

REVISION HISTORY**32M Bits (2Mx16/4Mx8 Switchable)
AS6C3216A-55TIN 48pin-TSOPI PACKAGE**

Revision	Details	Date
Rev 1.0	Initial Issue	Mar. 2017

FEATURES

- Fast access time : 55ns
- Low power consumption:
Operating current : 12mA (TYP.)
Standby current : 8 μ A(TYP.) SL-version
- Single 2.7V ~ 3.6V power supply
- All inputs and outputs TTL compatible
- Fully static operation
- Tri-state output
- Data byte control :
 - (i) BYTE# fixed to V_{CC}
DQ0 ~ DQ7 controlled by LB#,
DQ8 ~ DQ15 controlled by UB#.
 - (ii) BYTE# fixed to V_{SS}
DQ15 used as address pin,
while DQ8~DQ14 pins not used.
- Data retention voltage : 1.2V (MIN.)
- **Green package available**
- Package : 48-pin 12mm x 20mm TSOP I

GENERAL DESCRIPTION

The AS6C3216A-55TIN is a 33,554,432-bit low power CMOS static random access memory organized as 2,097,152 words by 16 bits or 4,194,304 words by 8 bits. It is fabricated using very high performance, high reliability CMOS technology. Its standby current is stable within the range of operating temperature.

The AS6C3216A-55TIN is well designed for low power application, and particularly well suited for battery back-up nonvolatile memory application.

The AS6C3216A-55TIN operates from a single power supply of 2.7V ~ 3.6V and all inputs and outputs are fully TTL compatible

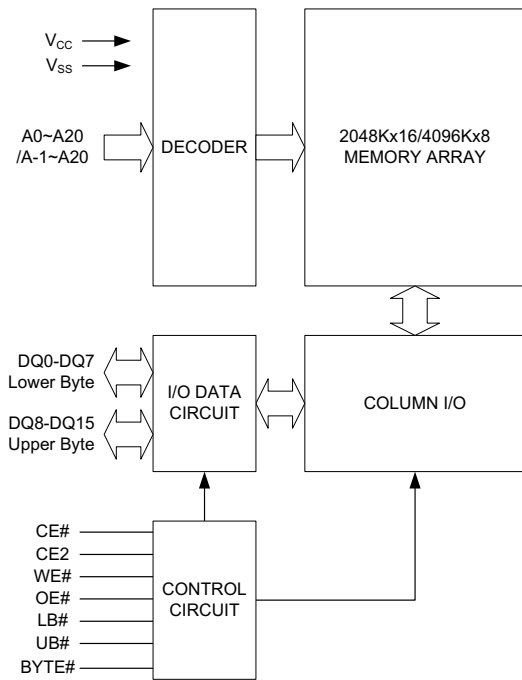
PRODUCT FAMILY

Product Family	Operating Temperature	V _{CC} Range	Speed	Power Dissipation	
				Standby(I _{SB1} ,TYP.)	Operating(I _{CC} ,TYP.)
AS6C3216A-55TIN	-40 ~ 85°C	2.7 ~ 3.6V	55ns	8 μ A(SL)	12mA

ORDERING INFORMATION

Package Type	Access Time (Speed)(ns)	Power Type	Temperature Range(°C)	Packing Type	Alliance Memory Part Number
48-pin TSOP I (12mm x 20mm)	55	Special Ultra Low Power	-40°C~85°C	Tray	AS6C3216A-55TIN
				Tape Reel	AS6C3216A-55TINTR

FUNCTIONAL BLOCK DIAGRAM



PIN DESCRIPTION

SYMBOL	DESCRIPTION
A_0 – A_{20}	Address Inputs(word mode)
A_{-1} – A_{20}	Address Inputs(byte mode)
DQ_0 – DQ_{15}	Data Inputs/Outputs
$CE\#$, $CE2$	Chip Enable Input
$WE\#$	Write Enable Input
$OE\#$	Output Enable Input
$LB\#$	Lower Byte Control
$UB\#$	Upper Byte Control
$BYTE\#$	Byte Enable
V_{CC}	Power Supply
V_{SS}	Ground

