Document Title

256Kx8 bit Low Power and Low Voltage CMOS Static RAM

Revision History

Revision No.	History	Draft Data	Remark
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

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

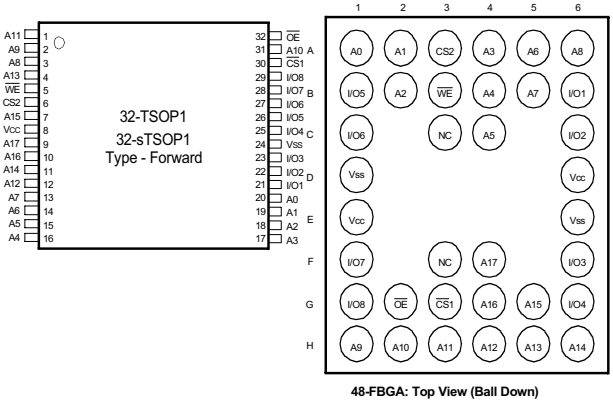
The K6T2008V2A and K6T2008U2A families are fabricated by SAMSUNG′s advanced CMOS process technology. The family support various operating temperature ranges and have various package types for user flexibility of system design. The family also support low data retention voltage for battery back-up operation 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	Commercial(0~70°C)	3.0~3.6V	70/85ns	10µA	30mA[2]	32-TSOP1-0820F 32-TSOP1-0813.4F 48-FBGA-6.00x7.00
K6T2008U2A-B		2.7~3.3V	70[1]/85/100ns			
K6T2008V2A-F	Industrial(-40~85°C)	3.0~3.6V	70[1]/85/100ns	15µA		
K6T2008U2A-F		2.7~3.3V				

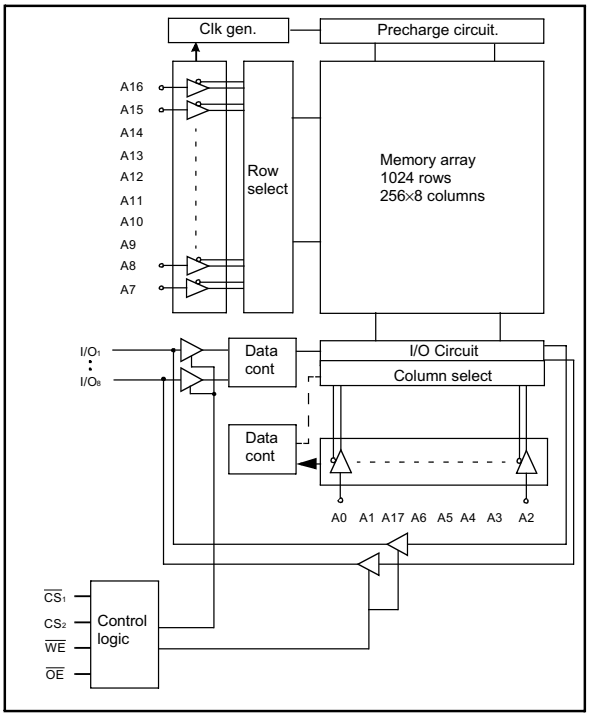
1. The parameters are tested with 30pF test load
2. K6T2008V2A Family = 35mA

PIN DESCRIPTION



Name	Function	Name	Function
$\overline{CS_1}$,CS_2	Chip Select Inputs	I/O_1~I/O_8	Data Inputs/Outputs
$\overline{OE}$	Output Enable Input	Vcc	Power
$\overline{WE}$	Write Enable Input	Vss	Ground
A_0~A_{17}	Address Inputs	N.C.	No Connection

