



# 128K x 32 SRAM MODULE

## PUMA 68S4000/A - 020/025/35/45

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Issue 4.5 : April 2001

### Description

The PUMA68S4000/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 (CS1-4).

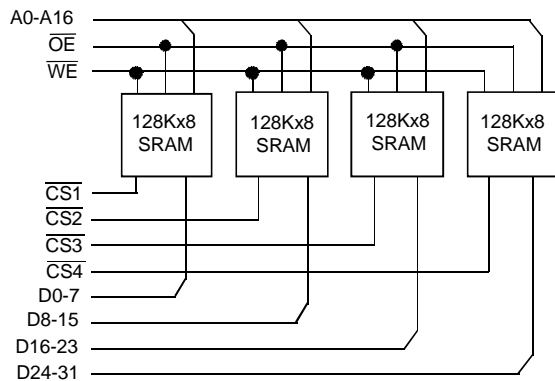
The device features multiple ground pins for maximum noise immunity and TTL compatible inputs and outputs. The PUMA 68S4000/A offers a dramatic space saving advantage over four standard 128Kx8 devices.

### Features

- Fast Access Times of 20 ,25, 35 and 45 ns.
- JEDEC 68 'J' leaded plastic surface mount Substrate
- Industrial or Military Grade.
- Upgradeable footprint.
- User Configurable as 8 / 16 / 32 bit wide output.
- Operating Power (32-BIT) 4.00 W (Max)  
Low Power Standby (TTL) 1.43 W (Max)
- Fully Static operation.
- Multiple ground pins for maximum noise immunity.
- Single 5V±10% Power supply.

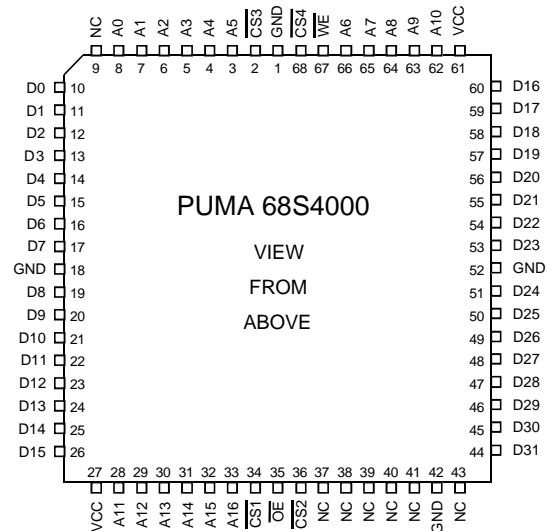
### Block Diagram

(PUMA 68 S4000A page 2)



### Pin Definition

(PUMA 68 S4000A page 2)



