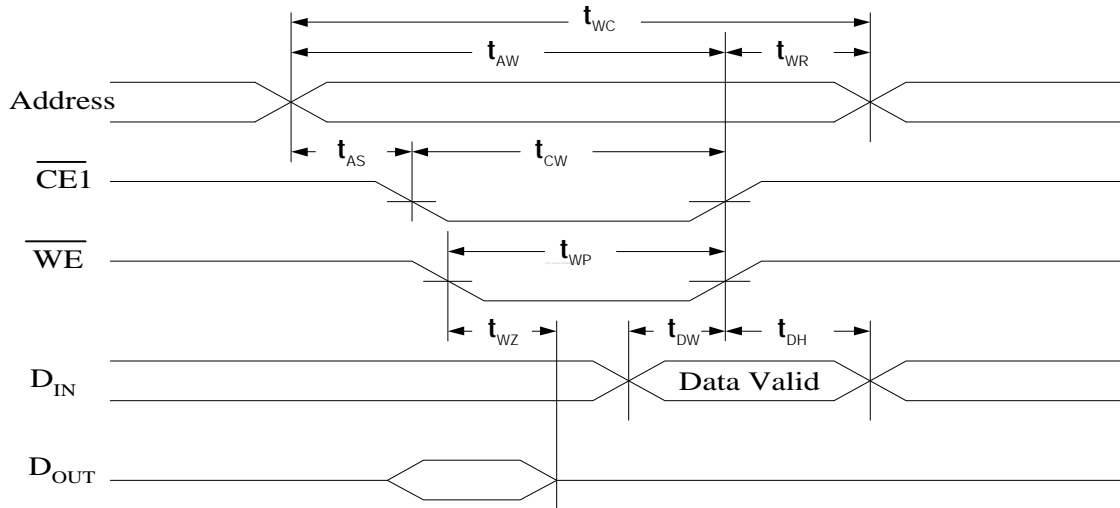
Timing Waveform of Read Cycle 3 ^(3,6,8,9) ($\overline{CE2}$ Controlled)



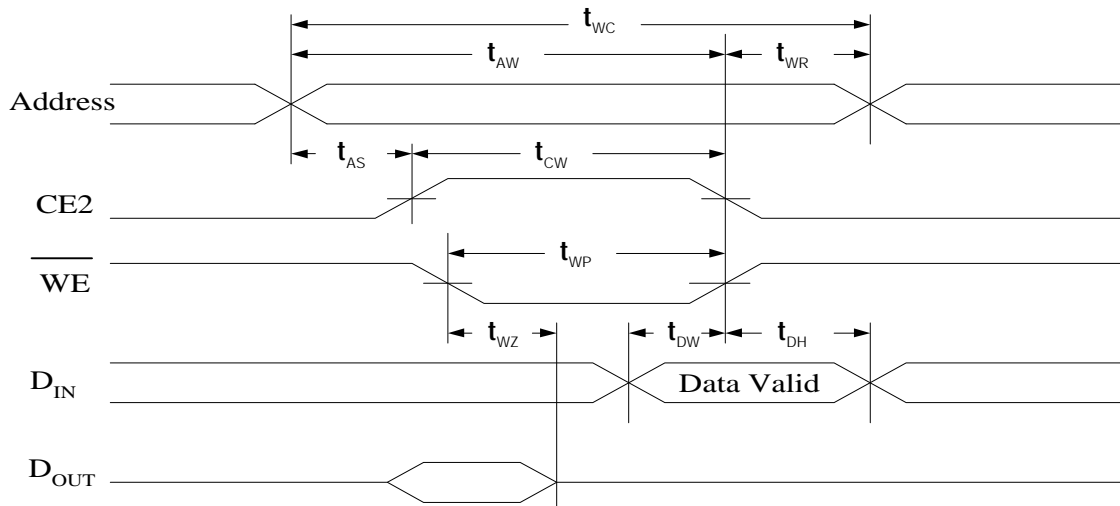
Timing Waveform of Write Cycle 1 ^(10,11) ($\overline{\text{WE}}$ Controlled)



Timing Waveform of Write Cycle 2 ^(10,11) ($\overline{\text{CE1}}$ Controlled)



