



512K X 8 BIT LOW POWER CMOS SRAM

FEATURES

- Access time : 55 ns
- Low power consumption:
Operating current : 30 mA (TYP)
Standby current : 4 μA (TYP)
- Single 2.7V ~ 5.5V power supply
- All outputs TTL compatible
- Fully static operation
- Tri-state output
- Data retention voltage : 1.5V (MIN.)
- All products ROHS Compliant
- Package : 32-pin 450 mil SOP; 32-pin 600 mil P-DIP
32-pin 8mm x 20mm TSOP-I
32-pin 8mm x 13.4mm STSOP
36-ball 6mm x 8mm TFBGA
32-pin 400 mil TSOP-II

GENERAL DESCRIPTION

The AS6C4008 is a 4,194,304-bit low power CMOS static random access memory organized as 524,288 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.

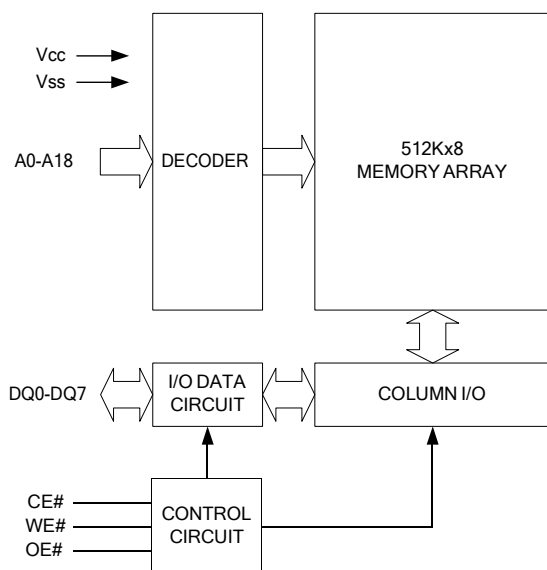
The AS6C4008 is well designed for very low power system applications, and particularly well suited for battery back-up non-volatile memory application.

The AS6C4008 operates from a single power supply of 2.7V ~ 5.5V and all inputs and outputs are fully TTL compatible

PRODUCT FAMILY

Product Family	Operating Temperature	Vcc Range	Speed	Power Dissipation	
				Standby(I _{SB1} , TYP.)	Operating(I _{CC} , TYP.)
AS6C4008	-40 ~ +85 °C	2.7 ~ 5.5V	55ns	4μA(LL)	30mA

FUNCTIONAL BLOCK DIAGRAM



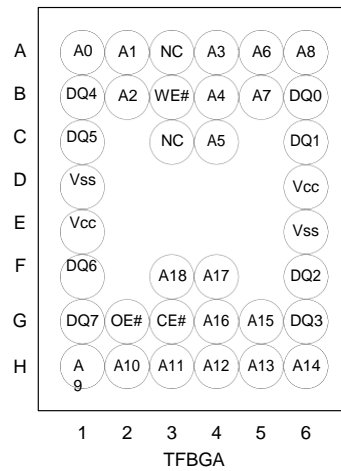
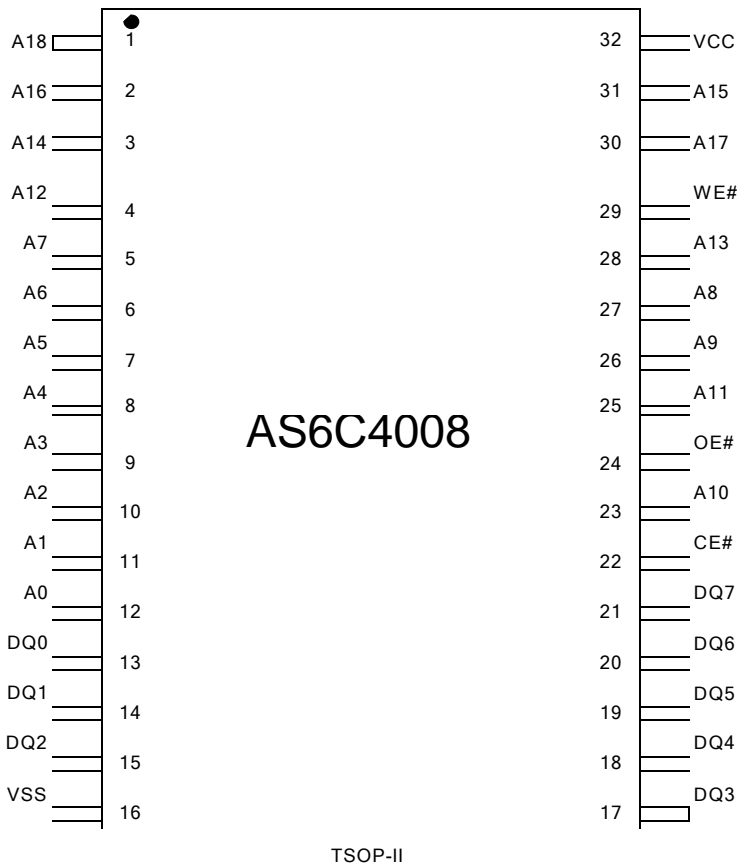
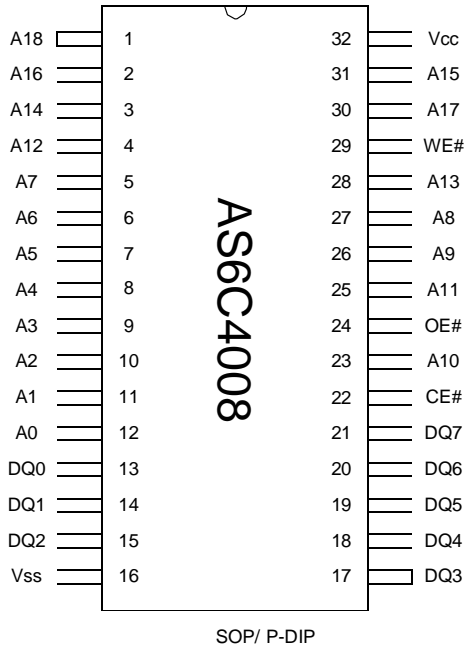
PIN DESCRIPTION**