PIN CONFIGURATION



TSOP I

ABSOLUTE MAXIMUM RATINGS*

PARAMETER	SYMBOL	RATING	UNIT
Voltage on V_{CC} relative to V_{SS}	V_{T1}	-0.5 to 4.6	V
Voltage on any other pin relative to V_{SS}	V_{T2}	-0.5 to $V_{CC}+0.5$	V
Operating Temperature	T_A	-40 to 85(I grade)	°C
Storage Temperature	T_{STG}	-65 to 150	°C
Power Dissipation	P_D	1	W
DC Output Current	I_{OUT}	50	mA

*Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to the absolute maximum rating conditions for extended period may affect device reliability.

TRUTH TABLE

MODE	CE#	CE2	BYTE#	OE#	WE#	LB#	UB#	I/O OPERATION			SUPPLY CURRENT
								DQ0-DQ7	DQ8-DQ14	DQ15	
Standby	H	X	X	X	X	X	X	High – Z	High – Z	High – Z	I_{SB1}
	X	L	X	X	X	X	X	High – Z	High – Z	High – Z	
	X	X	H	X	X	H	H	High – Z	High – Z	High – Z	
Output Disable	L	H	H	H	H	L	X	High – Z	High – Z	High – Z	I_{CC}, I_{CC1}
	L	H	H	H	H	X	L	High – Z	High – Z	High – Z	
	L	H	L	H	H	L	L	High – Z	High – Z	A-1	
Read	L	H	H	L	H	L	H	D_{OUT}	High – Z	High – Z	I_{CC}, I_{CC1}
	L	H	H	L	H	H	L	High – Z	D_{OUT}	D_{OUT}	
	L	H	H	L	H	L	L	D_{OUT}	D_{OUT}	D_{OUT}	
Write	L	H	H	X	L	L	H	D_{IN}	High – Z	High – Z	I_{CC}, I_{CC1}
	L	H	H	X	L	H	L	High – Z	D_{IN}	D_{IN}	
	L	H	H	X	L	L	L	D_{IN}	D_{IN}	D_{IN}	
Byte# Read	L	H	L	L	H	L	L	D_{OUT}	High – Z	A-1	I_{CC}, I_{CC1}
Byte # Write	L	H	L	X	L	L	L	D_{IN}	High – Z	A-1	I_{CC}, I_{CC1}

Note: H = V_{IH} , L = V_{IL} , X = Don't care.

DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP. ^{*4}	MAX.	UNIT	
Supply Voltage	V_{CC}		2.7	3.0	3.6	V	
Input High Voltage	V_{IH}^{*1}		2.2	-	$V_{CC}+0.3$	V	
Input Low Voltage	V_{IL}^{*2}		- 0.2	-	0.6	V	
Input Leakage Current	I_{LI}	$V_{CC} \geq V_{IN} \geq V_{SS}$	- 1	-	1	μA	
Output Leakage Current	I_{LO}	$V_{CC} \geq V_{OUT} \geq V_{SS}$ Output Disabled	- 1	-	1	μA	
Output High Voltage	V_{OH}	$I_{OH} = -1mA$	2.2	2.7	-	V	
Output Low Voltage	V_{OL}	$I_{OL} = 2mA$	-	-	0.4	V	
Average Operating Power supply Current	I_{CC}	Cycle time = Min. $CE\# \leq 0.2V$ and $CE2 \geq V_{CC}-0.2V$ $I_{I/O} = 0mA$ Other pins at 0.2V or $V_{CC}-0.2V$	-	12	20	mA	
	I_{CC1}	Cycle time = $1\mu s$ $CE\# \leq 0.2V$ and $CE2 \geq V_{CC}-0.2V$ $I_{I/O} = 0mA$ Other pins at 0.2V or $V_{CC}-0.2V$	-	3	5	mA	
Standby Power Supply Current	I_{SB1}	$CE\# \geq V_{CC}-0.2V$ or $CE2 \leq 0.2V$ Other pins at 0.2V or $V_{CC}-0.2V$	-SL ^{*5} 25°C	-	8	18	μA
			-SLI ^{*5} 40°C	-	8	20	μA
			-SL ^{*6}	-	-	50	μA
			-SLI ^{*7}	-	-	80	μA

