

Description

The PUMA 68S4000/A is a 4Mbit CMOS High Speed Static RAM organised as 128K x 32 in a JEDEC 68 pin surface mount PLCC, available with access times of 20, 25, 35, and 45ns. The output width is user configurable as 8, 16 or 32 bits using four Chip Selects ($\overline{CS1}\sim\overline{CS4}$) and is available in two pinout options, single $\overline{WE}$ or $\overline{WE1}\sim\overline{WE4}$ ('A' version). The plastic device is screened to ensure high reliability.

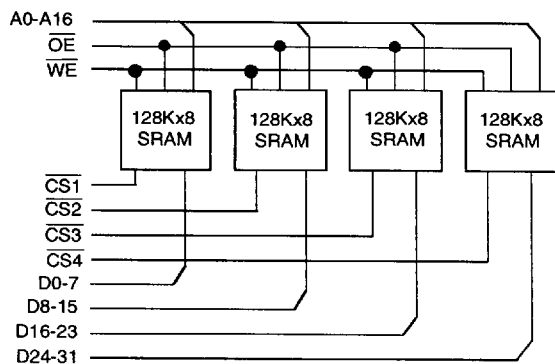
The device features low power standby, multiple ground pins for maximum noise immunity and TTL compatible inputs and outputs. The PUMA 68S4000/A offers a dramatic space saving advantage over four standard 128K x 8 devices. A low power standby option with 2V data retention mode is available.

Features

- Very Fast Access Times of 020,025,35,45 ns.
- JEDEC 68 pin surface mount PLCC, available in two pinouts : Single $\overline{WE}$, $\overline{WE1}\sim\overline{WE4}$ is version A.
- Industrial, Military or Military(High Rel) Grade.
- User Configurable as 8 / 16 / 32 bit wide output.
- Operating Power : 2.86 W (max)
- Standby Power : -L Part 44 mW (max)
- TTL Compatible Inputs and Outputs.
- Fully Static operation.
- Multiple ground pins for maximum noise immunity.
- Single $5V\pm 10\%$ Power supply.

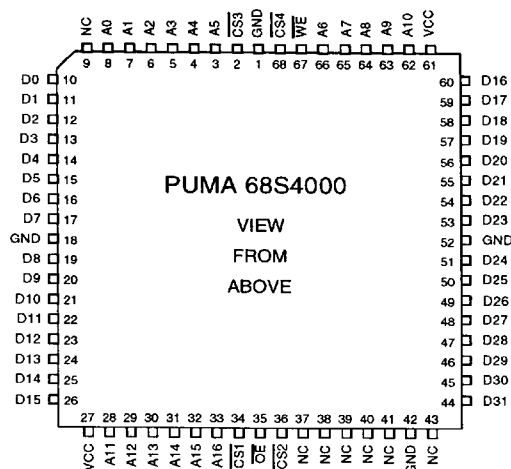
Block Diagram

Refer to page 7 for 'A' version Block Diagram



Pin Definition

Refer to page 7 for 'A' version Pinout



Pin Functions

Address Inputs	A0 - A16
Data Input/Output	D0 - D31
Chip Select	$\overline{CS1}\sim\overline{CS4}$
Write Enable	$\overline{WE}$
	$\overline{WE1}\sim\overline{WE4}$ ('A' version)
Output Enable	$\overline{OE}$
No Connect	NC
Power (+5V)	V _{cc}
Ground	GND

Package Details

Plastic 68 J-Leaded JEDEC PLCC

Refer to page 8

DC OPERATING CONDITIONS**Absolute Maximum Ratings ⁽¹⁾**

Parameter	Symbol	Min	Typ	Max	Unit
Voltage on any pin relative to V_{SS}	$V_T^{(2)}$	-0.5	-	7.0	V
Power Dissipation	P_T	-	-	5.0	W
Storage Temperature	T_{STG}	-65	-	150	°C

Notes : (1) Stresses above those listed may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

(2) V_T can be -3.0V pulse of less than 10ns.

Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	V_{CC}	4.5	5.0	5.5	V
Input High Voltage	V_{IH}	2.2	-	$V_{CC}+0.5$	V
Input Low Voltage	V_{IL}	-0.3	-	0.8	V
Operating Temperature (Commercial)	T_A	0	-	70	°C
(Industrial)	T_{AI}	-40	-	85	°C (Suffix I)
(Military)	T_{AM}	-55	-	125	°C (Suffix M,MB)

DC Electrical Characteristics ($V_{CC}=5V\pm10\%$, $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$)

Parameter	Symbol	Test Condition	Min	Typ	max	Unit
I/P Leakage Current Address, $\overline{OE}$, $\overline{WE}^{(4)}$	I_{LI}	$0V \leq V_{IN} \leq V_{CC}$	-20	-	20	μA
Output Leakage Current	I_{LO}	$\overline{CS} = V_{IH}$, $V_{IO} = \text{GND to } V_{CC}$	-20	-	20	μA
Operating Supply Current 32-bit mode	I_{CC32}	Min. Cycle, $\overline{CS} = V_{IL}$, $f=f_{MAX}$, $I_{OUT} = 0\text{mA}$	-	-	520	mA
32-bit mode	I_{CC32}	Min. Cycle, $\overline{CS} = V_{IL}$, $f=f_{MAX}$, $I_{OUT} = 0\text{mA}$	-	-	600	mA
16-bit mode	I_{CC16}	As Above.	-	-	320	mA
8-bit mode	I_{CC8}	As Above.	-	-	250	mA
Standby Supply Current TTL levels	I_{SB1}	$\overline{CS} = V_{IH}$, $f=f_{MAX}$	-	-	160	mA
CMOS levels	I_{SB2}	$\overline{CS} \geq V_{CC}-0.2V$, $0.2 \leq V_{IN} \leq V_{CC}-0.2V$, $f=0$	-	-	40	mA
-L Version (CMOS)	I_{SB3}	$\overline{CS} \geq V_{CC}-0.2V$, $0.2 \leq V_{IN} \leq V_{CC}-0.2V$, $f=0$	-	-	8	mA
Output Voltage	V_{OL}	$I_{OL} = 8.0\text{mA}$	-	-	0.4	V
	V_{OH}	$I_{OH} = -4.0\text{mA}$	2.4	-	-	V

Notes :

1/ Typical values are at $V_{CC}=5.0V$, $T_A=25^\circ\text{C}$ and specified loading.

2/ $\overline{CS}$ above refers to $\overline{CS}1\sim4$.

3/ At $f=f_{MAX}$ address and data inputs are cycling at maximum frequency.

4/ Also for $\overline{WE}1\sim4$ on the PUMA 68S4000A version.

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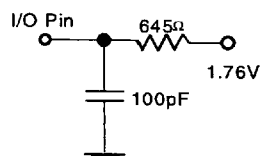
Capacitance ($V_{CC}=5V\pm10\%$, $T_A=25^\circ C$)		Note: Capacitance calculated, not measured.		
Parameter	Symbol	Test Condition	max	Unit
Input Capacitance (Address, $\overline{OE}$, $\overline{WE}^{(1)}$)	C_{IN1}	$V_{IN} = 0V$	30	pF
I/P Capacitance (other)	C_{IN2}	$V_{IN} = 0V$	7	pF
I/O Capacitance	C_{IO}	$V_{IO} = 0V$	38	pF

Notes

1/ Also for $\overline{WE}1\sim4$ on the PUMA 68S4000A version.

AC Test Conditions	Output Load
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- * Input pulse levels: 0V to 3.0V
- * Input rise and fall times: 5ns
- * Input and Output timing reference levels: 1.5V
- * Output load: see diagram
- * $V_{CC}=5V\pm10\%$



Operation Truth Table

$\overline{CS}$	$\overline{OE}$	$\overline{WE}$	DATA PINS	SUPPLY CURRENT	MODE
H	X	X	High Impedance	$I_{SB1}, I_{SB2}, I_{SB3}$	Standby
L	L	H	Data Out	$I_{CC32}, I_{CC16}, I_{CC8}$	Read
L	H	L	Data In	$I_{CC32}, I_{CC16}, I_{CC8}$	Write
L	L	L	Data In	$I_{CC32}, I_{CC16}, I_{CC8}$	Write
L	H	H	High-Impedance	$I_{SB1}, I_{SB2}, I_{SB3}$	High-Z

Notes : H = V_{IH} : L = V_{IL} : X = V_{IH} or V_{IL}

$\overline{CS}$ above refers to $\overline{CS}1\sim4$.

