

Document Title**512K x8 bit Low Power and Low Voltage CMOS Static RAM****Revision History**

<u>Revision No.</u>	<u>History</u>	<u>Draft Date</u>	<u>Remark</u>
0.0	Initial Draft	August 16, 1994	Advance
0.1	Revise - Speed bin=70/85/100ns at Vcc=3.3V	December 22, 1994	Preliminary
0.2	Revise - Seperate read and write for Icc1, Icc2 : Icc1= Icc2 → Read=10mA and Write=20mA at Vcc=3.3V - One datasheet for commercial and industrial product.	April 15, 1996	Preliminary
1.0	Finalize - Add 85ns with 30pF part in 3.3V product.	September 19, 1996	Final
2.0	Revise - Change datasheet format - Remove 70/100ns part from KM68V4000A Family - Remove 70ns part form KM68U4000A Family	February 25, 1998	Final

The attached datasheets are provided by SAMSUNG Electronics. SAMSUNG Electronics CO., LTD. reserve the right to change the specifications and products. SAMSUNG Electronics will answer to your questions about device. If you have any questions, please contact the SAMSUNG branch offices.

512K x8 bit Low Power and Low Voltage CMOS Static RAM

FEATURES

- Process Technology :TFT
- Organization : 512Kx8
- Power Supply Voltage
 - KM68V4000A Family : 3.0~3.6V
 - KM68U4000A Family : 2.7~3.3V
- Low Data Retention Voltage : 2V(Min)
- Three state output and TTL Compatible
- Package Type : 32-SOP-525, 32-TSOP2-400F/R

GENERAL DESCRIPTION

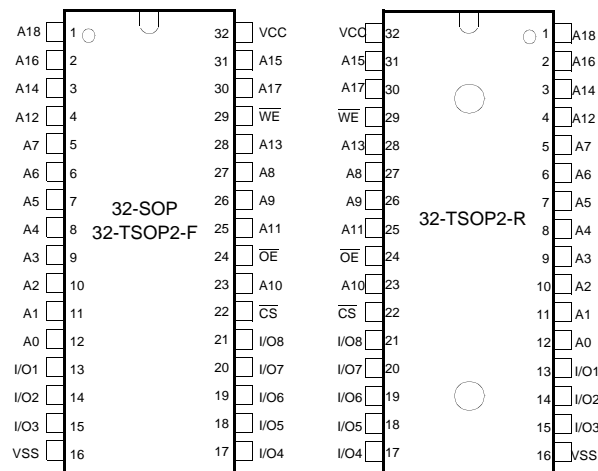
The KM68V4000A and KM68U4000A families are fabricated by SAMSUNG's advanced CMOS process technology. The families supports various operating temperature ranges and have various package types for user flexibility of system design. The families also support low data retention voltage for battery back-up operation with low data retention current.

PRODUCT FAMILY

Product Family	Operating Temperature	Vcc Range	Speed(ns)	Power Dissipation		PKG Type
				Standby (Isb1, Max)	Operating (Icc2, Max)	
KM68V4000AL KM68V4000AL-L	Commercial(0~70°C)	3.0~3.6V	85 ¹⁾	50/15μA	50mA	32-SOP 32-TSOP2-F/R
KM68V4000ALI LM68V4000ALI-L	Industrial(-40~85°C)	3.0~3.6V	85 ¹⁾	50/20μA		
KM68U4000AL KM68U4000ALI-L	Commercial(0~70°C)	2.7~3.3V	85 ¹⁾ /100	30/10μA		
KM68U4000ALI KM68U4000ALI-L	Industrial(-40~85°C)	2.7~3.3V	85 ¹⁾ /100	30/15μA		

