Document Title

128Kx8 bit Low Power CMOS Static RAM

Revision History

Revision No.	History	Draft Data	Remark
0.0	Initial draft	July 15, 2002	Preliminary
0.1	Revised - Deleted 32-TSOP1-0820R, 32-TSOP1-0813.4F/R Package Type. - Added Commercial product. - Added 55ns product(Vcc = 3.0V~3.6V)	December 4, 2002	Preliminary
0.2	Revised - Added Lead Free 32-SOP-525 Product - Added Lead Free 32-TSOP1-0820F Product	June 23, 2003	Preliminary
1.0	Finalized - Changed I_{CC} from 3mA to 2mA - Changed $I_{CC}2$ from 25mA to 20mA - Changed $I_{SB}1$(Commercial) from 10μA to 6μA - Changed $I_{SB}1$(industrial) from 10μA to 6μA - Changed $I_{SB}1$(Automotive) from 20μA to 10μA - Changed I_{DR}(Commercial) from 10μA to 6μA - Changed I_{DR}(industrial) from 10μA to 6μA - Changed I_{DR}(Automotive) from 20μA to 10μA	September 16, 2003	Final

128Kx8 bit Super Low Power and Low Voltage full CMOS Static RAM

FEATURES

- Process Technology: Full CMOS
- Organization: 128K x 8
- Power Supply Voltage: 2.7~3.6V
- Low Data Retention Voltage: 1.5V(Min)
- Three state outputs
- Package Type: 32-SOP-525, 32-TSOP1-0820F
  32-SOP-525, 32-TSOP1-0820F

GENERAL DESCRIPTION

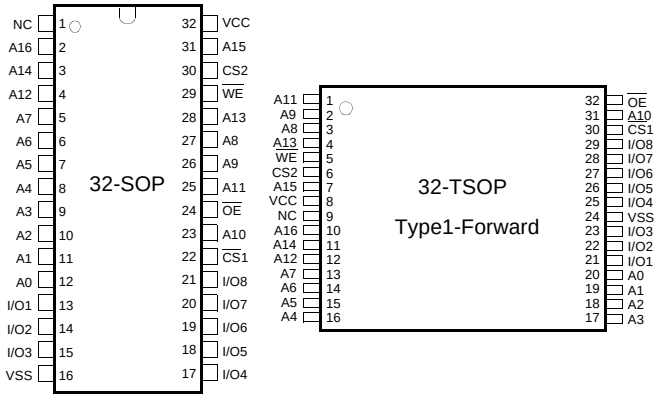
The K6X1008T2D families are fabricated by SAMSUNG′s advanced CMOS process technology. The families support verious operating temperature ranges and have various package types for user flexibility of system design. The families also support low data retention voltage for battery back-up operation with 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)	
K6X1008T2D-B	Commercial(0~70°C)	2.7~3.6V	55[1]/70[2]/85ns	6µA	20mA	32-SOP-525 32-TSOP1-0820F 32-SOP-525 32-TSOP1-0820F
K6X1008T2D-F	Industrial(-40~85°C)					
K6X1008T2D-Q	Automotive(-40~125°C)		70[2]/85ns	10µA		

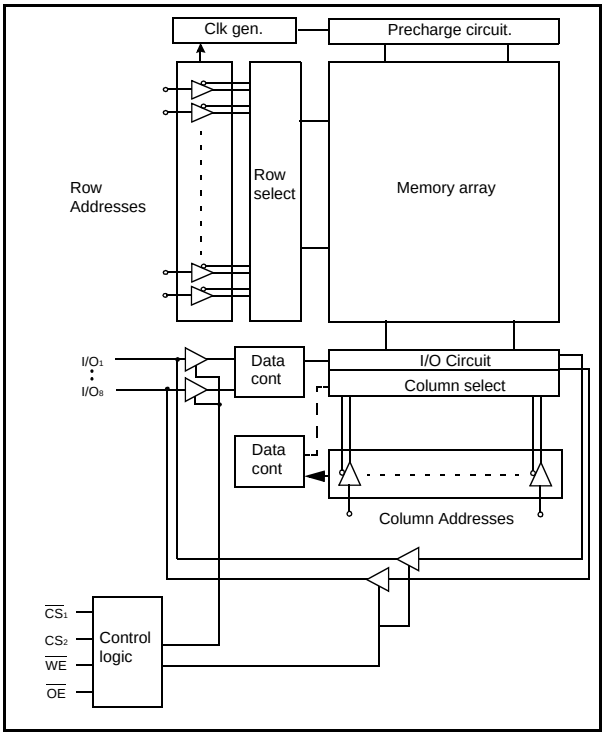
1. This parameter is measured in the voltage range of 3.0V~3.6V with 30pF test load.
2. This parameter is measured with 30pF test load.