$\overline{WE}1\sim4$ on the PUMA 68S4000A version.

Low V_{CC} Data Retention Characteristics - L Version Only							
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Parameter	Symbol	Test Condition	min	typ ⁽¹⁾	max	Unit
V_{CC} for Data Retention	V_{DR}	$\overline{CS} \geq V_{CC}-0.2V$	2.0	-	-	V
Data Retention Current	$I_{CCDR1}^{(1,2)}$	$V_{CC}=3.0V, \overline{CS} \geq V_{CC}-0.2$	-	-	4	mA
Chip Deselect to Data Retention Time	t_{CDR}	See Retention Waveform	0	-	-	ns
Operation Recovery Time	t_R	See Retention Waveform	t_{RC}	-	-	ms

Notes (1) Typical figures are measured at 25°C.

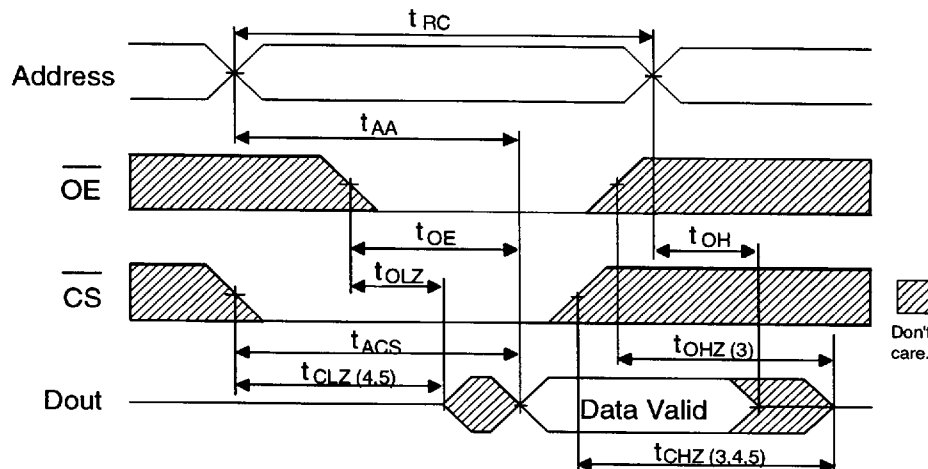
(2) This parameter is guaranteed not tested.

AC OPERATING CONDITIONS**Read Cycle**

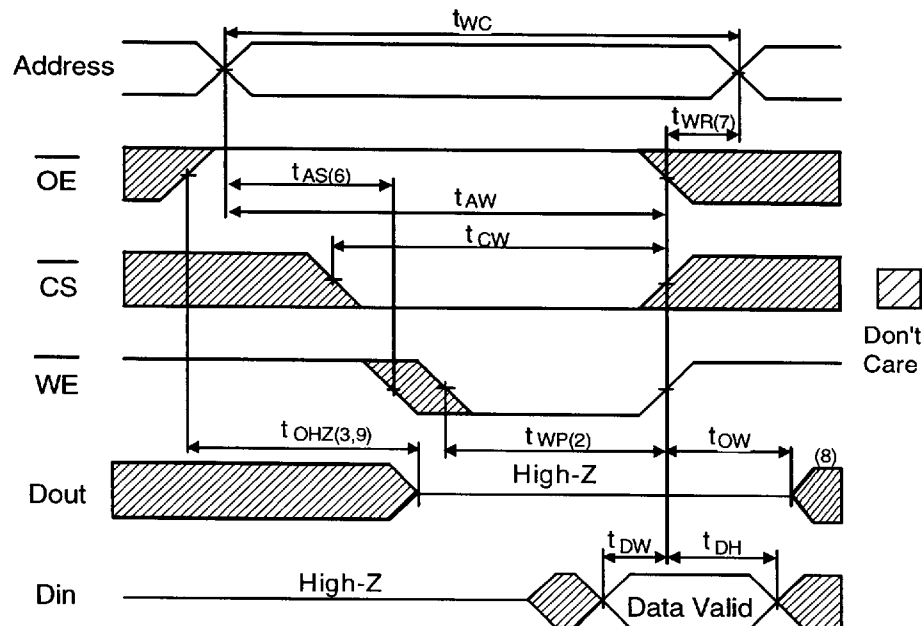
Parameter	Symbol	-020		-025		-35		-45		Unit
		min	max	min	max	min	max	min	max	
Read Cycle Time	t_{RC}	20	-	25	-	35	-	45	-	ns
Address Access Time	t_{AA}	-	20	-	25	-	35	-	45	ns
Chip Select Access Time	t_{ACS}	-	20	-	25	-	35	-	45	ns
Output Enable to Output Valid	t_{OE}	-	9	-	9	-	12	-	15	ns
Output Hold from Address Change	t_{OH}	3	-	3	-	3	-	3	-	ns
Chip Selection to Output in Low Z	t_{CLZ}	3	-	3	-	3	-	3	-	ns
Output Enable to Output in Low Z	t_{OLZ}	0	-	0	-	0	-	0	-	ns
Chip Deselection to O/P in High Z	t_{CHZ}	0	9	0	10	0	12	0	15	ns
Output Disable to Output in High Z	t_{OHZ}	0	7	0	10	0	12	0	15	ns