Notes:

- $V_{IH(max)} = V_{CC} + 2.0V$ for pulse width less than 6ns.
- $V_{IL(min)} = V_{SS} - 2.0V$ for pulse width less than 6ns.
- Over/Undershoot specifications are characterized on engineering evaluation stage, not for mass production test.
- Typical values, measured at $V_{CC} = V_{CC}(TYP.)$ and $T_A = 25^\circ C$, are included for reference only and are not guaranteed or tested.
- This parameter is measured at $V_{CC}=3.0V$.
- This parameter is measured at $T_A = 70^\circ C$
- This parameter is measured at $T_A = 85^\circ C$

CAPACITANCE ($T_A = 25^\circ C$, $f = 1.0MHz$)

PARAMETER	SYMBOL	MIN.	MAX	UNIT
Input Capacitance	C_{IN}	-	8	pF
Input/Output Capacitance	$C_{I/O}$	-	8	pF

Note : These parameters are guaranteed by device characterization, but not production tested.

AC TEST CONDITIONS

Input Pulse Levels	0.2V to $V_{CC} - 0.2V$
Input Rise and Fall Times	3ns
Input and Output Timing Reference Levels	1.5V
Output Load	$C_L = 30pF + 1TTL$, $I_{OH}/I_{OL} = -1mA/2mA$

AC ELECTRICAL CHARACTERISTICS

(1) READ CYCLE

PARAMETER	SYM.	AS6C3216A-55TIN		UNIT
		MIN.	MAX.	
Read Cycle Time	t_{RC}	55	-	ns
Address Access Time	t_{AA}	-	55	ns
Chip Enable Access Time	t_{ACE}	-	55	ns
Output Enable Access Time	t_{OE}	-	30	ns
Chip Enable to Output in Low-Z	t_{CLZ}^*	10	-	ns
Output Enable to Output in Low-Z	t_{OLZ}^*	5	-	ns
Chip Disable to Output in High-Z	t_{CHZ}^*	-	20	ns
Output Disable to Output in High-Z	t_{OHZ}^*	-	20	ns
Output Hold from Address Change	t_{OH}	10	-	ns
LB#, UB# Access Time	t_{BA}	-	55	ns
LB#, UB# to High-Z Output	t_{BHZ}^*	-	20	ns
LB#, UB# to Low-Z Output	t_{BLZ}^*	10	-	ns

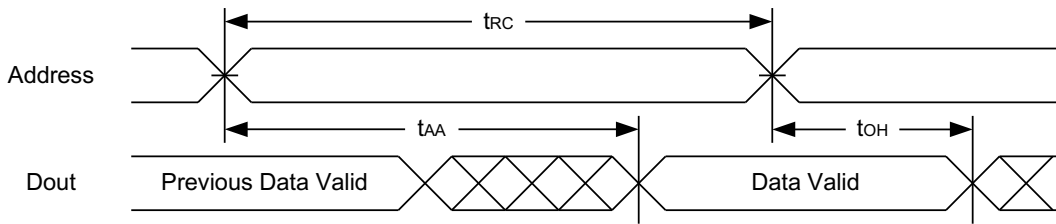
(2) WRITE CYCLE

PARAMETER	SYM.	AS6C3216A-55TIN		UNIT
		MIN.	MAX.	
Write Cycle Time	t_{WC}	55	-	ns
Address Valid to End of Write	t_{AW}	50	-	ns
Chip Enable to End of Write	t_{CW}	50	-	ns
Address Set-up Time	t_{AS}	0	-	ns
Write Pulse Width	t_{WP}	45	-	ns
Write Recovery Time	t_{WR}	0	-	ns
Data to Write Time Overlap	t_{DW}	25	-	ns
Data Hold from End of Write Time	t_{DH}	0	-	ns
Output Active from End of Write	t_{OW}^*	5	-	ns
Write to Output in High-Z	t_{WHZ}^*	-	20	ns
LB#, UB# Valid to End of Write	t_{BW}	50	-	ns