SYMBOL	DESCRIPTION
A0 - A18	Address Inputs
DQ0 – DQ7	Data Inputs/Outputs
CE#	Chip Enable Inputs
WE#	Write Enable Input
OE#	Output Enable Input
Vcc	Power Supply
Vss	Ground
NC	No Connection



512K X 8 BIT LOW POWER CMOS SRAM

PIN CONFIGURATION





512K X 8 BIT LOW POWER CMOS SRAM

ABSOLUTE MAXIMUM RATINGS*

PARAMETER	SYMBOL	RATING	UNIT
Terminal Voltage with Respect to V _{ss}	V _{TERM}	-0.5 to 6.5	V
Operating Temperature	T _A	0 to 70(C grade)	C°
		-40 to 85(I grade)	
Storage Temperature	T _{STG}	-65 to 150	C°
Power Dissipation	P _D	1	W
DC Output Current	I _{OUT}	50	mA
Soldering Temperature (under 10 sec)	T _{SOLDER}	260	C°

*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#	OE#	WE#	I/O OPERATION	SUPPLY CURRENT
Standby	H	X	X	High-Z	I _{SB1}
Output Disable	L	H	H	High-Z	I _{CC} , I _{CC1}
Read	L	L	H	D _{OUT}	I _{CC} , I _{CC1}
Write	L	X	L	D _{IN}	I _{CC} , I _{CC1}

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

DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP. ³	MAX.	UNIT	
Supply Voltage	V _{CC}		2.7	3.0	5.5	V	
Input High Voltage	V _{IH} ^{*1}	V _{CC} : 4.5 ~ 5.5V	2.4	-	V _{CC} +0.3	V	
		V _{CC} : 2.7 ~ 4.5V	2.2	-	V _{CC} +0.3	V	
Input Low Voltage	V _{IL} ^{*1}	V _{CC} : 4.5 ~ 5.5V	-0.2	-	0.8	V	
		V _{CC} : 2.7 ~ 4.5V	-0.2	-	0.6	V	
Input Leakage Current	I _{LI}	V _{CC} ≥ V _{IN} ≥ V _{SS}	-1	-	1	μA	
Output Leakage Current	I _{LO}	V _{CC} ≥ V _{OUT} ≥ V _{SS} , Output Disabled	-1	-	1	μA	
Output High Voltage	V _{OH}	I _{OH} = -1mA	2.4	-	-	V	
Output Low Voltage	V _{OL}	I _{OL} = 2mA	-	-	0.4	V	
Average Operating Power supply Current	I _{CC}	Cycle time = Min. CE# = 0.2V, I _{I/O} = 0mA other pins at 0.2V or V _{CC} - 0.2V	-55	-	30	60	mA
	I _{CC1}	Cycle time = 1μs CE# = 0.2V, I _{I/O} = 0mA other pins at 0.2V or V _{CC} - 0.2V	-	4	10	mA	
Standby Power Supply Current	I _{SB1}	CE# ≥ V _{CC} - 0.2V	-LL	-	4	50 ^{*4}	μA
			-LLE/-LLI	-	4	50 ^{*4}	μA

Notes: 1. V_{IH}(max) = V_{CC} + 3.0V for pulse width less than 10ns. V_{IL}(min) = V_{SS} - 3.0V for pulse width less than 10ns.

2. Over/Undershoot specifications are characterized, not 100% tested.

3. Typical values are included for reference only and are not guaranteed or tested.

Typical values are measured at V_{CC} = V_{CC}(TYP.) and T_A = 25°

4. 25μA for special request



512K X 8 BIT LOW POWER CMOS SRAM

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

PARAMETER	SYMBOL	MIN.	MAX	UNIT
Input Capacitance	C_{IN}	-	6	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	$C_L = 30\text{pF} + 1\text{TTL}$, $I_{OH}/I_{OL} = -2\text{mA}/4\text{mA}$

AC ELECTRICAL CHARACTERISTICS**(1) READ CYCLE**

PARAMETER	SYM.	AS6C4008-55		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

(2) WRITE CYCLE

PARAMETER	SYM.	AS6C4008-55		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

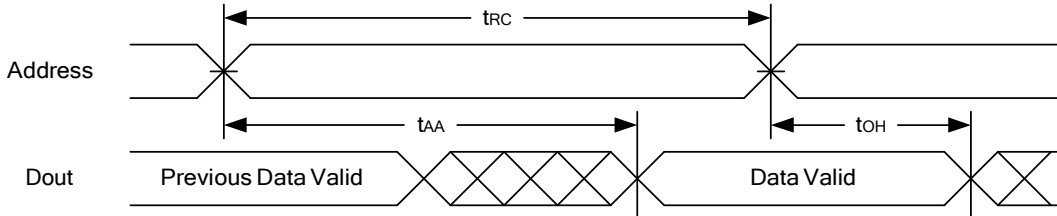
*These parameters are guaranteed by device characterization, but not production tested.



