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128K x 32 SRAM MODULE

PUMA 2S4000-70/85/10/12

Issue 4.1 : June 1996

Description

The PUMA2S4000 is a 4Mbit static RAM organised as 128K x 32 in a 66 pin PGA package with access times of 70ns, 85ns,100ns or 120ns. It has a user configurable output width and completely static operation. It has a low power standby mode and is 3.0V battery back-up compatible with 4 write enables and 4 chip selects. The package includes on board decoupling capacitors and is suitable for thermal ladder operations.

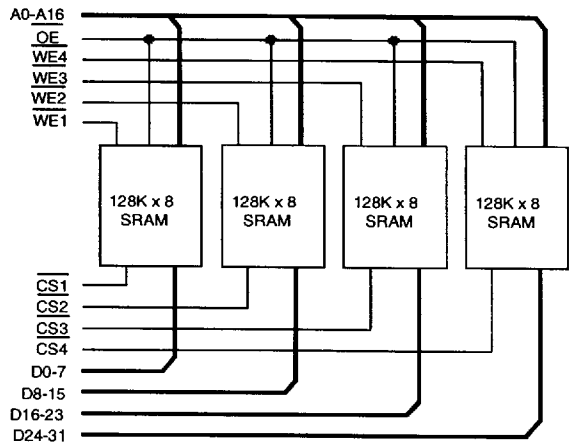
It may be screened in accordance with MIL-STD-883.

4,194,304 bit CMOS Static RAM

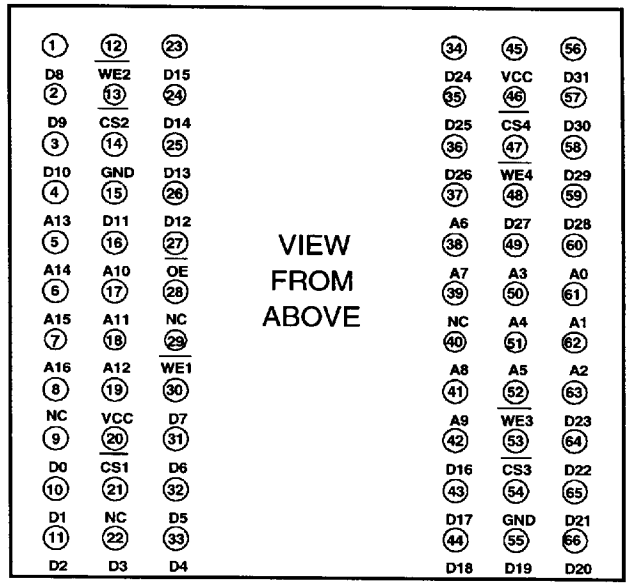
Features

Fast Access times of 70/85/100/120 ns.
Pin grid array gives 2:1 improvement over DIL.
User Configurable as 8 / 16 / 32 bit wide output.
Operating Power 109 / 206 / 400 mW (max.)
Low Power Standby 8.8 mW (max.) -L Version
3.0V Battery Back-up Capability.
Package Suitable for Thermal Ladder Applications.
On board decoupling capacitors.
Completly Static Operation.
May be screened in accordance with MIL-STD-883

Block Diagram



Pin Definition



Pin Functions

A0 - A16	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	V
Power Dissipation	P_T	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.

(2) Pulse width: -3.0V for less than 50ns.

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	-	5.8	V
Input Low Voltage	V_{IL}	-0.3	-	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**)

DC Electrical Characteristics (V_{CC}=5V±10%,T_A=-55°C to +125°C)

