Document Title

512Kx8 bit Low Power and Low Voltage CMOS Static RAM

Revision History

Revision No.	History	Draft Data	Remark
0.0	Initial draft	December 17, 1996	Preliminary
1.0	Finalize - Change datasheet format - Erase low power part from product - Erase 70ns part from KM68U4000B family - Power dissipation Improved 0.7 to 1.0W - V_{IL}(MAX) improved 0.4 to 0.6V. - I_{CC2} decreased 50 to 45mA.	Januarary 14, 1998	Final
2.0	Revise - I_{CC1} decreased 20 to 25mA	February 12, 1998	Final
3.0	Revise - Adopt new code. KM68V4000B → K6T4008V1B KM68U4000B → K6T4008U1B - Improve V_{OH} on DC AND OPERATING CHARACTERISTICS'from 2.2 to 2.4V.	February 25, 2000	Final
4.0	Revise - Add 70ns part to K6T4008V1B-F family	August 31, 2000	Final

512K×8 bit Low Power and Low Voltage CMOS Static RAM

FEATURES

- Process Technology: TFT
- Organization: 512K×8
- Power Supply Voltage
  K6T4008V1B Family: 3.0~3.6V
  K6T4008U1B Family: 2.7~3.3V
- Low Data Retention Voltage: 2V(Min)
- Three State Outputs
- Package Type: 32-SOP, 32-TSOP2-400F/R

GENERAL DESCRIPTION

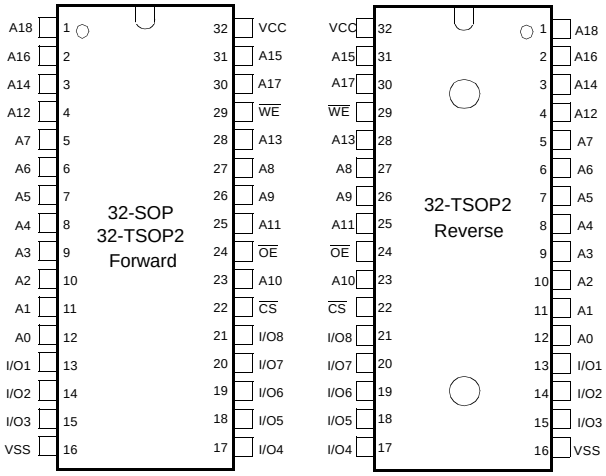
The K6T4008V1B and K6T4008U1B families are fabricated by SAMSUNG′s advanced CMOS process technology. The families support various operating temperature range and have various package type for user flexibility of system design. The families also support low data retention voltage for battery back-up operation 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)	
K6T4008V1B-B	Commercial(0~70°C)	3.0~3.6V	70[1]/85[1]/100ns	15μA	45mA	32-SOP 32-TSOP2-400F/R
K6T4008U1B-B		2.7~3.3V	85[1]/100ns			
K6T4008V1B-F	Industrial(-40~85°C)	3.0~3.6V	70[1]/85[1]/100ns	20μA		
K6T4008U1B-F		2.7~3.3V	85[1]/100ns			

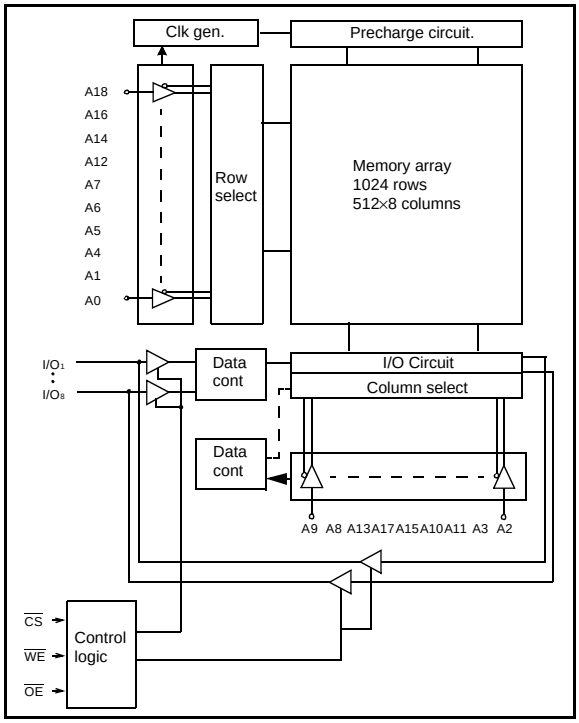
1. The paramerter is measured with 30pF test load.