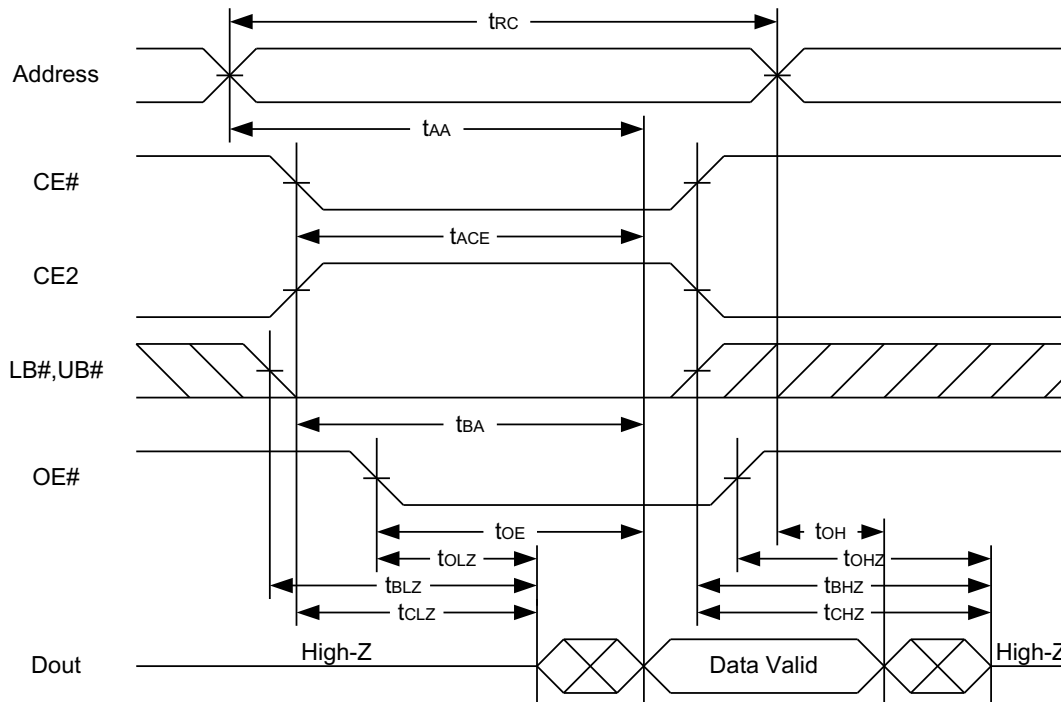
*These parameters are guaranteed by device characterization, but not production tested.

TIMING WAVEFORMS

READ CYCLE 1 (Address Controlled) (1,2)



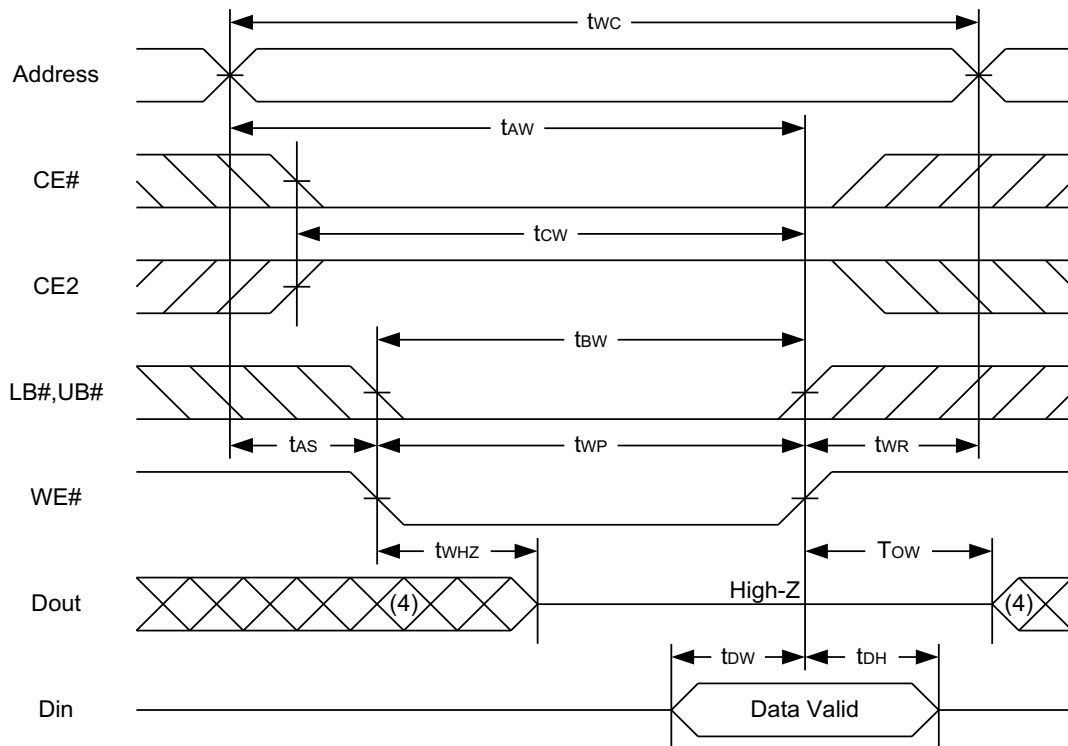
READ CYCLE 2 (CE# and CE2 and OE# Controlled) (1,3,4,5)



