Document Title

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

Revision History

Revision No.	History	Draft Data	Remark
0.0	Initial draft	July 3, 1996	Preliminary
1.0	Finalize - Increased I_{SB}, I_{DR} Commercial part = 10μA Industrial part = 20μA	December 16, 1996	Final
2.0	Revise - Change speed bin KM68V1000C Family: 70/85ns → 70/100ns KM68U1000C Family: 70/100ns → 85/100ns - Improved operating current: 40mA → 35mA - Improved power dissipation P_D: 0.7W → 1.0W - Improved standby current Extended/Industrial: 20 → 10μA - VIL: 0.4V → 0.6V	November 25, 1997	Final

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

FEATURES

- Process Technology: 0.4μm CMOS
- Organization: 128K x8
- Power Supply Voltage:
  KM68V1000C family: 3.0~3.6V
  KM68U1000C family: 2.7~3.3V
- Low Data Retention Voltage: 2V(Min)
- Three state output and TTL Compatible
- Package Type: 32-SOP-525, 32-TSOP1-0820F/R, 32-TSOP1-0813.4F/R

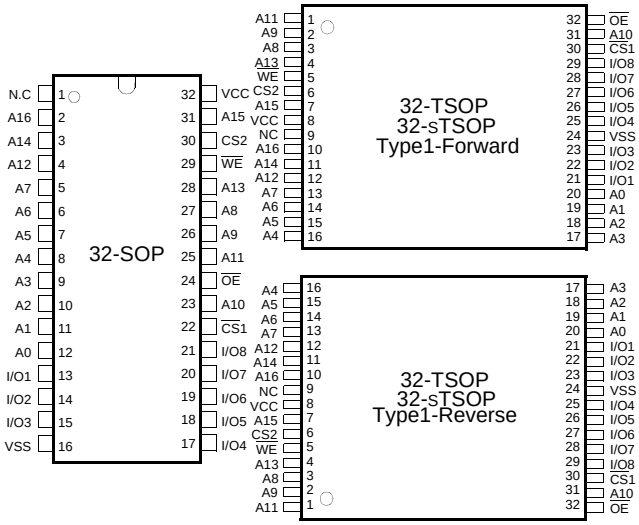
GENERAL DESCRIPTION

The KM68V1000C and KM68U1000C families are fabricated by SAMSUNG′s advanced CMOS process technology. The families support various operating temperature ranges and have various package types for user flexibility of system design. The families also supports low data retention voltage for battery back-up operation with low data retention current.

PRODUCT FAMILY

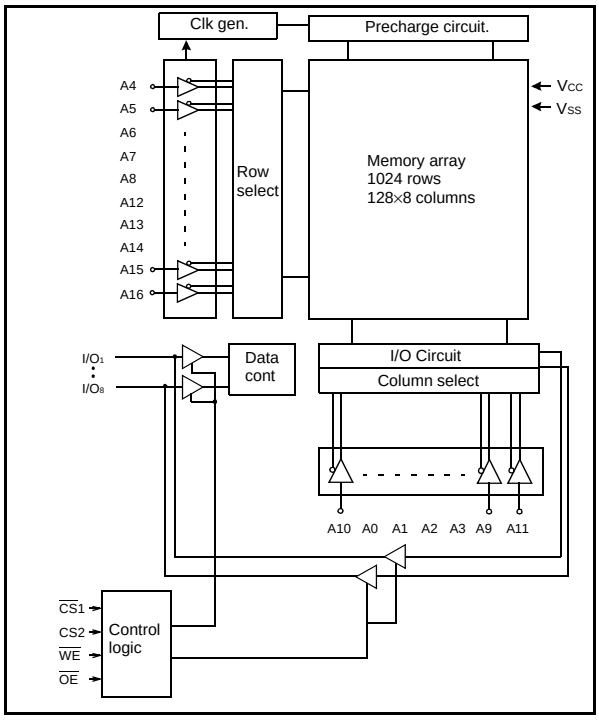
Product Family	Operating Temperature	Vcc Range(V)	Speed(ns)	Power Dissipation		PKG Type
				Standby (I_{SB1}, Max)	Operating (I_{CC2}, Max)	
KM68V1000CL-L	Commercial (0~70°C)	3.0~3.6V	70/100	10μA	35mA	32-SOP 32-TSOP1-F/R 32-sTSOP1-F/R
KM68U1000CL-L		2.7~3.3V	85/100			
KM68V1000CLE-L	Extended (-25~85°C)	3.0~3.6V	70/100			
KM68U1000CLE-L		2.7~3.3V	85/100			
KM68V1000CLI-L	Industrial (-40~85°C)	3.0~3.6V	70/100			
KM68U1000CLI-L		2.7~3.3V	85/100			

