

Document Title**128Kx8 bit Low Power CMOS Static RAM****Revision History**

<u>Revision No.</u>	<u>History</u>	<u>Draft Data</u>	<u>Remark</u>
0.0	Initial draft	July 15, 2002	Preliminary
0.1	Revised - Deleted 32-TSOP1-0820R Package Type. - Added Commercial product.	December 4, 2002	Preliminary
0.2	Revised - Added Lead Free 32-SOP-525 Product	May 13, 2003	Preliminary
0.3	Revised - Added Lead Free 32-TSOP1-0820F Product	June 21, 2003	Preliminary
1.0	Finalized - Changed Icc from 10mA to 5mA - Changed Icc2 from 35mA to 25mA - Changed Isb from 3mA to 0.4mA - Changed IdR(industrial) from 15μA to 10μA - Changed IdR(Automotive) from 25μA to 20μA	September 16, 2003	Final

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128Kx8 bit Low Power full CMOS Static RAM

FEATURES

- Process Technology: Full CMOS
- Organization: 128K x 8
- Power Supply Voltage: 4.5–5.5V
- Low Data Retention Voltage: 2V(Min)
- Three state output and TTL Compatible
- Package Type: 32-DIP-600, 32-SOP-525, 32-SOP-525, 32-TSOP1-0820F

GENERAL DESCRIPTION

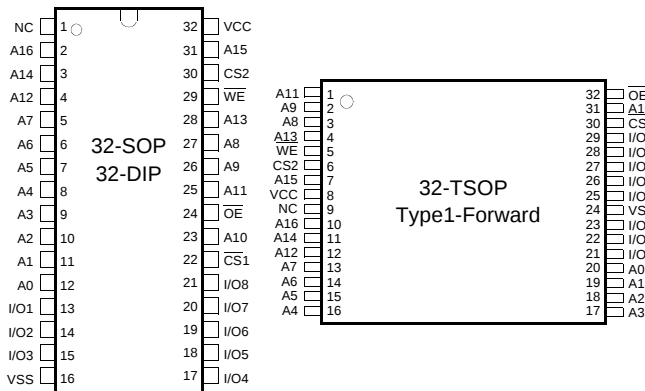
The K6X1008C2D families are fabricated by SAMSUNG's advanced CMOS process technology. The families support various operating temperature ranges and have various package types for user flexibility of system design. The families also support low data retention voltage for battery back-up operation with low data retention current.

PRODUCT FAMILY

Product Family	Operating Temperature	Vcc Range	Speed	Power Dissipation		PKG Type
				Standby (I _{SB1} , Max)	Operating (I _{CC2} , Max)	
K6X1008C2D-B	Commercial(0~70°C)	4.5~5.5V	55 ¹ /70ns	10μA	25mA	32-DIP-600, 32-SOP-525, 32-SOP-525, 32-TSOP1-0820F
K6X1008C2D-F	Industrial(-40~85°C)			15μA		
K6X1008C2D-Q	Automotive(-40~125°C)			25μA		32-SOP-525, 32-TSOP1-0820F

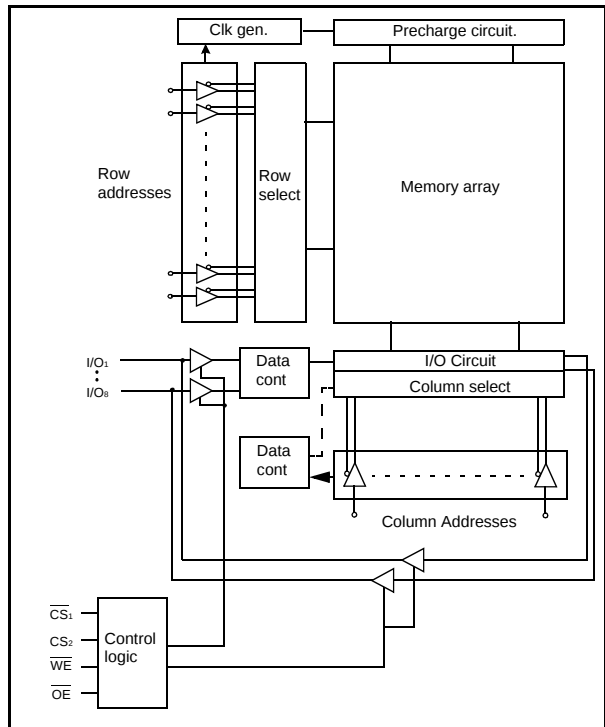
1. The parameters are tested with 50pF test load

PIN DESCRIPTION



Name	Function
CS ₁ , CS ₂	Chip Select Input
OE	Output Enable Input
WE	Write Enable Input
I/O ₁ ~I/O ₈	Data Inputs/Outputs
A ₀ ~A ₁₆	Address Inputs
Vcc	Power
Vss	Ground
NC	No Connection

FUNCTIONAL BLOCK DIAGRAM



SAMSUNG ELECTRONICS CO., LTD. reserves the right to change products and specifications without notice.