FUNCTIONAL BLOCK DIAGRAM



PRODUCT LIST

Commercial Temperature Products(0~70°C)		Industrial Temperature Products(-40~85°C)	
Part Name	**Function**	**Part Name**	**Function**
K6T2008V2A-TB70	32-TSOP1 F, 70ns, 3.3V,LL	K6T2008V2A-TF70	32-TSOP1 F, 70ns, 3.3V, LL
K6T2008V2A-TB85	32-TSOP1 F, 85ns, 3.3V,LL	K6T2008V2A-TF85	32-TSOP1 F, 85ns, 3.3V, LL
		K6T2008V2A-TF10	32-TSOP1 F, 100ns, 3.3V, LL
K6T2008U2A-TB70	32-TSOP1 F, 70ns, 3.0V, LL		
K6T2008U2A-TB85	32-TSOP1 F, 85ns, 3.0V, LL	K6T2008U2A-TF70	32-TSOP1 F, 70ns, 3.0V, LL
K6T2008U2A-TB10	32-TSOP1 F, 100ns, 3.0V, LL	K6T2008U2A-TF85	32-TSOP1 F, 85ns, 3.0V, LL
		K6T2008U2A-TF10	32-TSOP1 F, 100ns, 3.0V, LL
K6T2008V2A-YB70	32-sTSOP1 F, 70ns, 3.3V,LL		
K6T2008V2A-YB85	32-sTSOP1 F, 85ns, 3.3V,LL	K6T2008V2A-YF70	32-sTSOP1 F, 70ns, 3.3V, LL
		K6T2008V2A-YF85	32-sTSOP1 F, 85ns, 3.3V, LL
K6T2008U2A-YB70	32-sTSOP1 F, 70ns, 3.0V, LL	K6T2008V2A-YF10	32-sTSOP1 F, 100ns, 3.3V, LL
K6T2008U2A-YB85	32-sTSOP1 F, 85ns, 3.0V, LL		
K6T2008U2A-YB10	32-sTSOP1 F, 100ns, 3.0V, LL	K6T2008U2A-YF70	32-sTSOP1 F, 70ns, 3.0V, LL
		K6T2008U2A-YF85	32-sTSOP1 F, 85ns, 3.0V, LL
		K6T2008U2A-YF10	32-sTSOP1 F, 100ns, 3.0V, LL
		K6T2008V2A-FF70	48-FBGA, 70ns, 3.3V, LL
		K6T2008V2A-FF85	48-FBGA, 85ns, 3.3V, LL
		K6T2008U2A-FF70	48-FBGA, 70ns, 3.0V, LL
		K6T2008U2A-FF85	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 RATINGS[1)]

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 CONDITIONS[1)]

Item	Symbol	Product	Min	Typ	Max	Unit
Supply voltage	Vcc	K6T2008V2A Family K6T2008U2A Family	3.0 2.7	3.3 3.0	3.6 3.3	V
Ground	Vss	All Family	0	0	0	V
Input high voltage	V_{IH}	K6T2008V2A, K6T2008U2A Family	2.2	-	Vcc+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 specified
   Industrial Product : T_A=-40 to 85°C, otherwise specified
2. Overshoot : Vcc+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.

CAPACITANCE[1)] (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

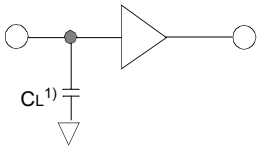
Item	Symbol	Test Conditions	Min	Typ	Max	Unit
Input leakage current	I_{LI}	V_{IN}=Vss to Vcc	-1	-	1	µA
Output leakage current	I_{LO}	$\overline{CS_1}$=V_{IH} or CS_2=V_{IL} or $\overline{OE}$=V_{IH} or $\overline{WE}$=V_{IL}, V_{IO}=Vss to Vcc	-1	-	1	µA
Operating power supply current	I_{CC}	I_{IO}=0mA, $\overline{CS_1}$=V_{IL}, CS_2=V_{IH}, V_{IN}=V_{IH} or V_{IL}	-	-	5	mA
Average operating current	I_{CC1}	Cycle time=1µs, 100%duty, I_{IO}=0mA, $\overline{CS_1}$≤0.2V, CS_2≥Vcc-0.2V, V_{IN}≤0.2V	-	-	4	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	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}, CS2=V_{IL}, Other inputs=V_{IH} or V_{IL}	-	-	0.3	mA
Standby Current(CMOS)	I_{SB1}	$\overline{CS_1}$≥Vcc-0.2V, CS_2≥Vcc-0.2V or CS_2≤0.2V, Other inputs=0~Vcc	-	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=100pF+1TTL
C_L=30pF+1TTL



