

Document Title

256Kx8 bit Low Power and Low Voltage CMOS Static RAM

Revision History

<u>Revision No.</u>	<u>History</u>	<u>Draft Data</u>	<u>Remark</u>
0.0	Design target	May 26, 1998	Advance
1.0	Finalize	October 8, 1998	Final
2.0	Revised - Add FBGA type package	July 21, 1999	Final

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256Kx8 bit Low Power and Low Voltage CMOS Static RAM

FEATURES

- Process Technology: TFT
- Organization: 256Kx8
- Power Supply Voltage
 - K6T2008V2A Family: 3.0V~3.6V
 - K6T2008U2A Family: 2.7V~3.3V
- Low Data Retention Voltage: 2V(Min)
- Three state output and TTL Compatible
- Package Type: 32-TSOP1-0820F, 32-TSOP1-0813.4F
48-FBGA-6.00x7.00

GENERAL DESCRIPTION

The K6T2008V2A and K6T2008U2A families are fabricated by SAMSUNG's advanced CMOS process technology. The family support various operating temperature ranges and have various package types for user flexibility of system design. The family also support low data retention voltage for battery back-up operation with low data retention current.

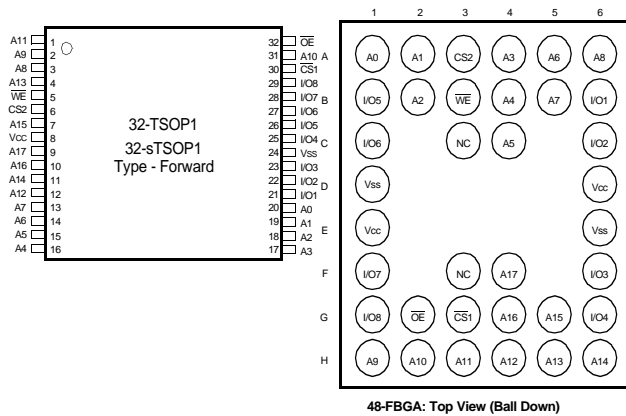
PRODUCT FAMILY

Product Family	Operating Temperature	Vcc Range	Speed	Power Dissipation		PKG Type
				Standby (I _{SB1} , Max)	Operating (I _{CC2} , Max)	
K6T2008V2A-B K6T2008U2A-B	Commercial(0~70°C)	3.0~3.6V 2.7~3.3V	70/85ns 70 ¹⁾ /85/100ns	10μA	30mA ²⁾	32-TSOP1-0820F 32-TSOP1-0813.4F 48-FBGA-6.00x7.00
K6T2008V2A-F K6T2008U2A-F	Industrial(-40~85°C)	3.0~3.6V 2.7~3.3V	70 ¹⁾ /85/100ns	15μA		

1. The parameters are tested with 30pF test load

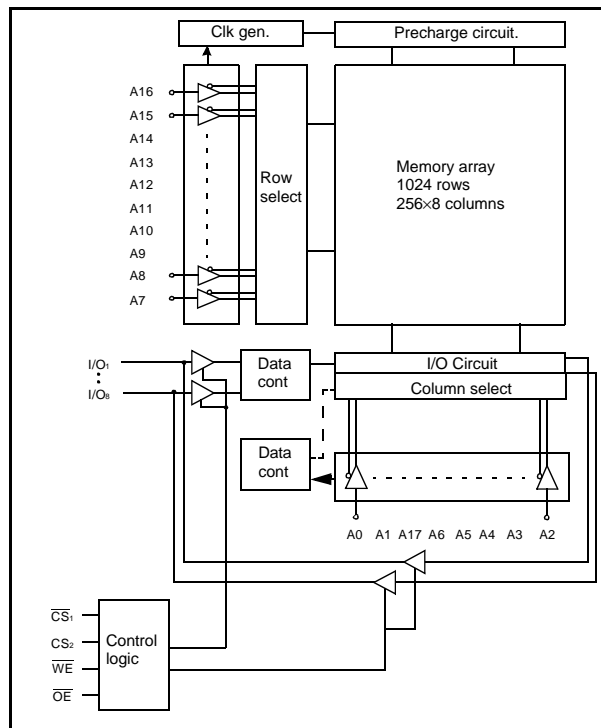
2. K6T2008V2A Family = 35mA

PIN DESCRIPTION



Name	Function	Name	Function
$\overline{CS}_1, \overline{CS}_2$	Chip Select Inputs	I/O1~I/O8	Data Inputs/Outputs
\overline{OE}	Output Enable Input	Vcc	Power
\overline{WE}	Write Enable Input	Vss	Ground
A0~A17	Address Inputs	N.C.	No Connection