PIN DESCRIPTION



Name	Function
A_0~A_{16}	Address Inputs
$\overline{WE}$	Write Enable Input
$\overline{CS_1}$,CS_2	Chip Select Input
$\overline{OE}$	Output Enable Input
I/O_1~I/O_8	Data Inputs/Outputs
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)		Atomotive Products(-40~125°C)	
Part Name	**Function**	**Part Name**	**Function**	**Part Name**	**Function**
K6X1008T2D-GB55[1)]	32-SOP, 55ns, LL	K6X1008T2D-GF55[1)]	32-SOP, 55ns, LL	K6X1008T2D-GQ70	32-SOP, 70ns, L
K6X1008T2D-GB70	32-SOP, 70ns, LL	K6X1008T2D-GF70	32-SOP, 70ns, LL	K6X1008T2D-GQ85	32-SOP, 85ns, L
K6X1008T2D-GB85	32-SOP, 85ns, LL	K6X1008T2D-GF85	32-SOP, 85ns, LL	K6X1008T2D-TQ70	32-TSOP-F, 70ns, L
K6X1008T2D-TB55[1)]	32-TSOP-F, 55ns, LL	K6X1008T2D-TF55[1)]	32-TSOP-F, 55ns, LL	K6X1008T2D-TQ85	32-TSOP-F, 85ns, L
K6X1008T2D-TB70	32-TSOP-F, 70ns, LL	K6X1008T2D-TF70	32-TSOP-F, 70ns, LL		
K6X1008T2D-TB85	32-TSOP-F, 85ns, LL	K6X1008T2D-TF85	32-TSOP-F, 85ns, LL		
K6X1008T2D-BB55[1,2)]	32-SOP, 55ns, LL	K6X1008T2D-BF55[1,2)]	32-SOP, 55ns, LL		
K6X1008T2D-BB70[2)]	32-SOP, 70ns, LL	K6X1008T2D-BF70[2)]	32-SOP, 70ns, LL		
K6X1008T2D-BB85[2)]	32-SOP, 85ns, LL	K6X1008T2D-BF85[2)]	32-SOP, 85ns, LL		
K6X1008T2D-PB55[1,2)]	32-TSOP-F, 55ns, LL	K6X1008T2D-PF55[1,2)]	32-TSOP-F, 55ns, LL		
K6X1008T2D-PB70[2)]	32-TSOP-F, 70ns, LL	K6X1008T2D-PF70[2)]	32-TSOP-F, 70ns, LL		
K6X1008T2D-PB85[2)]	32-TSOP-F, 85ns, LL	K6X1008T2D-PF85[2)]	32-TSOP-F, 85ns, LL		

1. Operating voltage range is 3.0V~3.6V
2. 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 RATINGS[1)]

Item	Symbol	Ratings	Unit	Remark
Voltage on any pin relative to Vss	V_{IN},V_{OUT}	-0.2 to V_{CC}+0.3V(Max. 3.9V)	V	-
Voltage on Vcc supply relative to Vss	V_{CC}	-0.2 to 3.9	V	-
Power Dissipation	P_D	1.0	W	-
Storage temperature	T_{STG}	-65 to 150	°C	-
Operating Temperature	T_A	0 to 70	°C	K6X1008T2D-B
		-40 to 85	°C	K6X1008T2D-F
		-40 to 125	°C	K6X1008T2D-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[1)]

Item	Symbol	Min	Typ	Max	Unit
Supply voltage	Vcc	2.7	3.0/3.3	3.6	V
Ground	Vss	0	0	0	V
Input high voltage	V_{IH}	2.2	-	Vcc+0.2[2)]	V
Input low voltage	V_{IL}	-0.2[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
   Automotive Product: T_A=-40 to 125°C, Otherwise specified
2. Overshoot: Vcc+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.