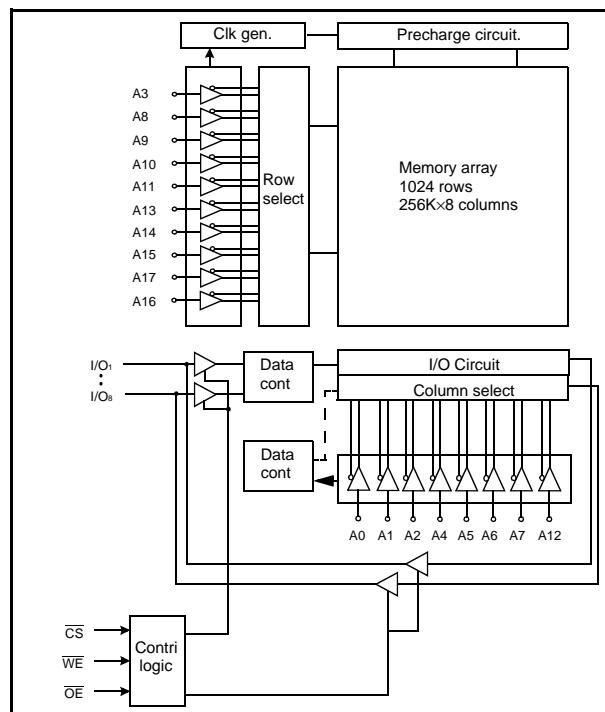
1. The parameter is measured with 30pF test load.

PIN DESCRIPTION



Name	Function	Name	Function
\overline{CS}	Chip Select Input	A0~A18	Address Inputs
\overline{OE}	Output Enable Input	I/O1~I/O8	Data Inputs/Outputs
\overline{WE}	Write Enable Input	Vcc	Power
		Vss	Ground

FUNCTIONAL BLOCK DIAGRAM



SAMSUNG ELECTRONICS CO., LTD. reserves the right to change products and specifications without notice.

PRODUCT LIST

Commercial Temperature Products(0~70°C)		Industrial Temperature Products(-40~85°C)	
Part Name	Function	Part Name	Function
KM68V4000ALG-8 KM68V4000ALG-8L	32-SOP, 85ns, 3.3V,L 32-SOP, 85ns, 3.3V,LL	KM68V4000ALGI-8 KM68V4000ALGI-8L	32-SOP, 85ns, 3.3V,L 32-SOP, 85ns, 3.3V,LL
KM68V4000ALT-8L KM68V4000ALR-8L	32-TSOP2-F, 85ns, 3.3V,LL 32-TSOP2-R, 85ns, 3.3V,LL	KM68V4000ALTI-8L KM68V4000ALRI-8L	32-TSOP2-F, 85ns, 3.3V,LL 32-TSOP2-R, 85ns, 3.3V,LL
KM68U4000ALG-8 KM68U4000ALG-8L KM68U4000ALG-10 KM68U4000ALG-10L	32-SOP, 85ns, 3.0V,L 32-SOP, 85ns, 3.0V,LL 32-SOP, 100ns, 3.0V,L 32-SOP, 100ns, 3.0V,LL	KM68U4000ALGI-8 KM68U4000ALGI-8L KM68U4000ALGI-10 KM68U4000ALGI-10L	32-SOP, 85ns, 3.0V,L 32-SOP, 85ns, 3.0V,LL 32-SOP, 100ns, 3.0V,L 32-SOP, 100ns, 3.0V,LL
KM68U4000ALT-8L KM68U4000ALT-10L KM68U4000ALR-8L KM68U4000ALR-10L	32-TSOP2-F, 85ns, 3.0V,LL 32-TSOP2-F, 100ns, 3.0V,LL 32-TSOP2-R, 85ns, 3.0V,LL 32-TSOP2-R, 100ns, 3.0V,LL	KM68U4000ALTI-8L KM68U4000ALTI-10L KM68U4000ALRI-8L KM68U4000ALRI-10L	32-TSOP2-F, 85ns, 3.0V,LL 32-TSOP2-F, 100ns, 3.0V,LL 32-TSOP2-R, 85ns, 3.0V,LL 32-TSOP2-R, 100ns, 3.0V,LL

FUNCTIONAL DESCRIPTION

CS	OE	WE	I/O	Mode	Power
H	X ¹⁾	X ¹⁾	High-Z	Deselected	Standby
L	H	H	High-Z	Output disbaled	Active
L	L	H	Dout	Read	Active
L	X ¹⁾	L	Din	Write	Active

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

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	0.7	W	-
Storage temperature	T _{STG}	-65 to 150	°C	-
Operating Temperature	T _A	0 to 70	°C	KM68V4000AL, KM68U4000AL
		-40 to 85	°C	KM68V4000ALI, KM68U4000ALI
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 CONDITIONS¹⁾