PIN DESCRIPTION



Name	Function	Name	Function
$\overline{CS}$	Chip Select Input	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_{18}	Address Inputs		

FUNCTIONAL BLOCK DIAGRAM



PRODUCT LIST

Commercial Temp Products(0~70°C)		Industrial Temp Products(-40~85°C)	
Part Name	**Function**	**Part Name**	**Function**
K6T4008V1B-GB70	32-SOP, 70ns, 3.3V,LL	K6T4008V1B-GF70	32-SOP, 70ns, 3.3V,LL
K6T4008V1B-GB80	32-SOP, 85ns, 3.3V,LL	K6T4008V1B-GF85	32-SOP, 85ns, 3.3V,LL
K6T4008V1B-GB10	32-SOP, 100ns, 3.3V,LL	K6T4008V1B-GF10	32-SOP, 100ns, 3.3V,LL
K6T4008V1B-VB70	32-TSOP2-F, 70ns, 3.3V,LL	K6T4008V1B-VF70	32-TSOP2-F, 70ns, 3.3V,LL
K6T4008V1B-VB85	32-TSOP2-F, 85ns, 3.3V,LL	K6T4008V1B-VF85	32-TSOP2-F, 85ns, 3.3V,LL
K6T4008V1B-VB10	32-TSOP2-F, 100ns, 3.3V,LL	K6T4008V1B-VF10	32-TSOP2-F, 100ns, 3.3V,LL
K6T4008V1B-MB70	32-TSOP2-R, 70ns, 3.3V,LL	K6T4008V1B-MF70	32-TSOP2-R, 70ns, 3.3V,LL
K6T4008V1B-MB85	32-TSOP2-R, 85ns, 3.3V,LL	K6T4008V1B-MF85	32-TSOP2-R, 85ns, 3.3V,LL
K6T4008V1B-MB10	32-TSOP2-R, 100ns, 3.3V,LL	K6T4008V1B-MF10	32-TSOP2-R, 100ns, 3.3V,LL
K6T4008U1B-GB85	32-SOP, 85ns, 3.0V,LL	K6T4008U1B-GF85	32-SOP, 85ns, 3.0V,LL
K6T4008U1B-GB10	32-SOP, 100ns, 3.0V,LL	K6T4008U1B-GF10	32-SOP, 100ns, 3.0V,LL
K6T4008U1B-VB85	32-TSOP2-F, 85ns, 3.0V,LL	K6T4008U1B-VF85	32-TSOP2-F, 85ns, 3.0V,LL
K6T4008U1B-VB10	32-TSOP2-F, 100ns, 3.0V,LL	K6T4008U1B-VF10	32-TSOP2-F, 100ns, 3.0V,LL
K6T4008U1B-MB85	32-TSOP2-R, 85ns, 3.0V,LL	K6T4008U1B-MF85	32-TSOP2-R, 85ns, 3.0V,LL
K6T4008U1B-MB10	32-TSOP2-R, 100ns, 3.0V,LL	K6T4008U1B-MF10	32-TSOP2-R, 100ns, 3.0V,LL

Note: LL means Low Low standby current

FUNCTIONAL DESCRIPTION

$\overline{CS}$	$\overline{OE}$	$\overline{WE}$	I/O	Mode	Power
H	X[1)]	X[1)]	High-Z	Deselected	Standby
L	H	H	High-Z	Output Disabled	Active
L	L	H	Dout	Read	Active
L	X[1)]	L	Din	Write	Active

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

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	W	-
Storage temperature	T_{STG}	-65 to 150	°C	-
Operating Temperature	T_A	0 to 70	°C	K6T4008V1B-B, K6T4008U1B-B
		-40 to 85	°C	K6T4008V1B-F, K6T4008U1B-F
Soldering temperature and time	T_{SOLDER}	260°C, 10sec (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.