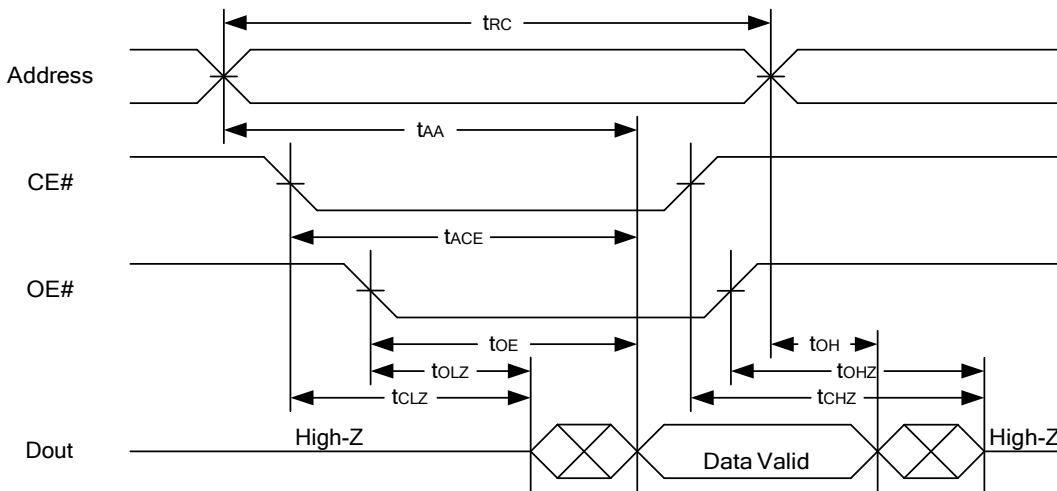
512K X 8 BIT LOW POWER CMOS SRAM

TIMING WAVEFORMS

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



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



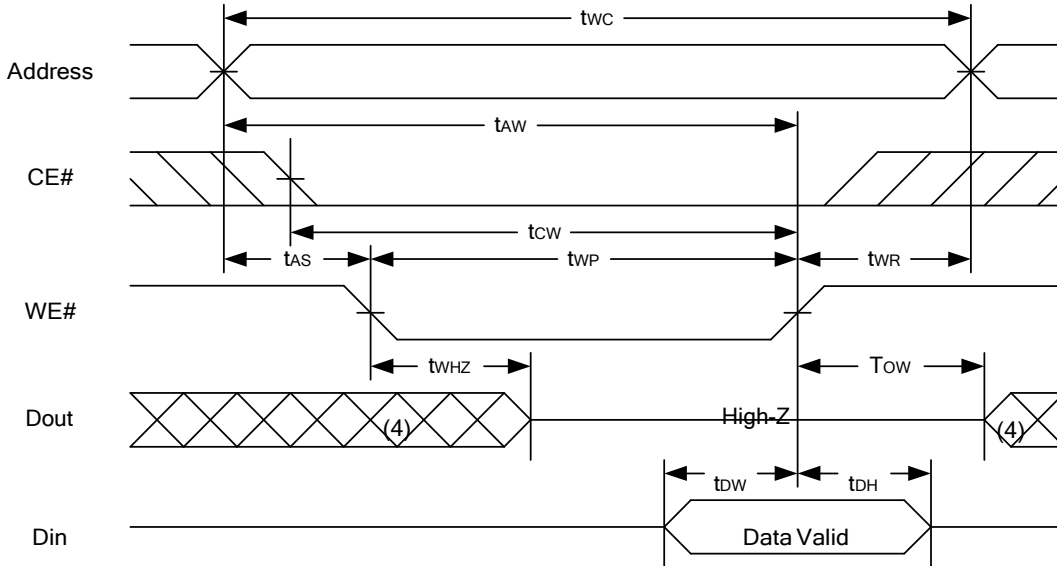
Notes :

1. WE# is high for read cycle.
2. Device is continuously selected OE# = low, CE# = low.
3. Address must be valid prior to or coincident with CE# = low,; otherwise t_{AA} is the limiting parameter.
4. t_{CLZ} , t_{OLZ} , t_{CHZ} 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_{OHZ} is less than t_{OLZ} .

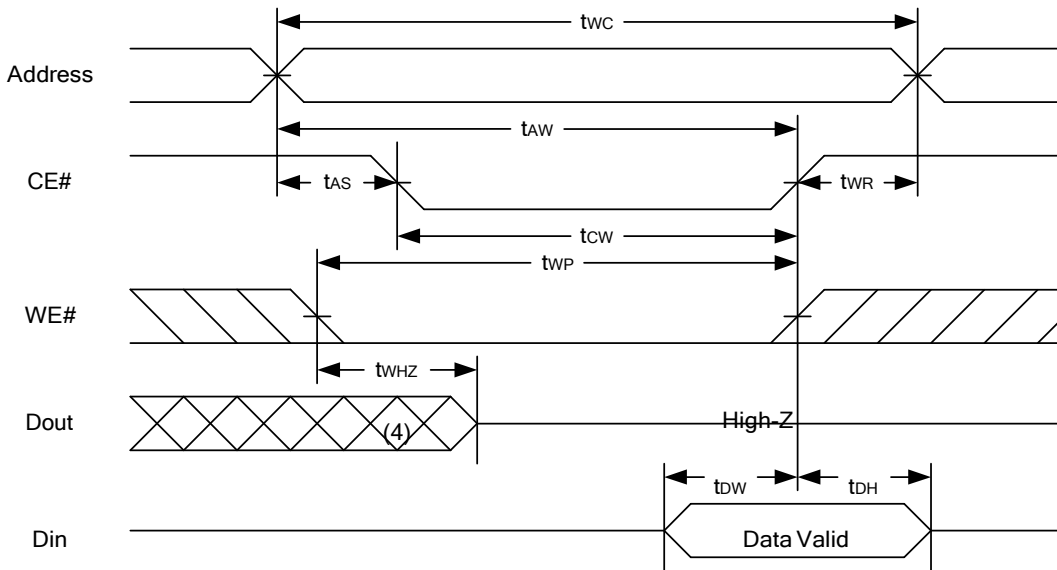


512K X 8 BIT LOW POWER CMOS SRAM

WRITE CYCLE 1 (WE# Controlled) (1,2,3,5,6)