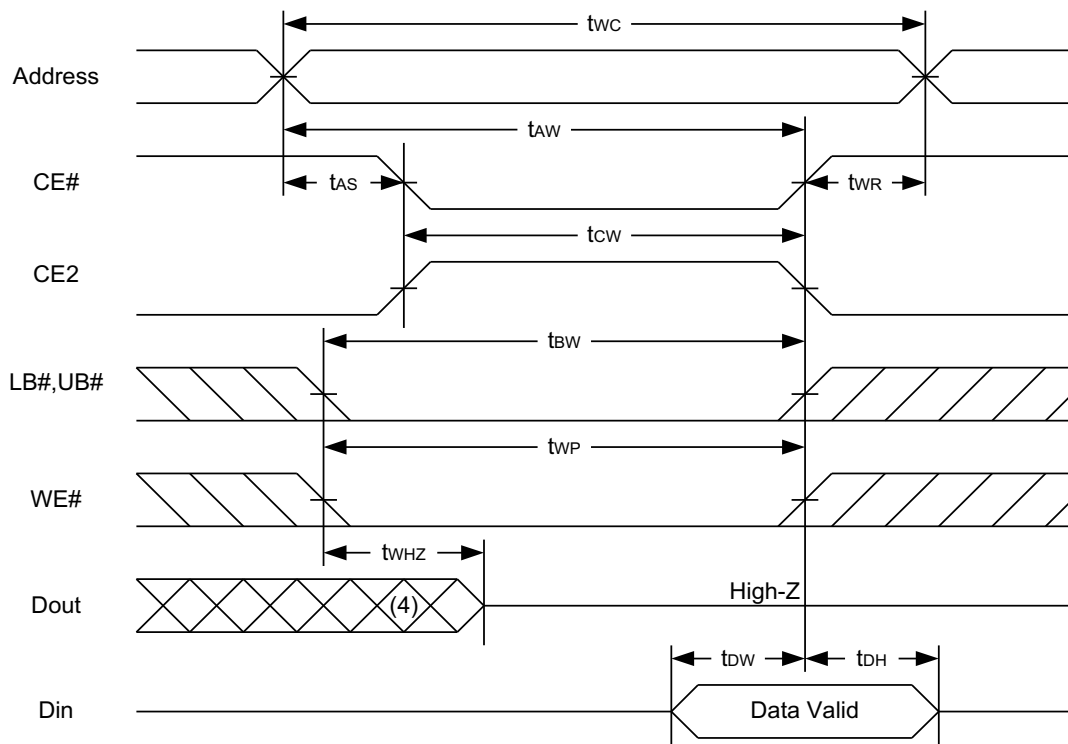
Notes :

1. WE# is high for read cycle.
2. Device is continuously selected OE# = low, CE# = low, CE2 = high, LB# or UB# = low.
3. Address must be valid prior to or coincident with CE# = low, CE2 = high, LB# or UB# = low transition; otherwise t_{AA} is the limiting parameter.
4. t_{CLZ} , t_{BLZ} , t_{OLZ} , t_{CHZ} , t_{BHZ} and t_{OHZ} are specified with $C_L = 5pF$. Transition is measured $\pm 500mV$ from steady state.
5. At any given temperature and voltage condition, t_{CHZ} is less than t_{CLZ} , t_{BHZ} is less than t_{BLZ} , t_{OHZ} is less than t_{OLZ} .