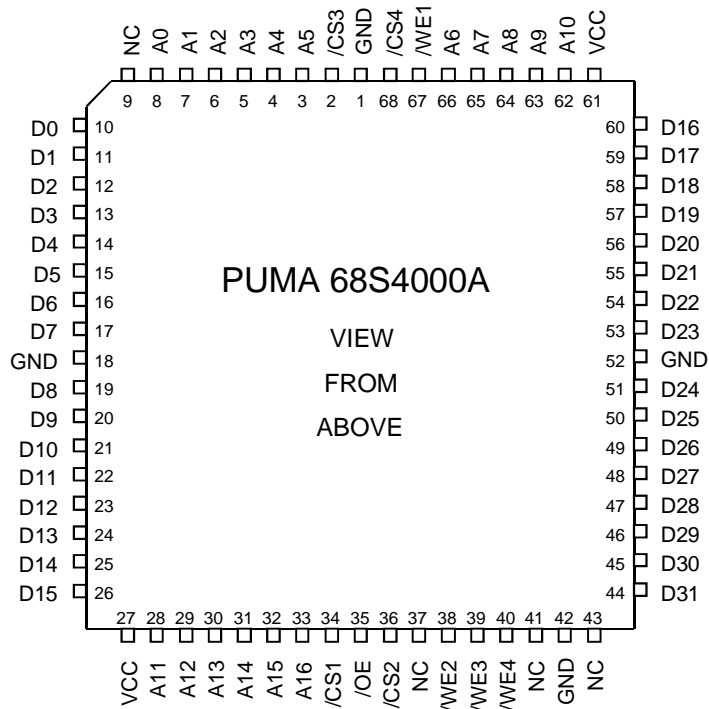
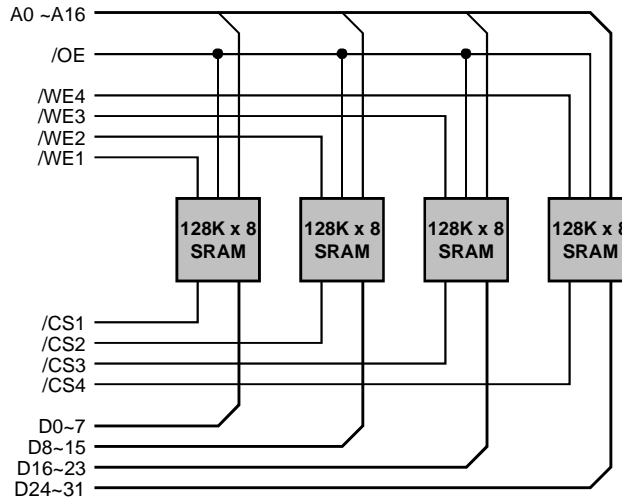
### Pin Functions

Address Inputs	<b>A0 - A16</b>
Data Input/Output	<b>D0 - D31</b>
Chip Select	<b>CS1-4</b>
Write Enable	<b>WE1-4</b>
Output Enable	<b>OE</b>
No Connect	<b>NC</b>
Power (+5V)	<b>V<sub>CC</sub></b>
Ground	<b>GND</b>

### Package Details

Plastic 68 J-Leaded JEDEC PLCC

**PUMA 68 S4000A Pinout and Block Diagram.**



**DC OPERATING CONDITIONS****Absolute Maximum Ratings**<sup>(1)</sup>

<i>Parameter</i>	<i>Symbol</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
Voltage on any pin relative to $V_{SS}$	$V_T^{(2)}$	-0.3	-	7.0	V
Power Dissipation	$P_T$	-	-	4.0	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.

**Recommended Operating Conditions**

<i>Parameter</i>	<i>Symbol</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
Supply Voltage	$V_{CC}$	4.5	5.0	5.5	V
Input High Voltage	$V_{IH}$	2.2	-	$V_{CC}+0.3$	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)

**DC Electrical Characteristics** ( $V_{CC}=5V\pm 10\%$ ,  $T_A = -55^\circ\text{C}$  to  $+125^\circ\text{C}$ )

<i>Parameter</i>	<i>Symbol</i>	<i>Test Condition</i>	<i>Min</i>	<i>Typ</i>	<i>max</i>	<i>Unit</i>
Input Leakage Current	$I_{LI1}$	$V_{IN}=0V$ to $V_{CC}$	-20	-	20	$\mu\text{A}$
Output Leakage Current	$I_{LO}$	$V_{I/O}=0V$ to $V_{CC}$	-40	-	40	$\mu\text{A}$
Operating Supply Current <sup>(2)</sup>	32 bit $I_{CC32}$	$\overline{CS}^{(1)}=V_{IL}$ , $I_{I/O}=0\text{mA}$ , $f=f_{max}$	-	-	840	mA
	16 bit $I_{CC16}$	As above.	-	-	540	mA
	8 bit $I_{CC8}$	As above.	-	-	400	mA
Standby Supply Current (TTL)	$I_{SB}$	$\overline{CS}^{(1)}=V_{IH}$ , $f=f_{max}$ , $V_{IN}=V_{IL}$ or $V_{IH}$	-	-	260	mA
Output Voltage Low	$V_{OL}$	$I_{OL} = 8.0\text{mA}$ , $V_{CC}=\text{Min}$	-	-	0.4	V
Output Voltage High	$V_{OH}$	$I_{OH} = -4.0\text{mA}$ , $V_{CC}=\text{Min}$	2.4	-	-	V