PIN DESCRIPTION



Name	Function
$\overline{CS_1}$,CS_2	Chip Select Inputs
$\overline{OE}$	Output Enable Input
$\overline{WE}$	Write Enable Input
A_0~A_{16}	Address Inputs
I/O_1~I/O_8	Data Inputs/Outputs
Vcc	Power
Vss	Ground
N.C	No Connection

FUNCTIONAL BLOCK DIAGRAM



PRODUCT LIST

Commercial Temperature Products (0~70°C)		Extended Temperature Products (-25~85°C)		Industrial Temperature Products (-40~85°C)	
Part Name	**Function**	**Part Name**	**Function**	**Part Name**	**Function**
KM68V1000CLG-7L	32-SOP, 70ns, 3.3V	KM68V1000CLGE-7L	32-SOP, 70ns, 3.3V	KM68V1000CLGI-7L	32-SOP, 70ns, 3.3V
KM68V1000CLG-10L	32-SOP, 100ns, 3.3V	KM68V1000CLGE-10L	32-SOP, 100ns, 3.3V	KM68V1000CLGI-10L	32-SOP, 100ns, 3.3V
KM68V1000CLT-7L	32-TSOP F, 70ns, 3.3V	KM68V1000CLTE-7L	32-TSOP F, 70ns, 3.3V	KM68V1000CLTI-7L	32-TSOP F, 70ns, 3.3V
KM68V1000CLT-10L	32-TSOP F, 100ns, 3.3V	KM68V1000CLTE-10L	32-TSOP F, 100ns, 3.3V	KM68V1000CLTI-10L	32-TSOP F, 100ns, 3.3V
KM68V1000CLR-7L	32-TSOP R, 70ns, 3.3V	KM68V1000CLRE-7L	32-TSOP R, 70ns, 3.3V	KM68V1000CLRI-7L	32-TSOP R, 70ns, 3.3V
KM68V1000CLR-10L	32-TSOP R, 100ns, 3.3V	KM68V1000CLRE-10L	32-TSOP R, 100ns, 3.3V	KM68V1000CLRI-10L	32-TSOP R, 100ns, 3.3V
KM68U1000CLG-8L	32-SOP, 85ns, 3.0V	KM68U1000CLGE-8L	32-SOP, 85ns, 3.0V	KM68U1000CLGI-8L	32-SOP, 85ns, 3.0V
KM68U1000CLG-10L	32-SOP, 100ns, 3.0V	KM68U1000CLGE-10L	32-SOP, 100ns, 3.0V	KM68U1000CLGI-10L	32-SOP, 100ns, 3.0V
KM68U1000CLT-8L	32-TSOP F, 85ns, 3.0V	KM68U1000CLTE-8	32-TSOP F, 85ns, 3.0V	KM68U1000CLTI-8L	32-TSOP F, 85ns, 3.0V
KM68U1000CLT-10L	32-TSOP F, 100ns, 3.0V	KM68U1000CLTE-10L	32-TSOP F, 100ns, 3.0V	KM68U1000CLTI-10L	32-TSOP F, 100ns, 3.0V
KM68U1000CLR-8L	32-TSOP R, 85ns, 3.0V	KM68U1000CLRE-8	32-TSOP R, 85ns, 3.0V	KM68U1000CLRI-8L	32-TSOP R, 85ns, 3.0V
KM68U1000CLR-10L	32-TSOP R, 100ns, 3.0V	KM68U1000CLRE-10L	32-TSOP R, 100ns, 3.0V	KM68U1000CLRI-10L	32-TSOP R, 100ns, 3.0V
KM68V1000CLTG-7L	32-sTSOP F, 70ns, 3.3V	KM68V1000CLTGE-7L	32-sTSOP F, 70ns, 3.3V	KM68V1000CLTGI-7L	32-sTSOP F, 70ns, 3.3V
KM68V1000CLTG-10L	32-sTSOP F, 100ns, 3.3V	KM68V1000CLTGE-10L	32-sTSOP F, 100ns, 3.3V	KM68V1000CLTGI-10L	32-sTSOP F, 100ns, 3.3V
KM68V1000CLRG-7L	32-sTSOP R, 70ns, 3.3V	KM68V1000CLRGE-7L	32-sTSOP R, 70ns, 3.3V	KM68V1000CLRGI-7L	32-sTSOP R, 70ns, 3.3V
KM68V1000CLRG-10L	32-sTSOP R, 100ns, 3.3V	KM68V1000CLRGE-10L	32-sTSOP R, 100ns, 3.3V	KM68V1000CLRGI-10L	32-sTSOP R, 100ns, 3.3V
KM68U1000CLTG-8L	32-sTSOP F, 85ns, 3.0V	KM68U1000CLTGE-8L	32-sTSOP F, 85ns, 3.0V	KM68U1000CLTGI-8L	32-sTSOP F, 85ns, 3.0V
KM68U1000CLTG-10L	32-sTSOP F, 100ns, 3.0V	KM68U1000CLTGE-10L	32-sTSOP F, 100ns, 3.0V	KM68U1000CLTGI-10L	32-sTSOP F, 100ns, 3.0V
KM68U1000CLTG-8L	32-sTSOP R, 85ns, 3.0V	KM68U1000CLTGE-8L	32-sTSOP R, 85ns, 3.0V	KM68U1000CLTGI-8L	32-sTSOP R, 85ns, 3.0V
KM68U1000CLTG-10L	32-sTSOP R, 100ns, 3.0V	KM68U1000CLTGE-10L	32-sTSOP R, 100ns, 3.0V	KM68U1000CLTGI-10L	32-sTSOP R, 100ns, 3.0V