WRITE CYCLE 2 (CE# Controlled) (1,2,5,6)



Notes :

1. WE#, CE# must be high during all address transitions.
2. A write occurs during the overlap of a low CE#, low WE#.
3. During a WE# controlled write cycle with OE# low, twp must be greater than twhz + tdw to allow the drivers to turn off and data to be placed on the bus.
4. During this period, I/O pins are in the output state, and input signals must not be applied.
5. If the CE# low transition occurs simultaneously with or after WE# low transition, the outputs remain in a high impedance state.
6. tow and twhz are specified with CL = 5pF. Transition is measured ±500mV from steady state.



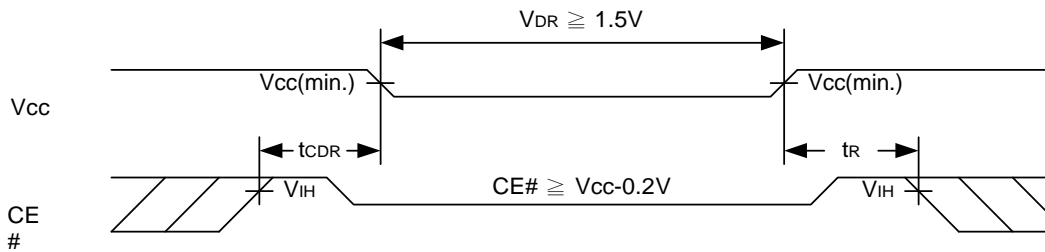
512K X 8 BIT LOW POWER CMOS SRAM

DATA RETENTION CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
VCC for Data Retention	V _{DR}	CE# ≥ V _{CC} - 0.2V	1.5	-	5.5	V
Data Retention Current	I _{DR}	V _{CC} = 1.5V CE# ≥ V _{CC} - 0.2V	-LL	2	30	μA
			-LLE/-LLI	2	30	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