PRODUCT LIST

Commercial Products(0~70°C)		Industrial Products(-40~85°C)		Automotive Products(-40~125°C)	
Part Name	Function	Part Name	Function	Part Name	Function
K6X1008C2D-DB55	32-DIP, 55ns, LL	K6X1008C2D-DF55	32-DIP, 55ns, LL	K6X1008C2D-GQ55	32-SOP, 55ns, L
K6X1008C2D-DB70	32-DIP, 70ns, LL	K6X1008C2D-DF70	32-DIP, 70ns, LL	K6X1008C2D-GQ70	32-SOP, 70ns, L
K6X1008C2D-GB55	32-SOP, 55ns, LL	K6X1008C2D-GF55	32-SOP, 55ns, LL	K6X1008C2D-TQ55	32-TSOP-F, 55ns, L
K6X1008C2D-GB70	32-SOP, 70ns, LL	K6X1008C2D-GF70	32-SOP, 70ns, LL	K6X1008C2D-TQ70	32-TSOP-F, 70ns, L
K6X1008C2D-BB55 ¹⁾	32-SOP, 55ns, LL	K6X1008C2D-BF55 ¹⁾	32-SOP, 55ns, LL		
K6X1008C2D-BB70 ¹⁾	32-SOP, 70ns, LL	K6X1008C2D-BF70 ¹⁾	32-SOP, 70ns, LL		
K6X1008C2D-TB55	32-TSOP-F, 55ns, LL	K6X1008C2D-TF55	32-TSOP-F, 55ns, LL		
K6X1008C2D-TB70	32-TSOP-F, 70ns, LL	K6X1008C2D-TF70	32-TSOP-F, 70ns, LL		
K6X1008C2D-PB55 ¹⁾	32-TSOP-F, 55ns, LL	K6X1008C2D-PF55 ¹⁾	32-TSOP-F, 55ns, LL		
K6X1008C2D-PB70 ¹⁾	32-TSOP-F, 70ns, LL	K6X1008C2D-PF70 ¹⁾	32-TSOP-F, 70ns, LL		

1. Lead Free Product

FUNCTIONAL DESCRIPTION

$\overline{CS}_1$	CS_2	$\overline{OE}$	$\overline{WE}$	I/O	Mode	Power
H	X ¹⁾	X ¹⁾	X ¹⁾	High-Z	Deselected	Standby
X ¹⁾	L	X ¹⁾	X ¹⁾	High-Z	Deselected	Standby
L	H	H	H	High-Z	Output Disabled	Active
L	H	L	H	Dout	Read	Active
L	H	X ¹⁾	L	Din	Write	Active

1. X means don't care (Must be in high or low states)

ABSOLUTE MAXIMUM RATINGS¹⁾

Item	Symbol	Ratings	Unit	Remark
Voltage on any pin relative to Vss	V _{IN} , V _{OUT}	-0.5 to V _{CC} +0.5V(Max. 7.0V)	V	-
Voltage on Vcc supply relative to Vss	V _{CC}	-0.3 to 7.0	V	-
Power Dissipation	P _D	1.0	W	-
Storage temperature	T _{STG}	-65 to 150	°C	-
Operating Temperature	T _A	0 to 70	°C	K6X1008C2D-B
		-40 to 85	°C	K6X1008C2D-F
		-40 to 125	°C	K6X1008C2D-Q

1. Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. Functional operation should be restricted to recommended operating condition. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

RECOMMENDED DC OPERATING CONDITIONS¹⁾

Item	Symbol	Min	Typ	Max	Unit
Supply voltage	V _{CC}	4.5	5.0	5.5	V
Ground	V _{SS}	0	0	0	V
Input high voltage	V _{IH}	2.2	-	V _{CC} +0.5 ²⁾	V
Input low voltage	V _{IL}	-0.5 ³⁾	-	0.8	V

Note:

1. Commercial Product: T_A=0 to 70°C, Otherwise specified
Industrial Product: T_A=-40 to 85°C, Otherwise specified
Automotive Product: T_A=-40 to 125°C, Otherwise specified
2. Overshoot: V_{CC}+3.0V in case of pulse width≤30ns.
3. Undershoot: -3.0V in case of pulse width≤30ns.
4. Overshoot and undershoot are sampled, not 100% tested.