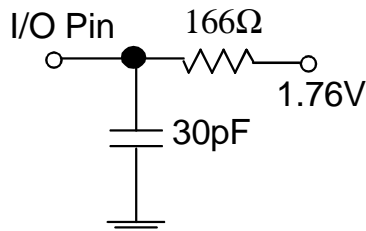
Notes: (1) CS1~4 inputs operate simultaneously for 32 bit mode, in pairs for 16 bit mode and singly for 8 bit mode.

(2) At  $f=f_{max}$  address and data inputs are cycling at max frequency.

<b>Capacitance</b> ( $V_{CC}=5V\pm 10\%$ , $T_A=25^\circ C$ )		Note: Capacitance calculated, not measured.				
<i>Parameter</i>	<i>Symbol</i>	<i>Test Condition</i>	<i>min</i>	<i>typ</i>	<i>max</i>	<i>Unit</i>
Input Capacitance Address, $\overline{OE}$ , $\overline{WE}$	$C_{IN1}$	$V_{IN}=0V$	-	-	34	pF
Output Capacitance 8-bit mode (worst case)	$C_{IO}$	$V_{IO}=0V$	-	-	42	pF

**AC Test Conditions** **Output Load**

- \* Input pulse levels: 0V to 3.0V
- \* Input rise and fall times: 3ns
- \* Input and Output timing reference levels: 1.5V
- \* Output load: see diagram
- \*  $V_{CC}=5V\pm 10\%$



**Operation Truth Table**

$\overline{CS1}$	$\overline{CS2}$	$\overline{CS3}$	$\overline{CS4}$	$\overline{OE}$	$\overline{WE}$	<b>SUPPLY CURRENT</b>	<b>MODE</b>
L	H	H	H	X	L	$I_{CC8}$	Write D0-7
H	L	H	H	X	L	$I_{CC8}$	Write D8-15
H	H	L	H	X	L	$I_{CC8}$	Write D16-23
H	H	H	L	X	L	$I_{CC8}$	Write D24-31
L	L	H	H	X	L	$I_{CC16}$	Write D0-15
H	H	L	L	X	L	$I_{CC16}$	Write D16-31
L	L	L	L	X	L	$I_{CC32}$	Write D0-31
L	H	H	H	L	H	$I_{CC8}$	Read D0-7
H	L	H	H	L	H	$I_{CC8}$	Read D8-15
H	H	L	H	L	H	$I_{CC8}$	Read D16-23
H	H	H	L	L	H	$I_{CC8}$	Read D24-31
L	L	H	H	L	H	$I_{CC16}$	Read D0-15
H	H	L	L	L	H	$I_{CC16}$	Read D16-31
L	L	L	L	L	H	$I_{CC32}$	Read D0-31
X	X	X	X	H	H	$I_{CC32}/I_{CC16}/I_{CC8}$	D0-31 High-Z
H	H	H	H	X	X	$I_{SB}, I_{SB1}$	D0-31 Standby

