

## 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

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# K6X1008C2D Family

## 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-TSOP1-0820F

### GENERAL DESCRIPTION

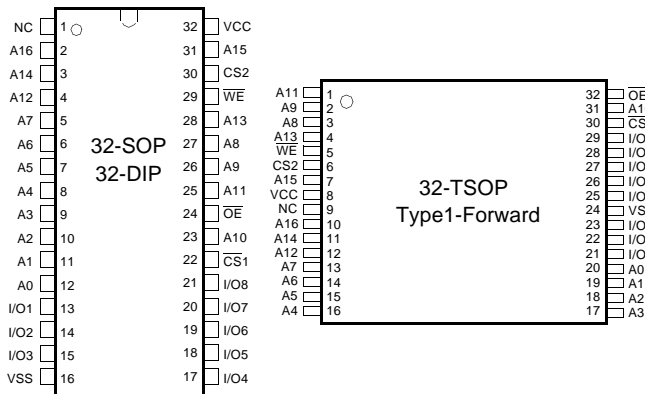
The K6X1008C2D families are fabricated by SAMSUNG's advanced CMOS process technology. The families support various operating temperature ranges and have various package types for user flexibility of system design. The families also support low data retention voltage for battery back-up operation with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

### PRODUCT FAMILY

Product Family	Operating Temperature	Vcc Range	Speed	Power Dissipation		PKG Type
				Standby (I <sub>SB1</sub> , Max)	Operating (I <sub>CC2</sub> , Max)	
K6X1008C2D-B	Commercial(0~70°C)	4.5~5.5V	55 <sup>1)</sup> /70ns	10μA	35mA	32-DIP-600, 32-SOP-525, 32-TSOP1-0820F
K6X1008C2D-F	Industrial(-40~85°C)			15μA		
K6X1008C2D-Q	Automotive(-40~125°C)			25μA		

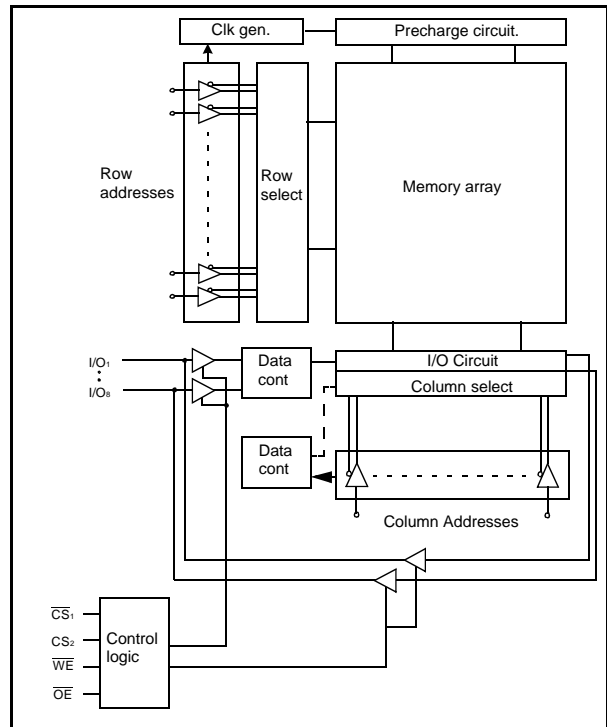
1. The parameters are tested with 50pF test load

### PIN DESCRIPTION



Name	Function
$\overline{CS1}$ , $\overline{CS2}$	Chip Select Input
$\overline{OE}$	Output Enable Input
$\overline{WE}$	Write Enable Input
I/O1~I/O8	Data Inputs/Outputs
A0~A16	Address Inputs
Vcc	Power
Vss	Ground
NC	No Connection

### FUNCTIONAL BLOCK DIAGRAM



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## 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-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		

## FUNCTIONAL DESCRIPTION

CS <sub>1</sub>	CS <sub>2</sub>	OE	WE	I/O	Mode	Power
H	X <sup>1)</sup>	X <sup>1)</sup>	X <sup>1)</sup>	High-Z	Deselected	Standby
X <sup>1)</sup>	L	X <sup>1)</sup>	X <sup>1)</sup>	High-Z	Deselected	Standby
L	H	H	H	High-Z	Output Disabled	Active
L	H	L	H	Dout	Read	Active
L	H	X <sup>1)</sup>	L	Din	Write	Active