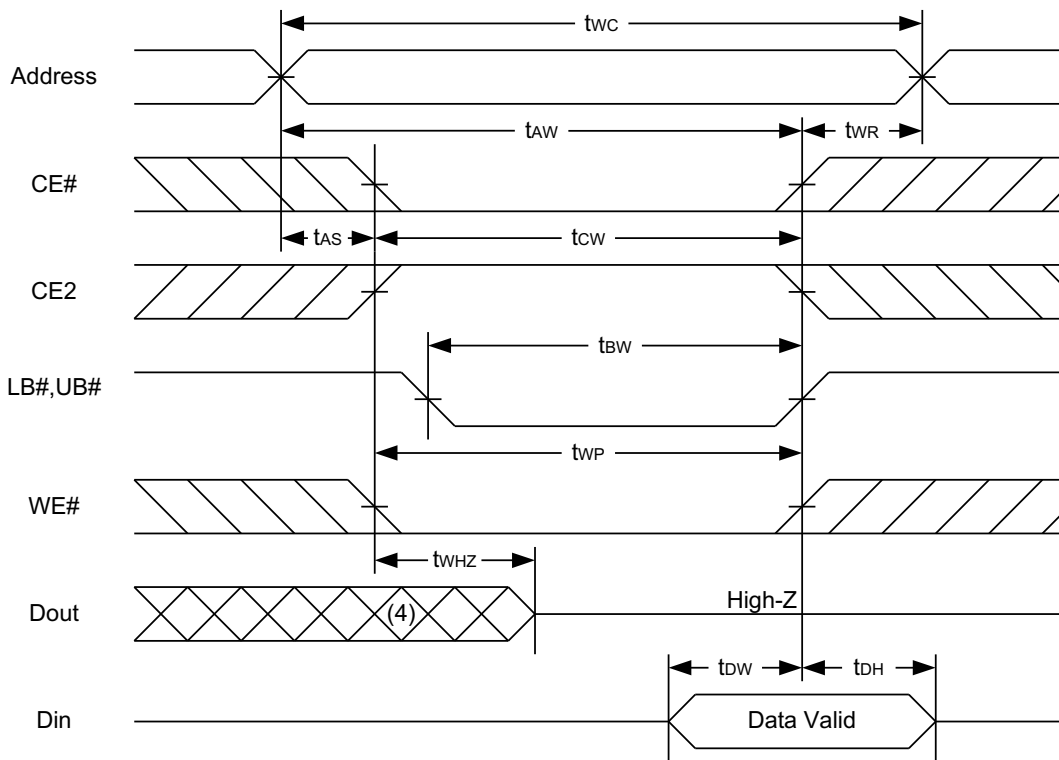
WRITE CYCLE 1 (WE# Controlled) (1,2,4,5)



WRITE CYCLE 2 (CE# and CE2 Controlled) (1,4,5)



WRITE CYCLE 3 (LB#,UB# Controlled) (1,4,5)



Notes :

1. A write occurs during the overlap of a low CE#, high CE2, low WE#, LB# or UB# = low.
2. During a WE# controlled write cycle with OE# low, t_{WP} must be greater than $t_{WHZ} + t_{DW}$ to allow the drivers to turn off and data to be placed on the bus.
3. During this period, I/O pins are in the output state, and input signals must not be applied.
4. If the CE#, LB#, UB# low transition and CE2 high transition occurs simultaneously with or after WE# low transition, the outputs remain in a high impedance state.
5. t_{ow} and t_{whz} are specified with $C_L = 5\text{pF}$. Transition is measured $\pm 500\text{mV}$ from steady state.