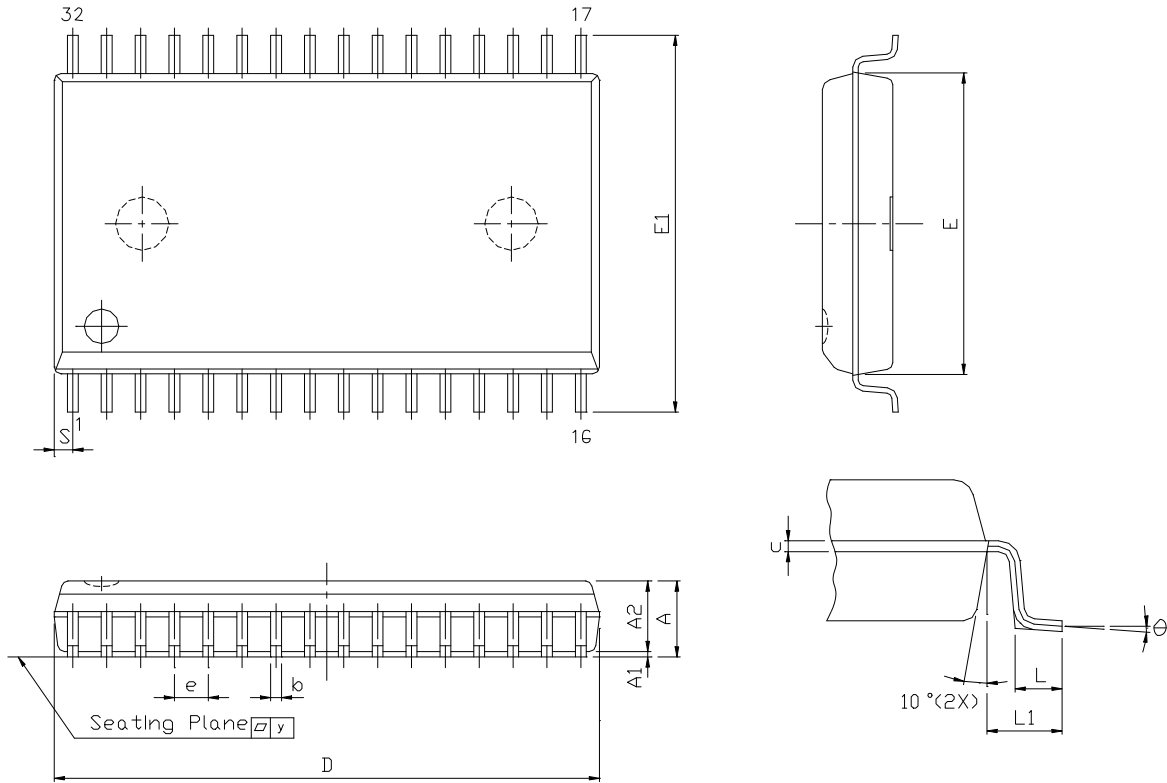




512K X 8 BIT LOW POWER CMOS SRAM

PACKAGE OUTLINE DIMENSION

32 pin 450 mil SOP Package Outline Dimension

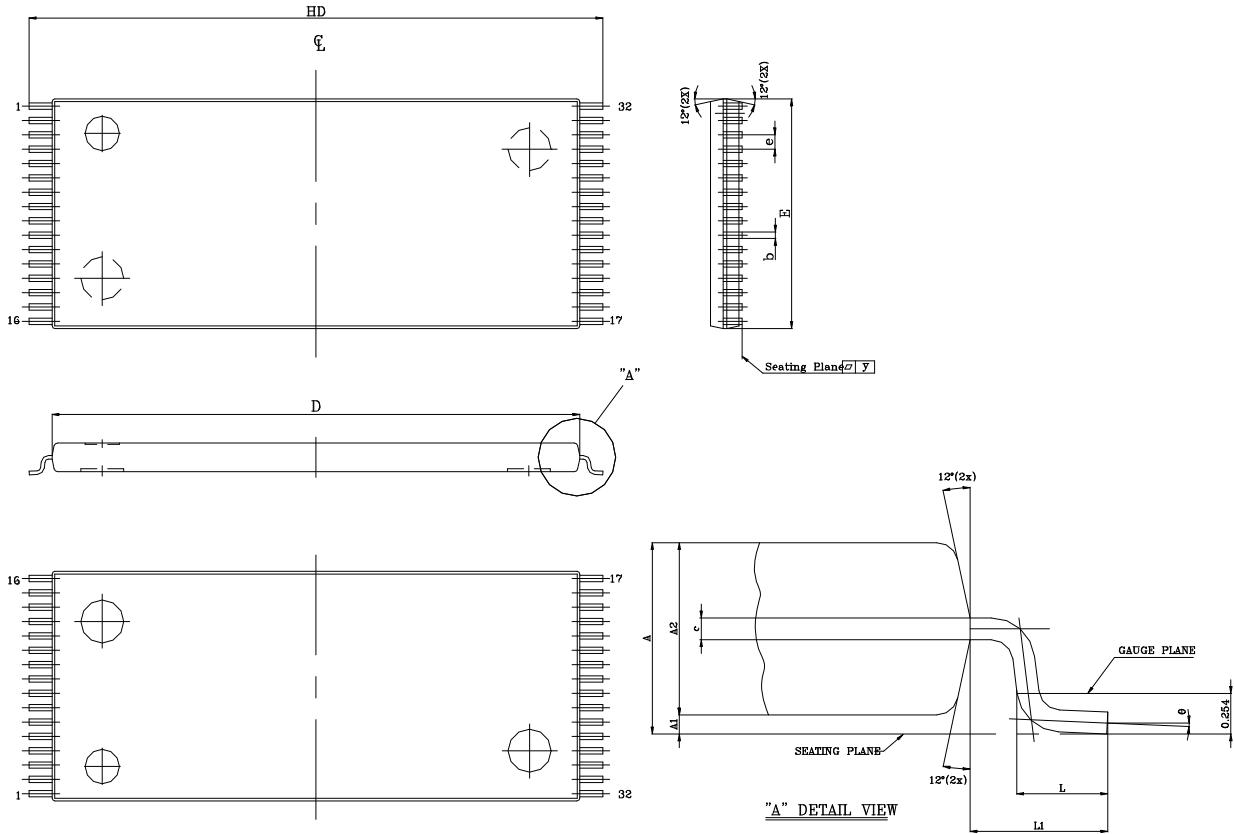


SYM.	UNIT	INCH.(BASE)	MM(REF)
A		0.118 (MAX)	2.997 (MAX)
A1		0.004(MIN)	0.102(MIN)
A2		0.111(MAX)	2.82(MAX)
b		0.016(TYP)	0.406(TYP)
c		0.008(TYP)	0.203(TYP)
D		0.817(MAX)	20.75(MAX)
E		0.445 ±0.005	11.303 ±0.127
E1		0.555 ±0.012	14.097 ±0.305
e		0.050(TYP)	1.270(TYP)
L		0.0347 ±0.008	0.881 ±0.203
L1		0.055 ±0.008	1.397 ±0.203
S		0.026(MAX)	0.660 (MAX)
y		0.004(MAX)	0.101(MAX)
Θ		0° -10°	0° -10°