CAPACITANCE[1)] (f=1MHz, TA=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

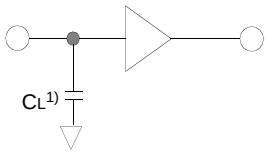
DC AND OPERATING CHARACTERISTICS

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}, Read		-	-	2	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 or V_{IN}≥V_{CC}-0.2V		-	-	3	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}		-	-	20	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	K6X1008T2D-B	-	-	6	µA
			K6X1008T2D-F	-	-	6	µA
			K6X1008T2D-Q	-	-	10	µA

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}=2.7~3.6V, Commercial product:T_A=0 to 70°C, Industrial product:T_A=-40 to 85°C, Automotive product:T_A=-40 to 125°C)

Parameter List		Symbol	Speed Bins						Units
			55ns[1]		70ns		85ns		
			Min	Max	Min	Max	Min	Max	
Read	Read Cycle Time	t_{RC}	55	-	70	-	85	-	ns
	Address Access Time	t_{AA}	-	55	-	70	-	85	ns
	Chip Select to Output	t_{CO}	-	55	-	70	-	85	ns
	Output Enable to Valid Output	t_{OE}	-	25	-	35	-	40	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	25	ns
	Output Disable to High-Z Output	t_{OHZ}	0	25	0	25	0	25	ns
	Output Hold from Address Change	t_{OH}	10	-	10	-	15	-	ns
Write	Write Cycle Time	t_{WC}	55	-	70	-	85	-	ns
	Chip Select to End of Write	t_{CW}	45	-	60	-	70	-	ns
	Address Set-up Time	t_{AS}	0	-	0	-	0	-	ns
	Address Valid to End of Write	t_{AW}	45	-	60	-	70	-	ns
	Write Pulse Width	t_{WP}	40	-	50	-	60	-	ns
	Write Recovery Time	t_{WR}	0	-	0	-	0	-	ns
	Write to Output High-Z	t_{WHZ}	0	25	0	25	0	30	ns
	Data to Write Time Overlap	t_{DW}	20	-	25	-	35	-	ns
	Data Hold from Write Time	t_{DH}	0	-	0	-	0	-	ns
	End Write to Output Low-Z	t_{OW}	5	-	5	-	5	-	ns

1. Voltage range is 3.0V~3.6V for commercial and industrial product.

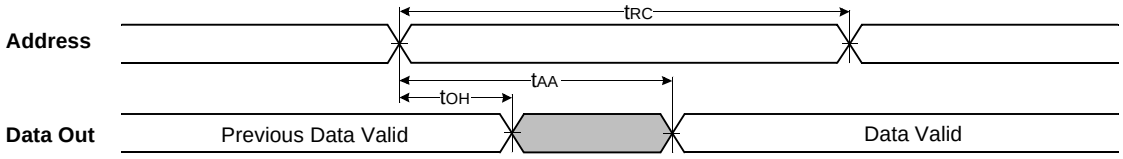
DATA RETENTION CHARACTERISTICS

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]	K6X1008T2D-B	-	-	6	µA
			K6X1008T2D-F	-	-	6	µA
			K6X1008T2D-Q			10	µA
Data retention set-up time	t_{SDR}	See data retention waveform		0	-	-	ms
Recovery time	t_{RDR}			5	-	-	

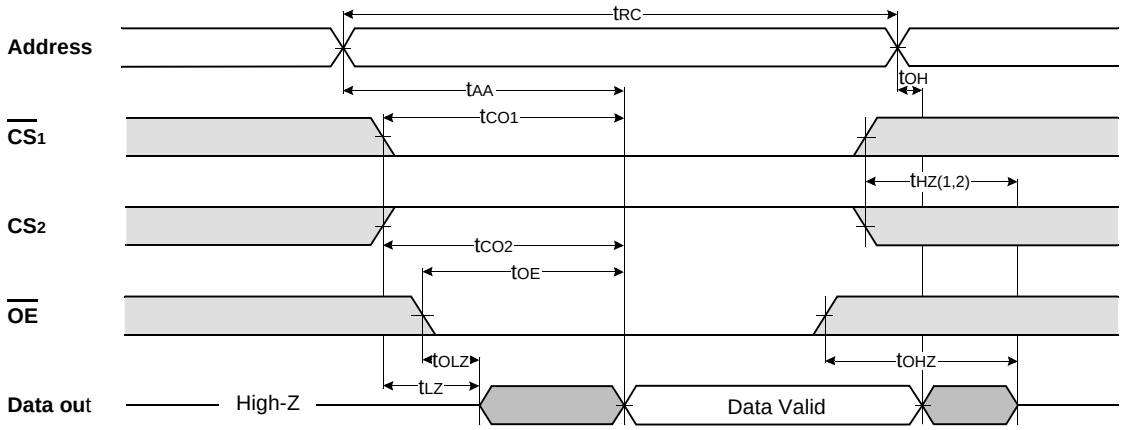
1. $\overline{CS_1}$≥Vcc-0.2V, CS_2≥Vcc-0.2V, or CS_2≤0.2V