Item	Symbol	Product	Min	Typ	Max	Unit
Supply voltage	V _{CC}	KM68V4000A Family KM68U4000A 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}	KM68V4000A, KM68U4000A Family	2.2	-	V _{CC} +0.3 ²⁾	V
Input low voltage	V _{IL}	KM68V4000A, KM68U4000A Family	-0.3 ³⁾	-	0.4	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 is 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 ¹⁾		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} =V _{IH} 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} =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} ≥ V _{CC} -0.2V	Read	-	-	10	mA
			Write	-	-	20	
	I _{CC2}	Cycle time=Min, 100% duty, I _{IO} =0mA, \overline{CS} =V _{IL} , V _{IN} =V _{IH} or V _{IL}		-	-	50	mA
Output low voltage	V _{OL}	I _{OL} =2.1mA		-	-	0.4	V
Output high voltage	V _{OH}	I _{OH} =-1.0mA		2.2	-	-	V
Standby Current(TTL)	I _{SB}	\overline{CS} =V _{IH} , Other inputs=V _{IL} or V _{IH}		-	-	0.5	mA
Standby Current(CMOS)	I _{SB1}	\overline{CS} ≥V _{CC} -0.2V, Other inputs=0~V _{CC}	KM68V4000AL KM68V4000AL-L	-	-	50 15	μA
			KM68V4000ALI KM68V4000ALI-L	-	-	50 20	μA
			KM68U4000AL KM68U4000AL-L	-	-	30 10	μA
			KM68U4000ALI KM68U4000ALI-L	-	-	30 15	μA

AC OPERATING CONDITIONS

TEST CONDITIONS (Test Load and Input/Output Reference)

Input pulse level : 0.4 to 2.2V

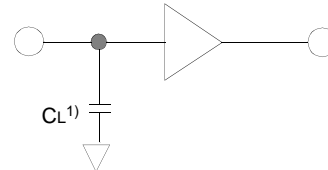
Input rising and falling time : 5ns

Input and output reference voltage : 1.5V

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

$C_L^{(2)} = 30\text{pF} + 1\text{TTL}$

1. KM68V4000A-8 Family, KM68U4000A-8 Family



1. Including scope and jig capacitance

AC CHARACTERISTICS (KM68V4000A Family : $V_{CC} = 3.0 \sim 3.3\text{V}$, KM68U4000A 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)

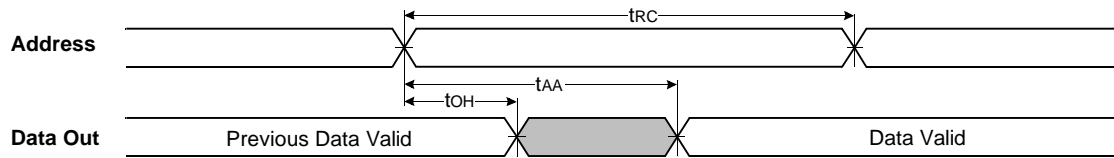
Parameter List		Symbol	Speed Bins				Units
			85ns		100ns		
			Min	Max	Min	Max	
Read	Read cycle time	tRC	85	-	100	-	ns
	Address access time	tAA	-	85	-	100	ns
	Chip select to output	tCO	-	85	-	100	ns
	Output enable to valid output	tOE	-	40	-	50	ns
	Chip select to low-Z output	tLZ	10	-	10	-	ns
	Output enable to low-Z output	tOLZ	5	-	5	-	ns
	Chip disable to high-Z output	tHZ	0	25	0	30	ns
	Output disable to high-Z output	tOHZ	0	25	0	30	ns
	Output hold from address change	tOH	10	-	15	-	ns
Write	Write cycle time	tWC	85	-	100	-	ns
	Chip select to end of write	tCW	70	-	80	-	ns
	Address set-up time	tAS	0	-	0	-	ns
	Address valid to end of write	tAW	70	-	80	-	ns
	Write pulse width	tWP	55	-	70	-	ns
	Write recovery time	tWR	0	-	0	-	ns
	Write to output high-Z	tWHZ	0	20	0	30	ns
	Data to write time overlap	tDW	35	-	40	-	ns
	Data hold from write time	tDH	0	-	0	-	ns
	End write to output low-Z	tOW	5	-	5	-	ns