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

## AC OPERATING CONDITIONS

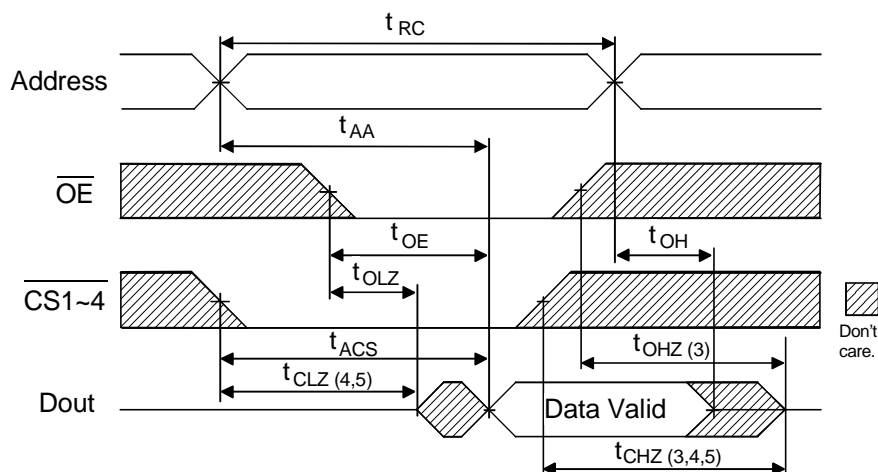
### Read Cycle

<i>Parameter</i>	<i>Symbol</i>	<i>-020</i>		<i>-025</i>		<i>-35</i>		<i>-45</i>		<i>Unit</i>
		<i>min</i>	<i>max</i>	<i>min</i>	<i>max</i>	<i>min</i>	<i>max</i>	<i>min</i>	<i>max</i>	
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	$t_{OE}$	-	10	-	12	-	15	-	17	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	8	0	10	0	12	0	15	ns

### Write Cycle

<i>Parameter</i>	<i>Symbol</i>	<i>-020</i>		<i>-025</i>		<i>-35</i>		<i>-45</i>		<i>Unit</i>
		<i>min</i>	<i>max</i>	<i>min</i>	<i>max</i>	<i>min</i>	<i>max</i>	<i>min</i>	<i>max</i>	
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	$t_{OW}$	3	-	3	-	3	-	3	-	ns

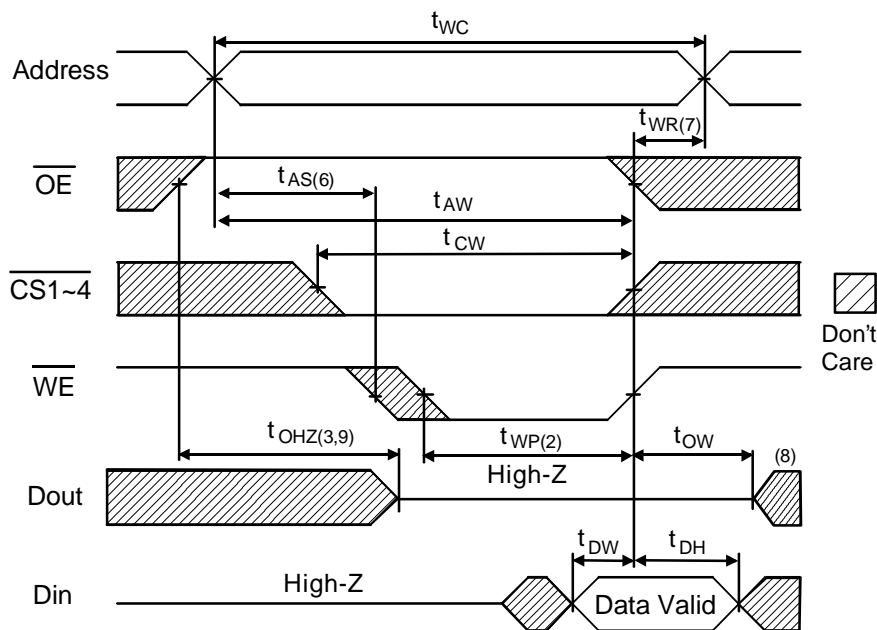
**Read Cycle Timing Waveform** <sup>(1,2)</sup>