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

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

Item	Symbol	Ratings	Unit	Remark
Voltage on any pin relative to V <sub>SS</sub>	V <sub>IN</sub> ,V <sub>OUT</sub>	-0.5 to V <sub>CC</sub> +0.5V(Max. 7.0V)	V	-
Voltage on V <sub>CC</sub> supply relative to V <sub>SS</sub>	V <sub>CC</sub>	-0.3 to 7.0	V	-
Power Dissipation	P <sub>D</sub>	1.0	W	-
Storage temperature	T <sub>STG</sub>	-65 to 150	°C	-
Operating Temperature	T <sub>A</sub>	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 CONDITIONS<sup>1)</sup>

Item	Symbol	Min	Typ	Max	Unit
Supply voltage	V <sub>CC</sub>	4.5	5.0	5.5	V
Ground	V <sub>SS</sub>	0	0	0	V
Input high voltage	V <sub>IH</sub>	2.2	-	V <sub>CC</sub> +0.5 <sup>2)</sup>	V
Input low voltage	V <sub>IL</sub>	-0.5 <sup>3)</sup>	-	0.8	V

Note:

- Commercial Product: T<sub>A</sub>=0 to 70°C, Otherwise specified  
Industrial Product: T<sub>A</sub>=-40 to 85°C, Otherwise specified  
Automotive Product: T<sub>A</sub>=-40 to 125°C, Otherwise specified
- Overshoot: V<sub>CC</sub>+3.0V in case of pulse width≤30ns.
- Undershoot: -3.0V in case of pulse width≤30ns.
- Overshoot and undershoot are sampled, not 100% tested.

## CAPACITANCE<sup>1)</sup> (f=1MHz, T<sub>A</sub>=25°C)

Item	Symbol	Test Condition	Min	Max	Unit
Input capacitance	C <sub>IN</sub>	V <sub>IN</sub> =0V	-	8	pF
Input/Output capacitance	C <sub>IO</sub>	V <sub>IO</sub> =0V	-	10	pF

- Capacitance is sampled, not 100% tested

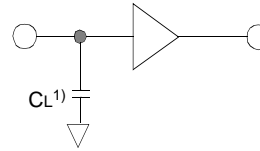
## DC AND OPERATING CHARACTERISTICS

Item	Symbol	Test Conditions	Min	Typ	Max	Unit	
Input leakage current	I <sub>LI</sub>	V <sub>IN</sub> =V <sub>SS</sub> to V <sub>CC</sub>	-1	-	1	μA	
Output leakage current	I <sub>LO</sub>	$\overline{CS}_1=V_{IH}$ or $CS_2=V_{IL}$ or $\overline{OE}=V_{IH}$ or $\overline{WE}=V_{IL}$ , V <sub>IO</sub> =V <sub>SS</sub> to V <sub>CC</sub>	-1	-	1	μA	
Operating power supply current	I <sub>CC</sub>	I <sub>IO</sub> =0mA, $\overline{CS}_1=V_{IL}$ , CS <sub>2</sub> =V <sub>IH</sub> , V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub> , Read	-	-	10	mA	
Average operating current	I <sub>CC1</sub>	Cycle time=1μs, 100%duty, I <sub>IO</sub> =0mA, $\overline{CS}_1 \leq 0.2V$ , CS <sub>2</sub> ≥V <sub>CC</sub> -0.2V, V <sub>IN</sub> ≤0.2V or V <sub>IN</sub> ≥V <sub>CC</sub> -0.2V	-	-	7	mA	
	I <sub>CC2</sub>	Cycle time=Min, 100% duty, I <sub>IO</sub> =0mA, $\overline{CS}_1=V_{IL}$ , CS <sub>2</sub> =V <sub>IH</sub> , V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub>	-	-	35	mA	
Output low voltage	V <sub>OL</sub>	I <sub>OL</sub> =2.1mA	-	-	0.4	V	
Output high voltage	V <sub>OH</sub>	I <sub>OH</sub> =-1.0mA	2.4	-	-	V	
Standby Current(TTL)	I <sub>SB</sub>	$\overline{CS}_1=V_{IH}$ , CS <sub>2</sub> =V <sub>IL</sub> , Other inputs=V <sub>IH</sub> or V <sub>IL</sub>	-	-	3	mA	
Standby Current(CMOS)	I <sub>SB1</sub>	$\overline{CS}_1 \geq V_{CC}-0.2V$ , CS <sub>2</sub> ≥V <sub>CC</sub> -0.2V or CS <sub>2</sub> ≤0.2V, Other inputs=0~V <sub>CC</sub>	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

