



512K x 32 SRAM MODULE

PUMA 2/77S16000/A - 020/025/35

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Issue 4.4 : April 2001

Description

Available in PGA (PUMA 2) and Gullwing (PUMA 77) footprints, the PUMA **S16000 is a 16 MBit SRAM module user configurable as 512K x 32, 1M x 16 or 2M x 8. The device is available with fast access times of 20,25 and 30ns. A low power standby and Data Retention mode is available. The device may be screened in accordance with MIL-STD-883.

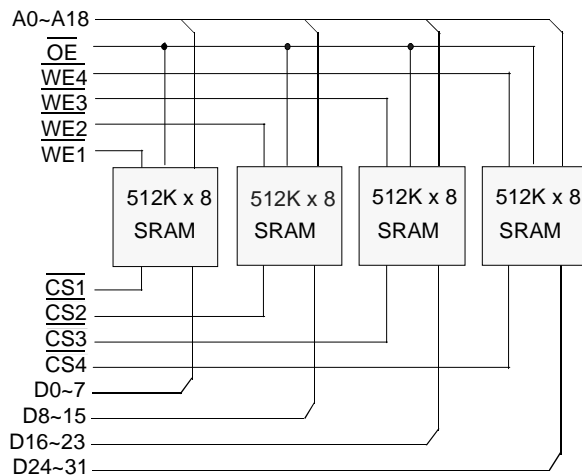
16,777,216 bit CMOS High Speed Static RAM

Features

- 16MBit Fast SRAM Module.
- Fast Access times of 20/25/35ns.
- Configurable as 8 / 16 / 32 bit wide output.
- Operating Power 1980 / 2640 / 3960 mW (max).
- Standby TTL 1320mW (max).
- Single 5V±10% Power supply.
- TTL compatible inputs and outputs.
- May be screened in accordance with MIL-STD-883.
- PUMA 2 - 66 pin ceramic PGA
- PUMA77 - 68 pin ceramic Gullwing

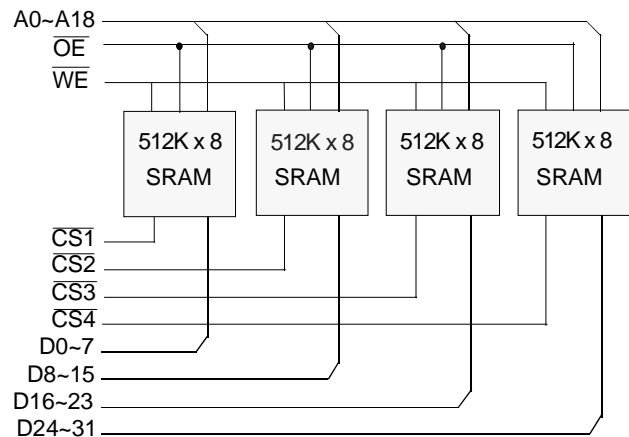
Block Diagram

PUMA 2S16000 and 77S16000A, 77S16000B



Block Diagram

PUMA 77S16000



Pin Functions

A0~A18	Address Inputs	D0~D31	Data Inputs/Outputs
CS1~4	Chip Select	OE	Output Enable
WE1~4	Write Enable	NC	No Connect
V_{cc}	Power (+5V)	GND	Ground

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

Voltage on any pin relative to V_{SS} ⁽²⁾	V_T	-0.5V to +7.0	V
Power Dissipation	P_D	4	W
Storage Temperature	T_{STG}	-55 to +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 these 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

Parameter	Symbol	min	typ	max	units
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}	-0.5	-	0.8	V
Operating Temperature	T_A	0	-	70	°C
	T_{AI}	-40	-	85	°C (Suffix I)
	T_{AM}	-55	-	125	°C (Suffix M, MB)