Parameter		*Symbol*	*Test Condition*	*min*	*typ*(1)	*max*	*Unit*
Input Leakage Current	Address, $\overline{OE}$	I_{LI1}	V_{IN} = 0V to V_{CC}	-4	-	4	µA
Output Leakage Current	8 bit	I_{LO}	$\overline{CS}$(2) = V_{IH} or $\overline{OE}$ = V_{IH}, $V_{I/O}$ = 0V to V_{CC}	-4	-	4	µA
Average Supply Current	32 bit	I_{CC32}	Minimum cycle, V_{IN} = V_{IL} or V_{IH}	-	-	400	mA
	16 bit	I_{CC16}	As above	-	-	206	mA
	8 bit	I_{CC8}	As above	-	-	109	mA
Standby Supply Current	TTL levels	I_{SB1}	$\overline{CS}$(2) = V_{IH} , I/P's static	-	-	12	mA
	-L Version	I_{SB2}	$\overline{CS}$(2) ≥ V_{CC}-0.2V, 0.2V ≥ V_{IN} ≥ V_{CC}-0.2V	-	-	1.6	mA
Output Voltage Low		V_{OL}	I_{OL} = 2.1 mA	-	-	0.4	V
Output Voltage High		V_{OH}	I_{OH} = -1.0 mA	2.4	-	-	V

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

(2) CS above is accessed through $\overline{CS1\text{-}4}$ 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±10%,T_A=25°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	-	42	pF
	$\overline{WE1\text{-}4}$, $\overline{CS1\text{-}4}$	C_{IN2}	V_{IN}=0V	-	18	pF
I/O Capacitance	D0-31	$C_{I/O}$	$V_{I/O}$=0V	-	50	pF

Operating Modes

The Table below shows the logic inputs required to control the operating modes of each of the SRAMs on the PUMA 2S4000.

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: $\overline{CS}$ is accessed through $\overline{CS1\text{-}4}$, and $\overline{WE}$ is accessed through $\overline{WE1\text{-}4}$. For correct operation, $\overline{CS1\text{-}4}$ must operate simultaneously for 32 bit operation, in pairs for 16 bit operation, or singly for 8 bit operation. $\overline{WE1\text{-}4}$ must also be operated in the same manner.

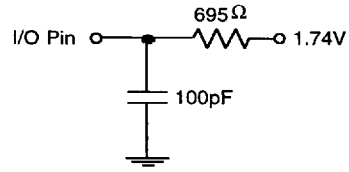
Low V_{cc} Data Retention Characteristics - L Version Only (T_A=-55°C to +125°C)

Parameter	*Symbol*	*Test Condition*	*min*	*typ*	*max*	*Unit*
V_{CC} for Data Retention	V_{DR}	$\overline{CS} \geq V_{CC}$-0.2V	2.0	-	-	V
Data Retention Current	I_{CCDR}	V_{CC}=3.0V, $\overline{CS} \geq V_{CC}$-0.2V, $V_{IN} > 0V$	-	-	2.4	mA
Chip Deselect to Data Retention	t_{CDR}	See Retention Waveform	0	-	-	ns
Operation Recovery Time	t_R	See Retention Waveform	5	-	-	ms

AC Test Conditions

*Input pulse levels: 0.0V to 3.0V
*Input rise and fall times: 5 ns
*Input and Output timing reference levels: 1.5V
*Output load: See Diagram
*V_{cc}=5V±10%
*PUMA module is tested in 32 bit mode.