RECOMMENDED DC OPERATING CONDITIONS[1)]

Item	Symbol	Product	Min	Typ	Max	Unit
Supply voltage	Vcc	K6T4008V1B Family K6T4008U1B 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}	K6T4008V1B, K6T4008U1B Family	2.2	-	Vcc+0.3[2)]	V
Input low voltage	V_{IL}	K6T4008V1B, K6T4008U1B 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: V_{CC}+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, 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}	$\overline{CS}$=V_{IH} or $\overline{OE}$=V_{IH} or $\overline{WE}$=V_{IL} V_{IO}=Vss to Vcc		-1	-	1	µA
Operating power supply	I_{CC}	I_{IO}=0mA, $\overline{CS}$=V_{IL}, V_{IN}=V_{IL} or V_{IH}, Read		-	-	10	mA
Average operating current	I_{CC1}	Cycle time=1µs, 100% duty, I_{IO}=0mA, $\overline{CS}$≤0.2V V_{IN}≤0.2V or V_{IN}≥Vcc-0.2V	Read	-	-	10	mA
			Write	-	-	25	
	I_{CC2}	Cycle time=Min, 100% duty, I_{IO}=0mA, $\overline{CS}$=V_{IL}, V_{IN}=V_{IH} or V_{IL}		-	-	45	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}	$\overline{CS}$=V_{IH}, Other inputs = V_{IL} or V_{IH}		-	-	0.5	mA
Standby	I_{SB1}	$\overline{CS}$≥Vcc-0.2V, Other inputs=0~Vcc		-	-	15[1)]	µA

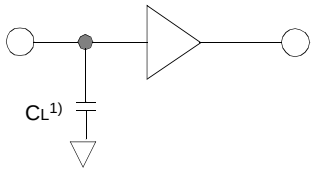
1. Industrial product = 20µA

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[1)]=30pF+1TTL

1. K6T4008V1B-70, K6T4008V1B-85 Family and K6T4008U1B-85 Family



1. Including scope and jig capacitance

AC CHARACTERISTICS (K6T4008V1B Family: Vcc=3.0~3.6V, K6T4008U1B Family: Vcc=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_{CO}	-	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	-	10	-	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	-	55	-	70	-	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}	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

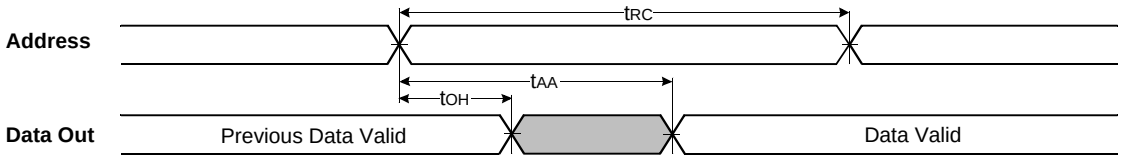
DATA RETENTION CHARACTERISTICS

Item	Symbol	Test Condition	Min	Typ	Max	Unit
Vcc for data retention	V_{DR}	$\overline{CS}$≥Vcc-0.2V	2.0	-	3.6	V
Data retention current	I_{DR}	Vcc=3.0V, $\overline{CS}$≥Vcc-0.2V	-	0.5	15[1)]	µA
Data retention set-up time	t_{SDR}	See data retention waveform	0	-	-	ms
Recovery time	t_{RDR}		5	-	-	