Parameter	Symbol	Test Condition	min	typ ⁽¹⁾	max	Unit
Input Leakage Current	Address, \overline{OE}	I_{L1}	$V_{IN} = 0V$ to V_{CC}	-8	-	8 μA
	\overline{WE} , \overline{CS}	I_{L2}	$V_{IN} = 0V$ to V_{CC}	-2	-	2 μA
Output Leakage Current		I_{LO}	$\overline{CS}^{(2)} = V_{IH}$ or $\overline{OE} = V_{IH}$, $V_{IO} = 0V$ to V_{CC}	-8	-	8 μA
Average Supply Current	32 bit	I_{CC32}	$\overline{WE}^{(2)} = V_{IL}$	-	-	720 mA
			$\overline{CS}^{(2)} = V_{IL}$, Minimum cycle, $I_{IO} = 0mA$	-	-	480 mA
	16 bit	I_{CC16}	As above	-	-	360 mA
	8 bit	I_{CC8}	As above	-	-	240 mA
Standby Supply Current	TTL levels	I_{SB}	$\overline{CS}^{(2)} = V_{IH}$, $V_{CC} = 5.5V$	-	-	240 mA
Output Voltage Low		V_{OL}	$I_{OL} = 8.0 mA$	-	-	0.4 V
Output Voltage High		V_{OH}	$I_{OH} = -4.0 mA$	2.4	-	- V

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

(2) \overline{CS} and \overline{WE} above are accessed through $\overline{CS}1\sim4$ and $\overline{WE}1\sim4$ respectively. These inputs must be operated simultaneously for 32 bit mode, in pairs for 16 bit mode and singly for 8 bit mode.

Capacitance ($V_{CC}=5V\pm 10\%$, $T_A=25^\circ C$) Note: These parameters are calculated and not measured.

Parameter	Symbol	Test Condition	typ	max	Unit
Input Capacitance Address, \overline{OE}	C_{IN1}	$V_{IN}=0V$	-	34	pF
	C_{IN2}	$V_{IN}=0V$	-	6	pF
I/O Capacitance	$C_{I/O}$	$V_{I/O}=0V$	-	42	pF (8 bit mode)

Operating Modes

The Table below shows the logic inputs required to control the operating modes of each of the SRAMs on the device.

Mode	\overline{CS}	\overline{OE}	\overline{WE}	V_{CC} Current	I/O Pin	Reference Cycle
Not Selected	1	X	X	I_{SB1}, I_{SB2}	High Z	Power Down
Output Disable	0	1	1	I_{CC}	High Z	
Read	0	0	1	I_{CC}	D_{OUT}	Read cycle
Write	0	X	0	I_{CC}	D_{IN}	Write Cycle

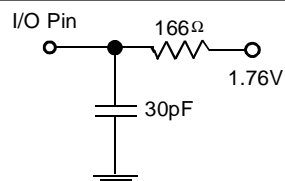
1 = V_{IH} ,
 0 = V_{IL} ,
 X = Don't Care

Note: \overline{CS} above is accessed through $\overline{CS1-4}$ and \overline{WE} is accessed through $\overline{WE1-4}$. For correct operation, $\overline{CS1-4}$ and $\overline{WE1-4}$ must operate simultaneously for 32 bit operation, in pairs for 16 bit operation, or singly for 8 bit operation.

AC Test Conditions

- *Input pulse levels: 0.0V to 3.0V
- *Input rise and fall times: 3 ns
- *Input and Output timing reference levels: 1.5V
- * $V_{CC}=5V\pm 10\%$
- *PUMA module is tested in 32 bit mode.