Output Load



AC OPERATING CONDITIONS

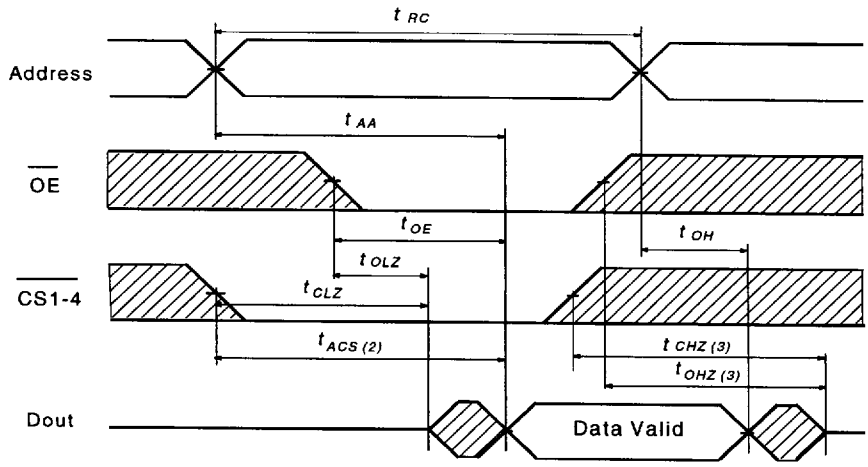
Read Cycle

Parameter	Symbol	70 min	70 max	85 min	85 max	10 min	10 max	12 min	12 max	Unit
Read Cycle Time	t_{RC}	70	-	85	-	100	-	120	-	ns
Address Access Time	t_{AA}	-	70	-	85	-	100	-	120	ns
Chip Select Access Time	t_{ACS}	-	70	-	85	-	100	-	120	ns
Output Enable to Output Valid	t_{OE}	-	35	-	45	-	50	-	60	ns
Output Hold from Address Change	t_{OH}	5	-	5	-	5	-	5	-	ns
Chip Selection to Output in Low Z	t_{CLZ}	10	-	10	-	10	-	10	-	ns
Output Enable to Output in Low Z	t_{OLZ}	5	-	5	-	5	-	5	-	ns
Chip Deselection to Output in High Z[3]	t_{CHZ}	0	35	0	35	0	35	0	45	ns
Output Disable to Output in High Z[3]	t_{OHZ}	0	30	0	30	0	35	0	45	ns

Write Cycle

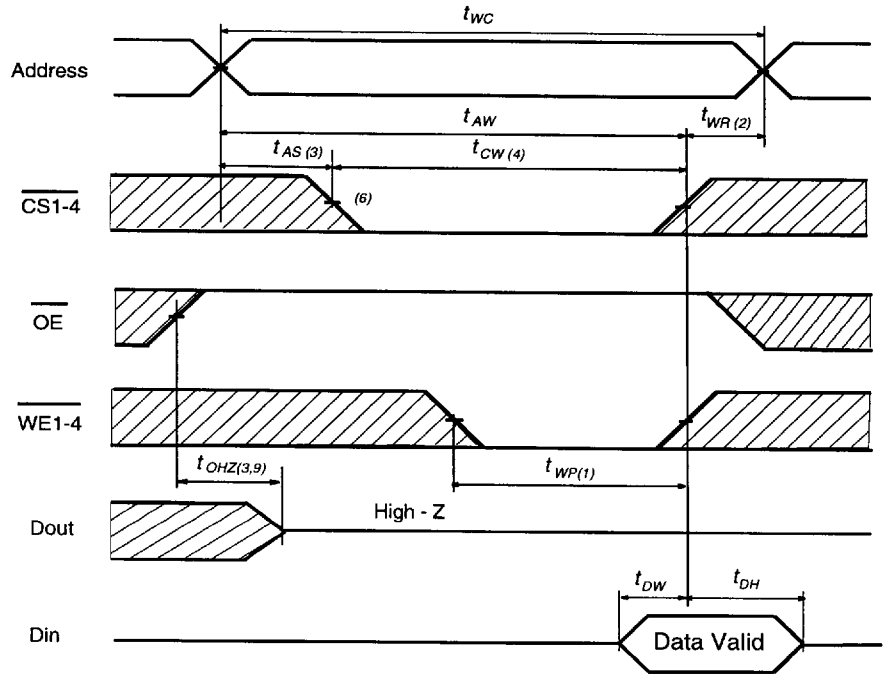
Parameter	Symbol	70 min	70 max	85 min	85 max	10 min	10 max	12 min	12 max	Unit
Write Cycle Time	t_{WC}	70	-	85	-	100	-	120	-	ns
Chip Selection to End of Write	t_{CW}	50	-	75	-	90	-	100	-	ns
Address Valid to End of Write	t_{AW}	50	-	75	-	90	-	100	-	ns
Address Setup Time	t_{AS}	0	-	0	-	0	-	0	-	ns
Write Pulse Width	t_{WP}	45	-	60	-	70	-	70	-	ns
Write Recovery Time	t_{WR}	10	-	10	-	10	-	10	-	ns
Write to Output in High Z	t_{WHZ}	0	30	0	30	0	35	0	40	ns
Data to Write Time Overlap	t_{DW}	30	-	35	-	40	-	45	-	ns
Data Hold from Write Time	t_{DH}	0	-	0	-	0	-	0	-	ns
Output Active from End of Write	t_{OW}	5	-	5	-	10	-	10	-	ns