FUNCTIONAL DESCRIPTION

$\overline{CS_1}$	CS_2	$\overline{OE}$	$\overline{WE}$	I/O Pin	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 status.)

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	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	KM68V1000CL/KM68U1000CL
		-25 to 85	°C	KM68V1000CLE/KM68U1000CLE
		-40 to 85	°C	KM68V1000CLI/KM68U1000CLI
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	KM68V1000C Family KM68U1000C 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}	KM68V1000C, KM68U1000C Family	2.2	-	Vcc+0.3[2)]	V
Input low voltage	V_{IL}	KM68V1000C, KM68U1000C Family	-0.3[3)]	-	0.6	V

1. Commercial Product: T_A=0 to 70°C, unless otherwise specified
   Extended Product: T_A=-25 to 85°C, unless otherwise specified
   Industrial Product: T_A=-40 to 85°C, unless 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.

CAPACITANCE[1)] (f=1MHz, TA=25°C)

Item	Symbol	Test Condition	Min	Max	Unit
Input capacitance	C_{IN}	V_{IN}=0V	-	6	pF
Input/Output capacitance	C_{IO}	V_{IO}=0V	-	8	pF

1. Capacitance is sampled, not 100% tested

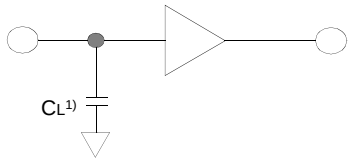
DC AND OPERATING CHARACTERISTICS

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	I_{CC}	I_{IO}=0mA, $\overline{CS_1}$=V_{IL}, CS_2=V_{IH}, V_{IN}=V_{IL} or V_{IH}, Read		-	2	5	mA
Average operating current	I_{CC1}	Cycle time=1µs, 100% duty, I_{IO}=0mA, $\overline{CS_1}$≤0.2V, CS_2≥V_{CC}-0.2V, V_{IN}≤0.2V or V_{IN}≥V_{CC}-0.2V	Read	-	1.5	5	mA
			Write		10	15	
	I_{CC2}	Cycle time=Min, 100% duty, I_{IO}=0mA, $\overline{CS_1}$=V_{IL}, CS_2=V_{IH}, V_{IN}=V_{IL} or V_{IH}		-	25	35	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}	$\overline{CS_1}$=V_{IH}, CS_2=V_{IL}, Other inputs=V_{IL} or V_{IH}		-	-	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		-	0.3	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



1. Including scope and jig capacitance

AC CHARACTERISTICS (Commercial product:T_A=0 to 70°C, Extended product:T_A=-25 to 85°C, Industrial product: T_A=-40 to 85°C KM68V1000C Family: Vcc=3.0~3.6V, KM68U1000C Family: Vcc=2.7~3.3V)

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

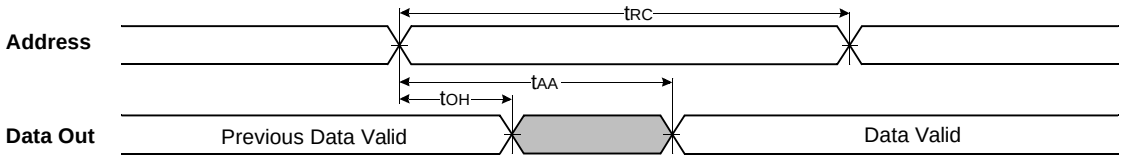
DATA RETENTION CHARACTERISTICS

Item	Symbol	Test Condition[1)]	Min	Typ	Max	Unit
Vcc for data retention	V_{DR}	$\overline{CS_1}$[1)]≥Vcc-0.2V	2.0	-	3.6	V
Data retention current	I_{DR}	Vcc=3.0V, $\overline{CS_1}$≥Vcc-0.2V, CS_2≥Vcc-0.2V, or CS_2≤0.2V	-	0.3	5	µA
Data retention set-up time	t_{SDR}	See data retention waveform	0	-	-	ms
Recovery time	t_{RDR}		5	-	-	

