

Document Title

128K x8 bit Super Low Power and Low Voltage Full CMOS Static RAM

Revision History

<u>Revision No.</u>	<u>History</u>	<u>Draft Date</u>	<u>Remark</u>
0.0	Initial draft	March 15, 1996	Advance
0.1	Revise - Erase 100ns from KM68FS1000 Family - Add 150ns for KM68FS1000 Family - Add 32-sTSSOP1 new package - Add high power version I _{SB1} =5.0μA(Max) - Change V _{DR} (Min) 1.0 to 1.5V	July 7, 1996	Preliminary
1.0	Finalize - Concept change high power version to low low power version I _{SB1} =5.0μA(Max) - Change super low power version with special handling I _{SB1} =1.0μA(Max) - I _{CC} & I _{CC1} (Read) decrease 10 to 5mA	December 1, 1996	Final
2.0	Revise - Change datasheet format - Remove reverse type package from product - Remove reserved speed bin(100ns)	February 26, 1998	Final
3.0	Revise - Add CSP type packaged product. - Improved I _{CC2}	July 29, 1998	Final

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128K x8 bit Super Low Power and Low Voltage Full CMOS Static RAM

FEATURES

- Process Technology: Full CMOS
- Organization: 128K x8 bit
- Power Supply Voltage
K6F1008V2M Family: 3.0V ~ 3.6V
K6F1008S2M Family: 2.3V ~ 3.3V
K6F1008R2M Family: 1.8V ~ 2.7V
- Low Data Retention Voltage: 1.5V(Min)
- Three state output and TTL Compatible
- Package Type: 32-SOP-525, 32-TSOP1-0820F, 32-TSOP1-0813.4F, 48-CSP

GENERAL DESCRIPTION

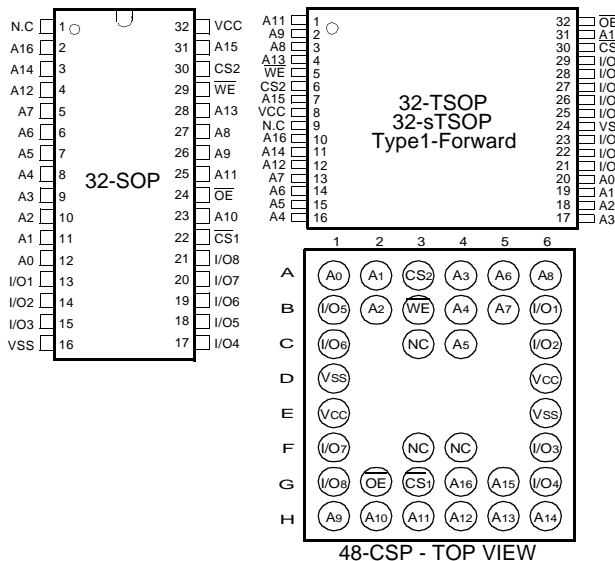
The K6F1008V2M, K6F1008S2M and K6F1008R2M families are fabricated by SAMSUNG's advanced Full CMOS process technology. The families support various operating temperature range and have various package types for user flexibility of system design. The families also support low data retention voltage for battery back-up operation with low data retention current.

PRODUCT FAMILY

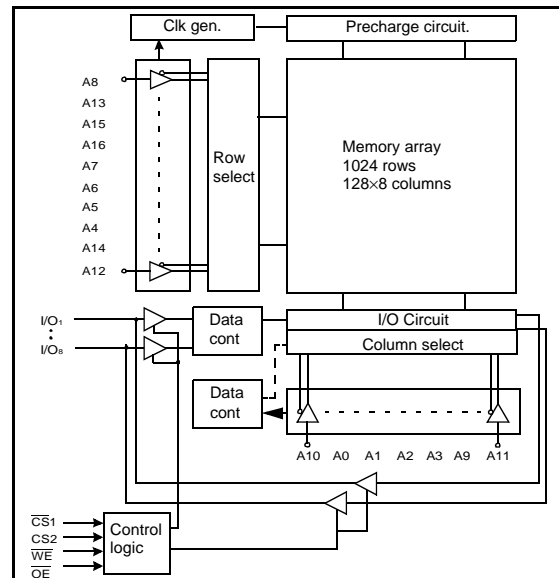
Product Family	Operating Temperature	Vcc Range	Speed(ns)	Power Dissipation		PKG Type
				Standby (I _{SB1} , Max)	Operating (I _{CC2} , Max)	
K6F1008V2M-C	Commercial(0~70°C)	3.0~3.6V	70 ¹⁾ /85@V _{CC} =3.3±0.3V	5μA ²⁾	40mA	32-SOP
K6F1008S2M-C		2.3~3.3V	70 ¹⁾ /85@V _{CC} =3.0±0.3V 120 ¹⁾ /150@V _{CC} =2.5±0.2V		35mA	32-TSOP1 Forward
K6F1008R2M-C		1.8~2.7V	300 ¹⁾ @V _{CC} =2.0±0.2V		30mA	32-TSOP1 Forward
K6F1008V2M-I	Industrial(-40~85°C)	3.0~3.6V	70 ¹⁾ /85@V _{CC} =3.3±0.3V		40mA	32-sTSOP1 Forward
K6F1008S2M-I		2.3~3.3V	70 ¹⁾ /85/100@V _{CC} =3.0±0.3V 120 ¹⁾ /150@V _{CC} =2.5±0.2V		35mA	48-CSP
K6F1008R2M-I		1.8~2.7V	300 ¹⁾ @V _{CC} =2.0±0.2V		30mA	48-CSP
					15mA	