Read Cycle Timing Waveform (1,2)

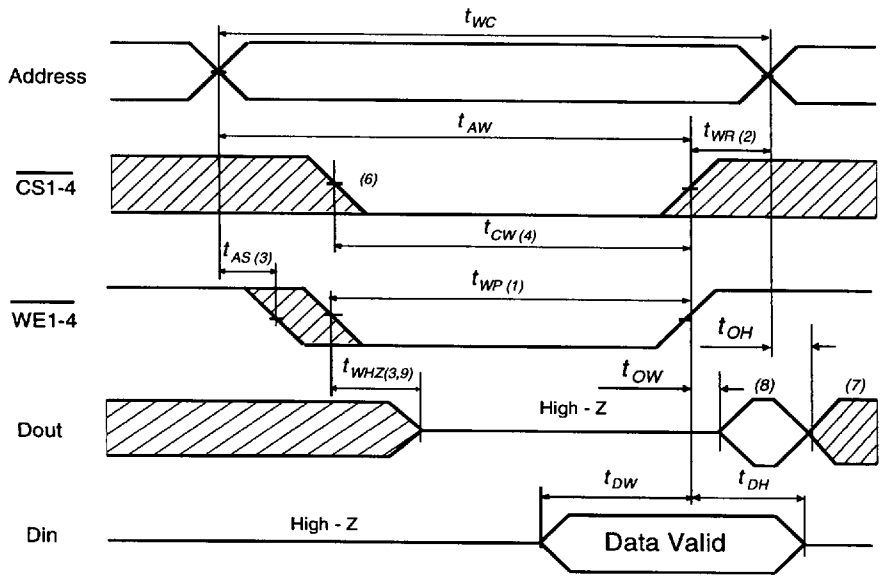


Notes:
(1) WE1-4 is High for Read Cycle.
(2) Address valid prior to or coincident with CS1-4 transition Low.
(3) t_{CHZ} and t_{OHZ} are defined as the time at which the outputs achieve the open circuit conditions and are not referenced to output voltage levels. These parameters are sampled and not 100% tested.

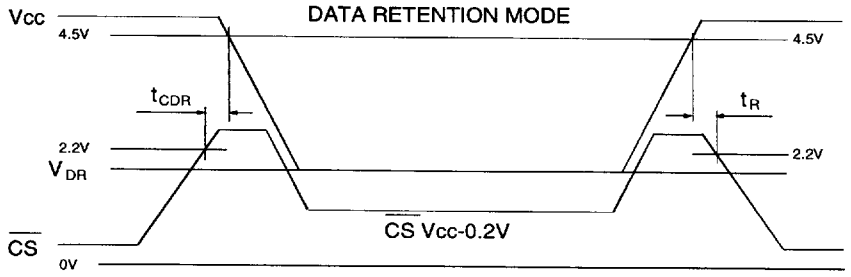
Write Cycle No.1 Timing Waveform



Write Cycle No.2 Timing Waveform (5)