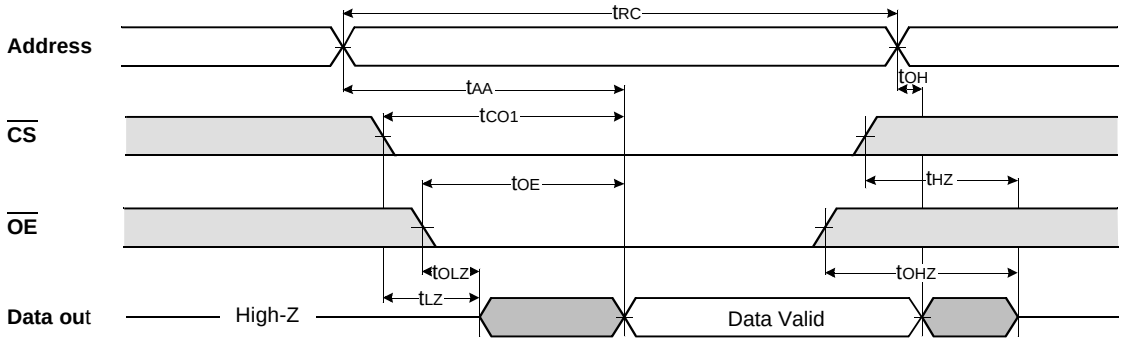
1. Industrial product = 20µA

TIMING DIAGRAMS

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



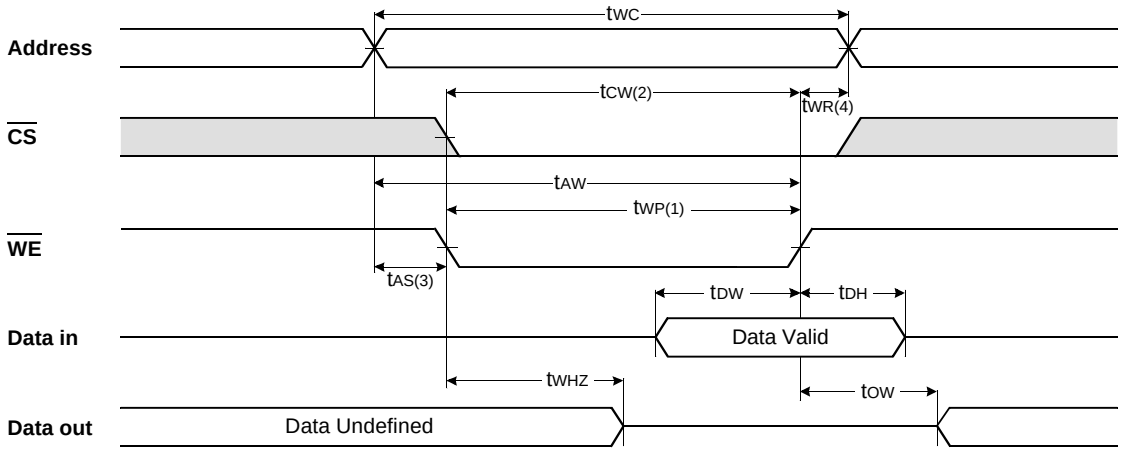
TIMING WAVEFORM OF READ CYCLE(2) ($\overline{WE}$=V_{IH})



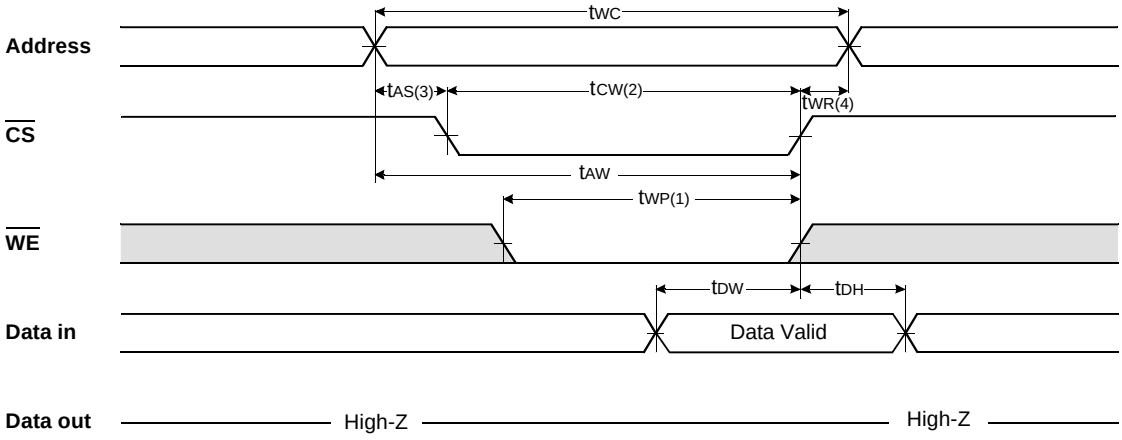
NOTES (READ CYCLE)