1. Including scope and jig capacitance

AC CHARACTERISTICS (V_{CC}=3.0~3.6V, K6T2008U2A Family: V_{CC}=2.7~3.3V

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	t_{RC}	70	-	85	-	100	-	ns
	Address access time	t_{AA}	-	70	-	85	-	100	ns
	Chip select to output	t_{CO1}, t_{CO2}	-	70	-	85	-	100	ns
	Output enable to valid output	t_{OE}	-	35	-	40	-	50	ns
	Chip select to low-Z output	t_{LZ}	10	-	10	-	10	-	ns
	Output enable to low-Z output	t_{OLZ}	5	-	5	-	5	-	ns
	Chip disable to high-Z output	t_{HZ}	0	25	0	25	0	30	ns
	Output disable to high-Z output	t_{OHZ}	0	25	0	25	0	30	ns
	Output hold from address change	t_{OH}	10	-	15	-	15	-	ns
Write	Write cycle time	t_{WC}	70	-	85	-	100	-	ns
	Chip select to end of write	t_{CW}	60	-	70	-	80	-	ns
	Address set-up time	t_{AS}	0	-	0	-	0	-	ns
	Address valid to end of write	t_{AW}	60	-	70	-	80	-	ns
	Write pulse width	t_{WP}	55	-	60	-	70	-	ns
	Write recovery time	t_{WR}	0	-	0	-	0	-	ns
	Write to output high-Z	t_{WHZ}	0	25	0	30	0	30	ns
	Data to write time overlap	t_{DW}	30	-	35	-	40	-	ns
	Data hold from write time	t_{DH}	0	-	0	-	0	-	ns
	End write to output low-Z	t_{OW}	5	-	5	-	5	-	ns

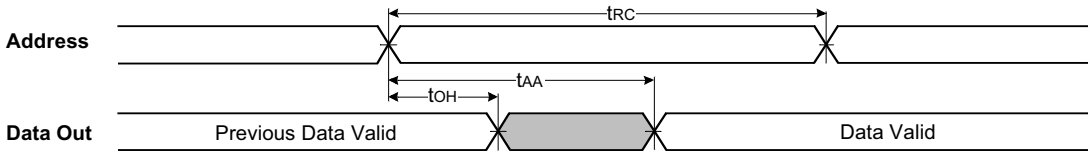
DATA RETENTION CHARACTERISTICS

Item	Symbol	Test Condition	Min	Typ	Max	Unit
Vcc for data retention	V_{DR}	$\overline{CS_1}$≥Vcc-0.2V[1)]	2.0	-	3.6	V
Data retention current	I_{DR}	Vcc=3.0V, $\overline{CS_1}$≥Vcc-0.2V[1)]	-	0.2	10[2)]	µA
Data retention set-up time	t_{SDR}	See data retention waveform	0	-	-	ms
Recovery time	t_{RDR}		5	-	-	