Low V_{CC} Data Retention Timing Waveform

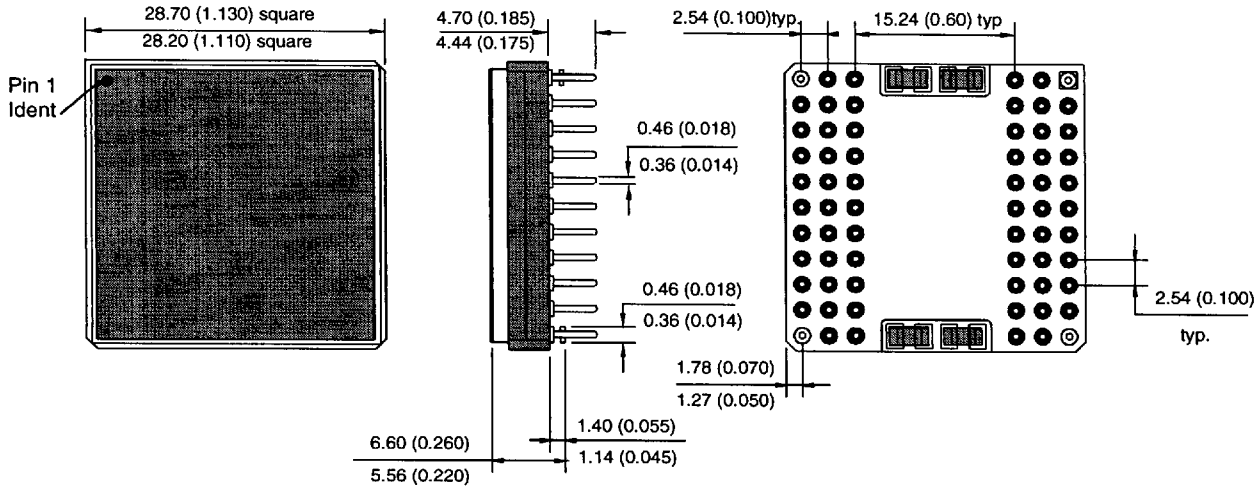


AC Characteristics Notes

(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) Dout is in the same phase as written data of this write cycle.
(7) Dout 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 to I/O pins.
(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.

PACKAGE DETAILS

66 PIN PGA Dimensions in mm (inches).



SCREENING

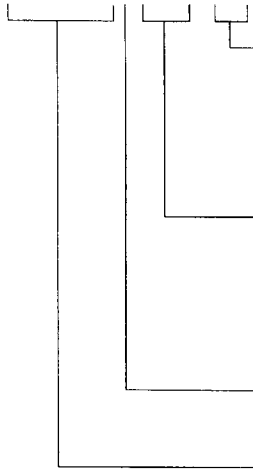
Military Screening Procedure

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	2010 Condition B or manufacturers equivalent	100%
Temperature cycle	1010 Condition C (10 Cycles,-65°C to +150°C)	100%
Constant acceleration	2001 Condition E (Y_1 only) (10,000g)	100%
Burn-In		
Pre-Burn-in electrical	Per applicable device specifications at T_A=+25°C	100%
Burn-in	Method 1015,Condition D,T_A=+125°C,160hrs min	100%
Final Electrical Tests	Per applicable Device Specification	
Static (dc)	a) @ T_A=+25°C and power supply extremes	100%
	b) @ temperature and power supply extremes	100%
Functional	a) @ T_A=+25°C and power supply extremes	100%
	b) @ temperature and power supply extremes	100%
Switching (ac)	a) @ T_A=+25°C and power supply extremes	100%
	b) @ temperature and power supply extremes	100%
Percent Defective allowable (PDA)	Calculated at post burn-in at T_A=+25°C	10%
Hermeticity	1014	
Fine	Condition A	100%
Gross	Condition C	100%
Quality Conformance	Per applicable Device Specification	Sample
External Visual	2009 Per vendor or customer specification	100%

ORDERING INFORMATION

PUMA 2S4000LMB-10



Speed	70	= 70 ns
	85	= 85 ns
	10	= 100 ns
	12	= 120 ns
Temp. range/screening	Blank	= Commercial Temp.
	I	= Industrial Temp.
	M	= Military Temp.
	MB	= Screened in accordance with MIL-STD 883
Power Consumption	Blank	= Standard Power
	L	= Low Power
Memory Type	S4000	= 128K X 32 SRAM (Configurable as 256K x 16 and 512K x 8)