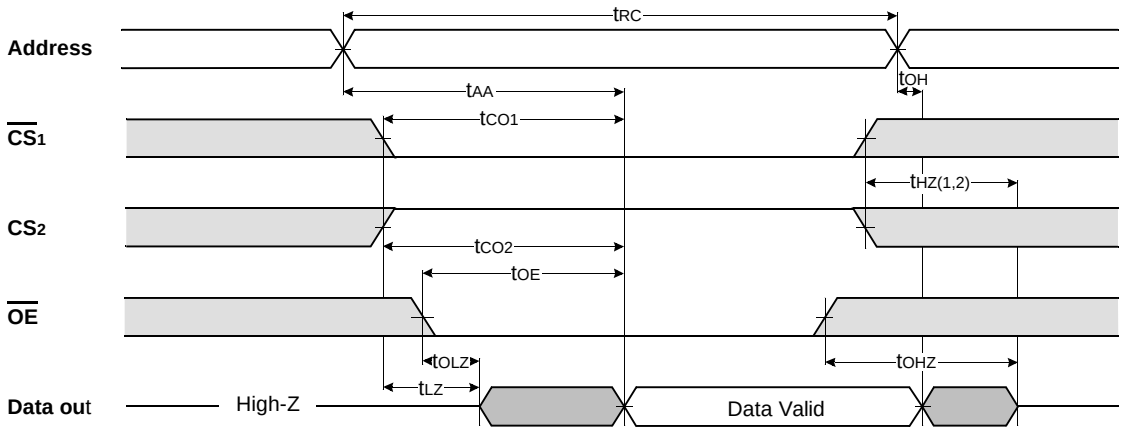
1. $\overline{CS_1}$≥Vcc-0.2V, CS_2≥Vcc-0.2V, or CS_2≤0.2V

TIMMING DIAGRAMS

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



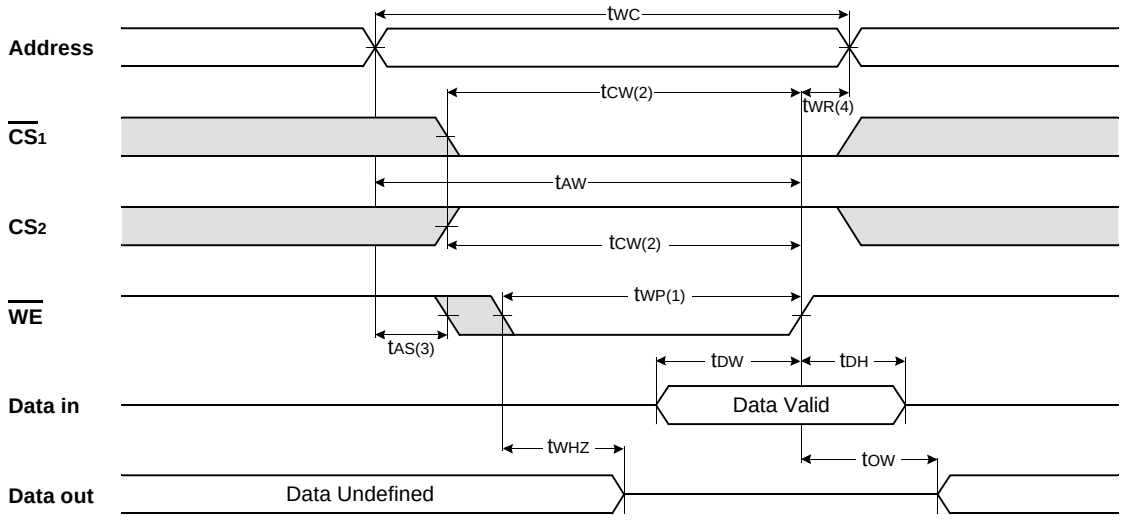
TIMING WAVEFORM OF READ CYCLE(2) ($\overline{WE}$=V_{IH})