Output Load



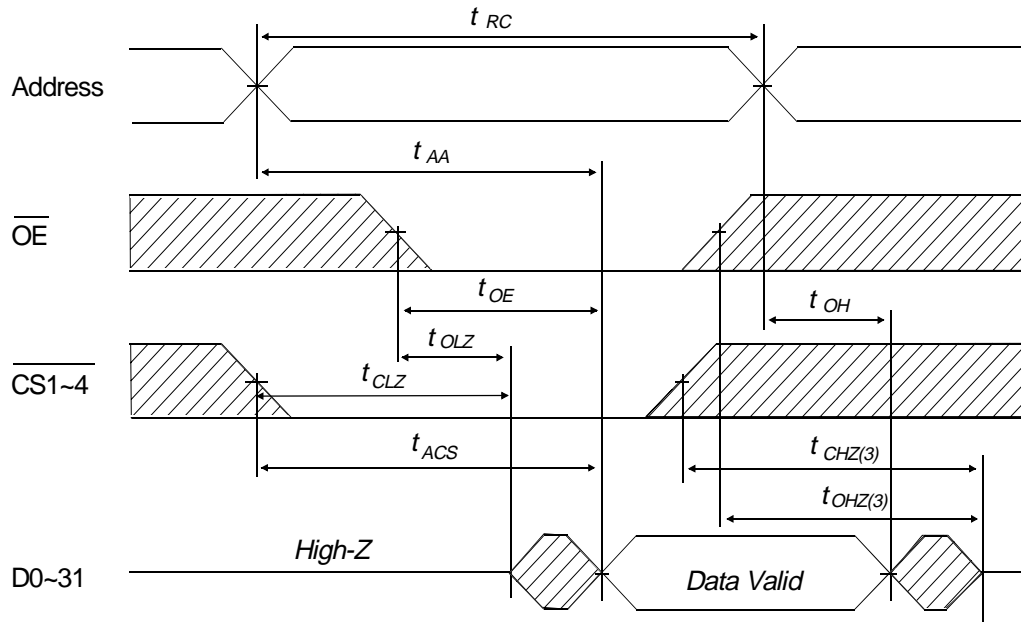
AC OPERATING CONDITIONS**Read Cycle**

<i>Parameter</i>	<i>Symbol</i>	<i>020</i>		<i>025</i>		<i>35</i>		<i>Units</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	-	ns
Address Access Time	t_{AA}	-	20	-	25	-	35	ns
Chip Select Access Time	t_{ACS}	-	20	-	25	-	35	ns
Output Enable to Output Valid	t_{OE}	-	10	-	15	-	15	ns
Output Hold from Address Change	t_{OH}	5	-	5	-	5	-	ns
Chip Selection to Output in Low Z	t_{CLZ}	5	-	5	-	5	-	ns
Output Enable to Output in Low Z	t_{OLZ}	5	-	0	-	0	-	ns
Chip Deselection to Output in High Z ⁽³⁾	t_{CHZ}	-	10	0	10	0	10	ns
Output Disable to Output in High Z ⁽³⁾	t_{OHZ}	0	10	0	10	0	10	ns

Write Cycle

<i>Parameter</i>	<i>Symbol</i>	<i>020</i>		<i>025</i>		<i>35</i>		<i>Unit</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	-	ns
Chip Selection to End of Write	t_{CW}	15	-	15	-	15	-	ns
Address Valid to End of Write	t_{AW}	15	-	15	-	15	-	ns
Address Setup Time	t_{AS}	0	-	0	-	0	-	ns
Write Pulse Width	t_{WP}	15	-	15	-	15	-	ns
Write Recovery Time	t_{WR}	0	-	0	-	0	-	ns
Write to Output in High Z	t_{WHZ}	0	10	0	10	0	10	ns
Data to Write Time Overlap	t_{DW}	10	-	10	-	10	-	ns
Data Hold from Write Time	t_{DH}	0	-	0	-	0	-	ns
Output Active from End of Write	t_{OW}	5	-	5	-	5	-	ns

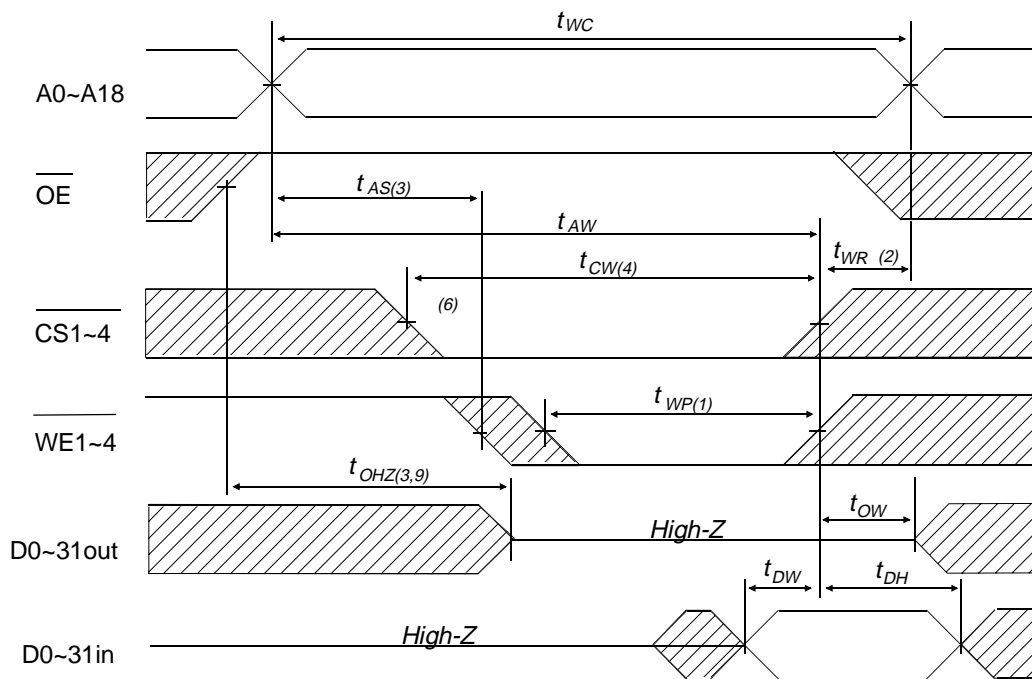
Read Cycle Timing Waveform^(1,2)