CAPACITANCE¹⁾ (f=1MHz, T_A=25°C)

Item	Symbol	Test Condition	Min	Max	Unit
Input capacitance	C _{IN}	V _{IN} =0V	-	8	pF
Input/Output capacitance	C _{IO}	V _{IO} =0V	-	10	pF

1. Capacitance is sampled, not 100% tested

DC AND OPERATING CHARACTERISTICS

Item	Symbol	Test Conditions		Min	Typ	Max	Unit
Input leakage current	I _{LI}	V _{IN} =V _{SS} to V _{CC}		-1	-	1	μA
Output leakage current	I _{LO}	$\overline{CS}_1=V_{IH}$ or $CS_2=V_{IL}$ or $\overline{OE}=V_{IH}$ or $\overline{WE}=V_{IL}$, V _{IO} =V _{SS} to V _{CC}		-1	-	1	μA
Operating power supply current	I _{CC}	I _{IO} =0mA, $\overline{CS}_1=V_{IL}$, $CS_2=V_{IH}$, V _{IN} =V _{IH} or V _{IL} , Read		-	-	5	mA
Average operating current	I _{CC1}	Cycle time=1μs, 100%duty, I _{IO} =0mA, $\overline{CS}_1\leq 0.2V$, $CS_2\geq V_{CC}-0.2V$, V _{IN} ≤0.2V or V _{IN} ≥V _{CC} -0.2V		-	-	7	mA
	I _{CC2}	Cycle time=Min, 100% duty, I _{IO} =0mA, $\overline{CS}_1=V_{IL}$, $CS_2=V_{IH}$, V _{IN} =V _{IH} or V _{IL}		-	-	25	mA
Output low voltage	V _{OL}	I _{OL} =2.1mA		-	-	0.4	V
Output high voltage	V _{OH}	I _{OH} =-1.0mA		2.4	-	-	V
Standby Current(TTL)	I _{SB}	$\overline{CS}_1=V_{IH}$, $CS_2=V_{IL}$, Other inputs=V _{IH} or V _{IL}		-	-	0.4	mA
Standby Current(CMOS)	I _{SB1}	$\overline{CS}_1\geq V_{CC}-0.2V$, $CS_2\geq V_{CC}-0.2V$ or $CS_2\leq 0.2V$, Other inputs=0~V _{CC}	K6X1008C2D-B	-	-	10	μA
			K6X1008C2D-F	-	-	15	μA
			K6X1008C2D-Q	-	-	25	μA

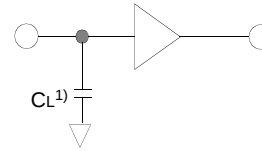
AC OPERATING CONDITIONS

TEST CONDITIONS (Test Load and Input/Output Reference)

Input pulse level: 0.8 to 2.4V

Input rising and falling time: 5ns

Input and output reference voltage: 1.5V

Output load (see right): $C_L = 100\text{pF} + 1\text{TTL}$
 $C_L = 50\text{pF} + 1\text{TTL}$ 

1. Including scope and jig capacitance

AC CHARACTERISTICS

(V_{CC}=4.5~5.5V, Commercial product: T_A=0 to 70°C, Industrial product: T_A=-40 to 85°C, Automotive product: T_A=-40~125°C)

Parameter List		Symbol	Speed Bins				Units
			55ns		70ns		
			Min	Max	Min	Max	
Read	Read Cycle Time	t _{RC}	55	-	70	-	ns
	Address Access Time	t _{AA}	-	55	-	70	ns
	Chip Select to Output	t _{CO}	-	55	-	70	ns
	Output Enable to Valid Output	t _{OE}	-	25	-	35	ns
	Chip Select to Low-Z Output	t _{LZ}	10	-	10	-	ns
	Output Enable to Low-Z Output	t _{OLZ}	5	-	5	-	ns
	Chip Disable to High-Z Output	t _{HZ}	0	20	0	25	ns
	Output Disable to High-Z Output	t _{OHZ}	0	20	0	25	ns
	Output Hold from Address Change	t _{OH}	10	-	10	-	ns
Write	Write Cycle Time	t _{WC}	55	-	70	-	ns
	Chip Select to End of Write	t _{CW}	45	-	60	-	ns
	Address Set-up Time	t _{AS}	0	-	0	-	ns
	Address Valid to End of Write	t _{AW}	45	-	60	-	ns
	Write Pulse Width	t _{WP}	40	-	50	-	ns
	Write Recovery Time	t _{WR}	0	-	0	-	ns
	Write to Output High-Z	t _{WHZ}	0	20	0	25	ns
	Data to Write Time Overlap	t _{DW}	20	-	25	-	ns
	Data Hold from Write Time	t _{DH}	0	-	0	-	ns
	End Write to Output Low-Z	t _{OW}	5	-	5	-	ns