512K X 8 BIT LOW POWER CMOS SRAM

32 pin 8mm x 20mm TSOP-I Package Outline Dimension

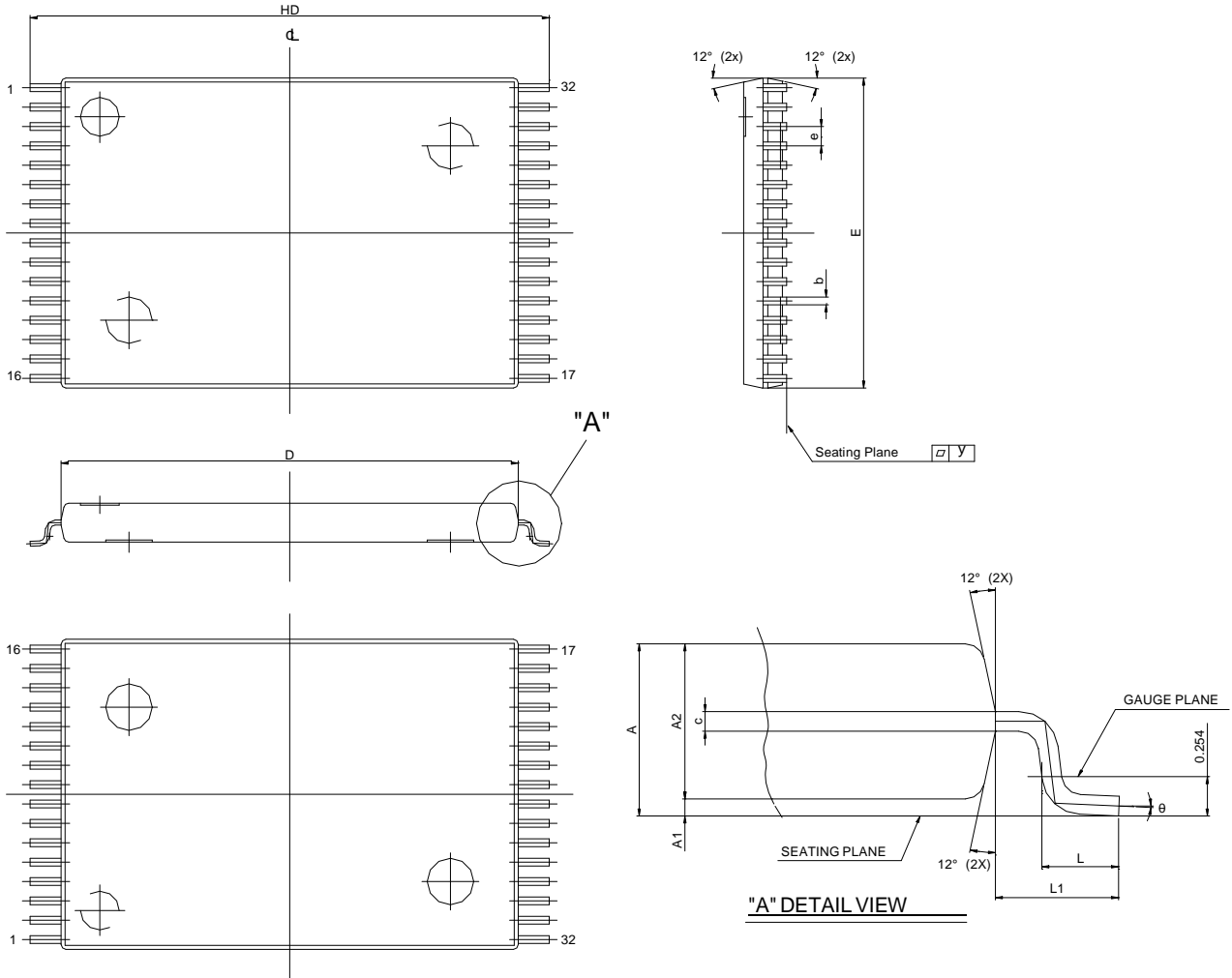


SYM.	UNIT	
	INCH(BASE)	MM(REF)
A	0.047 (MAX)	1.20 (MAX)
A1	0.004 ±0.002	0.10 ±0.05
A2	0.039 ±0.002	1.00 ±0.05
b	0.008 + 0.002 - 0.001	0.20 + 0.05 - 0.03
c	0.005 (TYP)	0.127 (TYP)
D	0.724 ±0.004	18.40 ±0.10
E	0.315 ±0.004	8.00 ±0.10
e	0.020 (TYP)	0.50 (TYP)
HD	0.787 ±0.008	20.00 ±0.20
L	0.0197 ±0.004	0.50 ±0.10
L1	0.0315 ±0.004	0.08 ±0.10
y	0.003 (MAX)	0.076 (MAX)
Θ	0°~5°	0°~5°



512K X 8 BIT LOW POWER CMOS SRAM

32 pin 8mm x 13.4mm STSOP Package Outline Dimension

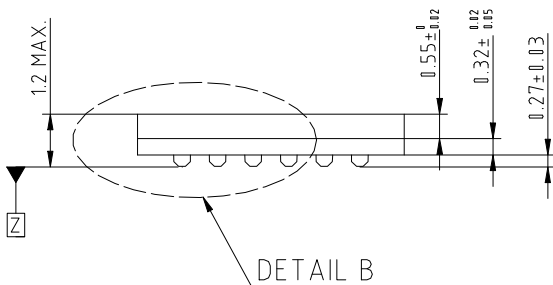
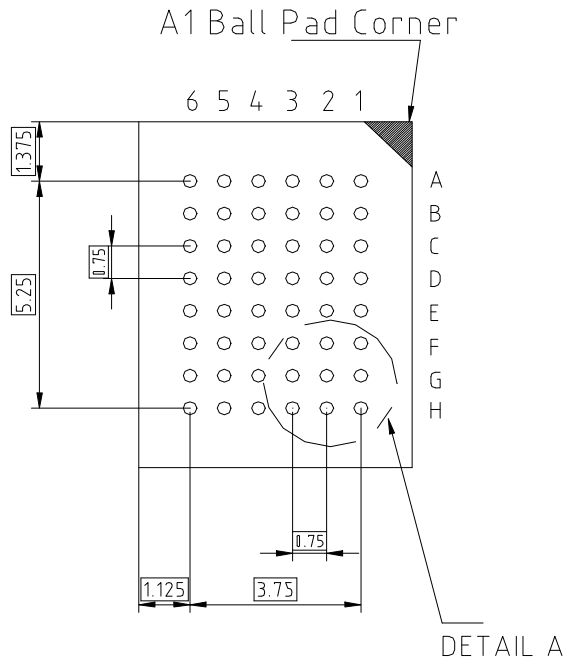
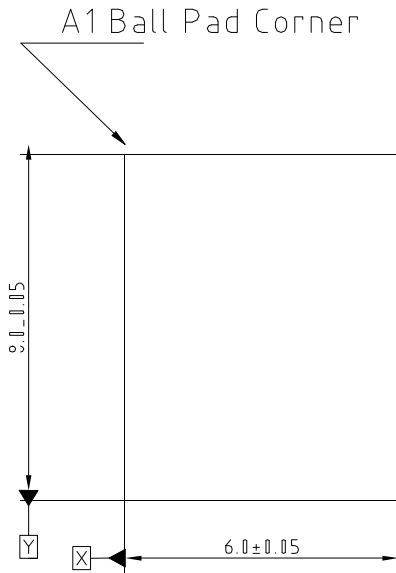