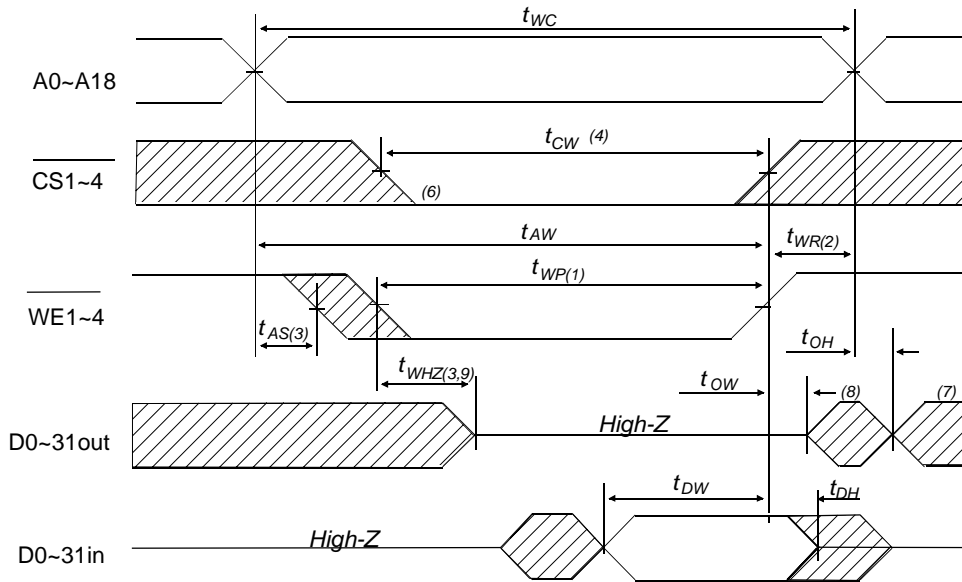
Notes:

- (1) During the Read Cycle, \overline{WE} is high for the module.
- (2) Address valid prior to or coincident with \overline{CS} transition Low.
- (3) t_{CHZ} 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. These parameters are sampled and not 100% tested.