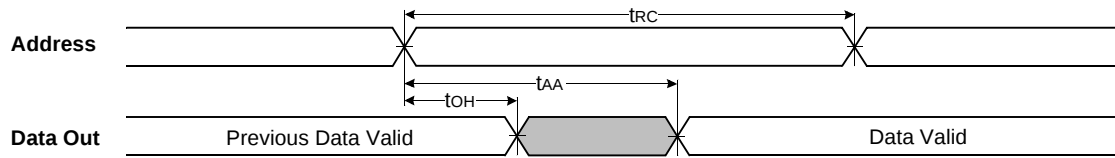
DATA RETENTION CHARACTERISTICS

Item	Symbol	Test Condition		Min	Typ	Max	Unit
V _{CC} for data retention	V _{DR}	$\overline{CS}_1 \geq V_{CC} - 0.2V^{(1)}$		2.0	-	5.5	V
Data retention current	I _{DR}	$V_{CC} = 3.0V, \overline{CS}_1 \geq V_{CC} - 0.2V^{(1)}$	K6X1008C2D-B	-	-	10	μA
			K6X1008C2D-F	-	-	10	μA
			K6X1008C2D-Q	-	-	20	μA
Data retention set-up time	t _{SDR}	See data retention waveform		0	-	-	ms
Recovery time	t _{RDR}			5	-	-	

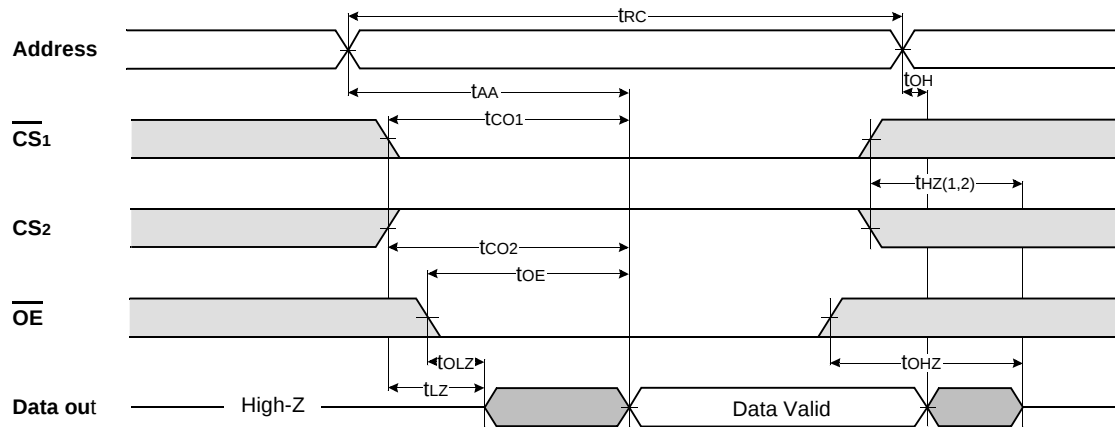
1. $\overline{CS}_1 \geq V_{CC} - 0.2V$, $\overline{CS}_2 \geq V_{CC} - 0.2V$, or $\overline{CS}_2 \leq 0.2V$

TIMING DIAGRAMS

TIMING WAVEFORM OF READ CYCLE(1) (Address Controlled, $\overline{CS1}=\overline{OE}=V_{IL}$, $CS2=\overline{WE}=V_{IH}$)