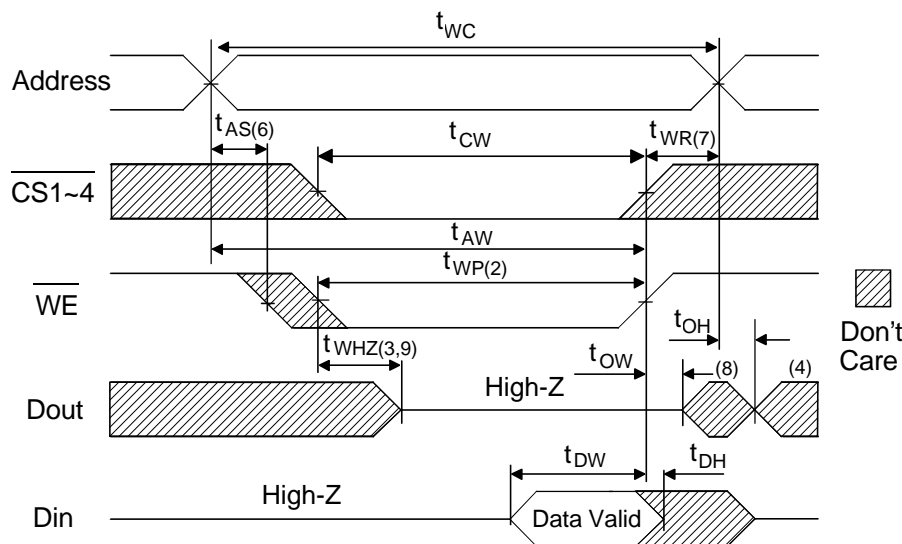
**AC Read Characteristics Notes**

- (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,  $t_{CHZ}$  (max) is less than  $t_{CLZ}$  (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** <sup>(1,4)</sup>



**Write Cycle No.2 Timing Waveform <sup>(1,5)</sup>**

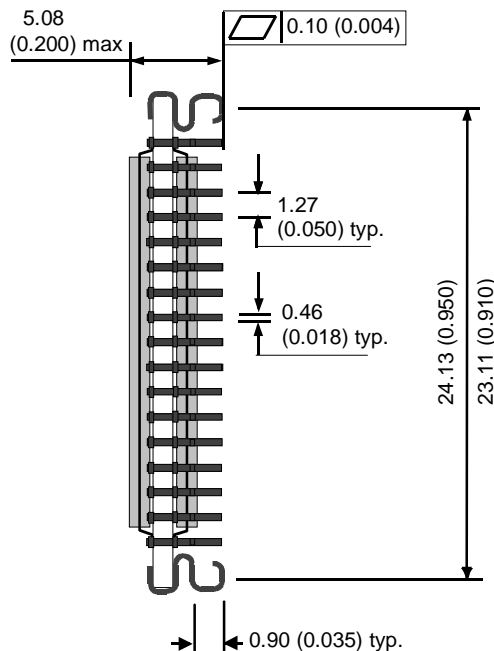
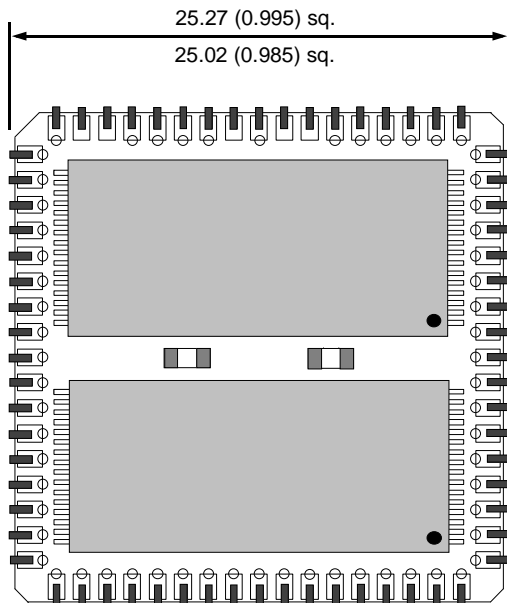


**AC Write Characteristics Notes**

- (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 CS1~4 and WE low.
- (3) If  $\overline{OE}$ , CS1~4, and 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 CS1~4 and WE low, too avoid inadvertant writes.
- (7) CS1~4 or WE must be high during address transitions.
- (8) When CS1~4 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.