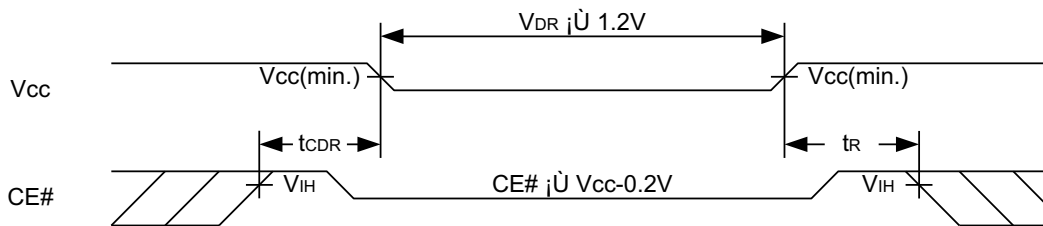
DATA RETENTION CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT		
V _{CC} for Data Retention	V _{DR}	CE# ≥ V _{CC} - 0.2V or CE2 ≤ 0.2V	1.2	-	3.6	V		
Data Retention Current	I _{DR}	V _{CC} = 1.2V CE# ≥ V _{CC} - 0.2V or CE2 ≤ 0.2V other pins at 0.2V or V _{CC} - 0.2V	-SL	25°C	-	6.5	16	μA
			-SLI	40°C	-	6.5	20	μA
			-SL		-	-	50	μA
			-SLI		-	-	80	μA
Chip Disable to Data Retention Time	t _{CDR}	See Data Retention Waveforms (below)	0	-	-	ns		
Recovery Time	t _R		t _{RC} *	-	-	ns		

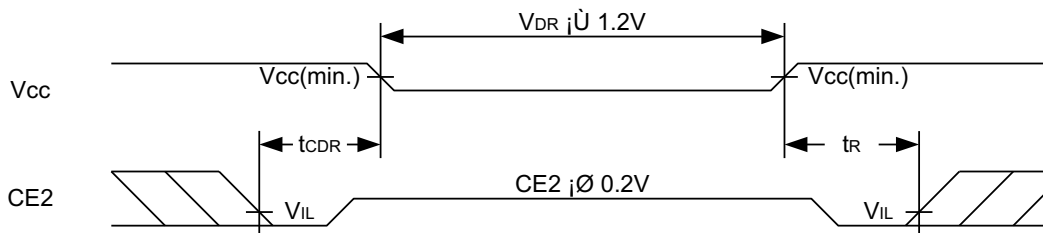
t_{RC}* = Read Cycle Time

DATA RETENTION WAVEFORM

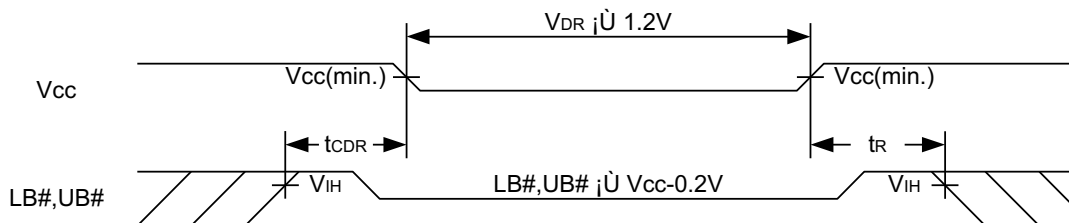
Low Vcc Data Retention Waveform (1) (CE# controlled)



Low Vcc Data Retention Waveform (2) (CE2 controlled)