Write Cycle No.1 Timing Waveform



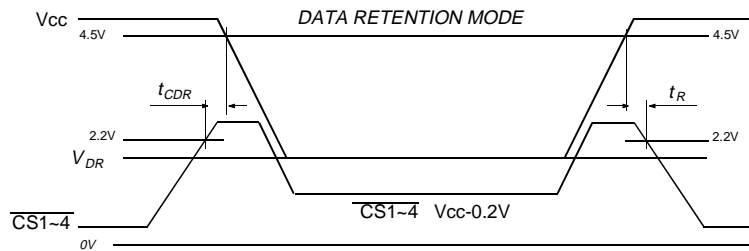
Write Cycle No.2 Timing Waveform ⁽⁵⁾



AC Characteristics Notes

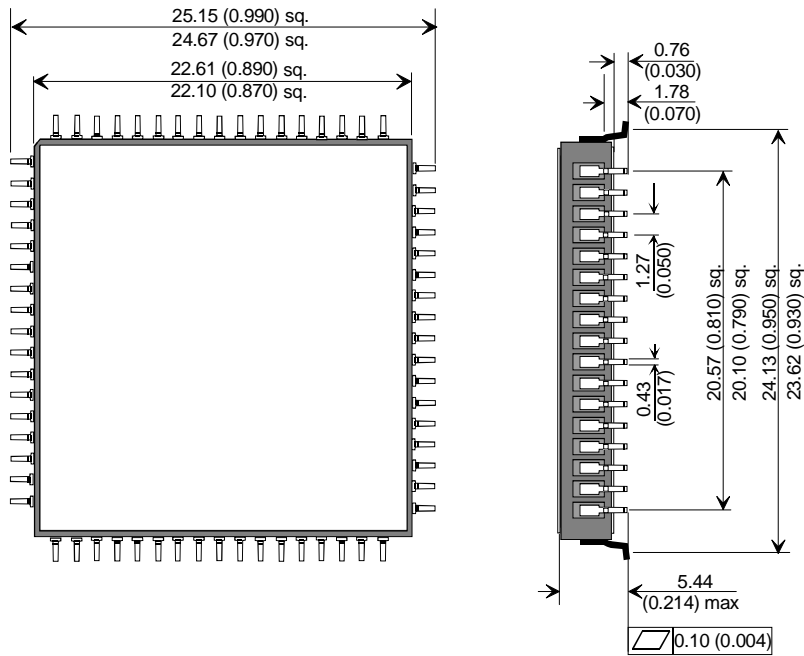
- (1) A write occurs during the overlap (t_{WP}) of a low \overline{CS} and a low \overline{WE} .
- (2) t_{WR} is measured from the earlier of \overline{CS} or \overline{WE} going high to the end of write cycle.
- (3) During this period, I/O pins are in the output state. Input signals out of phase must not be applied.
- (4) If the \overline{CS} low transition occurs simultaneously with the \overline{WE} low transition or after the \overline{WE} low transition, outputs remain in a high impedance state.
- (5) \overline{OE} is continuously low. ($\overline{OE}=V_{IL}$)
- (6) D_{OUT} is in the same phase as written data of this write cycle.
- (7) D_{OUT} is the read data of next address.
- (8) If \overline{CS} is low during this period, I/O pins are in the output state. Input signals out of phase must not be applied.
- (9) t_{WHZ} 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. These parameters are sampled and not 100% tested.