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}(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) ($\overline{CS}$ Controlled)

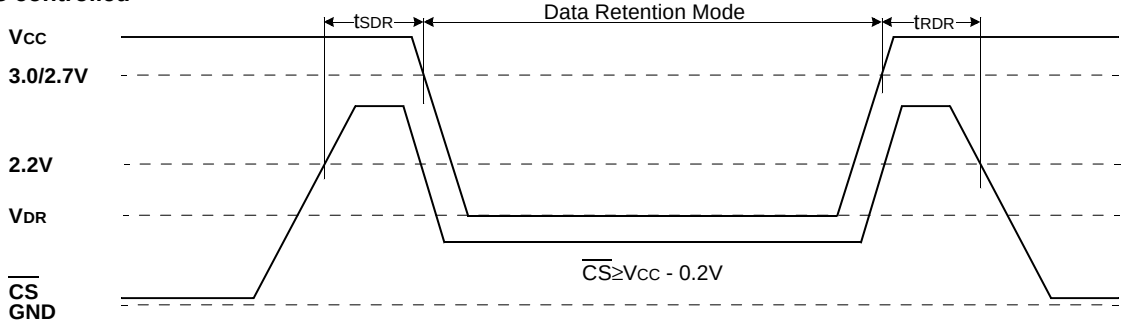


NOTES (WRITE CYCLE)

1. A write occurs during the overlap of a low $\overline{CS}$ and a low $\overline{WE}$. A write begins at the latest transition among $\overline{CS}$ going Low and $\overline{WE}$ going low : A write end at the earliest transition among $\overline{CS}$ going high 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 $\overline{CS}$ going low 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 $\overline{CS}$ or $\overline{WE}$ going high.