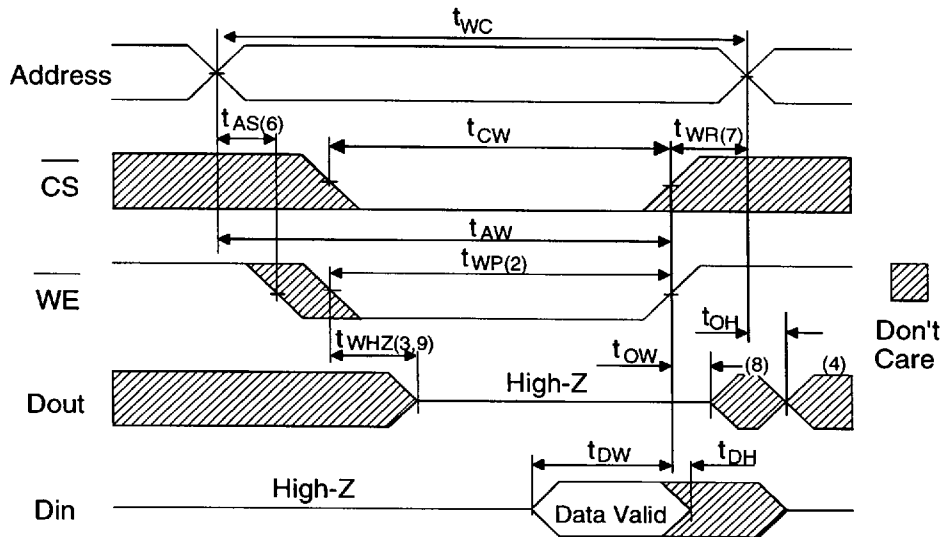
Write Cycle

Parameter	Symbol	-020		-025		-35		-45		Unit
		min	max	min	max	min	max	min	max	
Write Cycle Time	t_{WC}	20	-	25	-	35	-	45	-	ns
Chip Selection to End of Write	t_{CW}	15	-	20	-	25	-	35	-	ns
Address Valid to End of Write	t_{AW}	15	-	20	-	25	-	35	-	ns
Address Setup Time	t_{AS}	0	-	0	-	0	-	0	-	ns
Write Pulse Width	t_{WP}	12	-	15	-	17	-	20	-	ns
Write Recovery Time	t_{WR}	0	-	0	-	0	-	0	-	ns
Write to Output in High Z	t_{WHZ}	0	10	0	12	0	15	0	15	ns
Data to Write Time Overlap	t_{DW}	10	-	12	-	15	-	15	-	ns
Data Hold from Write Time	t_{DH}	0	-	0	-	0	-	0	-	ns
Output active from end of write	t_{OW}	2	-	2	-	2	-	2	-	ns