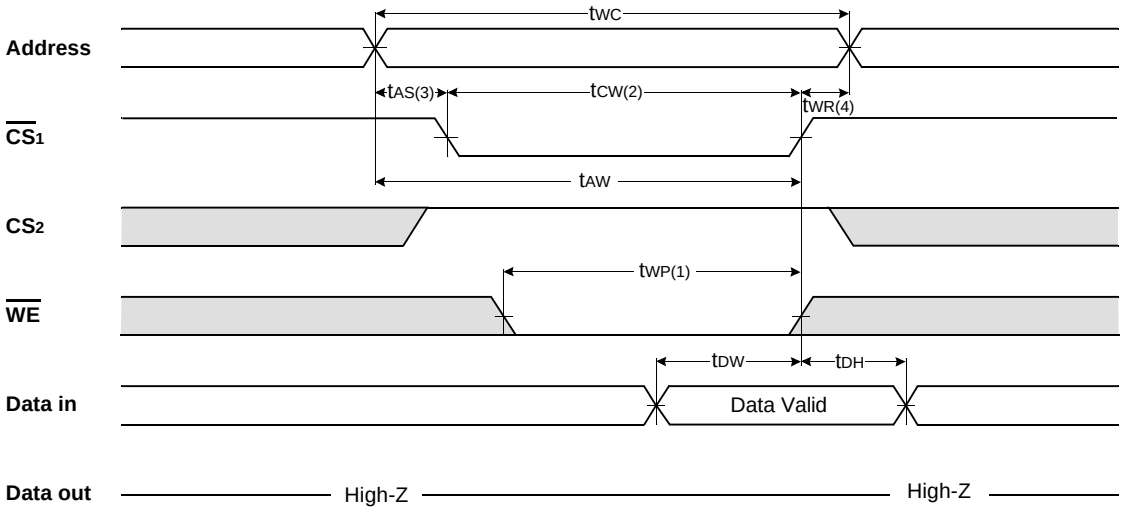
NOTES (READ CYCLE)

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

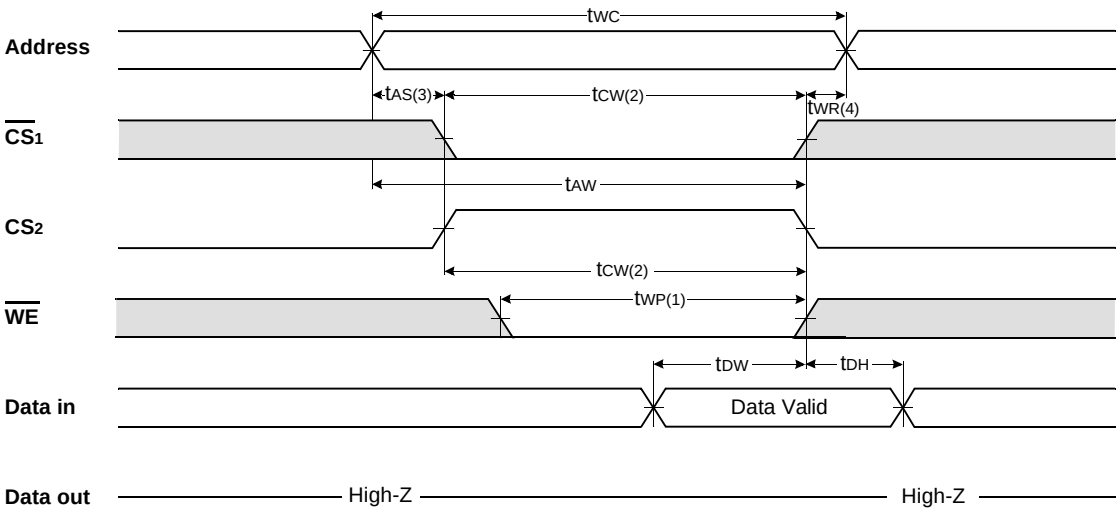
TIMING WAVEFORM OF WRITE CYCLE(1) ($\overline{WE}$ Controlled)



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



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

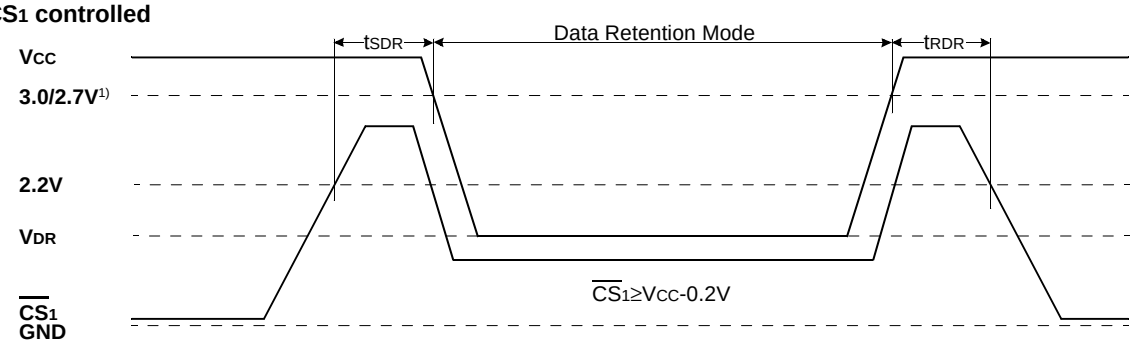


NOTES (WRITE CYCLE)