SYM.	UNIT	INCH(BASE)	MM(REF)
A		0.049 (MAX)	1.25 (MAX)
A1		0.005 \pm 0.002	0.130 \pm 0.05
A2		0.039 \pm 0.002	1.00 \pm 0.05
b		0.008 \pm 0.01	0.20 \pm 0.025
c		0.005 (TYP)	0.127 (TYP)
D		0.465 \pm 0.004	11.80 \pm 0.10
E		0.315 \pm 0.004	8.00 \pm 0.10
e		0.020 (TYP)	0.50 (TYP)
HD		0.528 \pm 0.008	13.40 \pm 0.20.
L		0.0197 \pm 0.004	0.50 \pm 0.10
L1		0.0315 \pm 0.004	0.8 \pm 0.10
y		0.003 (MAX)	0.076 (MAX)
Θ		0 $^\circ$ ~5 $^\circ$	0 $^\circ$ ~5 $^\circ$

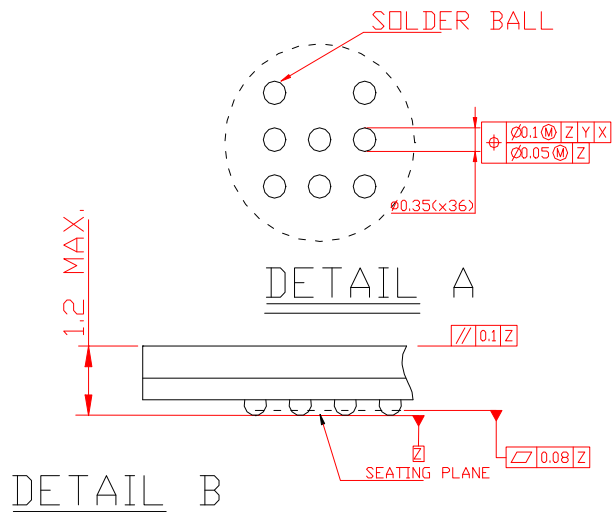


512K X 8 BIT LOW POWER CMOS SRAM

36 ball 6mm x 8mm TFBGA Package Outline Dimension



SIDE VIEW

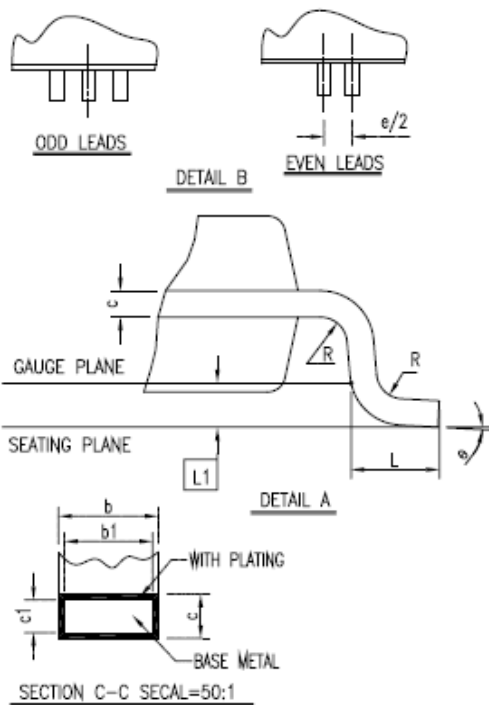
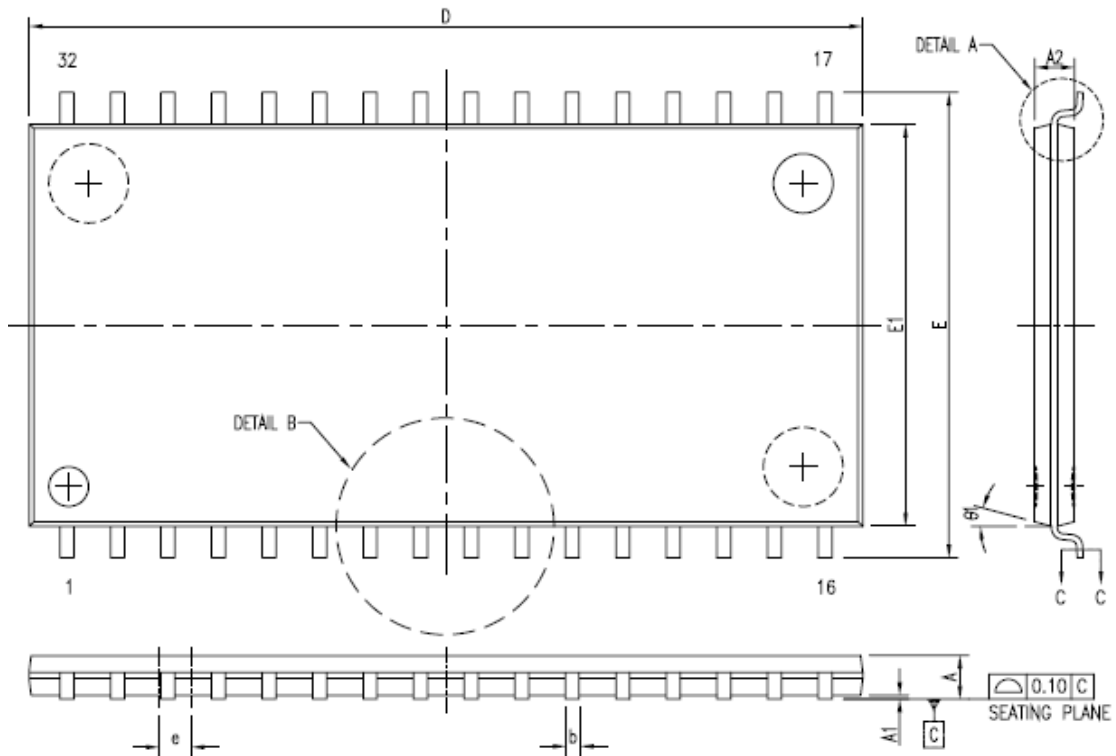