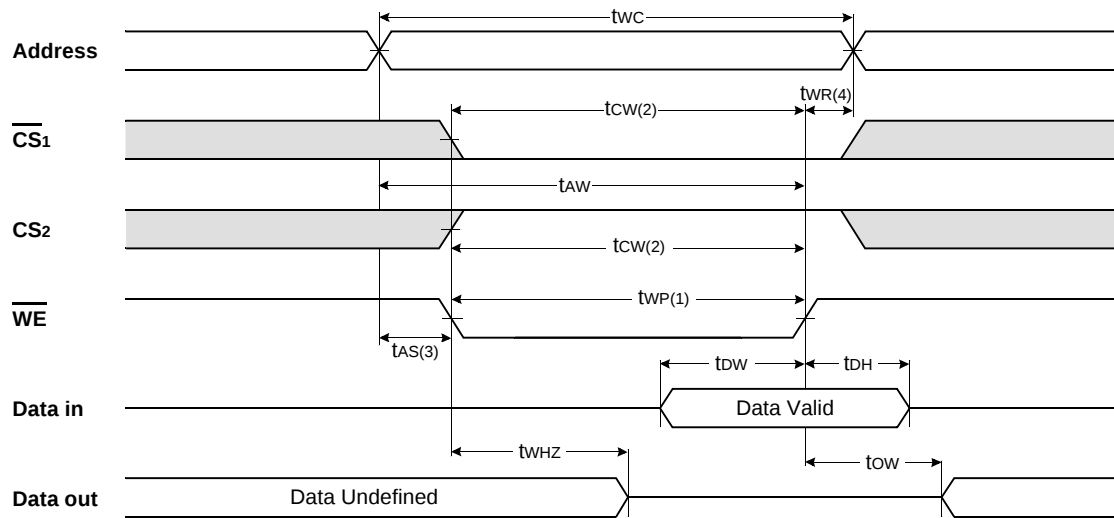
TIMING WAVEFORM OF READ CYCLE(2) ($\overline{WE}=V_{IH}$)



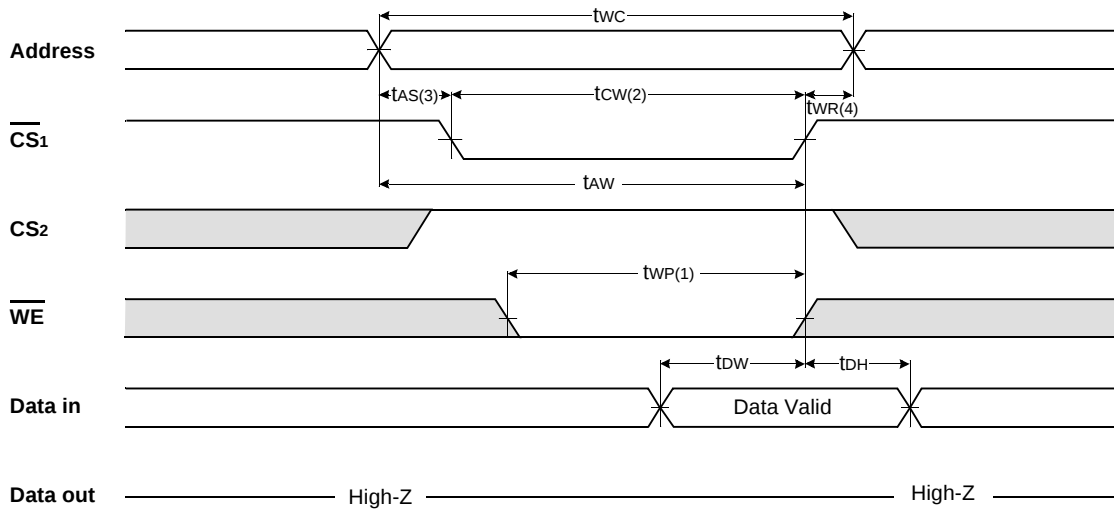
NOTES (READ CYCLE)

1. t_{HZ} and t_{OHZ} are defined as the time at which the outputs achieve the open circuit conditions and are not referenced to output voltage levels.
2. At any given temperature and voltage condition, $t_{HZ}(\text{Max.})$ is less than $t_{LZ}(\text{Min.})$ both for a given device and from device to device interconnection.

