

**GENERAL DESCRIPTION**

The HMS51232J4 is a static random access memory (SRAM) module containing 524,288 words organized in a x32-bit configuration. The module consists of four 512K x 8 SRAMs mounted on a 68-pin, single-sided, FR4-printed circuit board. Four chip enable inputs, (/CE1, /CE2, /CE3 and /CE4) are used to enable the module's 4 bytes independently. Output enable(/OE) and write enable(/WE) can set the memory input and output.

Data is written into the SRAM memory when write enable (/WE) and chip enable (/CE) inputs are both LOW. Reading is accomplished when /WE remains HIGH and /CE and output enable (/OE) are LOW.

For reliability, this SRAM module is designed as multiple power and ground pin. All module components may be powered from a single +5V DC power supply and all inputs and outputs are fully TTL-compatible.

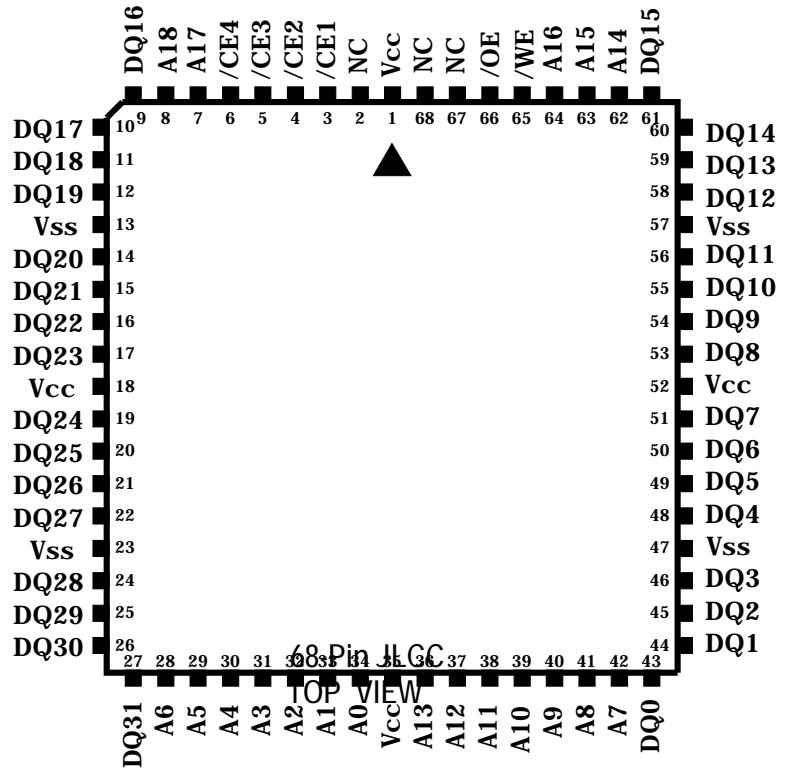
**FEATURES**

- w Access time : 10, 12 and 15ns
- w High-density 2MByte design
- w High-reliability, low-power design
- w Single +5V ±0.5V power supply
- w Three state output and TTL-compatible
- w FR4-PCB design
- w Low profile 68-Pin JLCC

**OPTIONS                      MARKING**

w Timing	
10ns access	-10
12ns access	-12
15ns access	-15
w Packages	
68-pin JLCC	J