1. The parameter is measured with 30pF test load.
2. 1μA for super low power version with special handling.

PIN DESCRIPTION



FUNCTIONAL BLOCK DIAGRAM



Name	Function	Name	Function	Name	Function	Name	Function
CS1, CS2	Chip Select Input	OE	Output Enable Input	Vcc	Power	I/O1~I/O8	Data Inputs/Outputs
N.C.	No Connection	WE	Write Enable Input	Vss	Ground	A0~A16	Address Inputs

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PRODUCT LIST

Commercial Temperature Products(0~70°C)		Industrial Temperature Products(-40~85°C)	
Part Name	Function	Part Name	Function
K6F1008V2M-GC70	32-SOP, 70ns, 3.3V	K6F1008V2M-GI70	32-SOP, 70ns, 3.3V
K6F1008V2M-GC85	32-SOP, 85ns, 3.3V	K6F1008V2M-GI85	32-SOP, 85ns, 3.3V
K6F1008V2M-TC70	32-TSOP1 F, 70ns, 3.3V	K6F1008V2M-TI70	32-TSOP1 F, 70ns, 3.3V
K6F1008V2M-TC85	32-TSOP1 F, 85ns, 3.3V	K6F1008V2M-TI85	32-TSOP1 F, 85ns, 3.3V
K6F1008S2M-GC12	32-SOP, 120/70ns, 2.5/3.0V	K6F1008S2M-GI12	32-SOP, 120/70ns, 2.5/3.0V
K6F1008S2M-GC15	32-SOP, 150/85ns, 2.5/3.0V	K6F1008S2M-GI15	32-SOP, 150/85ns, 2.5/3.0V
K6F1008S2M-TC12	32-TSOP1 F, 120/70ns, 2.5/3.0V	K6F1008S2M-TI12	32-TSOP1 F, 120/70ns, 2.5/3.0V
K6F1008S2M-TC15	32-TSOP1 F, 150/85ns, 2.5/3.0V	K6F1008S2M-TI15	32-TSOP1 F, 150/85ns, 2.5/3.0V
K6F1008S2M-YC12	32-sTSOP1 F, 120/70ns, 2.5/3.0V	K6F1008S2M-YI12	32-sTSOP1 F, 120/70ns, 2.5/3.0V
K6F1008S2M-YC15	32-sTSOP1 F, 150/85ns, 2.5/3.0V	K6F1008S2M-YI15	32-sTSOP1 F, 150/85ns, 2.5/3.0V
K6F1008R2M-GC30	32-SOP, 300ns, 2.0/2.5V	K6F1008R2M-GI30	32-SOP, 300ns, 2.0/2.5V
K6F1008R2M-TC30	32-TSOP1 F, 300ns, 2.0/2.5V	K6F1008R2M-TI30	32-TSOP1 F, 300ns, 2.0/2.5V
K6F1008R2M-YC30	32-sTSOP1 F, 300ns, 2.0/2.5V	K6F1008R2M-YI30	32-sTSOP1 F, 300ns, 2.0/2.5V
		K6F1008R2M-ZI30	48-CSP, 300ns, 2.0/2.5V

FUNCTIONAL DESCRIPTION

CS ₁	CS ₂	OE	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 high or low states)

ABSOLUTE MAXIMUM RATINGS¹⁾

Item	Symbol	Ratings	Unit	Remark
Voltage on any pin relative to V _{SS}	V _{IN} , V _{OUT}	-0.2 to 3.6V ²⁾	V	-
Voltage on V _{CC} supply relative to V _{SS}	V _{CC}	-0.2 to 4.0V ³⁾	V	-
Power Dissipation	P _D	1.0	W	-
Storage temperature	T _{STG}	-55 to 150	°C	-
Operating Temperature	T _A	0 to 70	°C	K6F1008V2M-C, K6F1008S2M-C, K6F1008R2M-C
		-40 to 85	°C	K6F1008V2M-I, K6F1008S2M-I, K6F1008R2M-I
Soldering temperature and time	T _{SOLDER}	260°C, 5sec (Lead Only)	-	-

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.

2. V_{IN}/V_{OUT}=-0.2 to 3.9V for K6F1008V2M Family.

3. Maximum V_{CC}=-0.2 to 4.6V for K6F1008V2M Family.

RECOMMENDED DC OPERATING CONDITIONS¹⁾

Item	Symbol	Product	Min	Typ	Max	Unit	
Supply voltage	V _{CC}	K6F1008V2M Family	3.0	3.3	3.6	V	
		K6F1008S2M Family	2.3	2.5/3.0	3.3		
		K6F1008R2M Family	1.8	2.0/2.5	2.7		
Ground	V _{SS}	All Family	0	0	0	V	
Input high voltage	V _{IH}	K6F1008V2M Family	V _{CC} =3.3±0.3V	2.2	-	V _{CC} +0.2 ²⁾	V
		K6F1008S2M Family	V _{CC} =3.0±0.3V	2.2			
			V _{CC} =2.5±0.2V	2.0			
		K6F1008R2M Family	V _{CC} =2.5±0.2V	2.0			
V _{CC} =2.0±0.2V	1.6						
Input low voltage	V _{IL}	All Family	-0.2 ³⁾	-	0.4	V	