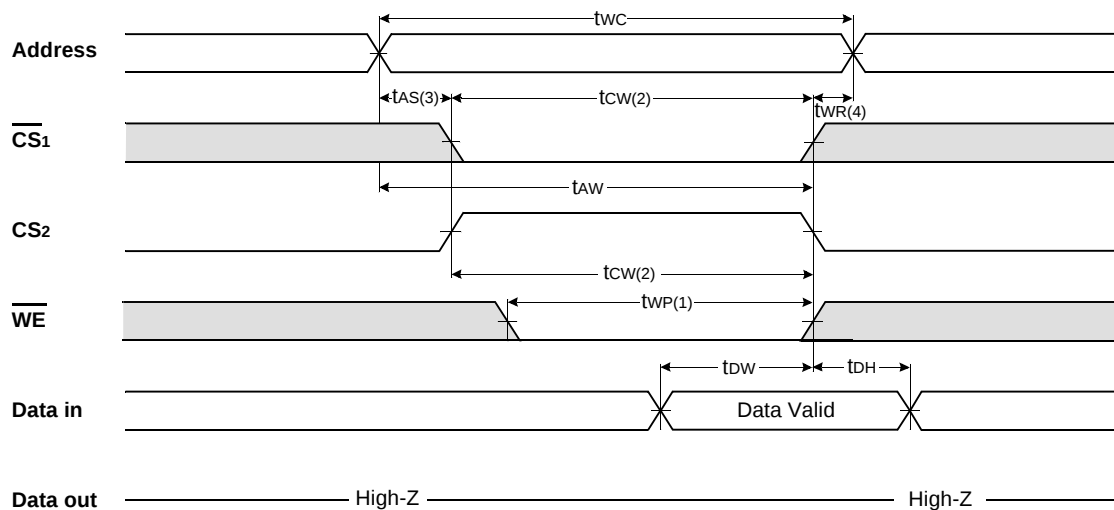
TIMING WAVEFORM OF WRITE CYCLE(1) ($\overline{\text{WE}}$ Controlled)



TIMING WAVEFORM OF WRITE CYCLE(2) ($\overline{\text{CS1}}$ Controlled)



TIMING WAVEFORM OF WRITE CYCLE(3) (CS₂ Controlled)

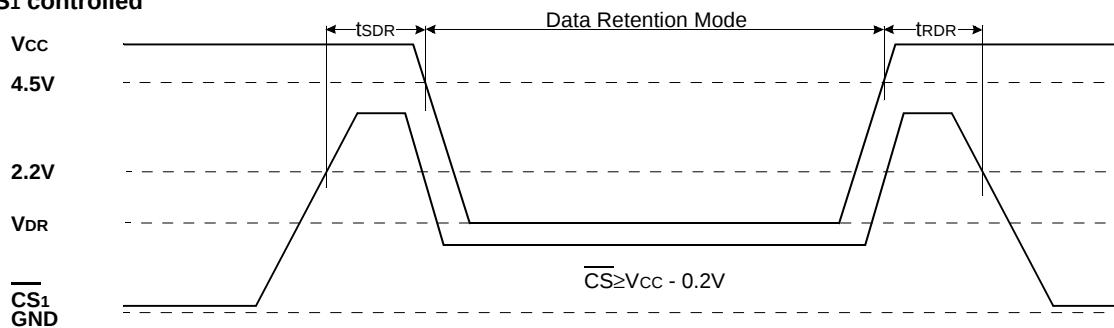


NOTES (WRITE CYCLE)

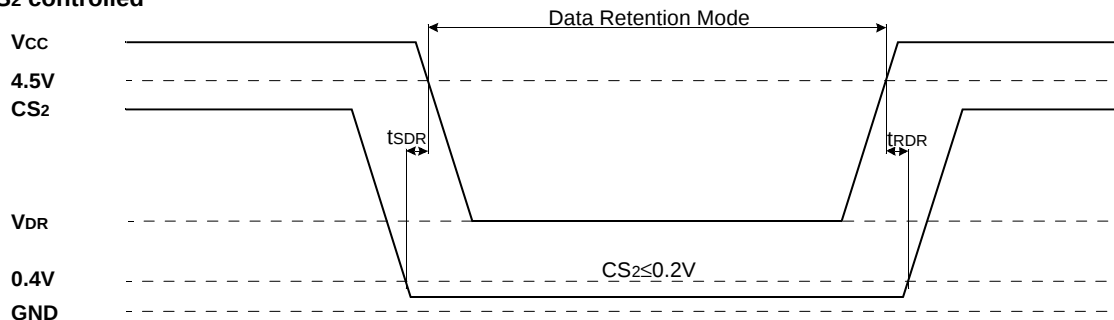
1. A write occurs during the overlap of a low $\overline{CS_1}$, a high CS_2 and a low $\overline{WE}$. A write begins at the latest transition among $\overline{CS_1}$ goes low, CS_2 going high and $\overline{WE}$ going low. A write ends at the earliest transition among CS_1 going high, CS_2 going low and $\overline{WE}$ going high, t_{WP} is measured from the beginning of write to the end of write.
2. t_{CW} is measured from the CS_1 going low or CS_2 going high to the end of write.
3. t_{AS} is measured from the address valid to the beginning of write.
4. t_{WR} is measured from the end of write to the address change. t_{WR} applied in case a write ends as $\overline{CS_1}$ or $\overline{WE}$ going high t_{WR2} applied in case a write ends as CS_2 going to low.