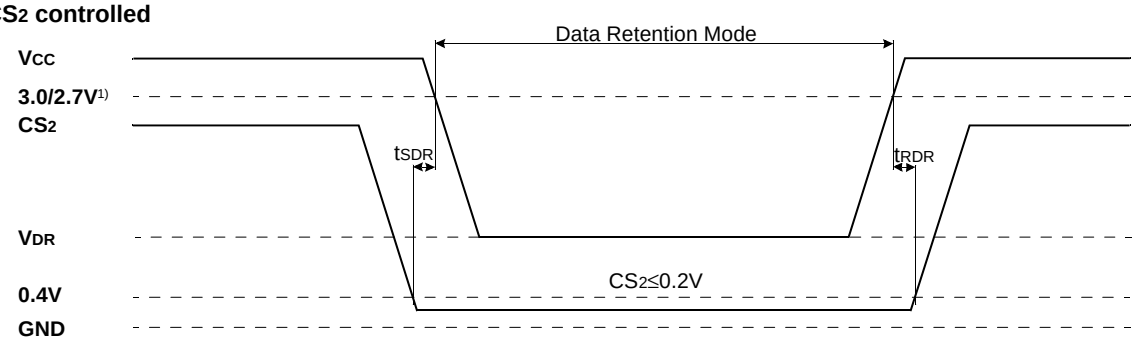
1. A write occurs during the overlap of a low $\overline{CS_1}$, a high CS_2 and a low $\overline{WE}$. A write begins at the latest transition among $\overline{CS_1}$ goes low, CS_2 going high and $\overline{WE}$ going low: A write end at the earliest transition among $\overline{CS_1}$ going high, CS_2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

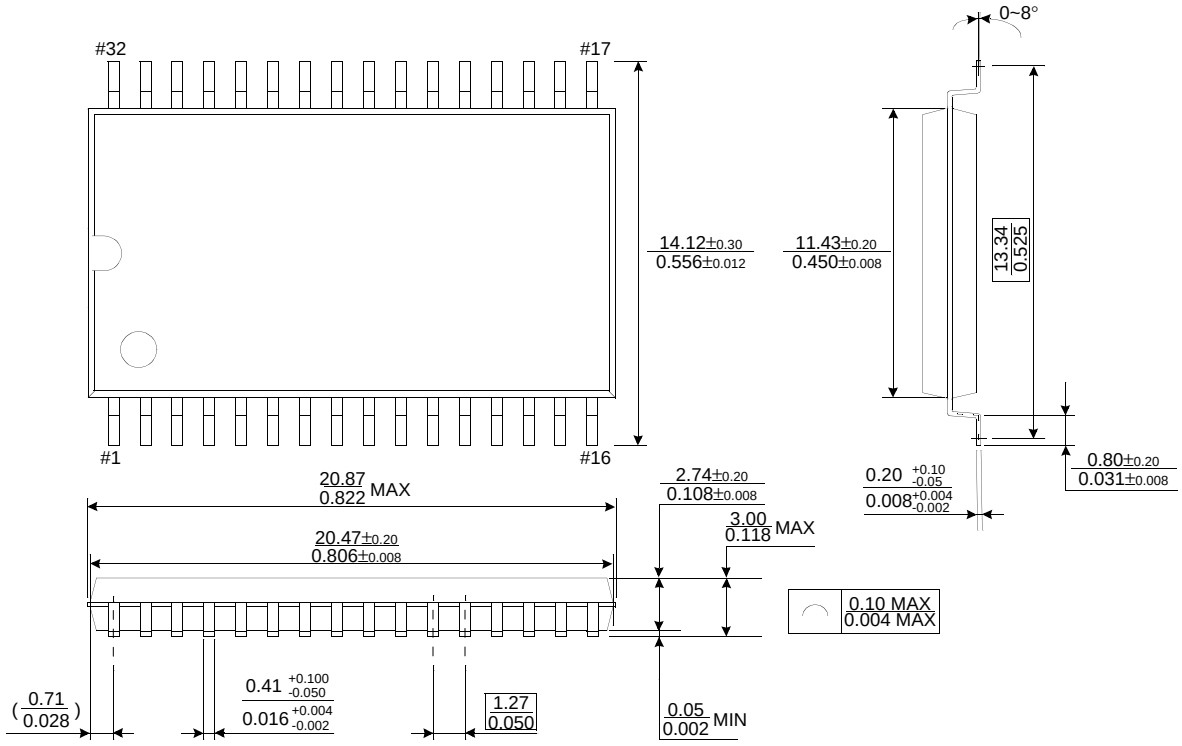


1. 3.0V for KM68V1000C Family, 2.7V for KM68U1000C Family

PACKAGE DIMENSIONS

Units: millimeter(inch)