FUNCTIONAL BLOCK DIAGRAM



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PRODUCT LIST

Commercial Temperature Products(0~70°C)		Industrial Temperature Products(-40~85°C)	
Part Name	Function	Part Name	Function
K6T2008V2A-TB70 K6T2008V2A-TB85	32-TSOP1 F, 70ns, 3.3V,LL 32-TSOP1 F, 85ns, 3.3V,LL	K6T2008V2A-TF70 K6T2008V2A-TF85 K6T2008V2A-TF10	32-TSOP1 F, 70ns, 3.3V, LL 32-TSOP1 F, 85ns, 3.3V, LL 32-TSOP1 F, 100ns, 3.3V, LL
K6T2008U2A-TB70 K6T2008U2A-TB85 K6T2008U2A-TB10	32-TSOP1 F, 70ns, 3.0V, LL 32-TSOP1 F, 85ns, 3.0V, LL 32-TSOP1 F, 100ns, 3.0V, LL	K6T2008U2A-TF70 K6T2008U2A-TF85 K6T2008U2A-TF10	32-TSOP1 F, 70ns, 3.0V, LL 32-TSOP1 F, 85ns, 3.0V, LL 32-TSOP1 F, 100ns, 3.0V, LL
K6T2008V2A-YB70 K6T2008V2A-YB85	32-sTSOP1 F, 70ns, 3.3V,LL 32-sTSOP1 F, 85ns, 3.3V,LL	K6T2008V2A-YF70 K6T2008V2A-YF85 K6T2008V2A-YF10	32-sTSOP1 F, 70ns, 3.3V, LL 32-sTSOP1 F, 85ns, 3.3V, LL 32-sTSOP1 F, 100ns, 3.3V, LL
K6T2008U2A-YB70 K6T2008U2A-YB85 K6T2008U2A-YB10	32-sTSOP1 F, 70ns, 3.0V, LL 32-sTSOP1 F, 85ns, 3.0V, LL 32-sTSOP1 F, 100ns, 3.0V, LL	K6T2008U2A-YF70 K6T2008U2A-YF85 K6T2008U2A-YF10	32-sTSOP1 F, 70ns, 3.0V, LL 32-sTSOP1 F, 85ns, 3.0V, LL 32-sTSOP1 F, 100ns, 3.0V, LL
		K6T2008V2A-FF70 K6T2008V2A-FF85	48-FBGA, 70ns, 3.3V, LL 48-FBGA, 85ns, 3.3V, LL
		K6T2008U2A-FF70 K6T2008U2A-FF85	48-FBGA, 70ns, 3.0V, LL 48-FBGA, 85ns, 3.0V, LL

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} +0.5	V	-
Voltage on Vcc supply relative to Vss	V _{CC}	-0.3 to 4.6	V	-
Power Dissipation	P _D	1.0	W	-
Storage temperature	T _{STG}	-65 to 150	°C	-
Operating Temperature	T _A	0 to 70	°C	K6T2008V2A-L, K6T2008U2A-L
		-40 to 85	°C	K6T2008V2A-P, K6T2008U2A-P

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	Product	Min	Typ	Max	Unit
Supply voltage	V _{CC}	K6T2008V2A Family K6T2008U2A Family	3.0 2.7	3.3 3.0	3.6 3.3	V
Ground	V _{SS}	All Family	0	0	0	V
Input high voltage	V _{IH}	K6T2008V2A, K6T2008U2A Family	2.2	-	V _{CC} +0.3	V
Input low voltage	V _{IL}	K6T2008V2A, K6T2008U2A Family	-0.3 ³⁾	-	0.6	V

Note:

1. Commercial Product : T_A=0 to 70°C, otherwise specifiedIndustrial Product : T_A=-40 to 85°C, otherwise specified2. Overshoot : V_{CC}+2.0V in case of pulse width≤30ns