DATA RETENTION WAVE FORM

CS₁ controlled



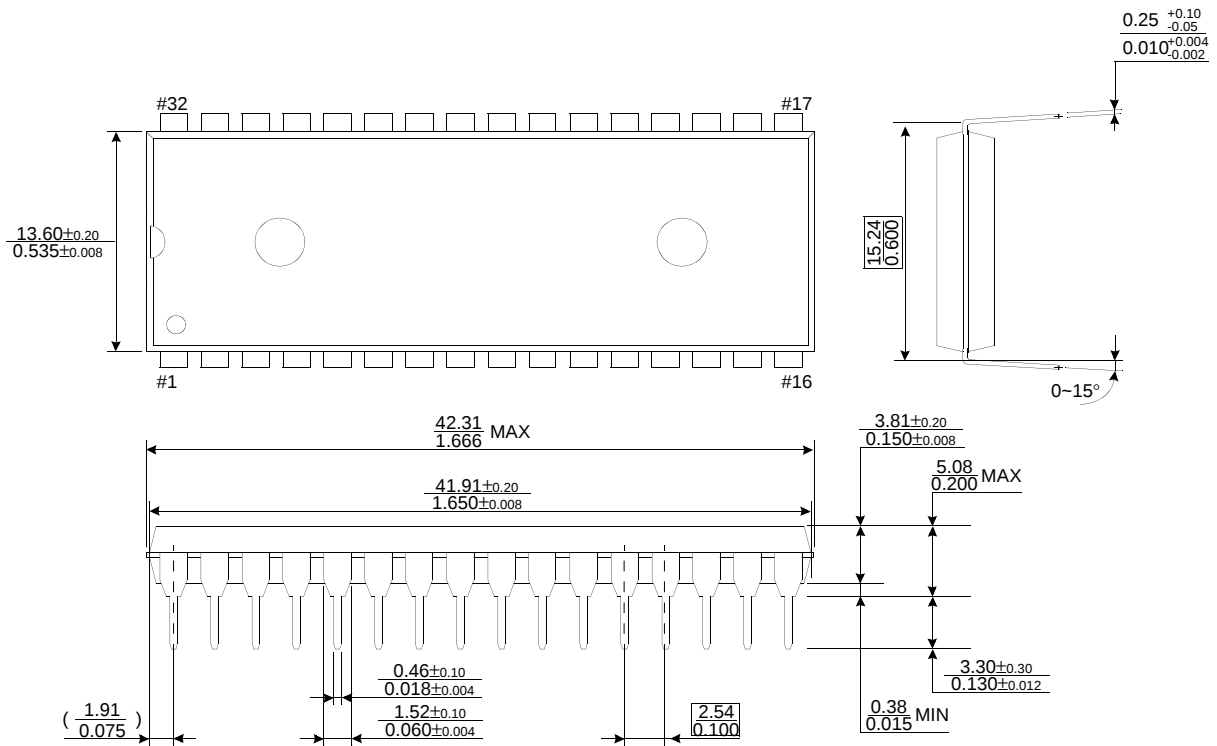
CS₂ controlled



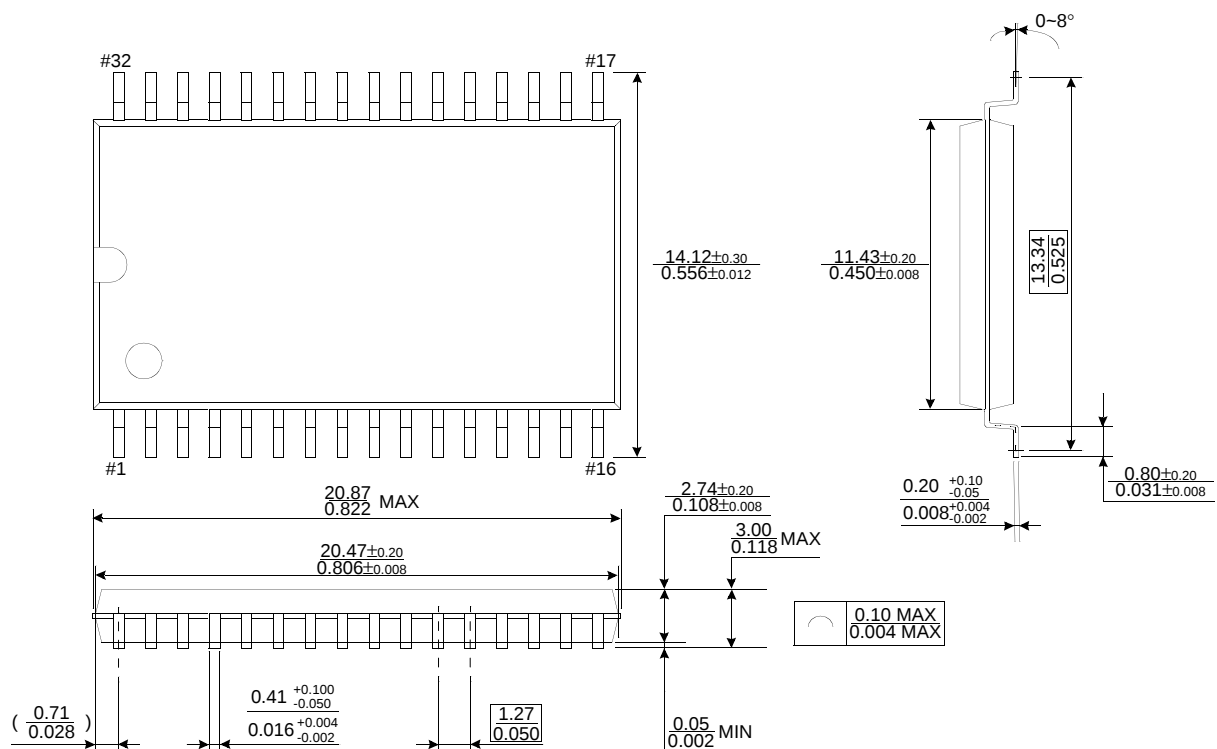
PACKAGE DIMENSIONS

32 DUAL INLINE PACKAGE (600mil)

Units: millimeters(inches)



32 PLASTIC SMALL OUTLINE PACKAGE (525mil)



Units: millimeters(inches)

Technical drawing of a rectangular component with dimensions and tolerances. The drawing includes a top view and a side view.

Top View Dimensions:

- Overall width: 20.00 ± 0.20
- Overall height: 0.787 ± 0.008
- Left side features:
 - Top edge: $0.20 \begin{smallmatrix} +0.10 \\ -0.05 \end{smallmatrix}$
 - Bottom edge: $0.008 \begin{smallmatrix} +0.004 \\ -0.002 \end{smallmatrix}$
 - Left side hole: $0.50 \begin{smallmatrix} 0.0197 \end{smallmatrix}$
- Right side features:
 - Top edge: $8.40 \begin{smallmatrix} 0.331 \end{smallmatrix} \text{ MAX}$