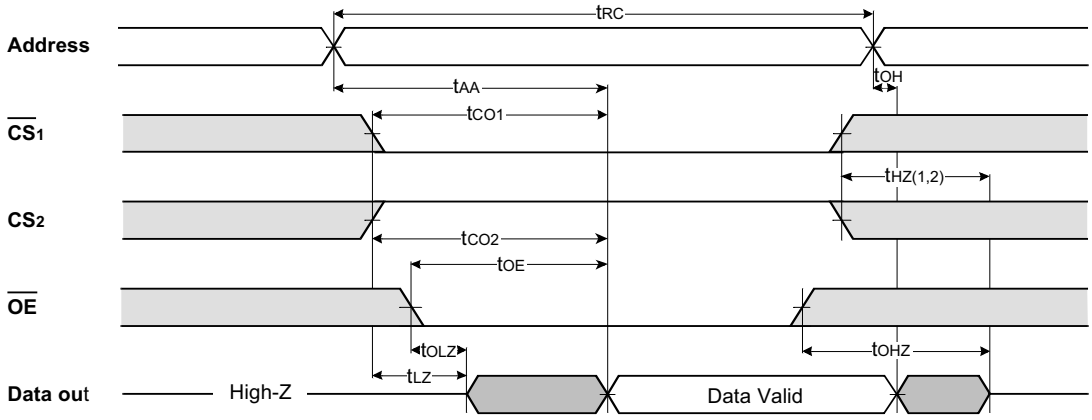
1. $\overline{CS_1}$≥Vcc-0.2V, CS_2≥Vcc-0.2V($\overline{CS_1}$ controlled) or CS_2≤0.2V(CS_2 controlled)
2. Industrial Products = 15µA

TIMMING DIAGRAMS

TIMING WAVEFORM OF READ CYCLE(1) (Address Controlled, $\overline{CS_1}$=$\overline{OE}$=V_{IL}, CS_2=$\overline{WE}$=V_{IH})



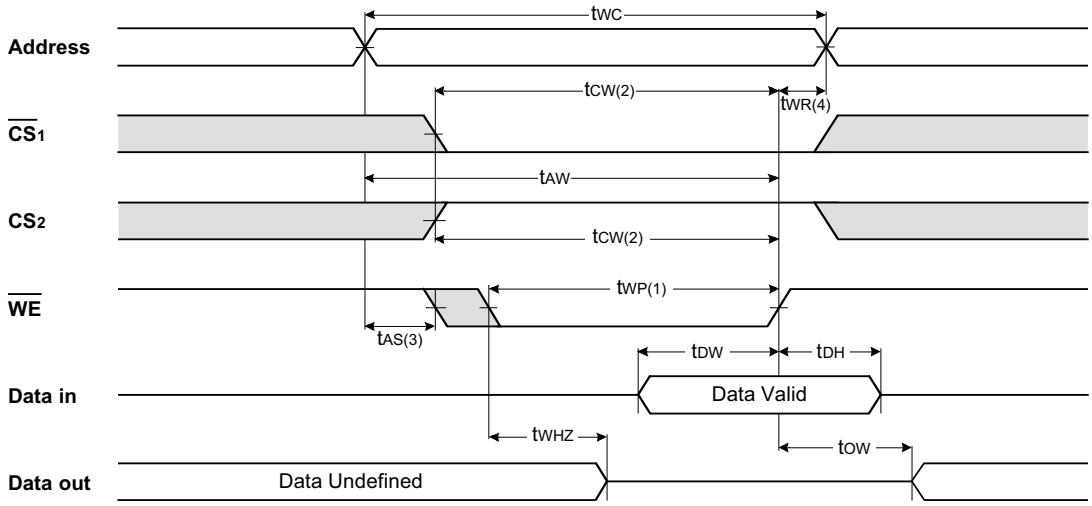
TIMING WAVEFORM OF READ CYCLE(2) ($\overline{WE}$=V_{IH})