DATA RETENTION CHARACTERISTICS

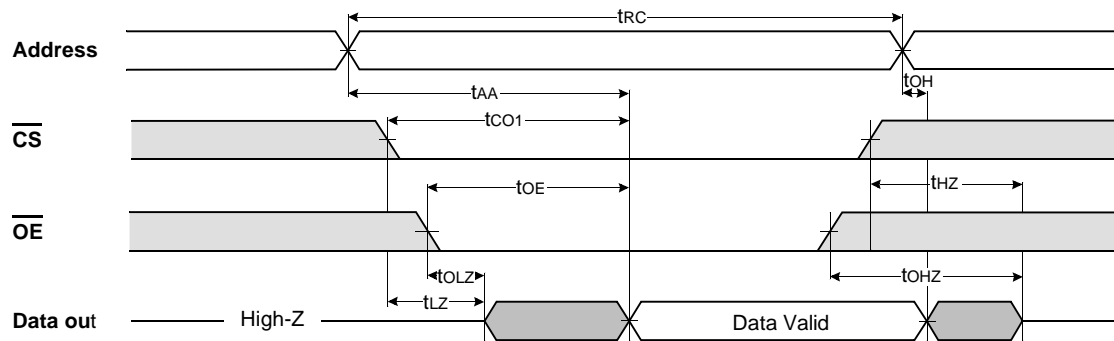
Item	Symbol	Test Condition		Min	Typ	Max	Unit
V _{CC} for data retention	V _{DR}	$\overline{CS} \geq V_{CC} - 0.2\text{V}$		2.0	-	3.6	V
Data retention current	I _{DR}	$V_{CC} = 3.0\text{V}, \overline{CS} \geq V_{CC} - 0.2\text{V}$	KM68V4000AL	-	1	30	μA
			KM68V4000AL-L	-	0.5	15	
			KM68V4000ALI	-	-	30	
			KM68V4000ALI-L	-	-	20	
			KM68U4000AL	-	1	30	
			KM68V4000AL-L	-	0.5	10	
			KM68U4000ALI	-	-	30	
Data retention set-up time	t _{SDR}	See data retention waveform		0	-	-	ms
Recovery time	t _{RDR}			5	-	-	

TIMMING DIAGRAMS

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



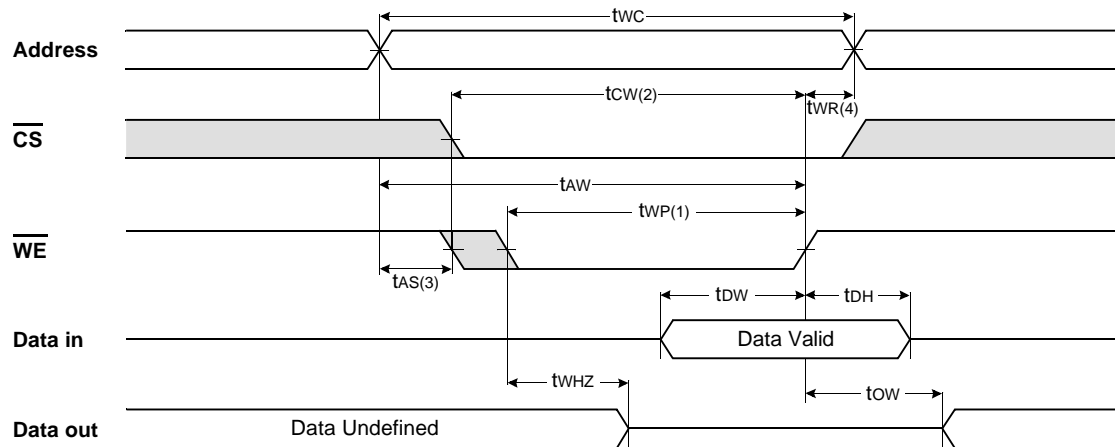
TIMING WAVEFORM OF READ CYCLE(2) ($\overline{WE}=V_{IH}$)