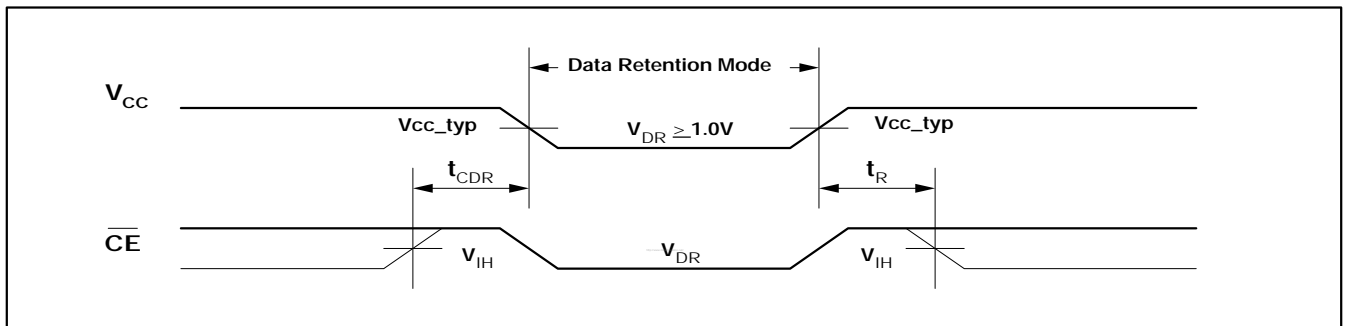
Timing Waveform of Write Cycle 3 ^(10,11) (CE2 Controlled)



Data Retention Characteristics (L Version Only)⁽¹⁾

Parameter	Symbol	Test Condition	Min	Max	Unit
V _{CC} for Data Retention	V _{DR}	$\overline{CE}_1 \geq V_{CC} - 0.2V$ or	1.0	-	V
Data Retention Current	I _{CCDR}	$CE_2 \leq +0.2V$	-	1	μA
Chip Deselect to Data Retention Time	t _{CDR}	$V_{IN} \geq V_{CC} - 0.2V$ or	0	-	ns
Operation Recovery Time ⁽²⁾	t _R	$V_{IN} \leq 0.2V$	t _{RC}	-	ns

Data Retention Waveform (L Version Only) (T_A = 0⁰C to +70⁰C / -40⁰C to +85⁰C)



Notes

1. L-version includes this feature.
2. This Parameter is samples and not 100% tested.
3. For test conditions, see *AC Test Condition*, Figure A.
4. This parameter is tested with CL = 5pF as shown in Figure B. Transition is measured ± 500mV from steady-state voltage.
5. This parameter is guaranteed, but is not tested.
6. \overline{WE} is HIGH for read cycle.
7. \overline{CE}_1 and \overline{OE} are LOW and CE2 is HIGH for read cycle.
8. Address valid prior to or coincident with \overline{CE}_1 transition LOW or CE2 transition HIGH.
9. All read cycle timings are referenced from the last valid address to the first transition address.
10. \overline{CE}_1 or \overline{WE} must be HIGH or CE2 must be LOW during address transition.
11. All write cycle timings are referenced from the last valid address to the first transition address.

Ordering Information

Device Type*	Speed	Package
SD18U128K-70	70 ns	8 x 20 mm 32-pin Plastic TSOP1
SD18U128K-85	85 ns	
SD18U128K-100	100 ns	
SD18U128K-150	150 ns	
SD18U128LK-70	70 ns	
SD18U128LK-85	85 ns	
SD18U128LK-100	100 ns	
SD18U128LK-150	150 ns	
SD18U128SK-70	70 ns	8 x 13.4 mm 32-pin Plastic STSOP
SD18U128SK-85	85 ns	
SD18U128SK-100	100 ns	
SD18U128SK-150	150 ns	
SD18U128LSK-70	70 ns	
SD18U128LSK-85	85 ns	
SD18U128LSK-100	100 ns	
SD18U128LSK-150	150 ns	
SD18U128FG-70	70 ns	
SD18U128FG-85	85 ns	
SD18U128FG-100	100 ns	
SD18U128FG-150	150 ns	

* For Industrial Temperature tested devices, an “I” designator will be added to the end of the Device number.

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