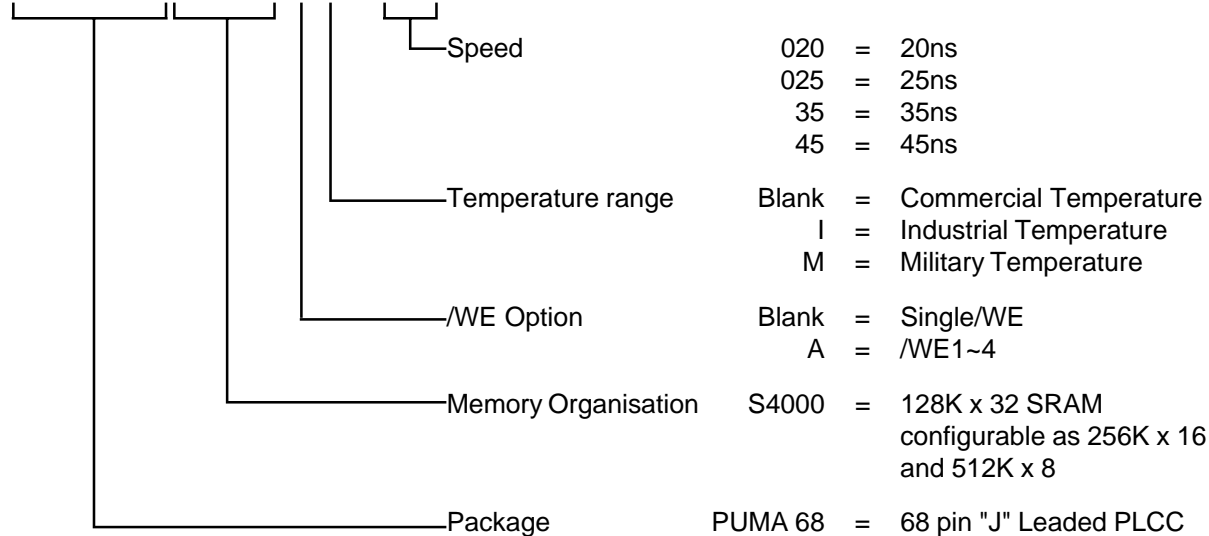
**Package Information**    Dimensions in mm( inches)

**Plastic 68 Pin JEDEC Surface mount PLCC**



**Ordering Information**

**PUMA 68S4000/AM - 020**



**Note :**

Although this data is believed to be accurate the information contained herein is not intended to and does not create any warranty of merchantability or fitness for a particular purpose. Our products are subject to a constant process of development. Data may be changed without notice. Products are not authorised for use as critical components in life support devices without the express written approval of a company director.

## Visual Inspection Standard

All devices inspected to ANSI/J-STD-001B Class 2 standard

## Moisture Sensitivity

Devices are **moisture sensitive**.

Shelf Life in Sealed Bag 12 months at <40°C and <90% relative humidity (RH).

After this bag has been opened, devices that will be subjected to infrared reflow, vapour phase reflow, or equivalent processing (peak package body temp 220°C) **must be** :

A : Mounted within 72 Hours at factory conditions of <30°C/60% RH

**OR**

B : Stored at <20% RH

If these conditions are not met or indicator card is >20% when read at 23°C +/-5% devices **require baking** as specified below.

If baking is required, devices may be baked for :-

A : 24 hours at 125°C +/-5% for high temperature device containers

**OR**

B : 192 hours at 40°C +5°C/-0°C and <5% RH for low temperature device containers.

## Packaging Standard

Devices packaged in dry nitrogen, JED-STD-020.

Packaged in trays as standard.

Tape and reel available for shipment quantities exceeding 200pcs upon request.

## Soldering Recommendations

IR/Convection -	Ramp Rate	6°C/sec max.
	Temp. exceeding 183°C	150 secs. max.
	Peak Temperature	225°C
	Time within 5°C of peak	20 secs max.
	Ramp down	6°C/sec max.
Vapour Phase -	Ramp up rate	6°C/sec max.
	Peak Temperature	215 - 219°C
	Time within 5°C of peak	60 secs max.
	Ramp down	6°C/sec max.

The above conditions must not be exceeded.

*Note : The above recommendations are based on standard industry practice. Failure to comply with the above recommendations invalidates product warranty.*