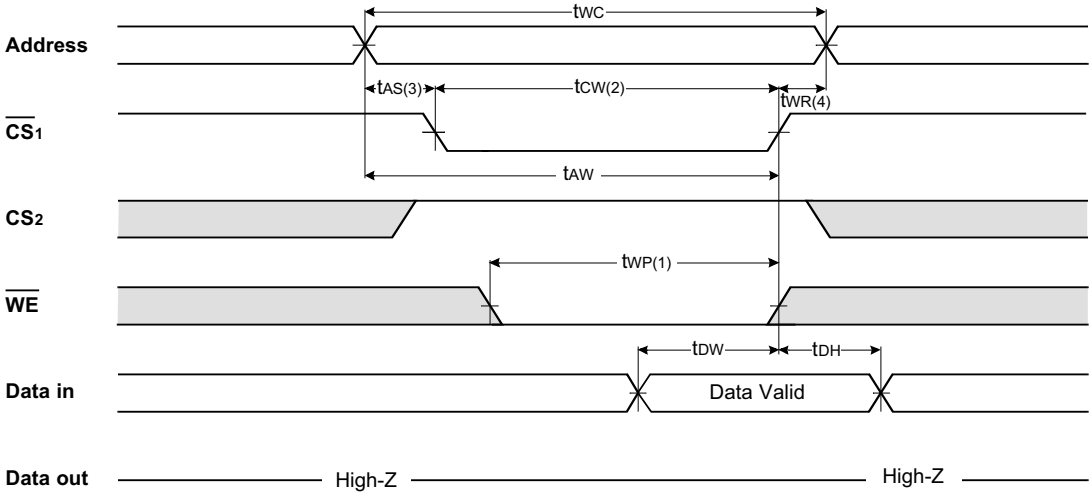
NOTES (READ CYCLE)

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}(Max.) is less than t_{LZ}(Min.) both for a given device and from device to device interconnection.

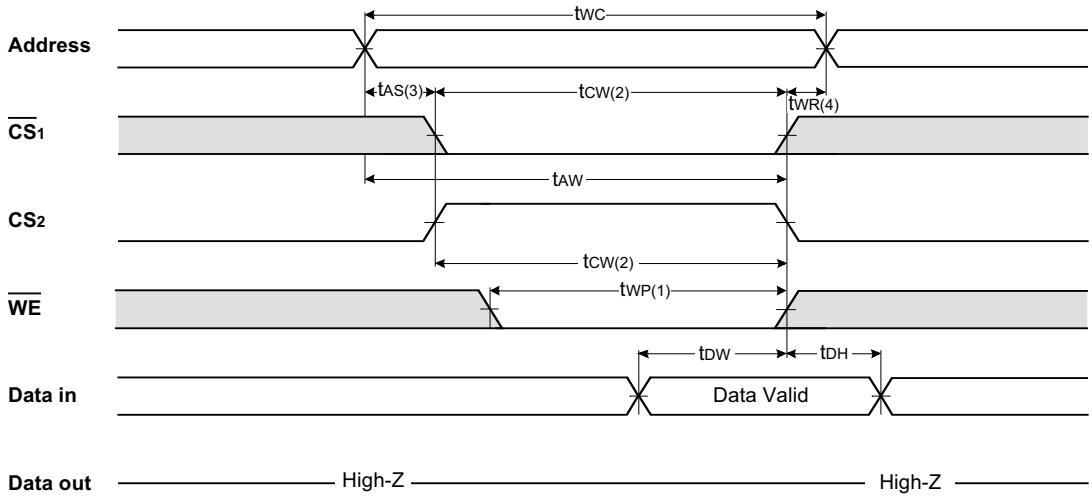
TIMING WAVEFORM OF WRITE CYCLE(1) ($\overline{WE}$ Controlled)



TIMING WAVEFORM OF WRITE CYCLE(2) ($\overline{CS_1}$ Controlled)



TIMING WAVEFORM OF WRITE CYCLE(3) (CS_2 Controlled)