TIMING DIAGRAMS

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



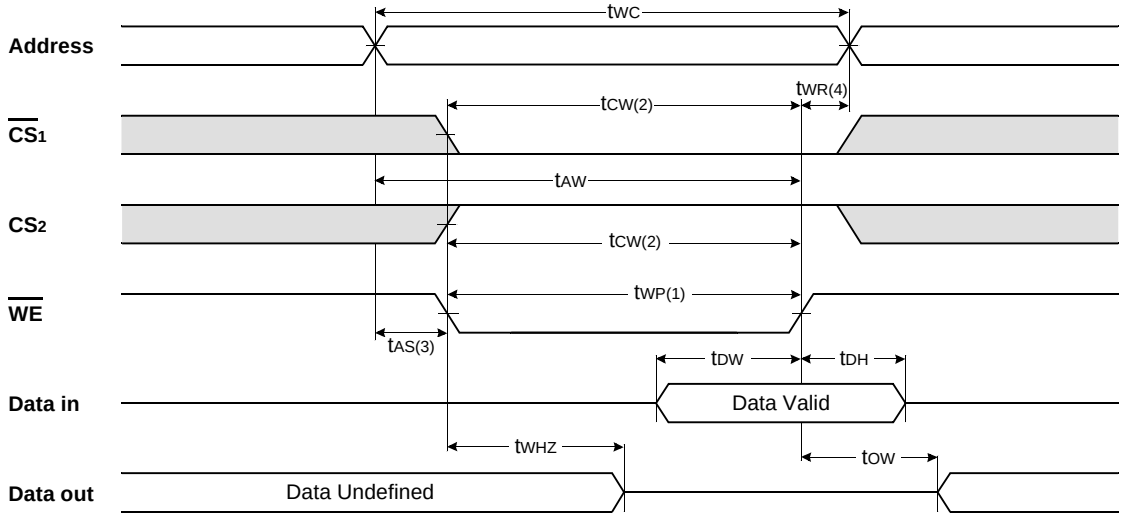
TIMING WAVEFORM OF READ CYCLE(2) ($\overline{WE}$=V_{IH})



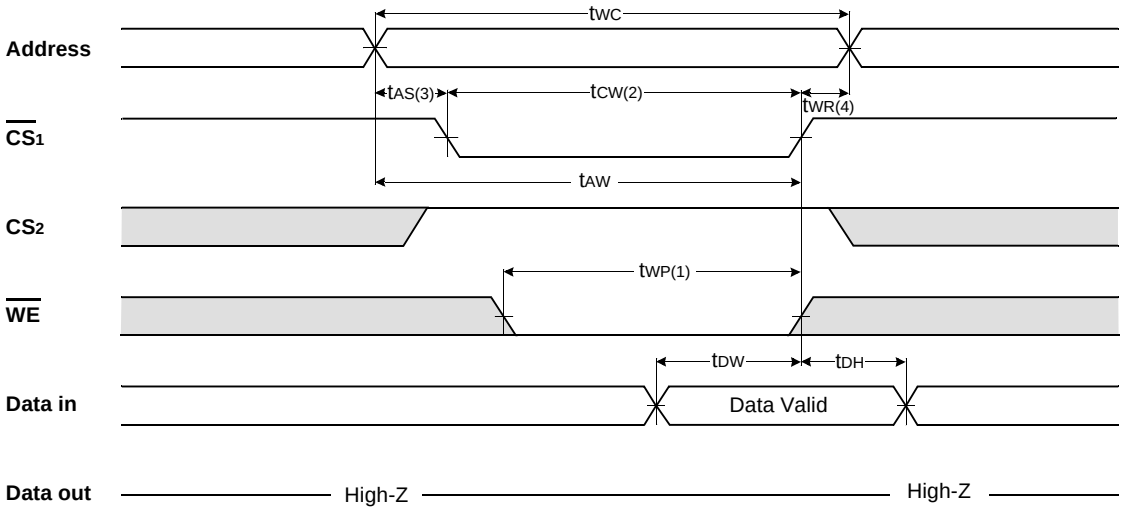
NOTES (READ CYCLE)