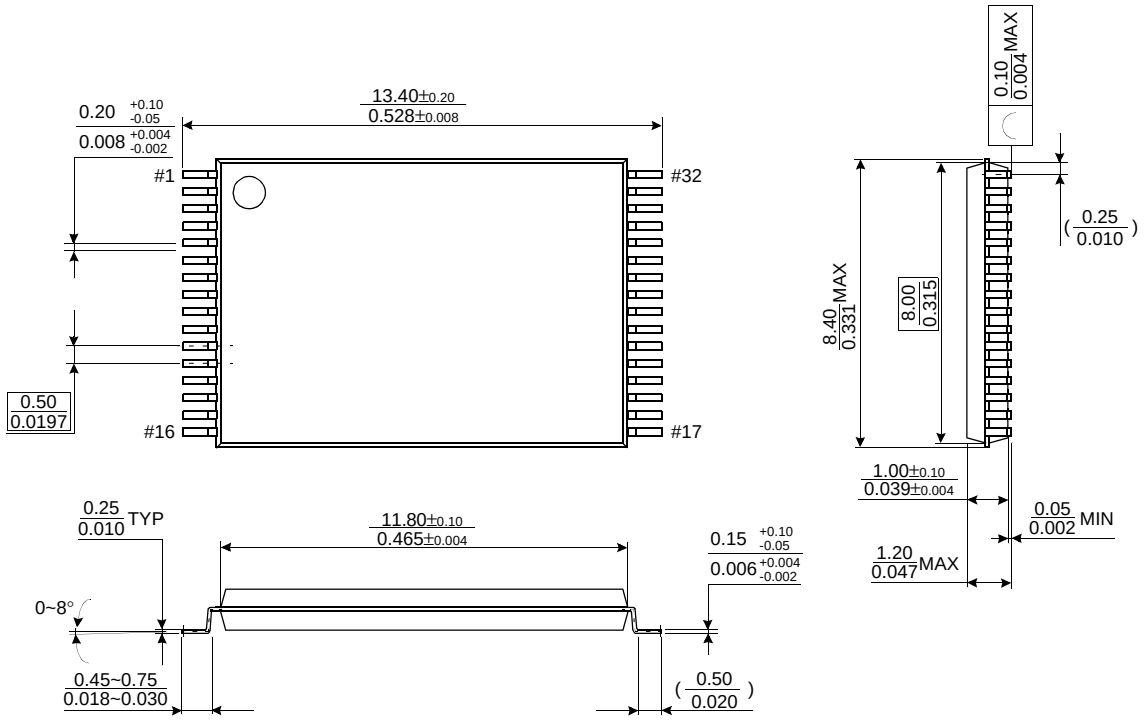
32 PIN PLASTIC SMALL OUTLINE PACKAGE (525mil)