Note

- Commercial Product : T_A=0 to 70°C, unless otherwise specified
Industrial Product : T_A=-40 to 85°C, unless otherwise specified
- Overshoot : V_{CC} + 1.0V in case of pulse width ≤20ns
- Undershoot : -1.0V in case of pulse width ≤20ns
- 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 _{IL} or V _{IH} , Read	-	-	2	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 or V _{IN} ≥V _{CC} -0.2V	Read	-	-	3	mA		
			Write	-	10	15			
	I _{CC2}	Cycle time=Min, 100% duty, I _{IO} =0mA, $\overline{CS}_1=V_{IL}$, $\overline{CS}_2=V_{IH}$, V _{IN} =V _{IL} or V _{IH}	V _{CC} =3.3V @70ns	-	-	35 ¹⁾	mA		
			V _{CC} =2.7V @120ns	-	-	30			
V _{CC} =2.2V @300ns			-	-	15				
Output low voltage	V _{OL}	I _{OL}	2.1mA at V _{CC} =3.0/3.3V 0.5mA at V _{CC} =2.5V 0.33mA at V _{CC} =2.0V			-	-	0.4	V
Output high voltage	V _{OH}	I _{OH}	-1.0mA at V _{CC} =3.0/3.3V			2.4	-	-	V
			-0.5mA at V _{CC} =2.5V			2.0	-	-	
			-0.44mA at V _{CC} =2.0V			1.6	-	-	
Standby Current(TTL)	I _{SB}	$\overline{CS}_1=V_{IH}$ or $\overline{CS}_2=V_{IL}$, Other inputs=V _{IL} or V _{IH}	-	-	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}	-	-	5 ¹⁾	μA			

- K6F1008V2M Family = 40mA
- Super low power product = 1μA with special handling.

AC OPERATING CONDITIONS

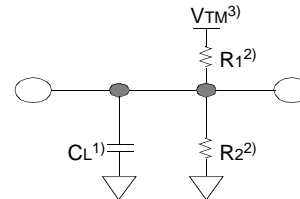
TEST CONDITIONS (Test Load and Test Input/Output Reference)

Input pulse level : 0.4 to 2.2V for V_{CC}=3.3V, 3.0V, 2.5V
0.4 to 1.8V for V_{CC}=2.0V

Input rising and falling time : 5ns

Input and output reference voltage : 1.5V for V_{CC}=3.3V, 3.0V
1.1V for V_{CC}=2.5V
0.9V for V_{CC}=2.0V

Output load (See right) : C_L=100pF+1TTL
C_L=30pF+1TTL



1. Including scope and jig capacitance
2. R₁=3070Ω, R₂=3150Ω
3. V_{TM}=2.8V for V_{CC}=3.0/3.3V
2.3V for V_{CC}=2.5V
1.8V for V_{CC}=2.0V

AC CHARACTERISTICS

(Commercial product : T_A=0 to 70°C, Industrial product : T_A=-40 to 85°C
K6F1008V2M Family : V_{CC}=3.0~3.6V, K6F1008S2M Family : V_{CC}=2.3~3.3V,
K6F1008R2M Family : V_{CC}=1.8~2.7V)

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Parameter List	Symbol	Speed Bins												Units	
		70ns		85ns		100ns		120ns		150ns		300ns			
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Read	Read cycle time	t _{RC}	70	-	85	-	100	-	120	-	150	-	300	-	ns
	Address access time	t _{AA}	-	70	-	85	-	100	-	120	-	150	-	300	ns
	Chip select to output	t _{CO1} , t _{CO2}	-	70	-	85	-	100	-	120	-	150	-	300	ns
	Output enable to valid output	t _{OE}	-	35	-	45	-	50	-	60	-	75	-	150	ns
	Chip select to low-Z output	t _{LZ1} , t _{LZ2}	10	-	10	-	10	-	10	-	20	-	50	-	ns
	Output enable to low-Z output	t _{OLZ}	5	-	5	-	5	-	5	-	10	-	30	-	ns
	Chip disable to high-Z output	t _{HZ1} , t _{HZ2}	0	25	0	25	0	30	0	35	0	40	0	60	ns
	Output disable to high-Z output	t _{OHZ}	0	25	0	25	0	30	0	35	0	40	0	60	ns
	Output hold from address change	t _{OH}	10	-	15	-	15	-	15	-	15	-	30	-	ns
Write	Write cycle time	t _{WC}	70	-	85	-	100	-	120	-	150	-	300	-	ns
	Chip select to end of write	t _{CW}	65	-	70	-	80	-	100	-	120	-	300	-	ns
	Address set-up time	t _{AS}	0	-	0	-	0	-	0	-	0	-	0	-	ns
	Address valid to end of write	t _{AW}	65	-	70	-	80	-	100	-	120	-	300	-	ns
	Write pulse width	t _{WP}	55	-	60	-	70	-	80	-	100	-	200	-	ns
	Write recovery time	t _{WR}	0	-	0	-	0	-	0	-	0	-	0	-	ns
	Write to output high-Z	t _{WHZ}	0	25	0	25	0	30	0	35	0	40	0	60	ns
	Data to write time overlap	t _{DW}	30	-	35	-	40	-	50	-	60	-	120	-	ns
	Data hold from write time	t _{DH}	0	-	0	-	0	-	0	-	0	-	0	-	ns
End write to output low-Z	t _{OW}	5	-	5	-	5	-	5	-	5	-	20	-	ns	