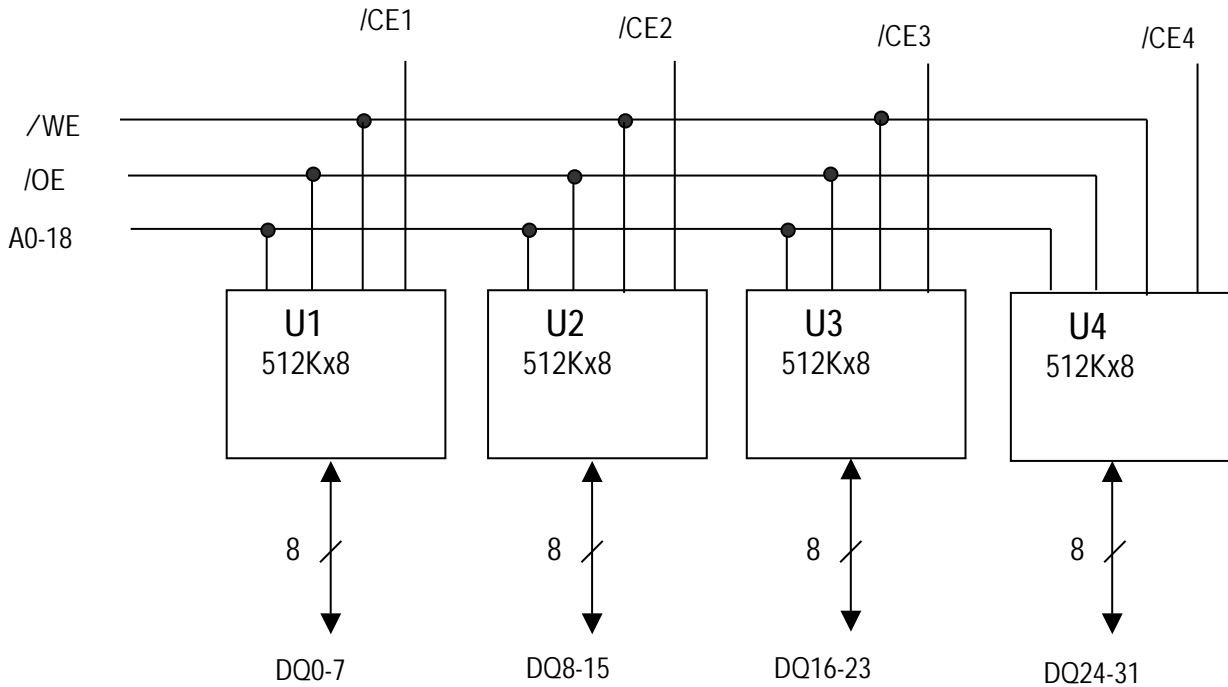
**PIN ASSIGNMENT**



**PIN DESCRIPTION**

DQ0 – DQ31	Data Inputs/Outputs
A0 – A18	Address Inputs
/WE	Write Enable
/CE1-4	Chip Selects
/OE	Output Enable
Vcc	Power Supply
Vss	Ground

**BLOCK DIAGRAM**



**TRUTH TABLE**

MODE	/OE	/CE	/WE	DQ	POWER
STANDBY	X	H	X	HIGH-Z	STANDBY
NOT SELECTED	H	L	H	HIGH-Z	ACTIVE
READ	L	L	H	Dout	ACTIVE
WRITE	X	L	L	Din	ACTIVE

**ABSOLUTE MAXIMUM RATINGS**

PARAMETER	SYMBOL	RATING
Voltage on Any Pin Relative to V <sub>SS</sub>	V <sub>IN,OUT</sub>	-0.5V to +7.0V
Voltage on V <sub>CC</sub> Supply Relative to V <sub>SS</sub>	V <sub>CC</sub>	-0.5V to +7.0V
Power Dissipation	P <sub>D</sub>	4W
Storage Temperature	T <sub>STG</sub>	-55°C to +125°C
Operating Temperature	T <sub>A</sub>	0°C to +70°C

w 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 at these or any other conditions above those indicated in the operating section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

**RECOMMENDED DC OPERATING CONDITIONS ( T<sub>A</sub>=0 to 70 ° C )**

PARAMETER	SYMBOL	MIN	TYP.	MAX
Supply Voltage	V <sub>CC</sub>	4.5V	5.0V	5.5V
Ground	V <sub>SS</sub>	0	0	0
Input High Voltage	V <sub>IH</sub>	2.2	-	V <sub>CC</sub> +0.5V**
Input Low Voltage	V <sub>IL</sub>	-0.5*	-	0.8V

\* V<sub>IL</sub>(Min.) = -2.0V (Pulse Width ≤ 10ns) for I ≤ 20 mA

\*\* V<sub>IH</sub>(Max.) = V<sub>CC</sub>+2.0V (Pulse Width ≤ 10ns) for I ≤ 20 mA

**DC AND OPERATING CHARACTERISTICS (1)(0°C ≤ T<sub>A</sub> ≤ 70 °C ; V<sub>CC</sub> = 5V ± 0.5V )**

PARAMETER	TEST CONDITIONS	SYMBOL	MIN	MAX	UNITS
Input Leakage Current	V <sub>IN</sub> = V <sub>SS</sub> to V <sub>CC</sub>	I <sub>L1</sub>	-8	8	μA
Output Leakage Current	/CE=V <sub>IH</sub> or /OE =V <sub>IH</sub> or /WE=V <sub>IL</sub> V <sub>OUT</sub> =V <sub>SS</sub> to V <sub>CC</sub>	I <sub>L0</sub>	-8	8	μA
Output High Voltage	I <sub>OH</sub> = -4.0mA	V <sub>OH</sub>	2.4	-	V
Output Low Voltage	I <sub>OL</sub> = 8.0mA	V <sub>OL</sub>		0.4	V