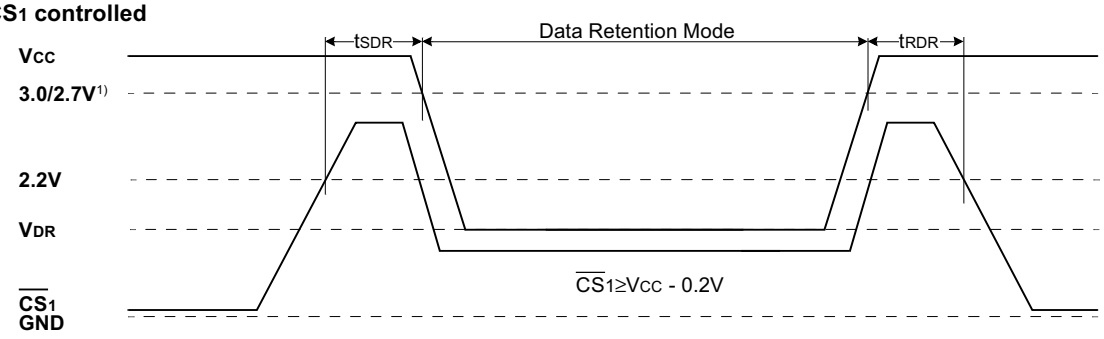


NOTES (WRITE CYCLE)

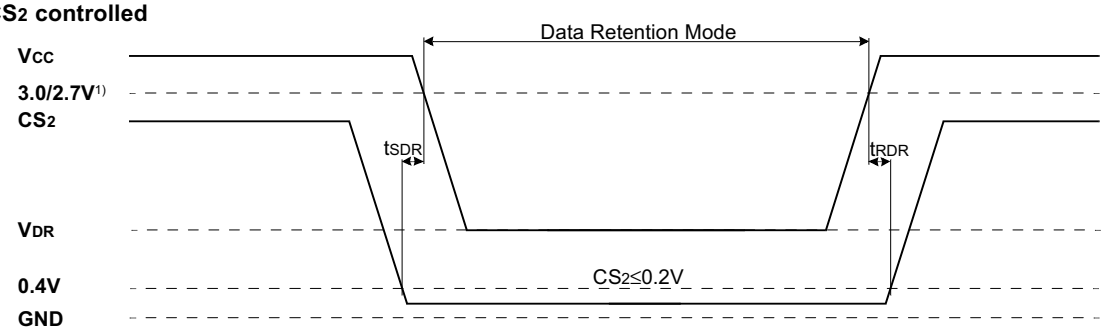
1. A write occurs during the overlap of a low $\overline{CS_1}$, a high CS_2 and a low $\overline{WE}$. A write begins at the latest transition among $\overline{CS_1}$ goes low, CS_2 going high and $\overline{WE}$ going low : A write end at the earliest transition among $\overline{CS_1}$ going high, CS_2 going low and $\overline{WE}$ going high, t_{WP} is measured from the begining 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