3. Undershoot : -2.0V 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 $\overline{CS}_2=V_{IL}$ 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, $\overline{CS}_1=V_{IL}$, $\overline{CS}_2=V_{IH}$, V _{IN} =V _{IH} or V _{IL}	-	-	5	mA
Average operating current	I _{CC1}	Cycle time=1μs, 100%duty, I _{IO} =0mA, $\overline{CS}_1\leq 0.2V$, $\overline{CS}_2\geq V_{CC}-0.2V$, V _{IN} ≤0.2V	-	-	4	mA
	I _{CC2}	Cycle time=Min, 100% duty, I _{IO} =0mA, $\overline{CS}_1=V_{IL}$, $\overline{CS}_2=V_{IH}$, V _{IN} =V _{IH} or V _{IL}	-	25	30 ¹⁾	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}	$\overline{CS}_1=V_{IH}$, $\overline{CS}_2=V_{IL}$, Other inputs=V _{IH} or V _{IL}	-	-	0.3	mA
Standby Current(CMOS)	I _{SB1}	$\overline{CS}_1\geq V_{CC}-0.2V$, $\overline{CS}_2\geq V_{CC}-0.2V$ or $\overline{CS}_2\leq 0.2V$, Other inputs=0~V _{CC}	-	0.2	10 ²⁾	μA

1. K6T2008V2A Family = 35mA

2. Industrial product = 15μA

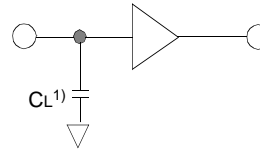
AC OPERATING CONDITIONS

TEST CONDITIONS (Test Load and Input/Output Reference)

Input pulse level : 0.4 to 2.2V

Input rising and falling time : 5ns

Input and output reference voltage : 1.5V

Output load(see right) : $C_L=100\text{pF}+1\text{TTL}$ $C_L=30\text{pF}+1\text{TTL}$ 

1. Including scope and jig capacitance

AC CHARACTERISTICS (K6T2008V2A Family: $V_{CC}=3.0\sim 3.6\text{V}$, K6T2008U2A Family: $V_{CC}=2.7\sim 3.3\text{V}$
 Commercial Product: $T_A=0$ to 70°C , Industrial Product: $T_A=-40$ to 85°C)

Parameter List		Symbol	Speed Bins						Units
			70ns		85ns		100ns		
			Min	Max	Min	Max	Min	Max	
Read	Read cycle time	tRC	70	-	85	-	100	-	ns
	Address access time	tAA	-	70	-	85	-	100	ns
	Chip select to output	tCO1, tCO2	-	70	-	85	-	100	ns
	Output enable to valid output	tOE	-	35	-	40	-	50	ns
	Chip select to low-Z output	tLZ	10	-	10	-	10	-	ns
	Output enable to low-Z output	tOLZ	5	-	5	-	5	-	ns
	Chip disable to high-Z output	tHZ	0	25	0	25	0	30	ns
	Output disable to high-Z output	tOHZ	0	25	0	25	0	30	ns
	Output hold from address change	tOH	10	-	15	-	15	-	ns
Write	Write cycle time	tWC	70	-	85	-	100	-	ns
	Chip select to end of write	tCW	60	-	70	-	80	-	ns
	Address set-up time	tAS	0	-	0	-	0	-	ns
	Address valid to end of write	tAW	60	-	70	-	80	-	ns
	Write pulse width	tWP	55	-	60	-	70	-	ns
	Write recovery time	tWR	0	-	0	-	0	-	ns
	Write to output high-Z	tWHZ	0	25	0	30	0	30	ns
	Data to write time overlap	tDW	30	-	35	-	40	-	ns
	Data hold from write time	tDH	0	-	0	-	0	-	ns
	End write to output low-Z	tOW	5	-	5	-	5	-	ns

DATA RETENTION CHARACTERISTICS

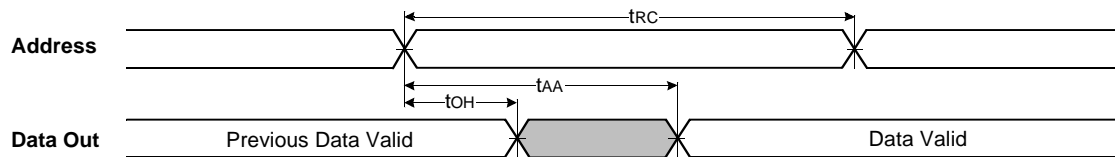
Item	Symbol	Test Condition	Min	Typ	Max	Unit
V _{CC} for data retention	V _{DR}	$\overline{CS}_1 \geq V_{CC}-0.2\text{V}^{(1)}$	2.0	-	3.6	V
Data retention current	I _{DR}	$V_{CC}=3.0\text{V}$, $\overline{CS}_1 \geq V_{CC}-0.2\text{V}^{(1)}$	-	0.2	10 ⁽²⁾	μA
Data retention set-up time	t _{SDR}	See data retention waveform	0	-	-	ms
Recovery time	t _{RDR}		5	-	-	