( $V_{CC} = 4.5 \sim 5.5\text{V}$ , Commercial product:  $T_A = 0$  to  $70^\circ\text{C}$ , Industrial product:  $T_A = -40$  to  $85^\circ\text{C}$ , Automotive product:  $T_A = -40 \sim 125^\circ\text{C}$ )

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

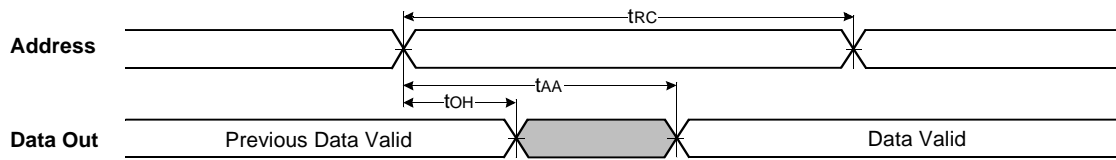
## DATA RETENTION CHARACTERISTICS

Item	Symbol	Test Condition	Min	Typ	Max	Unit	
V <sub>CC</sub> for data retention	V <sub>DR</sub>	$\overline{CS}_1 \geq V_{CC} - 0.2\text{V}^{(1)}$	2.0	-	5.5	V	
Data retention current	I <sub>DR</sub>	$V_{CC} = 3.0\text{V}$ , $\overline{CS}_1 \geq V_{CC} - 0.2\text{V}^{(1)}$	K6X1008C2D-B	-	-	10	$\mu\text{A}$
			K6X1008C2D-F	-	-	15	$\mu\text{A}$
			K6X1008C2D-Q	-	-	25	$\mu\text{A}$
Data retention set-up time	t <sub>SDR</sub>	See data retention waveform	0	-	-	ms	
Recovery time	t <sub>RDR</sub>		5	-	-		

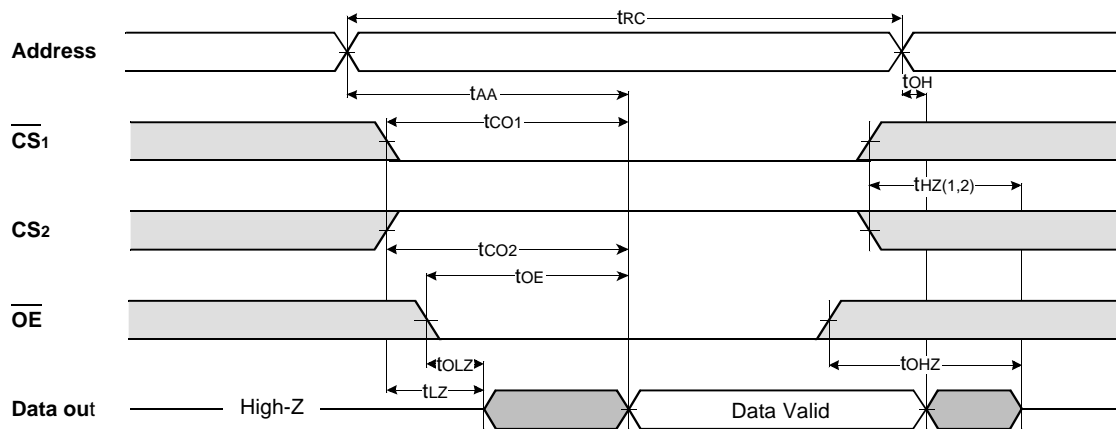
1.  $\overline{CS}_1 \geq V_{CC} - 0.2\text{V}$ ,  $\overline{CS}_2 \geq V_{CC} - 0.2\text{V}$ , or  $\overline{CS}_2 \leq 0.2\text{V}$