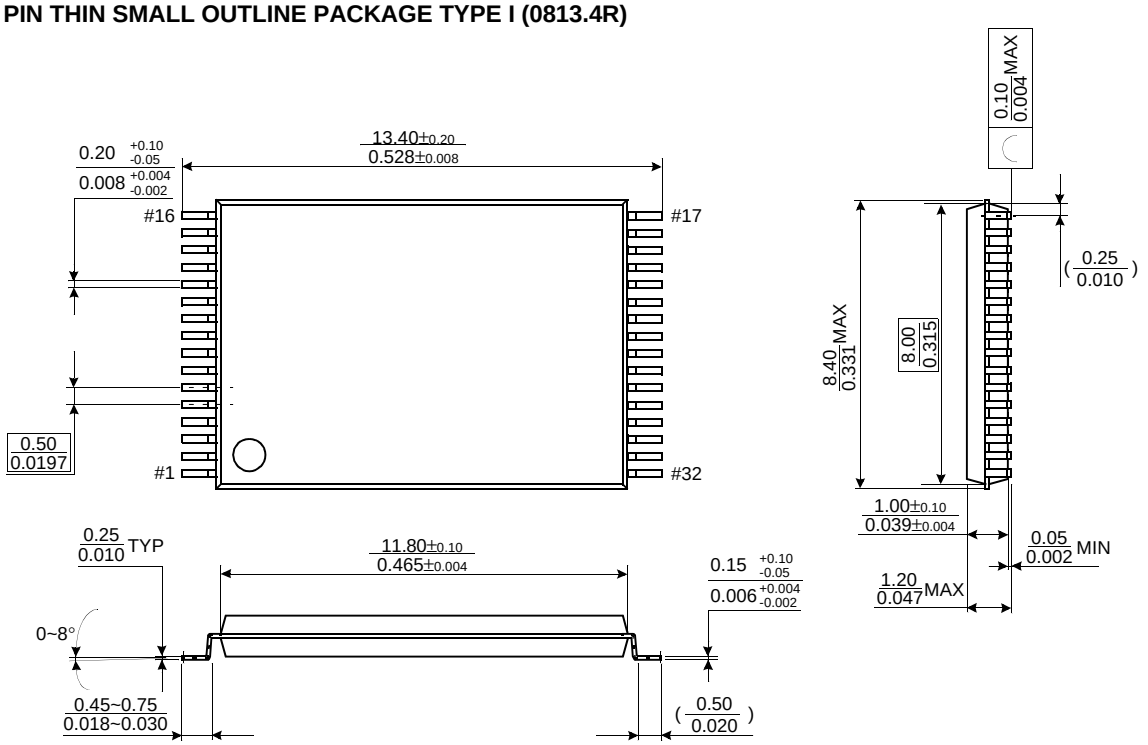
PACKAGE DIMENSIONS

Units: millimeter(inch)

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



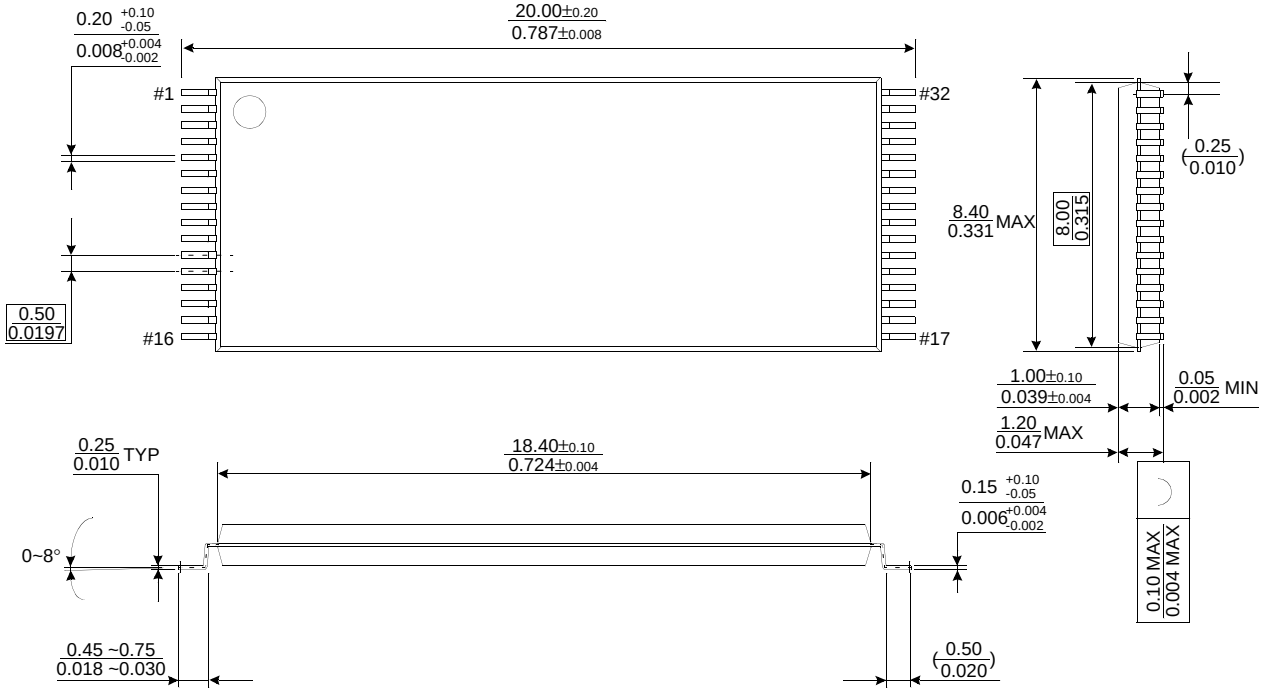
32 PIN THIN SMALL OUTLINE PACKAGE TYPE I (0813.4R)



PACKAGE DIMENSIONS

Units: millimeter(inch)

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



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