\* V<sub>CC</sub>=5.0V, Temp=25 °C

**DC AND OPERATING CHARACTERISTICS (2)**

DESCRIPTION	TEST CONDITIONS	SYMBOL	MAX			UNIT
			-10	-12	-15	
Power Supply Current: Operating	Min. Cycle, 100% Duty /CE=V <sub>IL</sub> , V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub> , I <sub>OUT</sub> =0mA	I <sub>CC</sub>	840	820	800	mA
Power Supply Current: Standby	Min. Cycle, /CE=V <sub>IH</sub>	I <sub>SB</sub>	200	200	200	mA
	f=0MHZ, /CE≥V <sub>CC</sub> -0.2V, V <sub>IN</sub> ≥ V <sub>CC</sub> -0.2V or V <sub>IN</sub> ≤0.2V	I <sub>SB1</sub>	40	40	40	mA

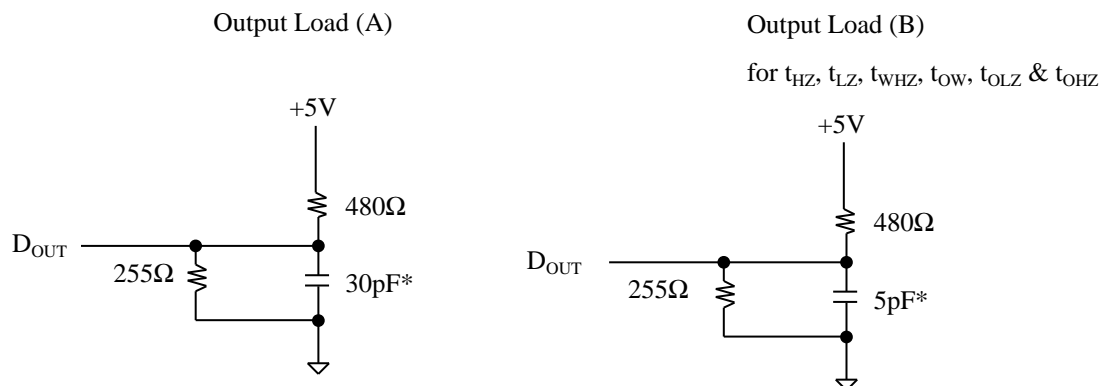
## CAPACITANCE

DESCRIPTION	TEST CONDITIONS	SYMBOL	MAX	UNIT
Input /Output Capacitance	$V_{I/O}=0V$	$C_{I/O}$	32	pF
Input Capacitance	$V_{IN}=0V$	$C_{IN}$	28	pF

\* **NOTE** : Capacitance is sampled and not 100% tested

**AC CHARACTERISTICS** ( $0^{\circ}C \leq T_A \leq 70^{\circ}C$  ;  $V_{CC} = 5V \pm 0.5V$ , unless otherwise specified)  
**TEST CONDITIONS**

PARAMETER	VALUE
Input Pulse Level	0.V to 3V
Input Rise and Fall Time	3ns
Input and Output Timing Reference Levels	1.5V
Output Load	See below



\* Including scope and jig capacitance

## READ CYCLE

PARAMETER	SYMBOL	-10		-12		-15		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
Read Cycle Time	$t_{RC}$	10	-	12	-	15	-	ns
Address Access Time	$t_{AA}$	-	10	-	12	-	15	ns
Chip Select to Output	$t_{CO}$	-	10	-	12	-	15	ns
Output Enable to Output	$t_{OE}$	-	5	-	6	-	7	ns
Output Enable to Low-Z Output	$t_{OLZ}$	0	-	0	-	0	-	ns
Chip Enable to Low-Z Output	$t_{LZ}$	3	-	3	-	3	-	ns
Output Disable to High-Z Output	$t_{OHZ}$	0	5	0	6	0	7	ns
Chip Disable to High-Z Output	$t_{HZ}$	0	5	0	6	0	7	ns
Output Hold from Address Change	$t_{OH}$	3	-	3	-	3	-	ns
Chip Select to Power Up Time	$t_{PU}$	0	-	0	-	0	-	ns
Chip Select to Power Down Time	$t_{PD}$	-	10	-	12	-	15	ns

**WRITE CYCLE**

PARAMETER	SYMBOL	-10		-12		-15		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
Write Cycle Time	$t_{WC}$	10	-	12	-	15	-	ns
Chip Select to End of Write	$t_{CW}$	10	-	12	-	15	-	ns
Address Set-up Time	$t_{AS}$	0	-	0	-	0	-	ns
Address Valid to End of Write	$t_{AW}$	7	-	8	-	10	-	ns
Write Pulse Width (/OE=High)	$t_{WP}$	7	-	8	-	10	-	ns
Write Pulse Width(/OE=Low)	$t_{WP1}$	10	-	12	-	14	-	ns
Write Recovery Time	$t_{WR}$	0	-	0	-	0	-	ns
Write to Output High-Z	$t_{WZ}$	0	5	0	6	0	7	ns
Data to Write Time Overlap	$t_{DW}$	5	-	6	-	7	-	ns
Data Hold from Write Time	$t_{DH}$	0	-	0	-	0	-	ns
End of Write to Output Low-Z	$t_{OW}$	3	-	3	-	3	-	ns