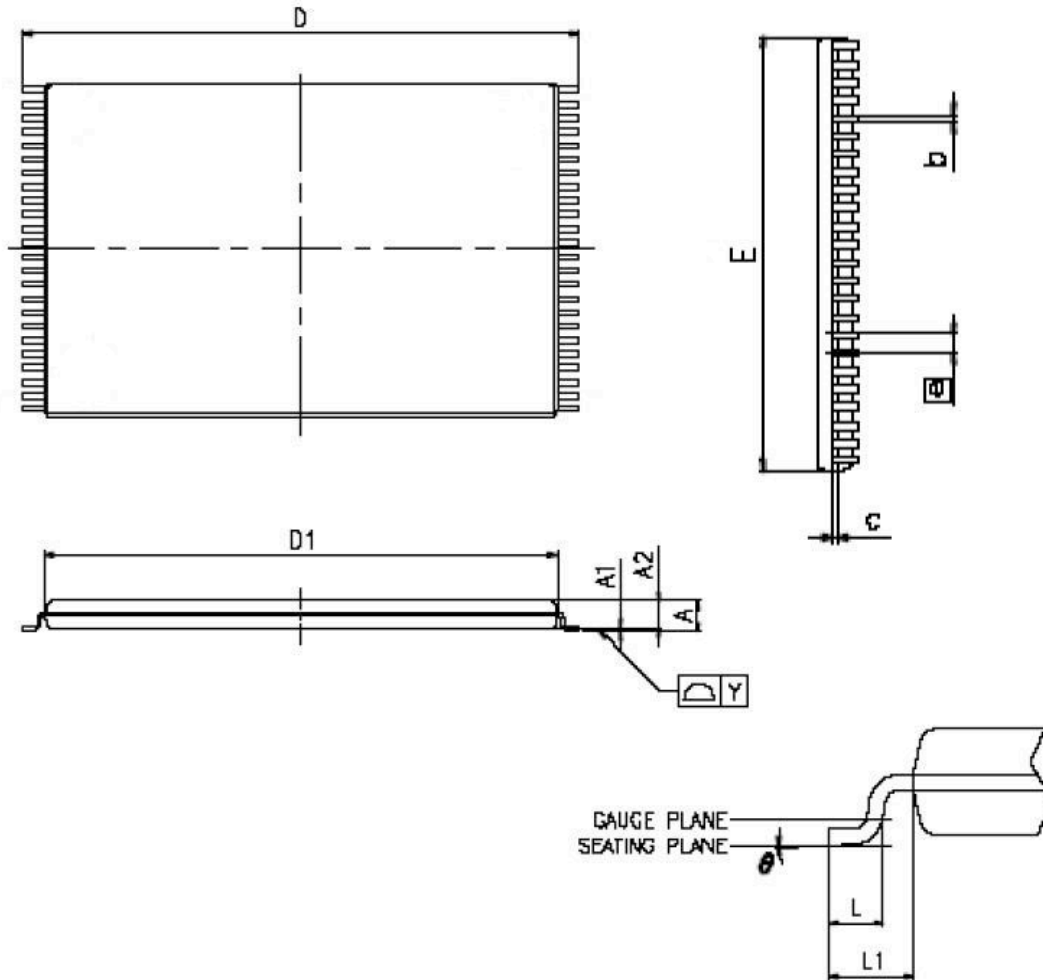


Low Vcc Data Retention Waveform (3) (LB#, UB# controlled)



PACKAGE OUTLINE DIMENSION

48-pin 12mm x 20mm TSOP I Package Outline Dimension



VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

SYMBOLS	MIN.	NOM.	MAX
A	-	-	1.20
A1	0.05	-	0.15
A2	0.95	1.00	1.05
b	0.17	0.22	0.27
c	0.10	-	0.21
Δ D	19.80	20.00	20.20
Δ D1	18.30	18.40	18.50
Δ E	11.90	12.00	12.10
\square e	0.50 BASIC		
L	0.50	0.60	0.70
Δ L1	-	0.80	-
Δ Y	-	-	0.10
Δ θ	0°	-	5°

NOTES:

1. JEDEC OUTLINE : MO-142 DD
2. PROFILE TOLERANCE ZONES FOR D1 AND E DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION ON E IS 0.15mm PER SIDE AND ON D1 IS 0.25mm PER SIDE.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08mm TOTAL IN EXCESS OF THE b DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT.

PART NUMBERING SYSTEM

AS6C	3216A	55	T	I	N
SRAM	32 = 32M 16 = x16 A = A die	55=55ns	T = TSOPI	I=Industrial (-40° C~+85° C)	Indicates Pb and Halogen Free



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