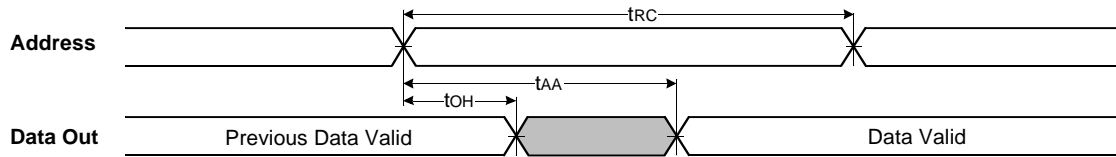
DATA RETENTION CHARACTERISTICS

Item	Symbol	Test Condition	Min	Typ	Max	Unit
V _{CC} for data retention	V _{DR}	$\overline{CS}_1 \geq V_{CC} - 0.2V^{(1)}$	1.5	-	3.6	V
Data retention current	I _{DR}	V _{CC} =3.0V, $\overline{CS}_1 \geq V_{CC} - 0.2V^{(1)}$	-	-	5.0 ⁽²⁾	μA
Data retention set-up time	t _{SDR}	See data retention waveform	0	-	-	ns
Recovery time	t _{RDR}		t _{RC}	-	-	

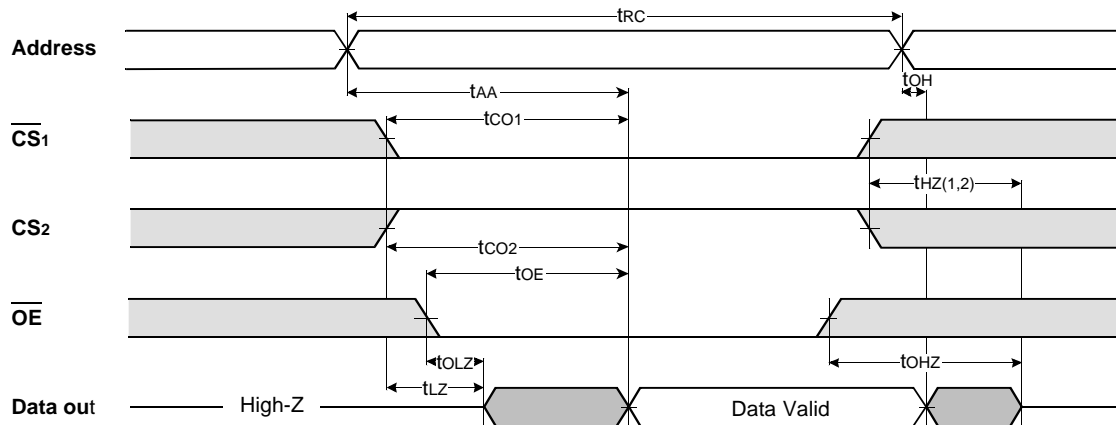
1. CS₁ ≥ V_{CC} - 0.2V, CS₂ ≥ V_{CC} - 0.2V (CS₁ controlled) or CS₂ ≤ 0.2V (CS₂ controlled)
2. Super low power product = 1μA with special handling.

TIMMING DIAGRAMS

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



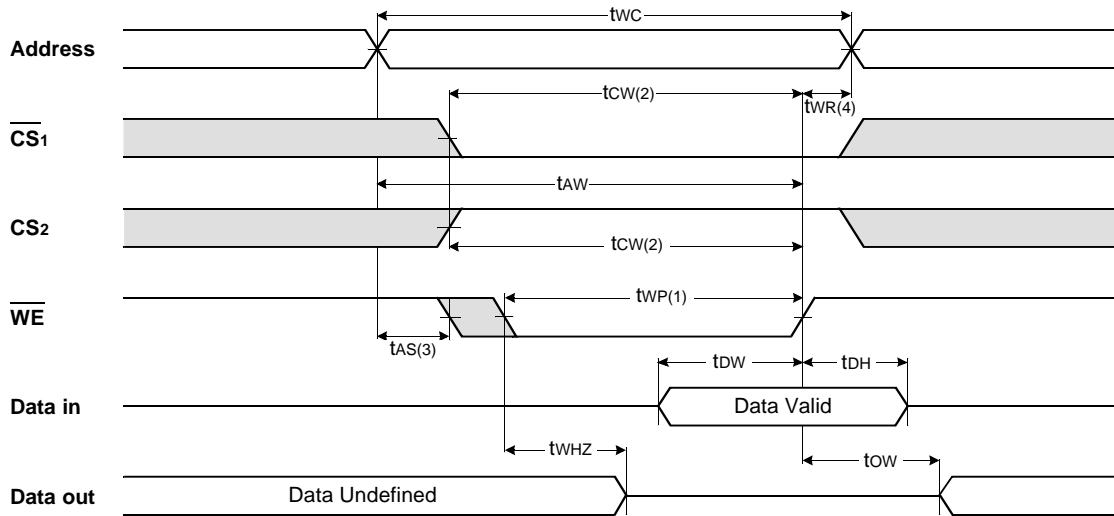
TIMING WAVEFORM OF READ CYCLE(2) ($\overline{WE}=V_{IH}$)