**TIMING DIAGRAMS**

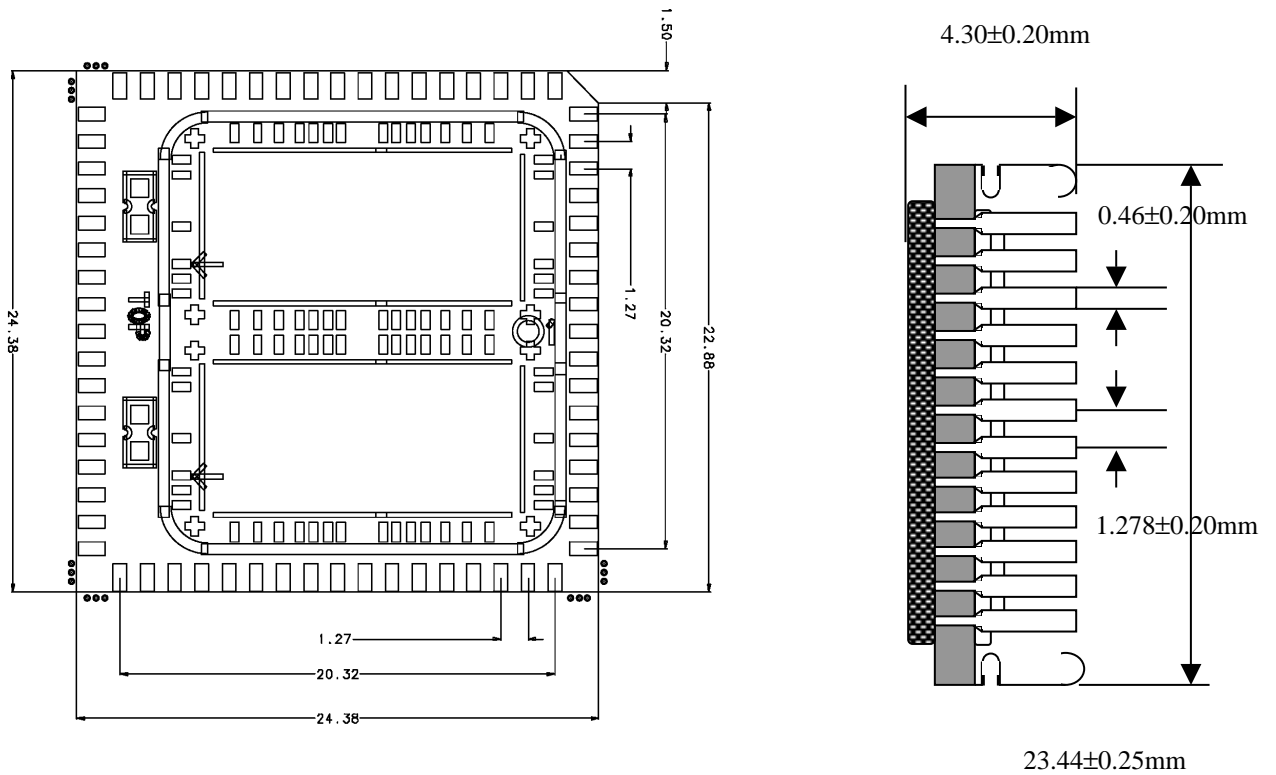
Please refer to timing diagram chart.

**FUNCTIONAL DESCRIPTION**

/CE	/WE	/OE	MODE	I/O PIN	SUPPLY CURRENT
H	X*	X	Not Select	High-Z	$I_{SB}, I_{SB1}$
L	H	H	Output Disable	High-Z	$I_{CC}$
L	H	L	Read	$D_{OUT}$	$I_{CC}$
L	L	X	Write	$D_{IN}$	$I_{CC}$

Note: X means Don't Care

PACKAGE DIMENSIONS



ORDERING INFORMATION

Part Number	Density	Org.	Package	Component Number	Vcc	Access time
HMS51232J4-10	2MByte	512KX 32bit	68 Pin-JLCC	4EA	5V	10ns
HMS51232J4-12	2MByte	512KX 32bit	68 Pin-JLCC	4EA	5V	12ns
HMS51232J4-15	2MByte	512KX 32bit	68 Pin-JLCC	4EA	5V	15ns