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

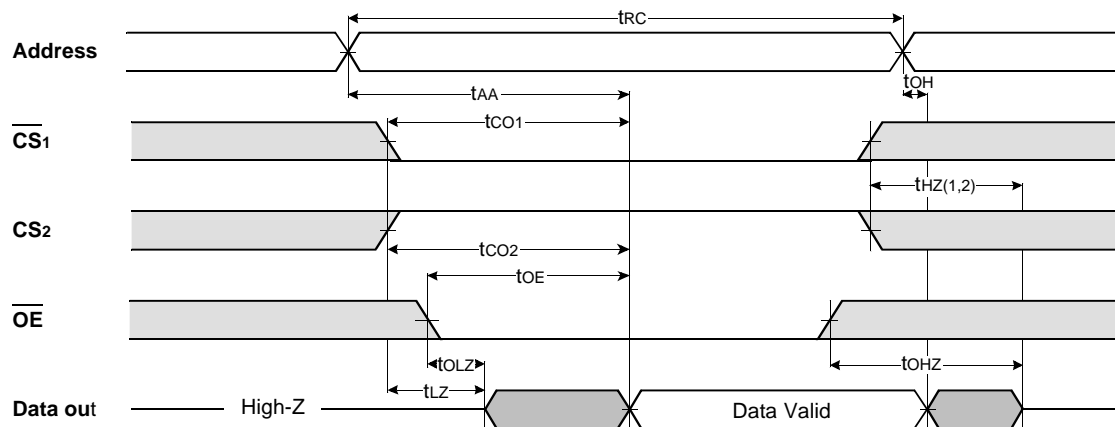
2. Industrial Products = 15μA

TIMMING DIAGRAMS

TIMING WAVEFORM OF READ CYCLE(1) (Address Controlled, $\overline{CS}_1 = \overline{OE} = V_{IL}$, $CS_2 = \overline{WE} = V_{IH}$)



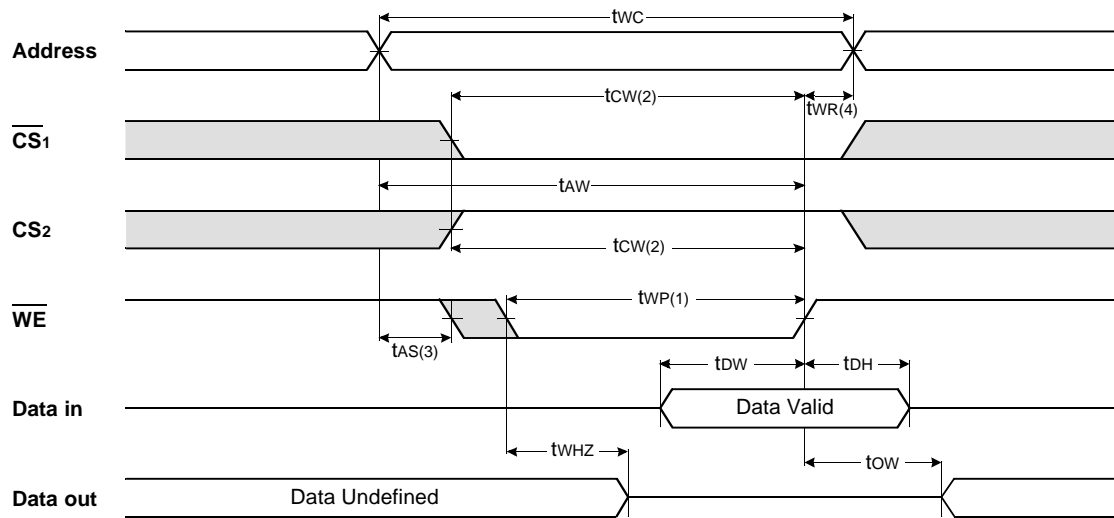
TIMING WAVEFORM OF READ CYCLE(2) ($\overline{WE} = V_{IH}$)