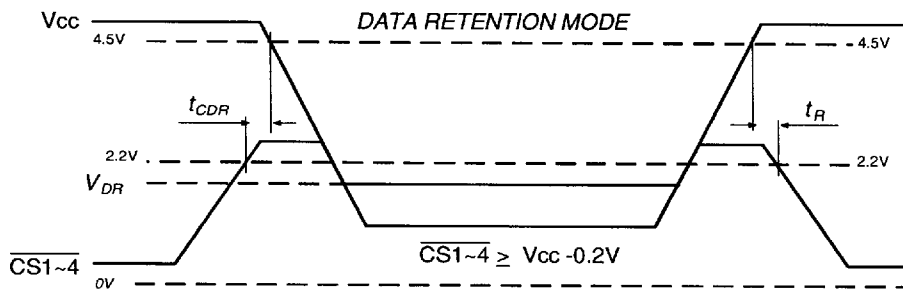
Read Cycle Timing Waveform^(1,2)**AC Read Characteristics Notes**

- (1) $\overline{WE}$ is High for Read Cycle.
- (2) All read cycle timing is referenced from the last valid address to the first transition address.
- (3) t_{CHZ} and t_{OHZ} are defined as the time at which the outputs achieve open circuit conditions and are not referenced to output voltage levels.
- (4) At any given temperature and voltage condition, $t_{CHZ}(\text{max})$ is less than $t_{CLZ}(\text{min})$ both for a given module and from module to module.
- (5) These parameters are sampled and not 100% tested.

Write Cycle No.1 Timing Waveform^(1,4)

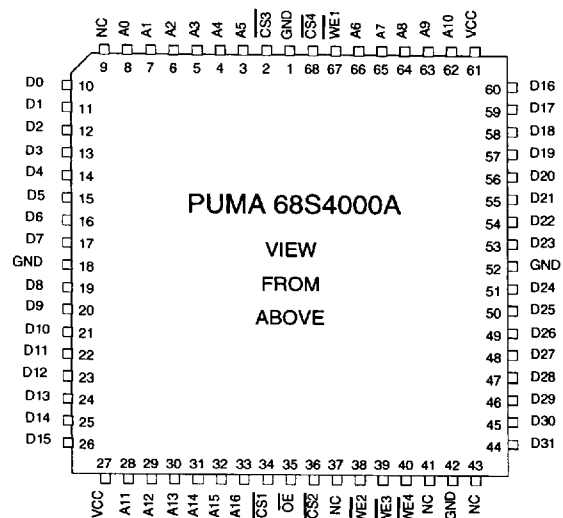
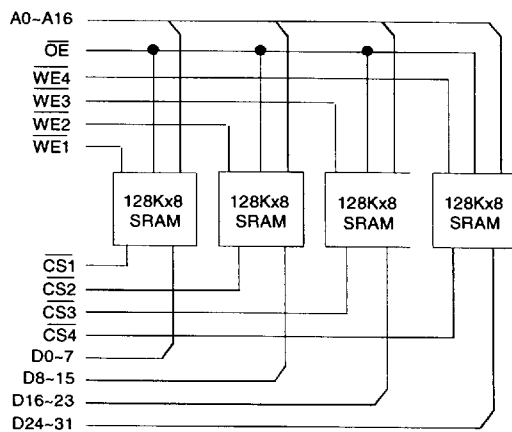
Write Cycle No.2 Timing Waveform ^(1,5)**AC Write Characteristics Notes**

- (1) All write cycle timing is referenced from the last valid address to the first transition address.
- (2) All writes occur during the overlap of $\overline{CS}$ and $\overline{WE}$ low.
- (3) If $\overline{OE}$, $\overline{CS}$, and $\overline{WE}$ are in the Read mode during this period, the I/O pins are low impedance state. Inputs of opposite phase to the output must not be applied because bus contention can occur.
- (4) Dout is the Read data of the new address.
- (5) $\overline{OE}$ is continuously low.
- (6) Address is valid prior to or coincident with $\overline{CS}$ and $\overline{WE}$ low, too avoid inadvertant writes.
- (7) $\overline{CS}$ or $\overline{WE}$ must be high during address transitions.
- (8) When $\overline{CS}$ are low : I/O pins are in the output state. Input signals of opposite phase leading to the output should not be applied.
- (9) Defined as the time at which the outputs achieve open circuit conditions and are not referenced to output voltage levels. These parameters are sampled and not 100% tested.