## TIMING DIAGRAMS

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



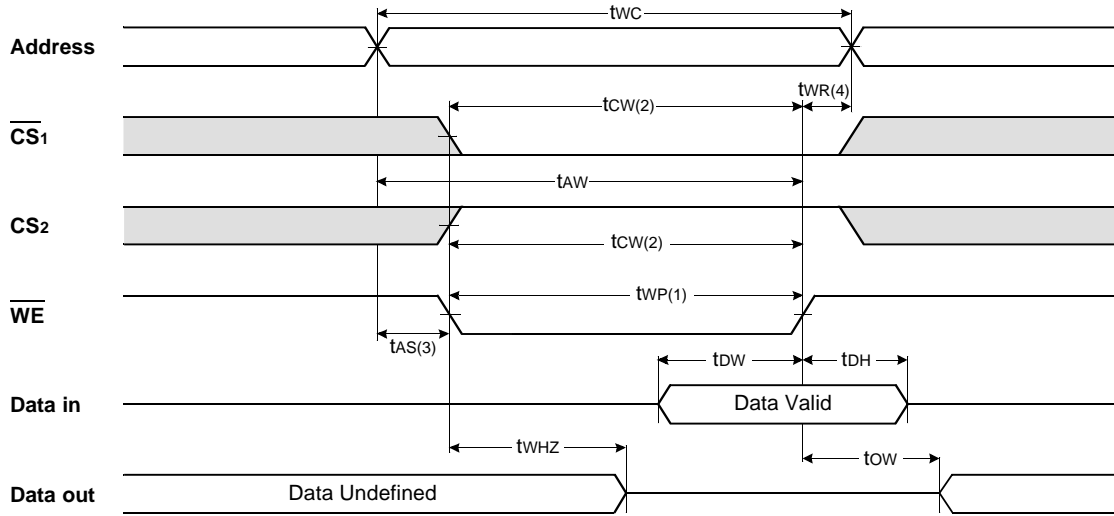
**TIMING WAVEFORM OF READ CYCLE(2)** ( $\overline{WE}=V_{IH}$ )



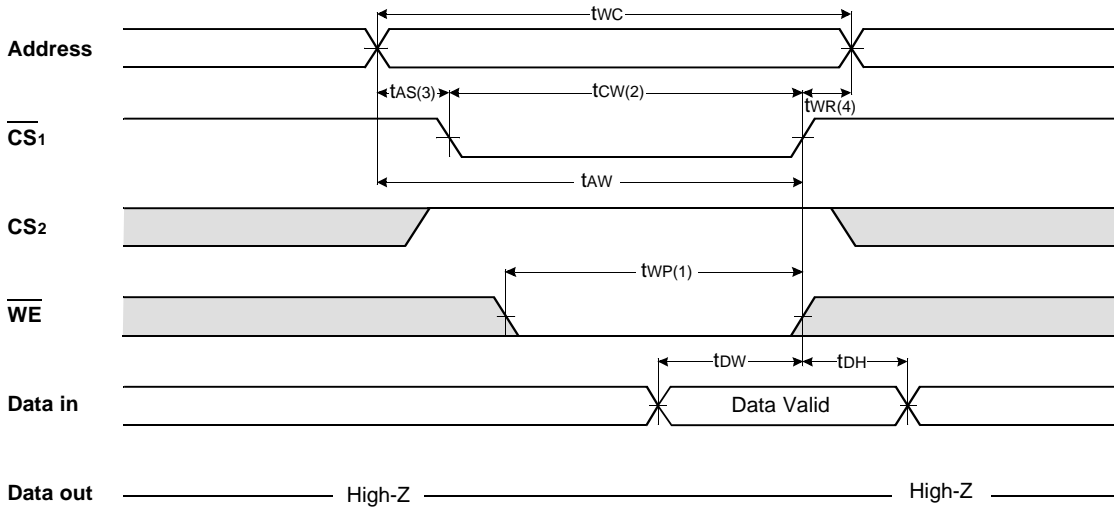
### NOTES (READ CYCLE)

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.