Low V_{CC} Data Retention Timing Waveform

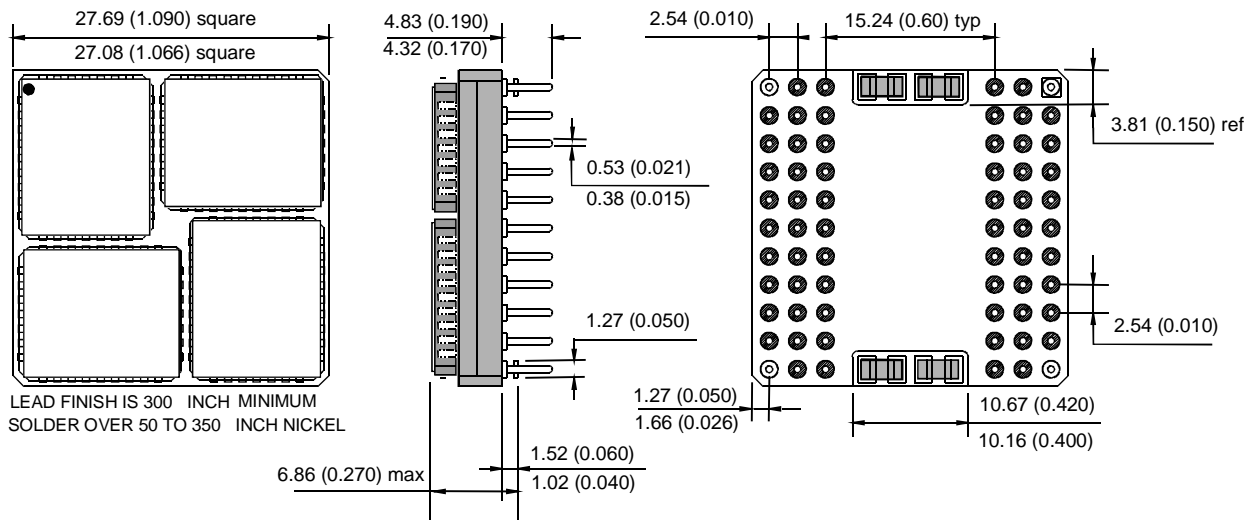


Package Details

PUMA 77S16000

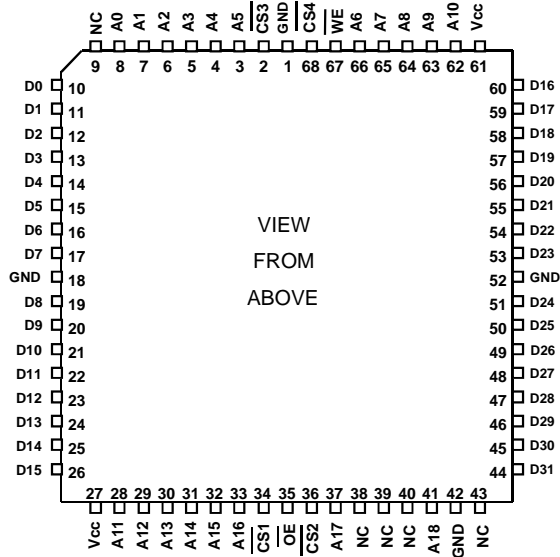


PUMA 2S16000

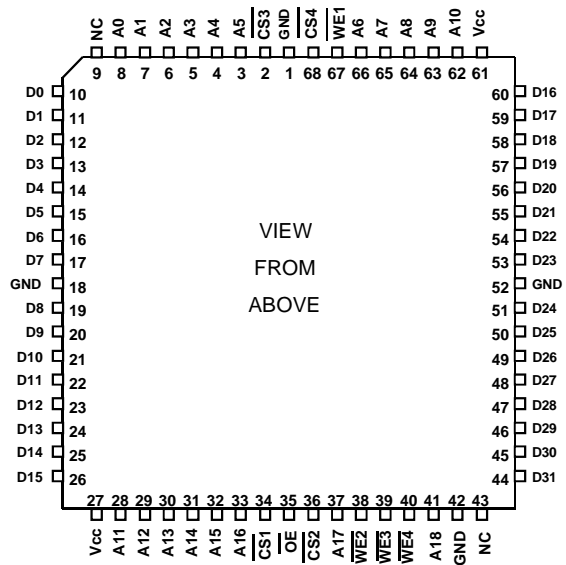


Pin Definitions

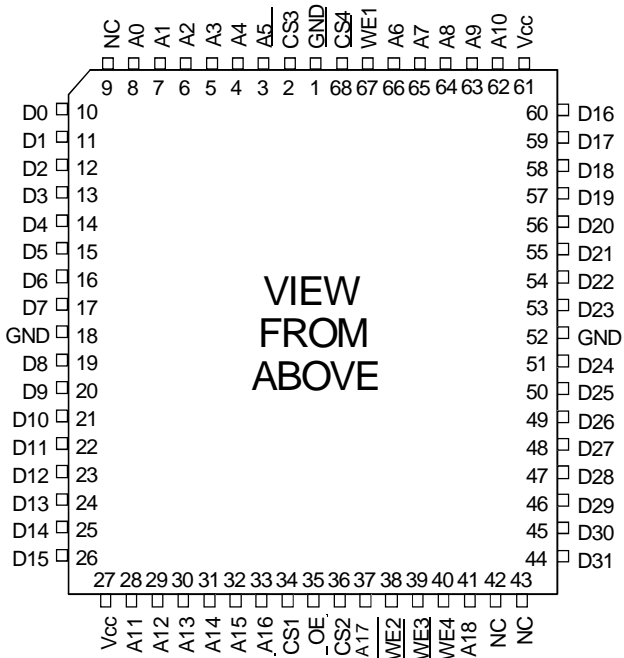
PUMA 77S16000



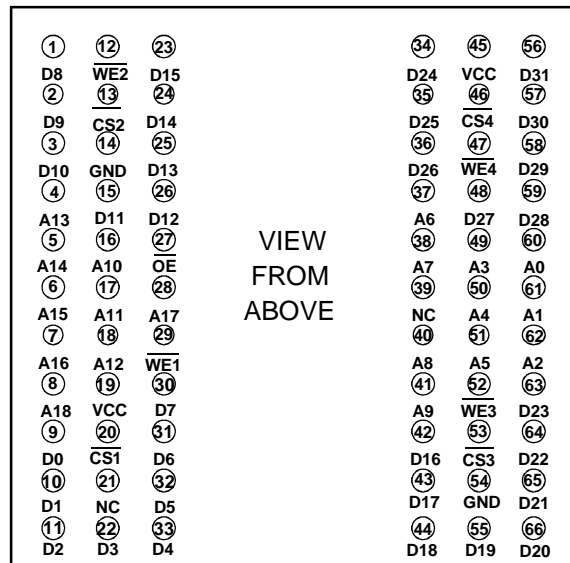
PUMA 77S16000A



PUMA 77S16000B



PUMA 2S16000



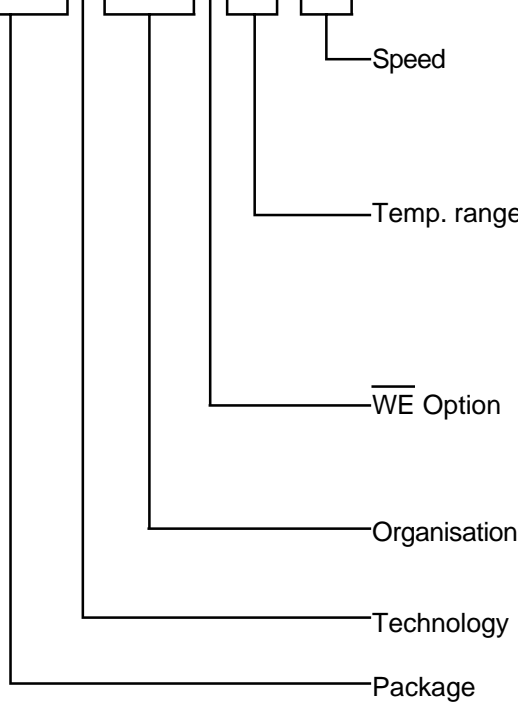
Military Screening Procedure

MultiChip Screening Flow for high reliability product in accordance with Mil-883 method 5004 shown below

MB MULTICHIP MODULE SCREENING FLOW		
SCREEN	TEST METHOD	LEVEL
Visual and Mechanical Internal visual Temperature cycle Constant acceleration	2017 Condition B or manufacturers equivalent 1010 Condition B (10 Cycles,-55°C to +125°C) 2001 Condition E (Y ₁ only) (10,000g)	100% 100% 100%
Burn-In Pre-Burn-in electrical Burn-in	Per applicable device specifications at T _A =+25°C Method 1015,Condition D,T _A =+125°C,160hrs min	100% 100%
Final Electrical Tests Static (dc) Functional Switching (ac)	Per applicable Device Specification a) @ T _A =+25°C and power supply extremes b) @ temperature and power supply extremes a) @ T _A =+25°C