DETAIL B



512K X 8 BIT LOW POWER CMOS SRAM

32-pin 400mil TSOP-II Package Outline Dimension



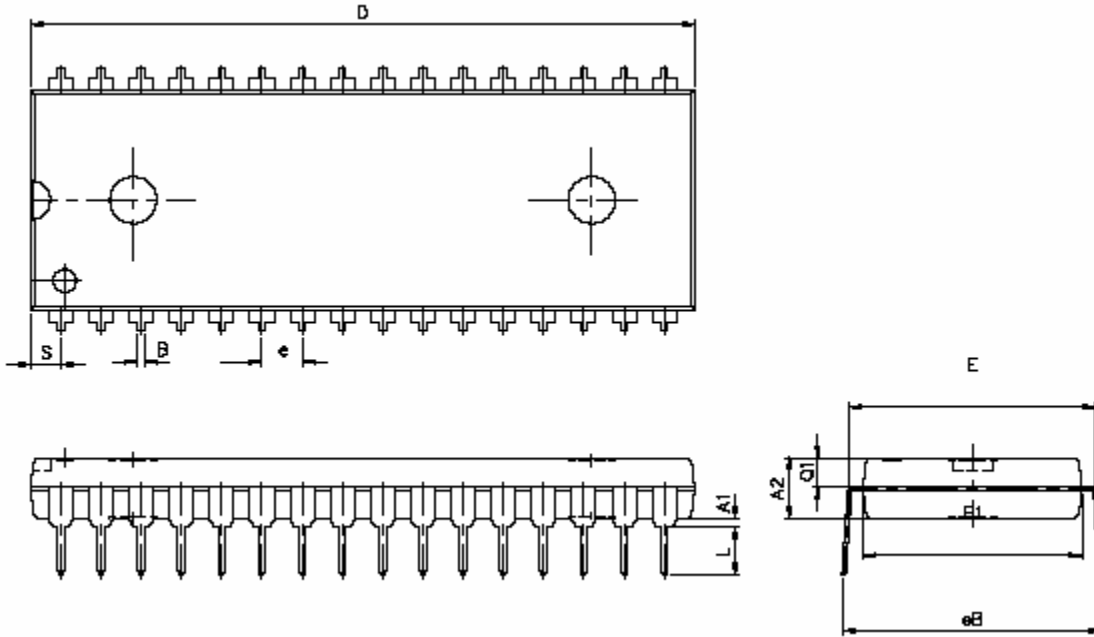
SYMBOL	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM	MAX.	MIN.	NOM	MAX.
A			1.20			0.047
A1	0.05		0.15	0.002		0.006
A2	0.95	1.00	1.05	0.037	0.039	0.041
c	0.12	---	0.21	0.005	---	0.008
c1	0.12	0.15	0.18	0.005	0.006	0.007
D	20.82	20.95	21.08	0.820	0.825	0.830
E	11.56	11.76	11.96	0.455	0.463	0.471
E1	10.03	10.16	10.29	0.395	0.400	0.405
L	0.40	0.50	0.60	0.016	0.020	0.024
L1	0.25 BASIC			0.010 BASIC		
R	0.11		0.25	0.004		0.010
θ	0		5	0		5
θ1	10	15	20	10	15	20

N	32L
e	1.27 BASIC
b	0.30 --- 0.52
b1	0.30 0.40 0.45
JEDEC	MS-024(BA)



512K X 8 BIT LOW POWER CMOS SRAM

32 pin 600 mil P-DIP Package Outline Dimension



SYM. \ UNIT	INCH(BASE)	MM(REF)
A1	0.015 (MIN)	0.381 (MIN)
A2	0.155 ± 0.005	3.937 ± 0.127
B	0.018 ± 0.005	0.457 ± 0.127
D	1.650 ± 0.005	41.910 ± 0.127
E	0.600 ± 0.010	15.240 ± 0.254
E1	0.545 ± 0.005	13.843 ± 0.127
e	0.100 (TYP)	2.540 (TYP)
eB	0.640 ± 0.020	16.256 ± 0.508.
L	0.130 ± 0.010	3.302 ± 0.254
S	0.075 ± 0.010	1.905 ± 0.254
Q1	0.070 ± 0.005	1.778 ± 0.127

Note : D/E1/S dimension do not include mold flash.