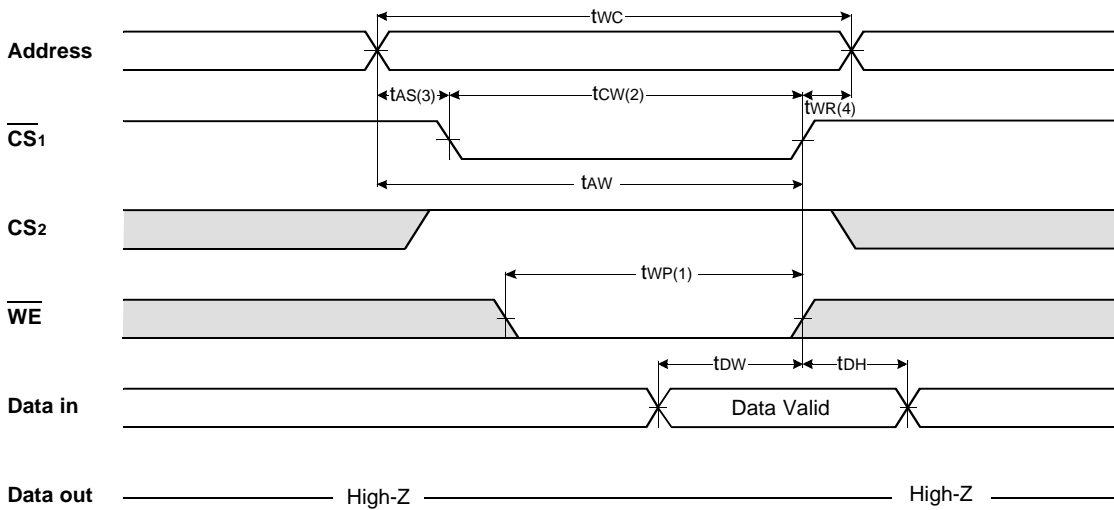
NOTES (READ CYCLE)

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.

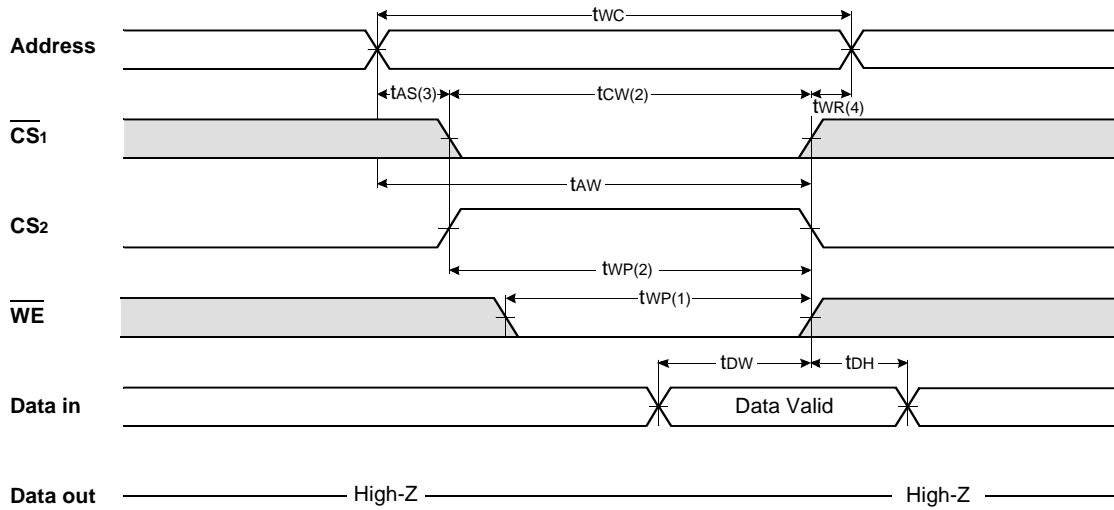
TIMING WAVEFORM OF WRITE CYCLE(1) (\overline{WE} Controlled)



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



TIMING WAVEFORM OF WRITE CYCLE(3) (\overline{CS}_1 Controlled)

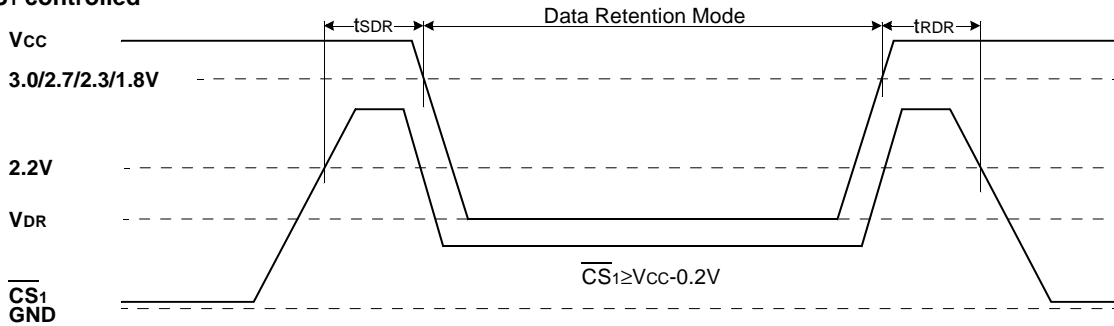


NOTES (WRITE CYCLE)