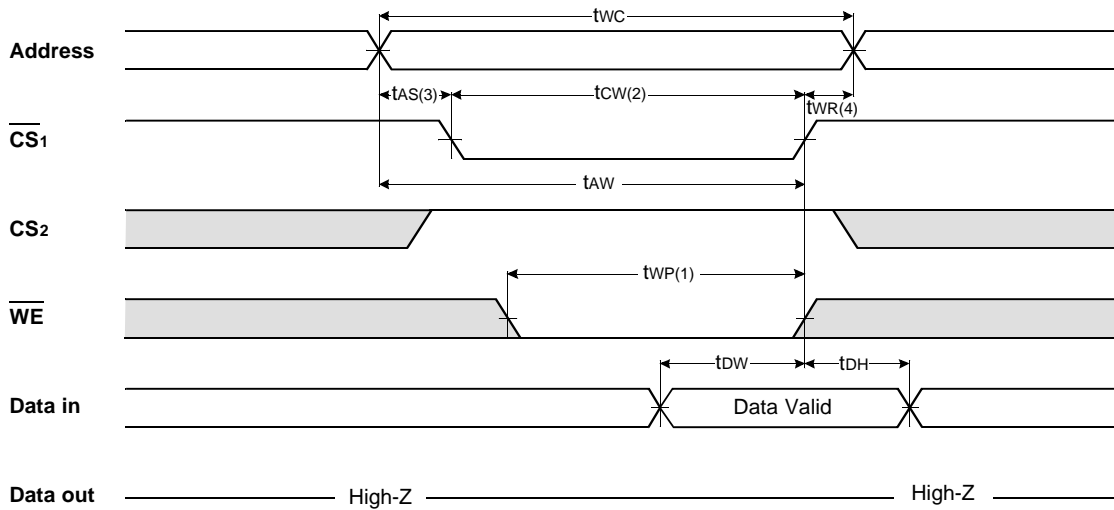
NOTES (READ CYCLE)

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.

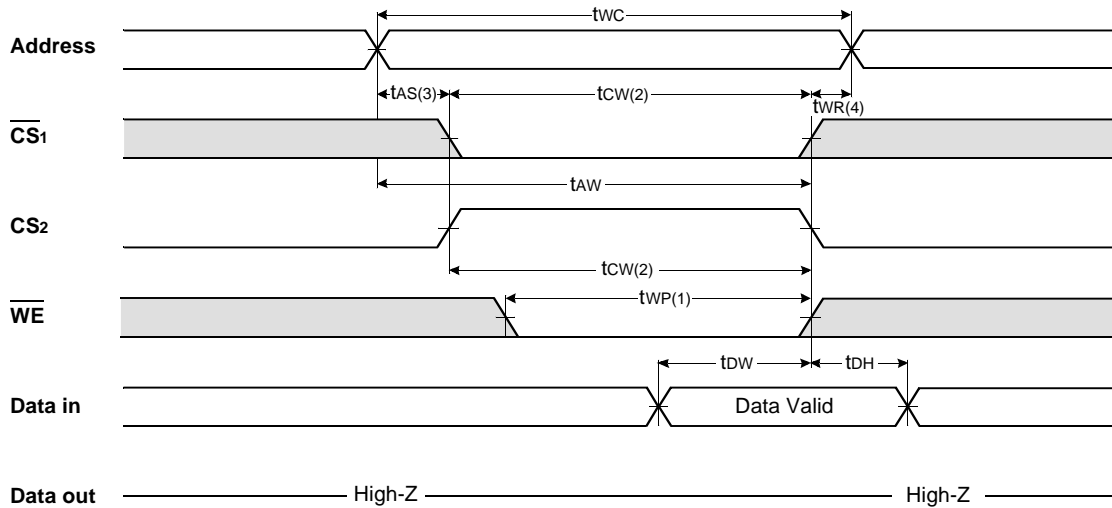
TIMING WAVEFORM OF WRITE CYCLE(1) ($\overline{\text{WE}}$ Controlled)