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

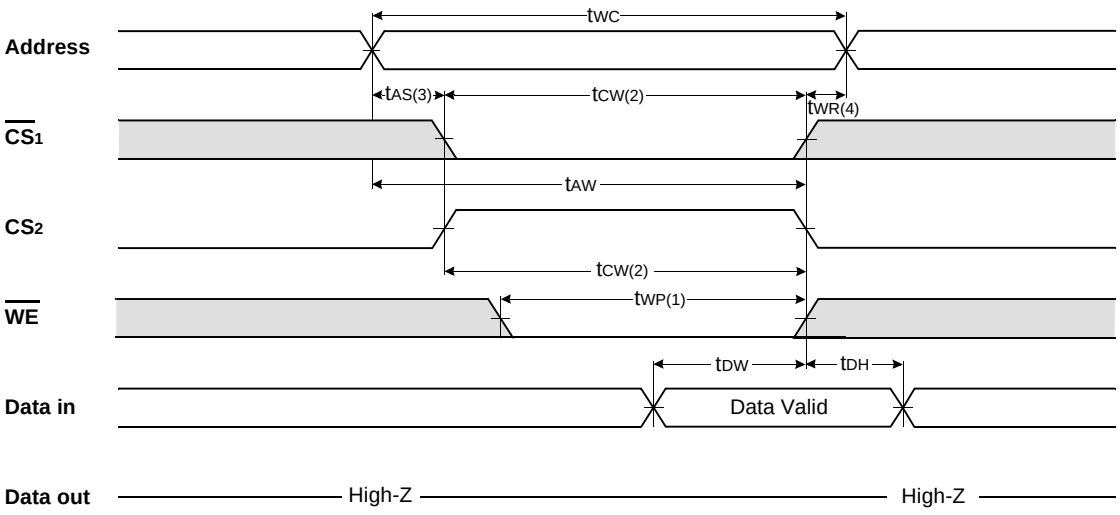
TIMING WAVEFORM OF WRITE CYCLE(1) ($\overline{WE}$ Controlled)



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



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

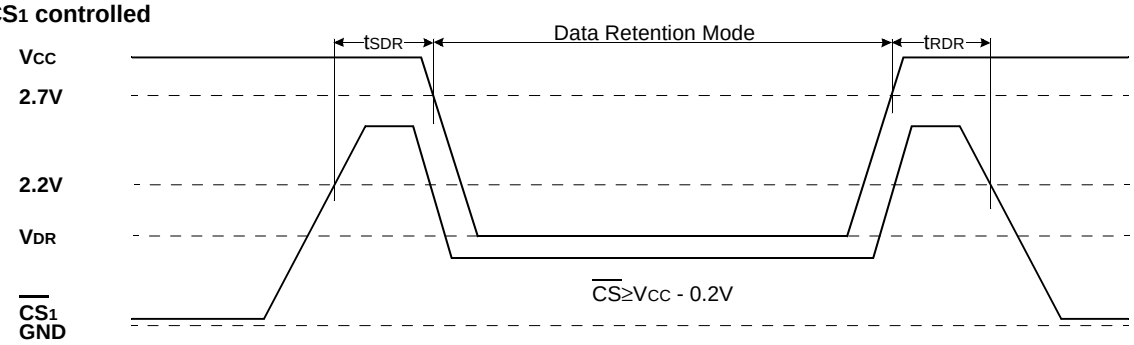


NOTES (WRITE CYCLE)