DATA RETENTION WAVE FORM

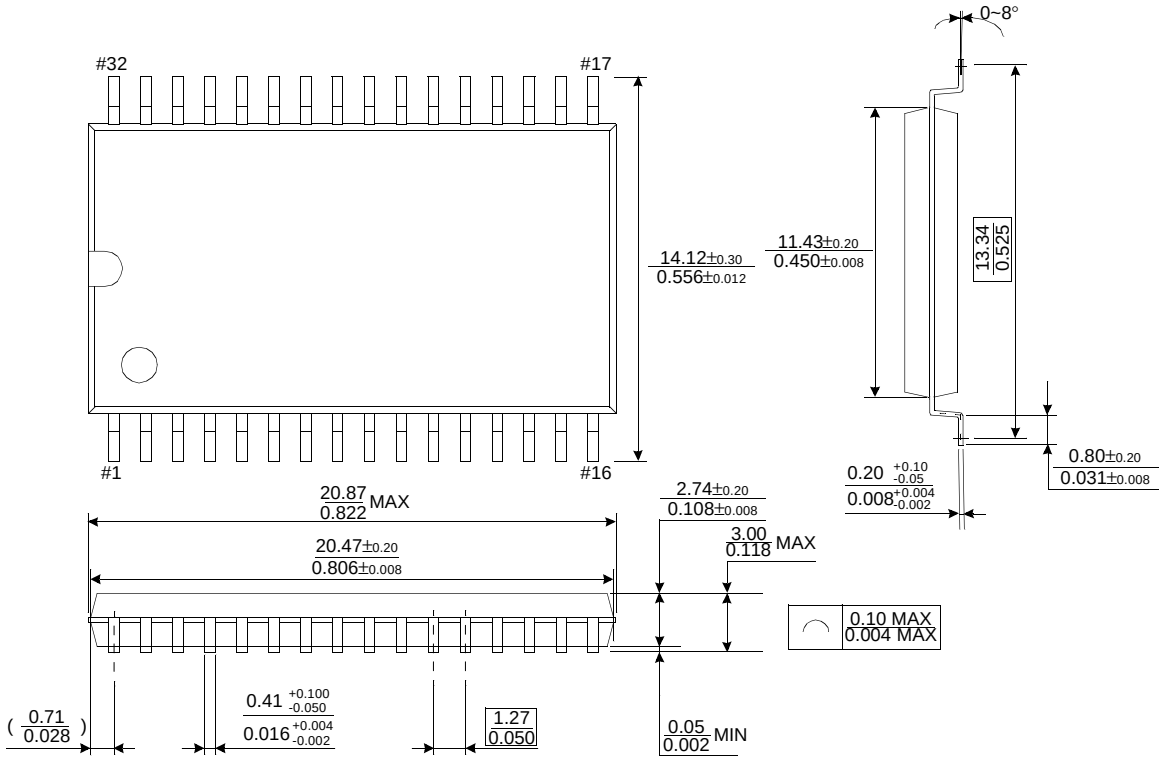
$\overline{CS}$ controlled



PACKAGE DIMENSIONS

Units : millimeter(inch)

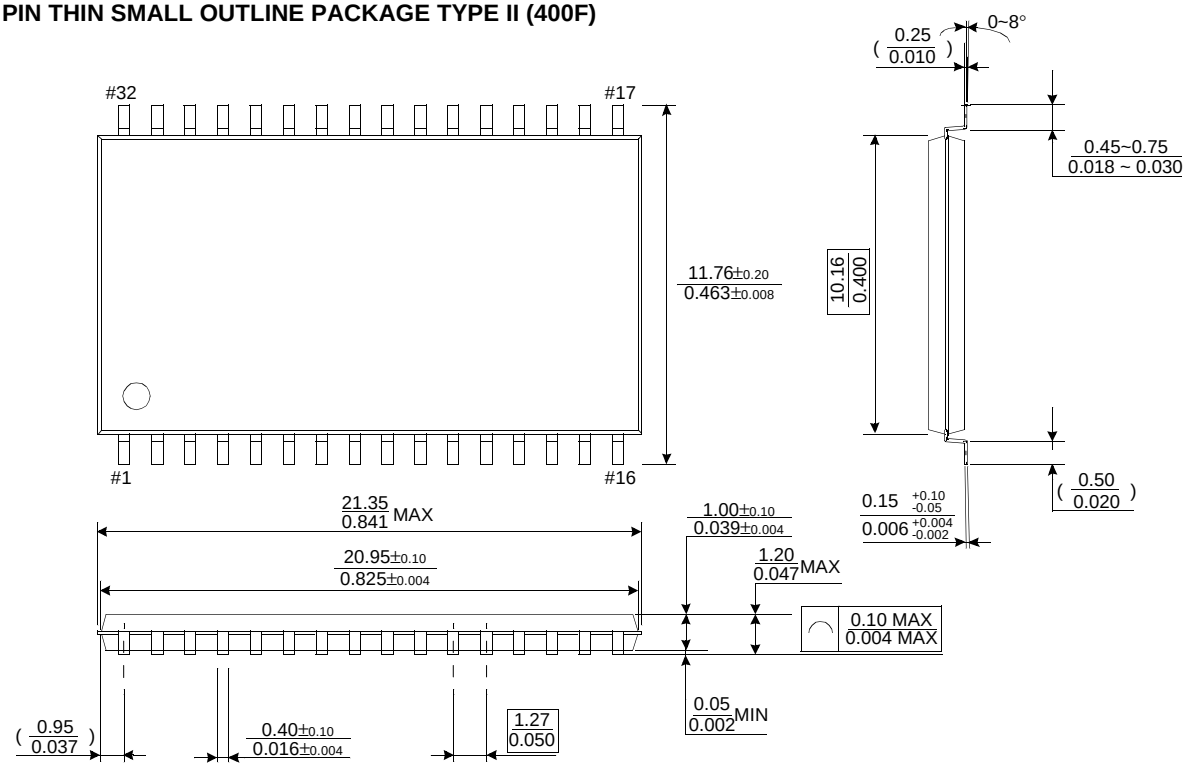
32 PIN PLASTIC SMALL OUTLINE PACKAGE (525mil)



PACKAGE DIMENSIONS

Units : millimeter(inch)

32 PIN THIN SMALL OUTLINE PACKAGE TYPE II (400F)



32 PIN THIN SMALL OUTLINE PACKAGE TYPE II (400R)