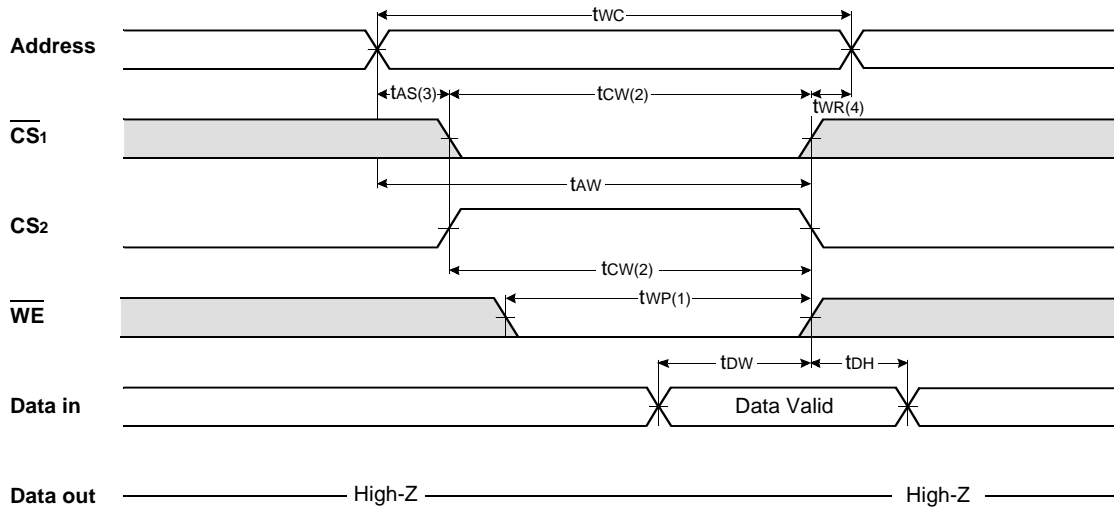
**TIMING WAVEFORM OF WRITE CYCLE(1) ( $\overline{WE}$  Controlled)**