$\overline{CS_1}$ controlled



CS_2 controlled

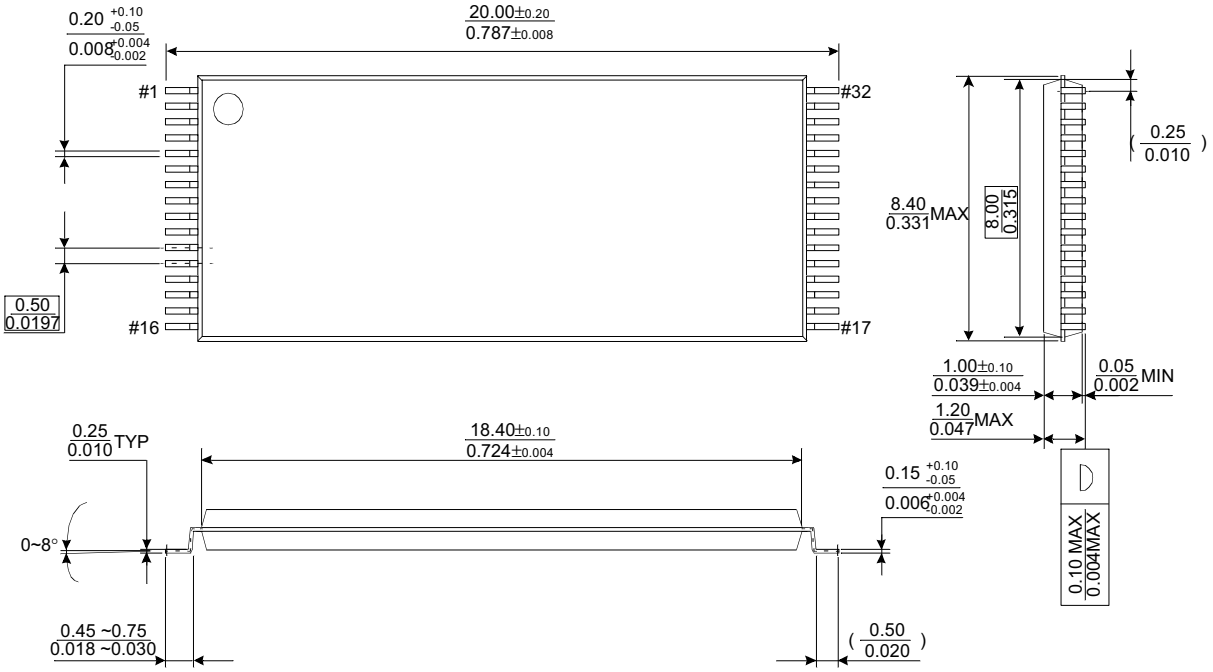


1. 3.0V for K6T2008V2A Family, 2.7V for K6T2008U2A Family

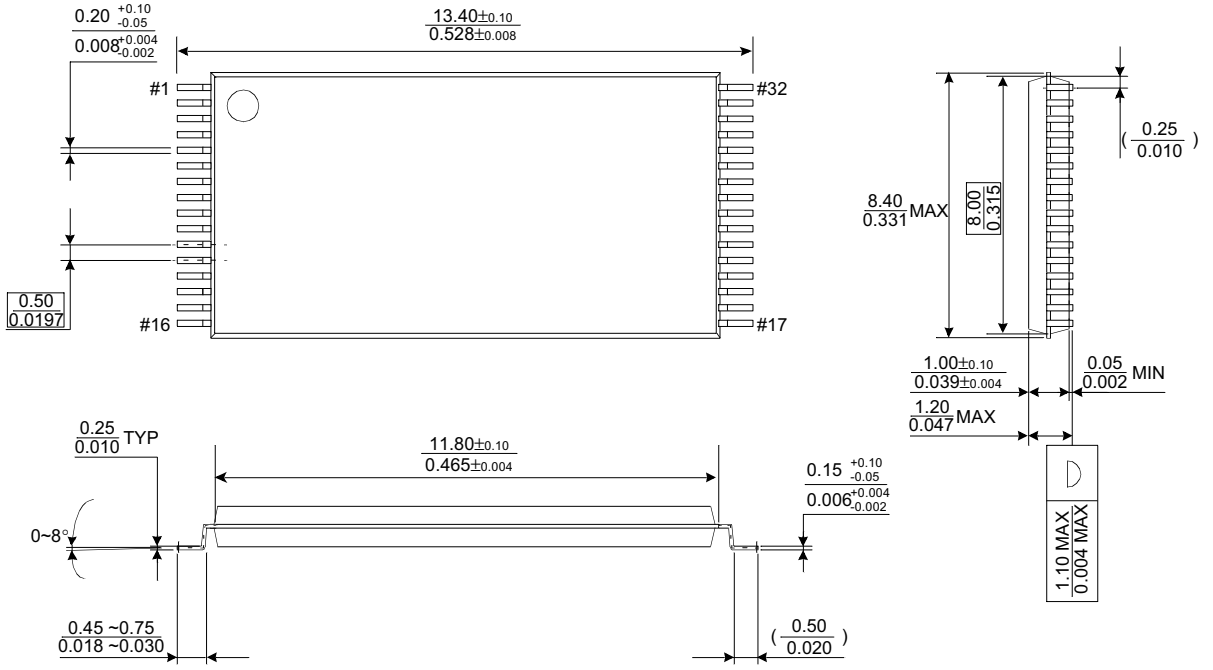
PACKAGE DIMENSIONS

Units: millimeter(inch)