and power supply extremes b) @ temperature and power supply extremes a) @ T _A =+25°C and power supply extremes b) @ temperature and power supply extremes	100% 100% 100% 100% 100% 100%
Percent Defective allowable (PDA)	Calculated at post burn-in at T _A =+25°C	10%
Hermeticity Fine Gross	1014 Condition A Condition C	100% 100%
Quality Conformance	Per applicable Device Specification	Sample
External Visual	2009 Per vendor or customer specification	100%

Ordering Information

PUMA 2S16000AMB-020



- 020 = 20 ns
- 025 = 25 ns
- 35 = 35 ns
- Blank = Commercial Temperature
- I = Industrial Temperature
- M = Military Temperature
- MB = processed in accordance with MIL-STD-883
- Blank = Single WE (PUMA 77 only)
- WE1~4 (PUMA 2 only)
- A = WE1~4 (PUMA 77 only)
- B = Pinout variant
- 16000 = 512Kx 32, user configurable as 1M x 16 and 2M x 8
- S = SRAM MEMORY
- PUMA 2 = JEDEC 66 Pin Ceramic PGA package
- PUMA 77 = JEDEC 68 Leaded Gull Wing Ceramic Surface Mount package

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 at any time without notice.

Products are not authorised for use as critical components in life support devices without the express written approval of a company director.