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



## TIMING WAVEFORM OF WRITE CYCLE(3) (CS<sub>2</sub> Controlled)

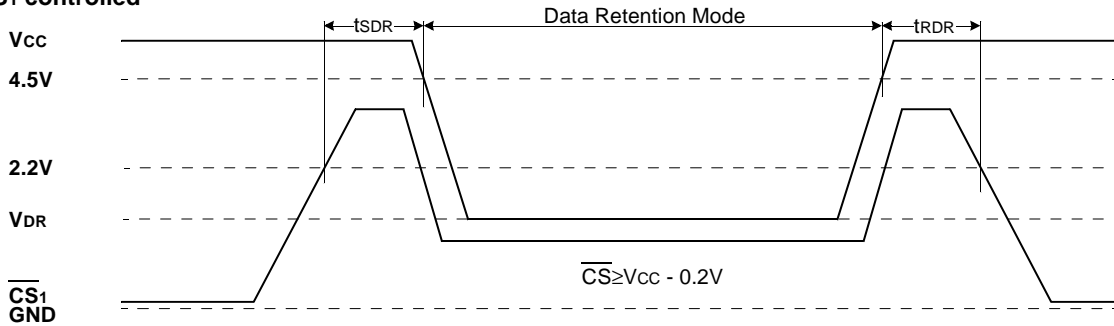


### NOTES (WRITE CYCLE)

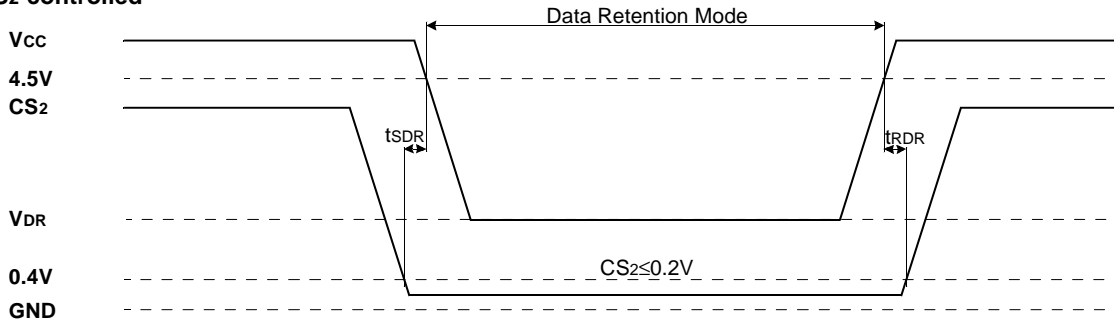
1. A write occurs during the overlap of a low CS<sub>1</sub>, a high CS<sub>2</sub> and a low WE. A write begins at the latest transition among CS<sub>1</sub> goes low, CS<sub>2</sub> going high and WE going low: A write ends at the earliest transition among CS<sub>1</sub> going high, CS<sub>2</sub> going low and WE going high, t<sub>WP</sub> is measured from the beginning of write to the end of write.
2. t<sub>WC</sub> is measured from the CS<sub>1</sub> going low or CS<sub>2</sub> going high to the end of write.
3. t<sub>AS</sub> is measured from the address valid to the beginning of write.
4. t<sub>WR</sub> is measured from the end of write to the address change. t<sub>WR</sub> applied in case a write ends as CS<sub>1</sub> or WE going high t<sub>WR2</sub> applied in case a write ends as CS<sub>2</sub> going to low.