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



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

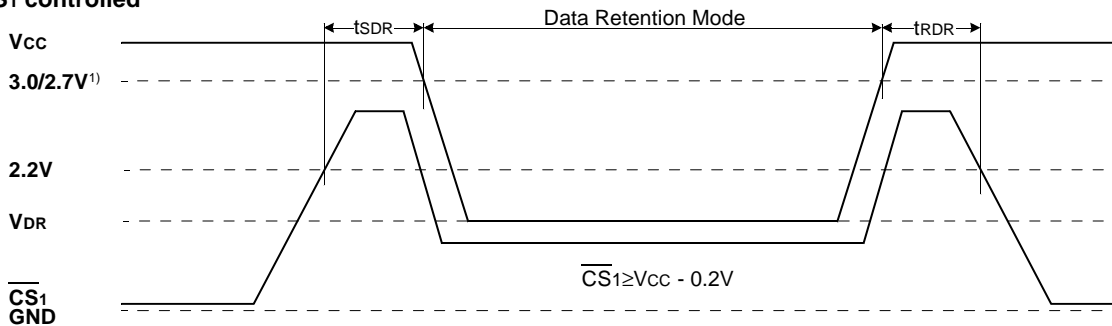


NOTES (WRITE CYCLE)

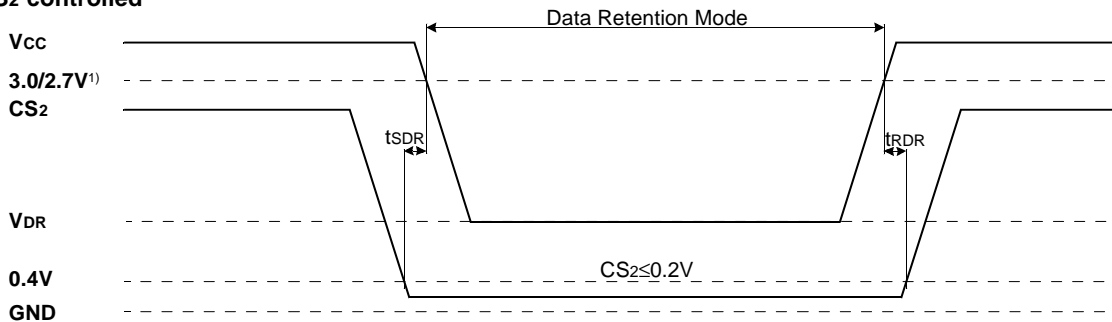
1. A write occurs during the overlap of a low $\overline{CS_1}$, a high CS_2 and a low \overline{WE} . A write begins at the latest transition among $\overline{CS_1}$ goes low, CS_2 going high and \overline{WE} going low : A write ends at the earliest transition among CS_1 going high, CS_2 going low 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 $\overline{CS_1}$ 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_{WR1} 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