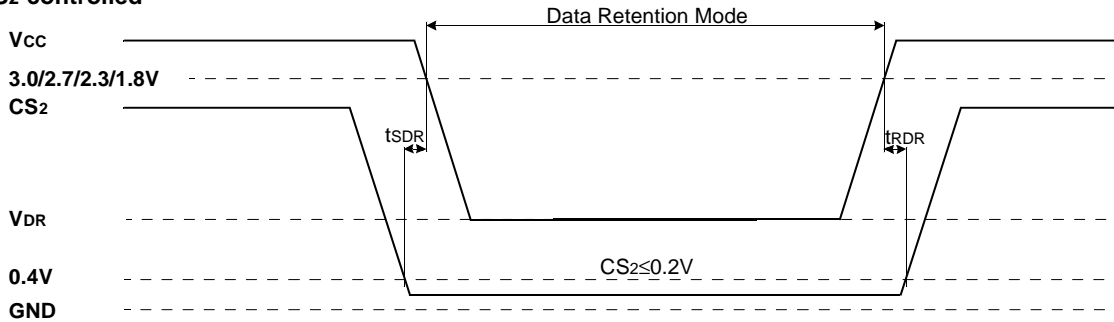
1. A write occurs during the overlap of a low \overline{CS}_1 , a high CS_2 and a low \overline{WE} . A write begins at the latest transition among \overline{CS}_1 goes low, CS_2 going high and \overline{WE} going low: A write ends at the earliest transition among \overline{CS}_1 going high, CS_2 going 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. $t_{WR(1)}$ applied in case a write ends as \overline{CS}_1 or \overline{WE} going high $t_{WR(2)}$ applied in case a write ends as CS_2 going to low.

DATA RETENTION WAVE FORM

\overline{CS}_1 controlled



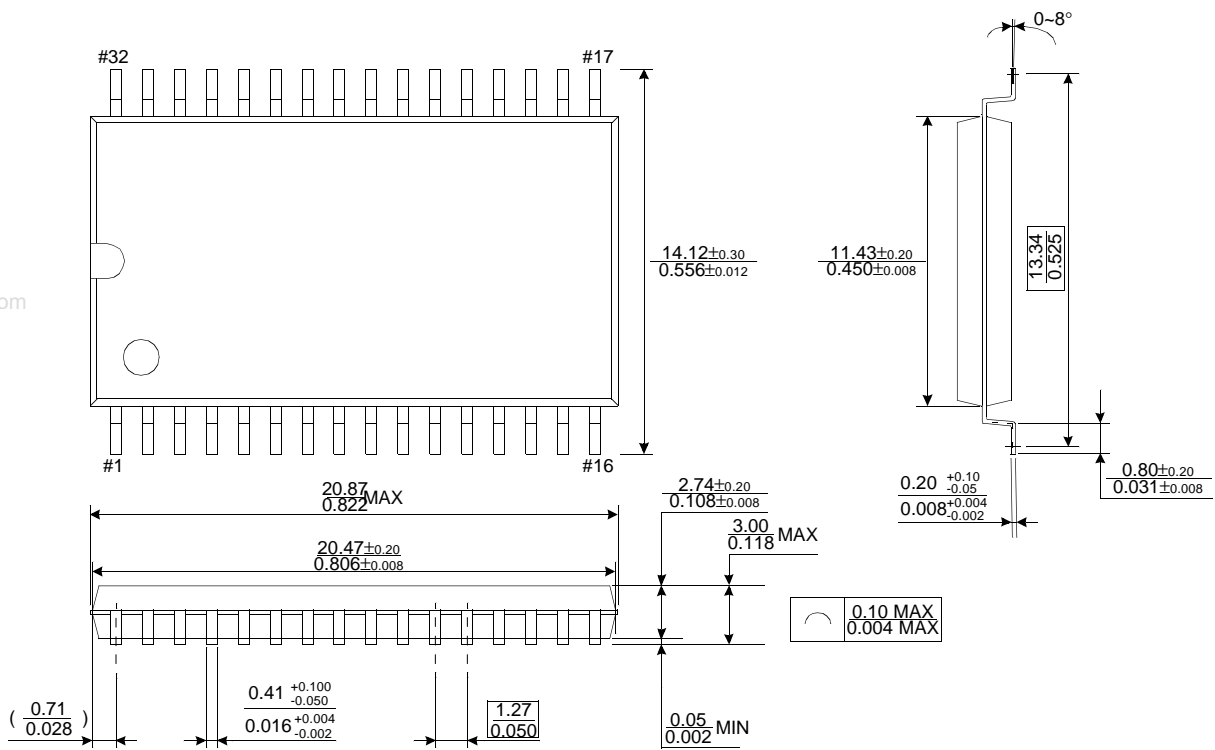
CS_2 controlled



PACKAGE DIMENSIONS

Units: millimeter(inch)