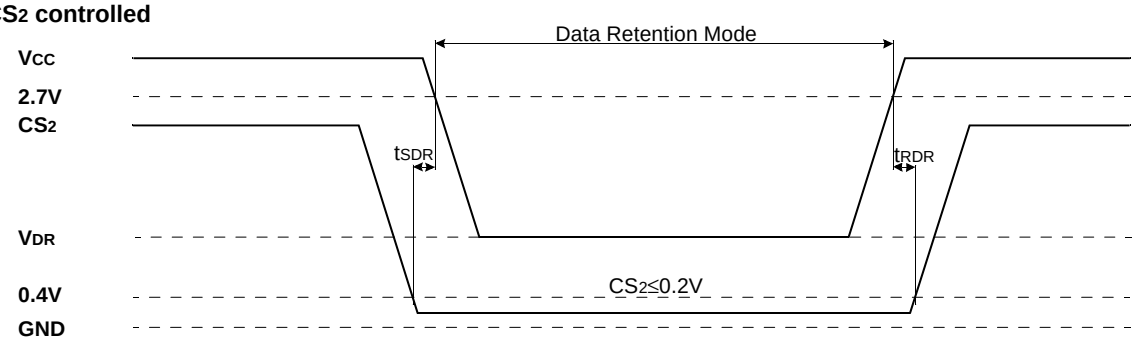
1. A write occurs during the overlap of a low $\overline{CS_1}$, a high CS_2 and a low $\overline{WE}$. A write begins at the latest transition among $\overline{CS_1}$ goes low, CS_2 going high and $\overline{WE}$ going low: A write end at the earliest transition among $\overline{CS_1}$ going high, CS_2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

$\overline{CS_1}$ controlled



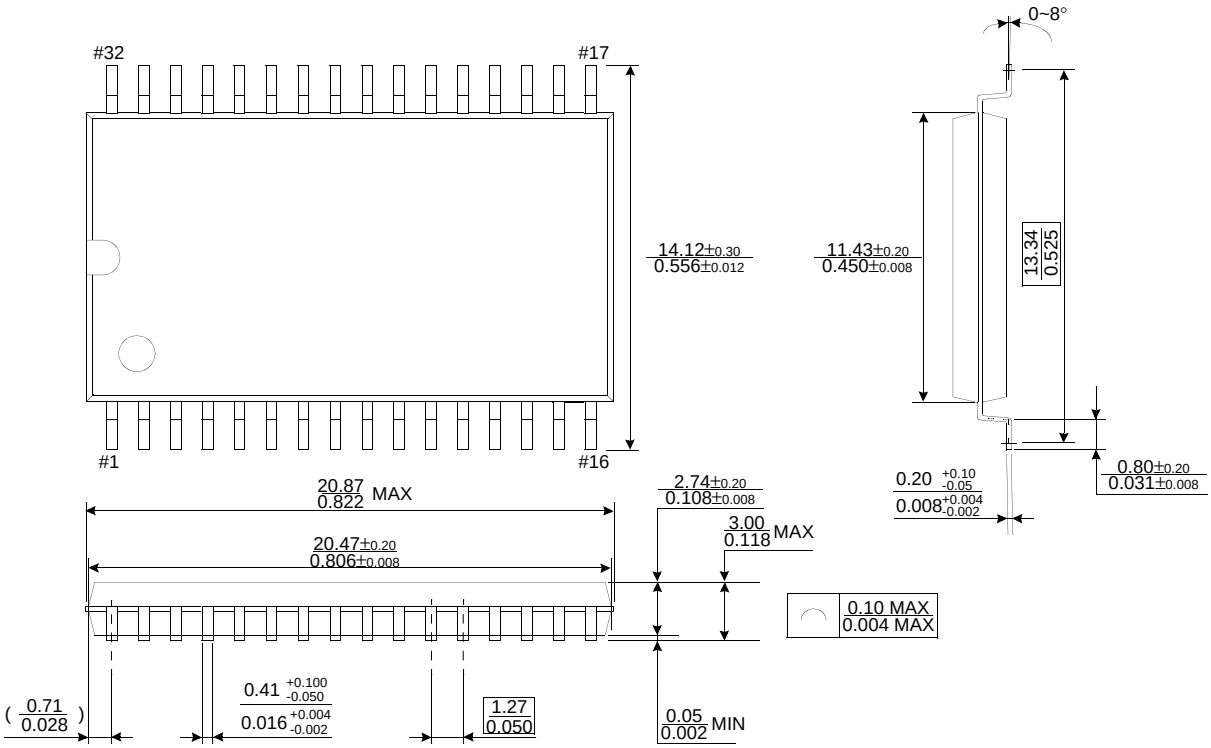
CS_2 controlled



PACKAGE DIMENSIONS

Units: millimeters(inches)

32 PLASTIC SMALL OUTLINE PACKAGE (525mil)



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