## DATA RETENTION WAVE FORM

### CS<sub>1</sub> controlled



### CS<sub>2</sub> controlled





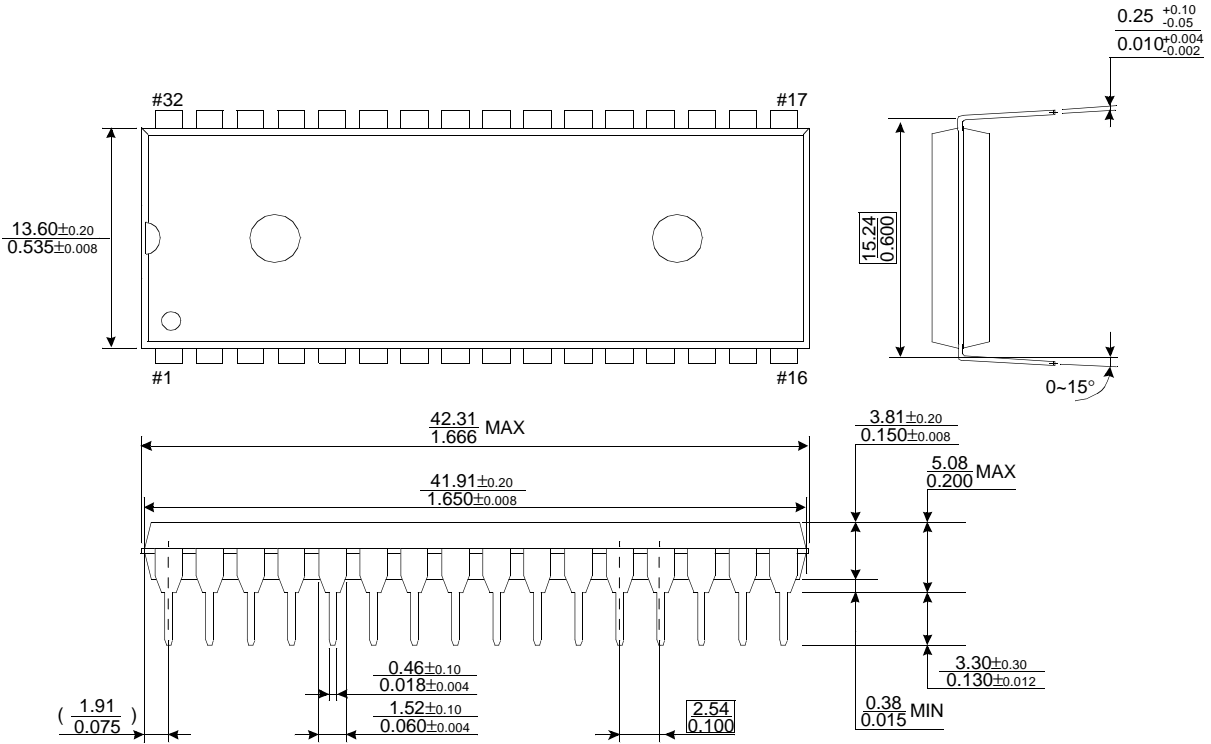
# K6X1008C2D Family

**Preliminary**  
**CMOS SRAM**

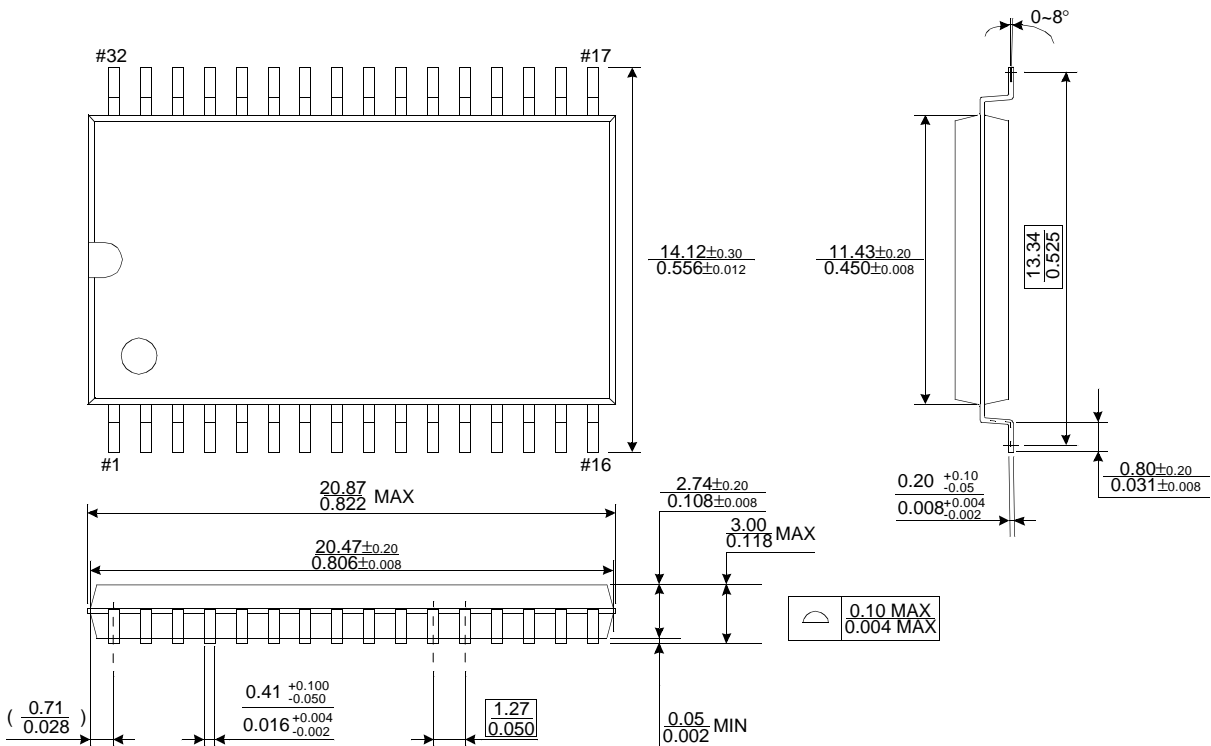
## PACKAGE DIMENSIONS

32 DUAL INLINE PACKAGE (600mil)

Units: millimeters( inches)



## 32 PLASTIC SMALL OUTLINE PACKAGE (525mil)



# K6X1008C2D Family

**Preliminary**  
**CMOS SRAM**

## PACKAGE DIMENSIONS

Units: millimeters(inches)

### 32 PIN THIN SMALL OUTLINE PACKAGE TYPE I (0820F)