32 PLASTIC SMALL OUTLINE PACKAGE (525mil)

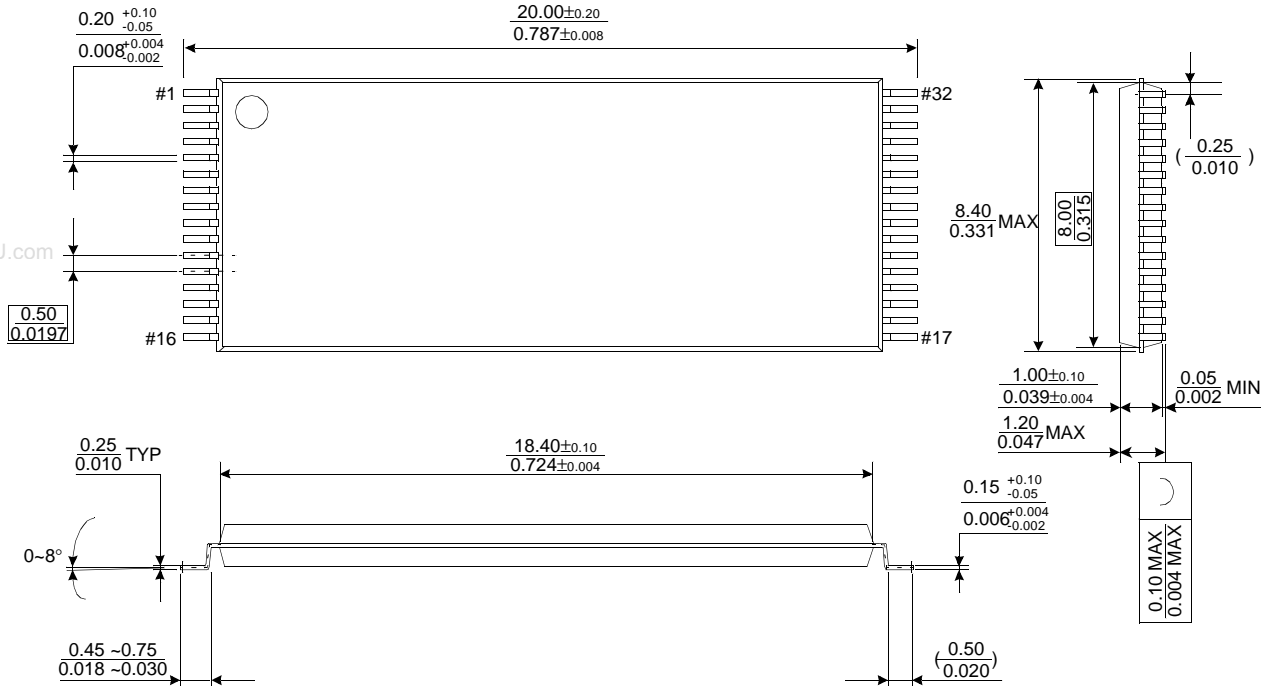


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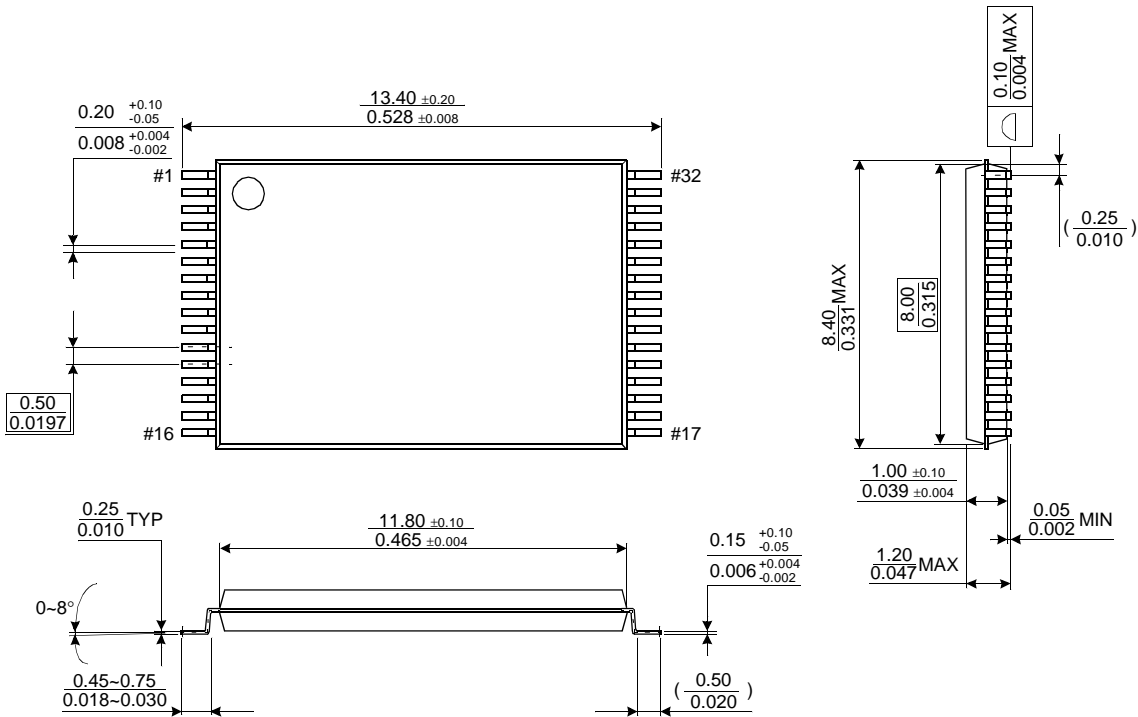
PACKAGE DIMENSIONS