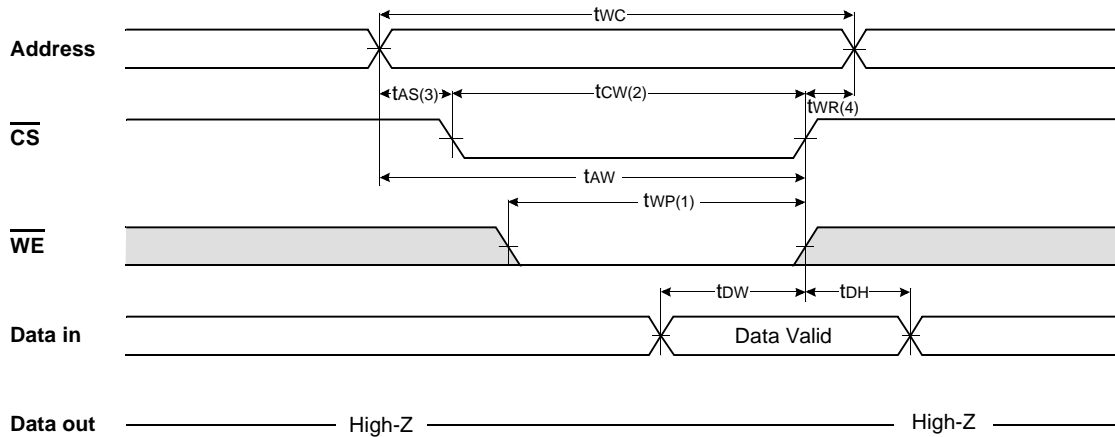
NOTES (READ CYCLE)

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

TIMING WAVEFORM OF WRITE CYCLE(1) (WE Controlled)



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

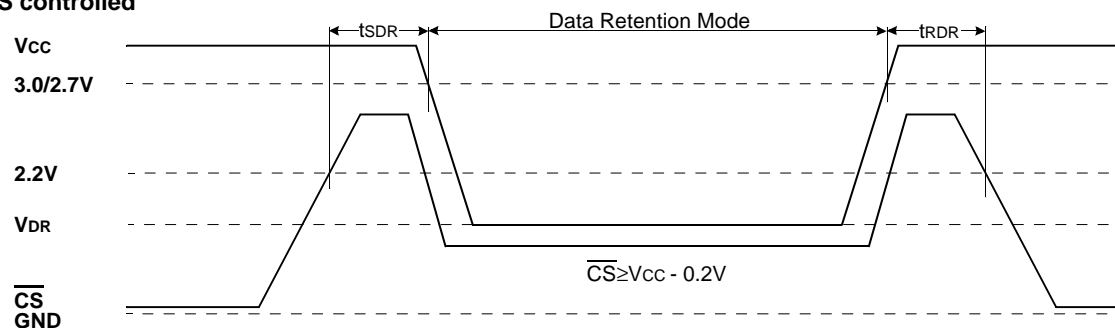


NOTES (WRITE CYCLE)

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 beginning of write to the end of write.
2. t_{CW} is measured from the \overline{CS} going low to 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