Data Retention Waveform

Block Diagram 'A' version

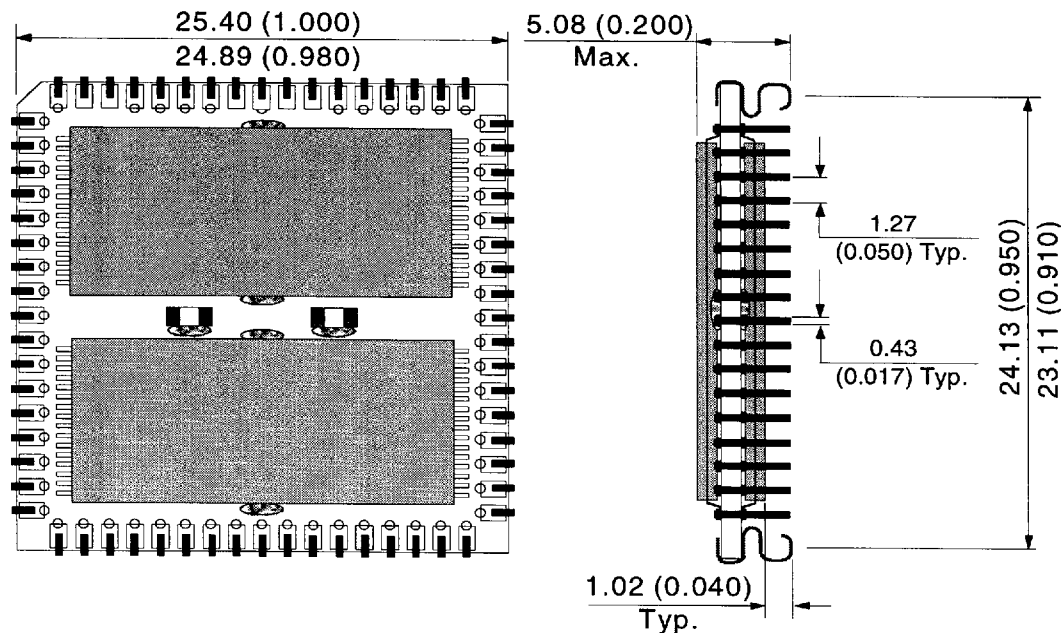
Pin Definition 'A' version



SCREENING**Military Screening Procedure**

Screening Flow for high reliability product is in accordance with Mil-883 method 5004 .

MB MODULE SCREENING FLOW		
SCREEN	TEST METHOD	LEVEL
Visual and Mechanical Temperature cycle	1010 Condition B (10 Cycles, -55°C to +125°C)	100%
Burn-In Pre-Burn-in electrical Burn-in	Per applicable device specifications at $T_A=+25^\circ\text{C}$ $T_A=+125^\circ\text{C}$, 160hrs minimum.	100% 100%
Final Electrical Tests Static (DC) Functional Switching (AC)	Per applicable Device Specification a) @ $T_A=+25^\circ\text{C}$ and power supply extremes b) @ temperature and power supply extremes a) @ $T_A=+25^\circ\text{C}$ and power supply extremes b) @ temperature and power supply extremes a) @ $T_A=+25^\circ\text{C}$ and power supply extremes b) @ temperature and power supply extremes	100% 100% 100% 100% 100% 100%
External Visual	2009 Per vendor or customer specification	100%

Package Information Dimensions in mm(inches)**Plastic 68 Pin JEDEC Surface mount PLCC**

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Ordering Information

PUMA 68S4000ALMB-020

					Speed	020 = 20 ns
						025 = 25 ns
						35 = 35 ns
						45 = 45 ns
					Temp. range/screening	Blank = Commercial Temperature
						I = Industrial Temperature
						M = Military Temperature
						MB = Screened in accordance with MIL STD-883
					Power Consumption	Blank = Standard
						L = Low Power
					$\overline{WE}$ Option	Blank = Single $\overline{WE}$ option
						A = Four $\overline{WE}$ option
					Memory Organisation	S4000 = 128K x 32 SRAM
						configurable as 256K x 16 and 512K x 8
					Package	PUMA 68 = 68 pin "J" Leadless PLCC