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



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

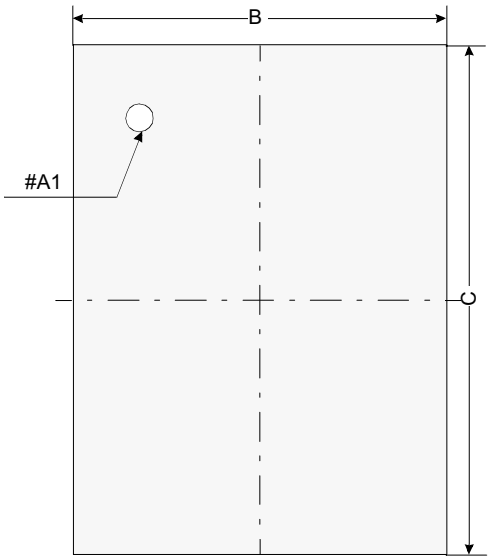


PACKAGE DIMENSIONS

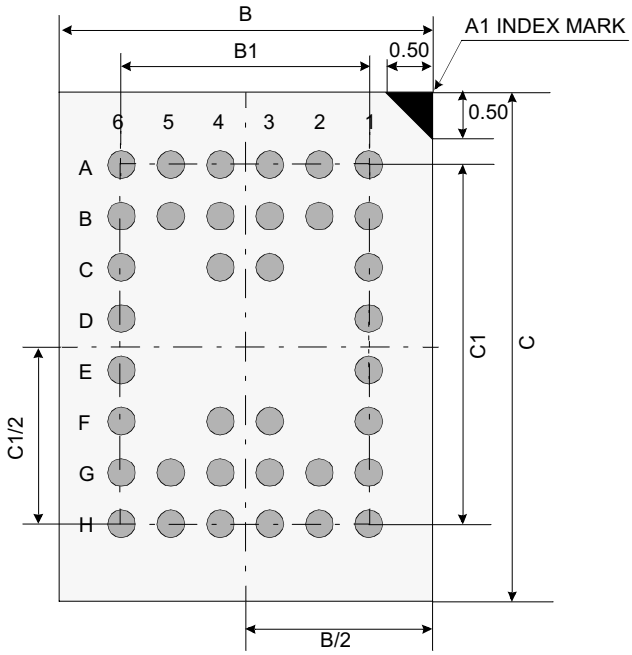
Units: millimeters

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

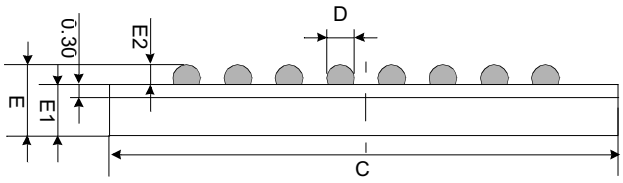
Top View



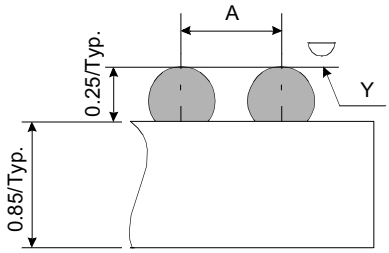
Bottom View



Side View



Detail A



	Min	Typ	Max
A	-	0.75	-
B	5.90	6.00	6.10
B1	-	3.75	-
C	6.90	7.00	7.10
C1	-	5.25	-
D	0.30	0.35	0.40
E	-	1.10	1.20
E1	-	0.85	-
E2	0.20	0.25	0.30
Y	-	-	0.08

Notes.

1. Bump counts: 48(8row x 6column)
2. Bump pitch : (x,y)=(0.75 x 0.75)(typ.)
3. All tolerence are +/-0.050 unless otherwise specified.
4. Typ : Typical
5. Y is coplanarity: 0.08(Max)