 - Bottom edge: $8.00 \begin{smallmatrix} 0.315 \end{smallmatrix}$
 - Right side hole: $0.25 \begin{smallmatrix} 0.010 \end{smallmatrix}$

Side View Dimensions:

- Overall length: 18.40 ± 0.10
- Overall thickness: 0.724 ± 0.004
- Left side features:
 - Top edge: $0.25 \begin{smallmatrix} 0.010 \end{smallmatrix} \text{ TYP}$
 - Bottom edge: $0.45 \begin{smallmatrix} -0.75 \\ 0.018 \end{smallmatrix} \begin{smallmatrix} -0.030 \end{smallmatrix}$
- Right side features:
 - Top edge: 1.00 ± 0.10
 - Bottom edge: 0.039 ± 0.004
 - Right side hole: $0.05 \begin{smallmatrix} 0.002 \end{smallmatrix} \text{ MIN}$

Other Dimensions:

- Bottom edge: $0.15 \begin{smallmatrix} +0.10 \\ -0.05 \end{smallmatrix}$
- Right side hole: $0.006 \begin{smallmatrix} +0.004 \\ -0.002 \end{smallmatrix}$
- Right side hole: 0.10 MAX
- Right side hole: 0.004 MAX
- Right side hole: $0.50 \begin{smallmatrix} 0.020 \end{smallmatrix}$