Units: millimeter(inch)

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



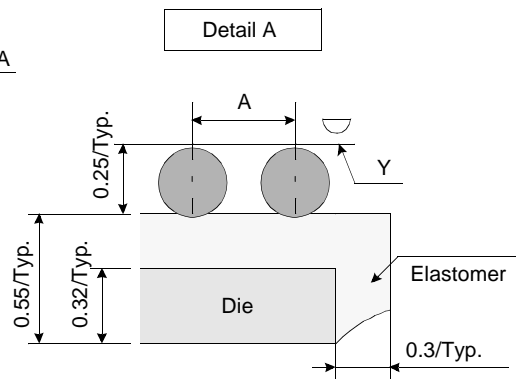
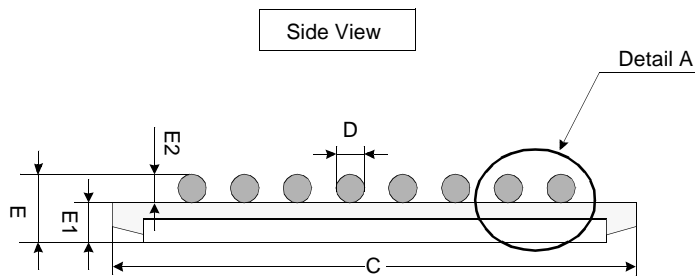
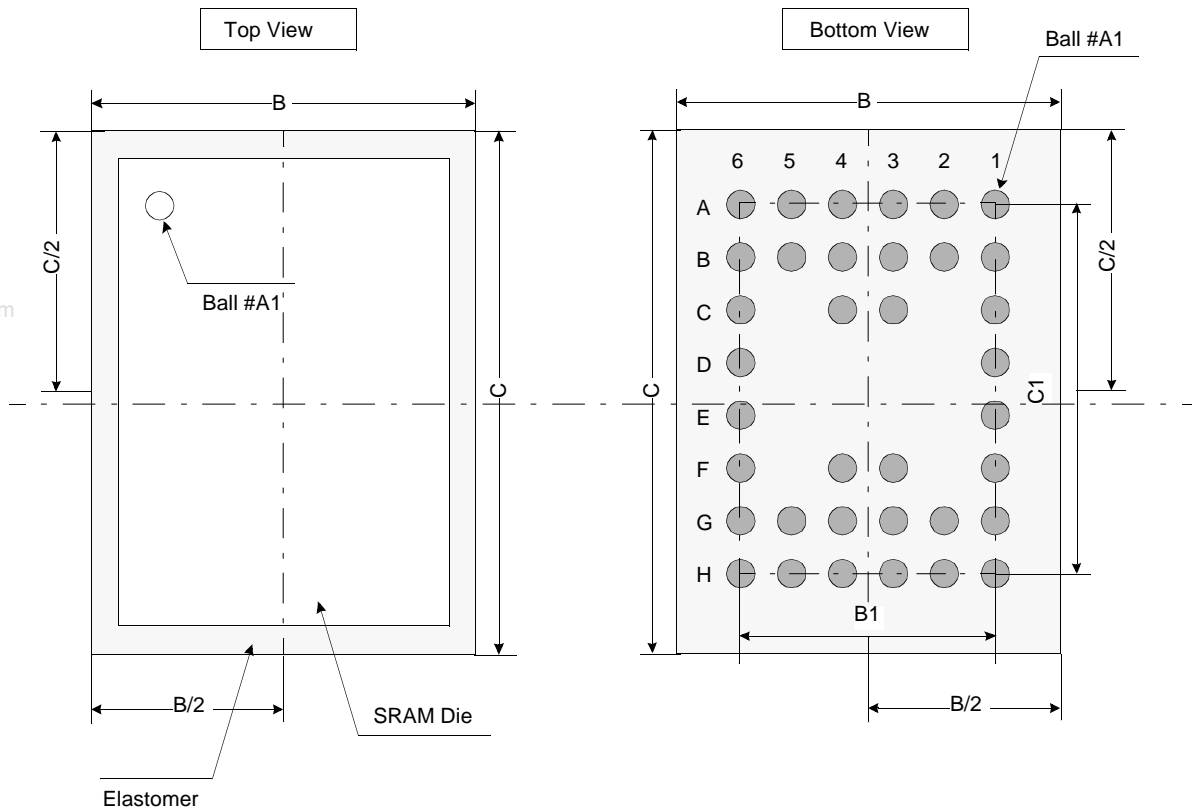
32 PIN THIN SMALL OUTLINE PACKAGE TYPE I (0813.4F)



PACKAGE DIMENSIONS

Units: millimeter(inch)

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



	Min	Typ	Max
A	-	0.75	-
B	5.90	6.00	6.10
B1	-	3.75	-
C	7.90	8.00	8.10
C1	-	5.25	-
D	0.30	0.35	0.40
E	-	0.80	0.81
E1	-	0.55	-
E2	-	0.25	-
Y	-	-	0.08

Notes.

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