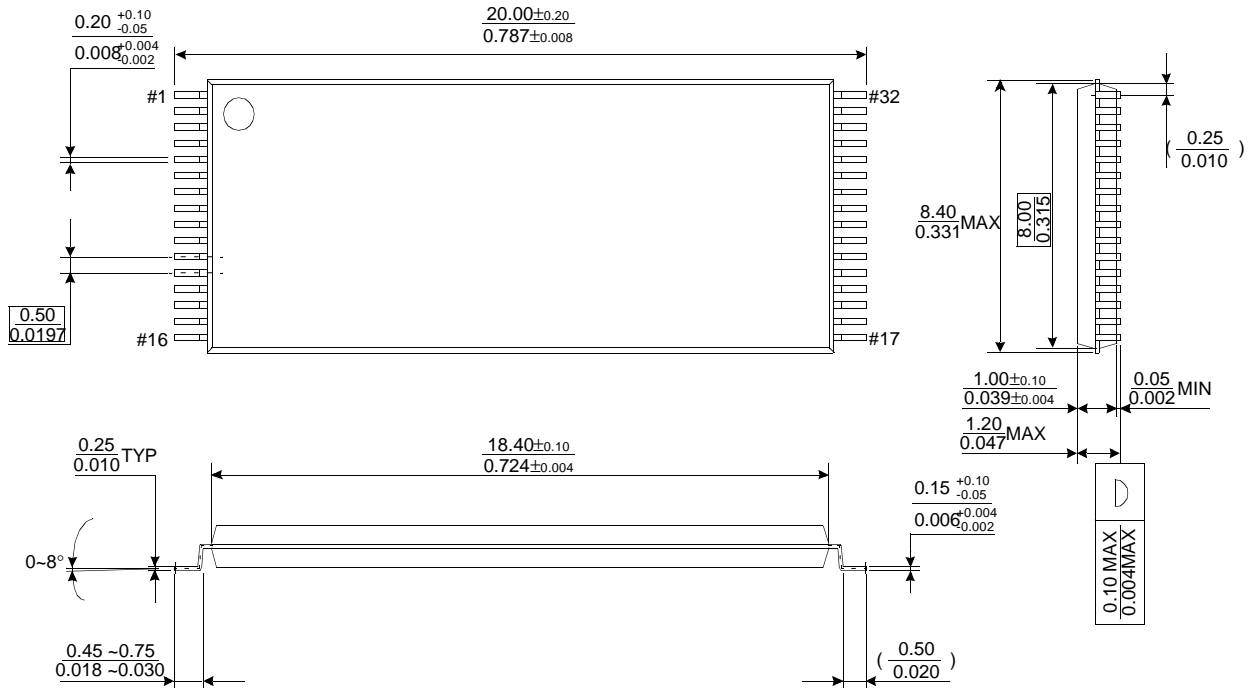


1. 3.0V for K6T2008V2A Family, 2.7V for K6T2008U2A Family

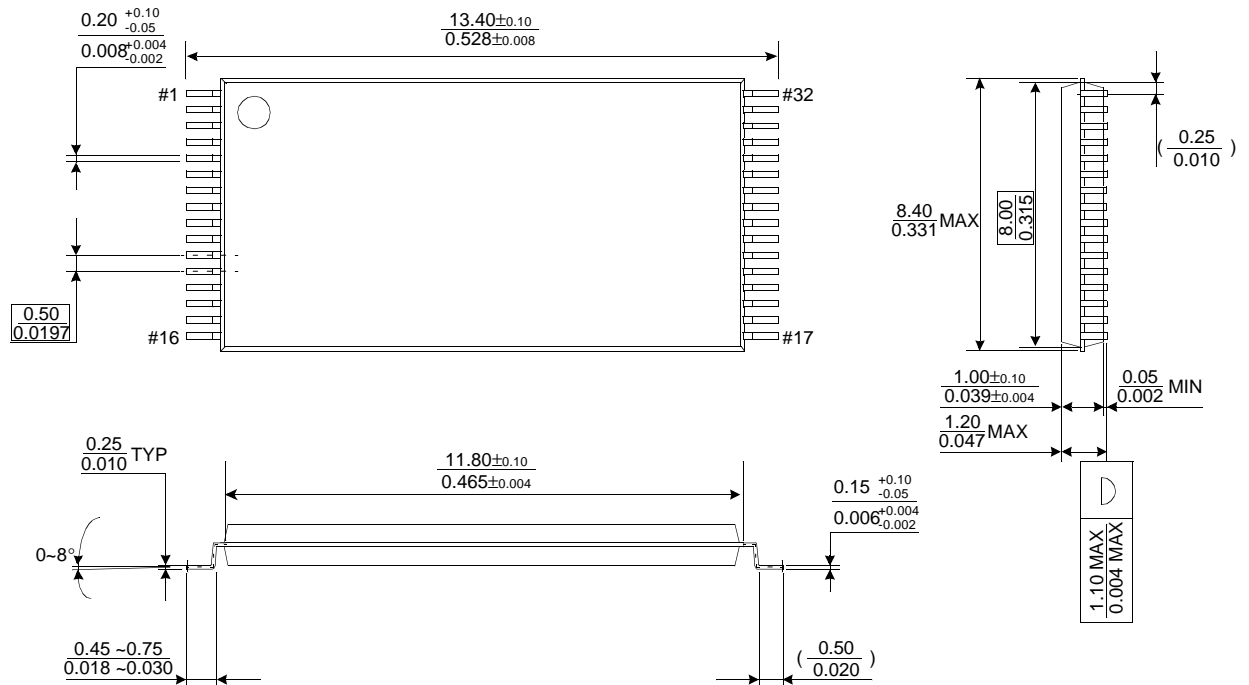
PACKAGE DIMENSIONS

Units: millimeter(inch)

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



32 PIN SMALLER THIN SMALL OUTLINE PACKAGE TYPE I (0813.4F)



PACKAGE DIMENSIONS

Units: millimeters

48 BALL FINE PITCH BALL GRID ARRAY(6.00X7.00)