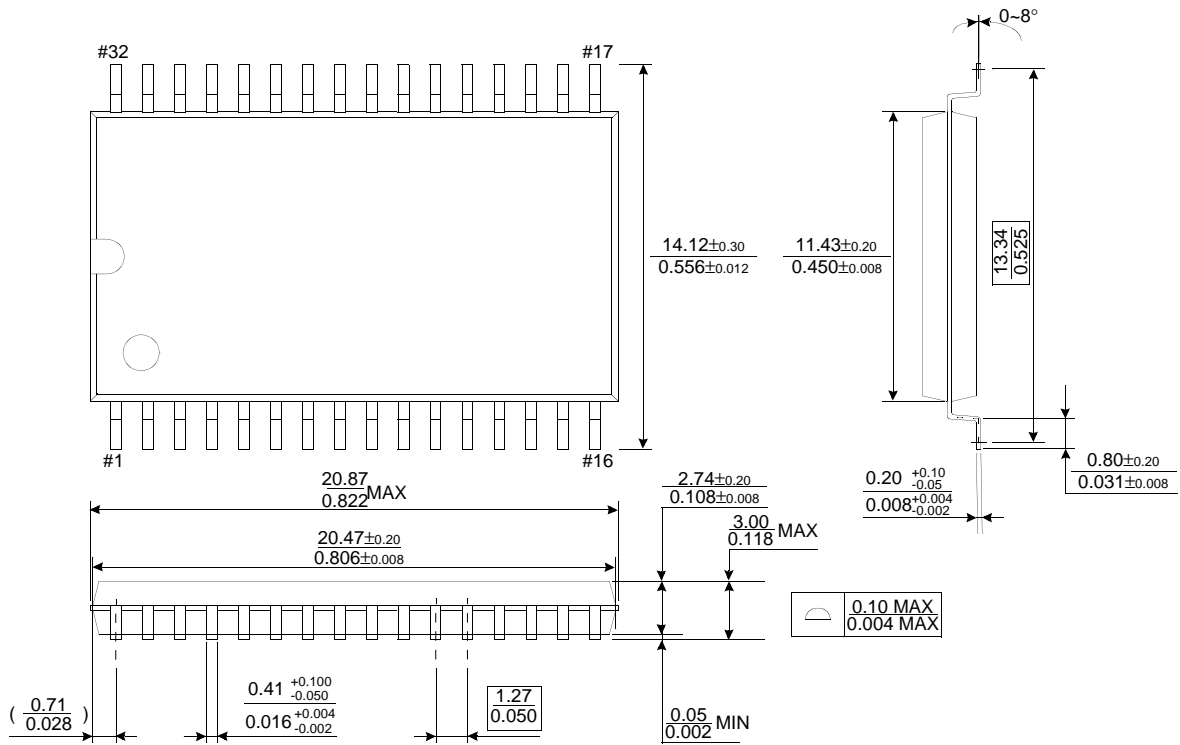
\overline{CS} controlled



PACKAGE DIMENSIONS

Units : millimeter(inch)

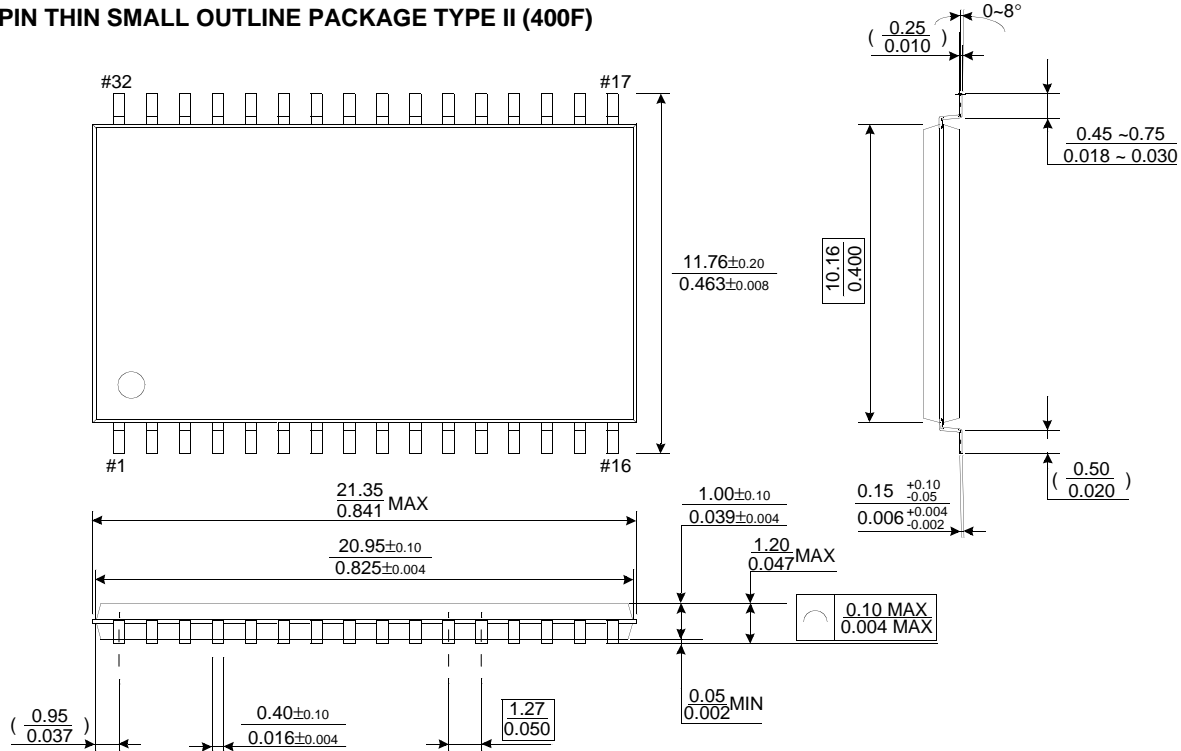
32 PIN PLASTIC SMALL OUTLINE PACKAGE (525mil)



PACKAGE DIMENSIONS

Units : millimeter(inch)

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



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

