H A N B I T

SRAM MODULE 768KBit (32K x 24-Bit)
Part No. HMS3224M3, HMS3224Z3

GENERAL DESCRIPTION

The HMS3224M3/Z3 is a high-speed static random access memory (SRAM) module containing 32,768 words organized in a x24-bit configuration. The module consists of three 32K x 8 SRAMs mounted on a 56-pin, single-sided, FR4-printed circuit board.

Writing to the device is accomplished when the chip enable (/CE) and write enable(/WE) inputs are both LOW. Data on the input/output pins (DQ0 through DQ23) of the device is written into the memory location specified on the address pins (A0 through A14).

Reading the device is accomplished by taking the chip enable (/CE) and output enable(/OE) LOW while write enable(/WE) remains HIGH. Under these conditions, the contents of the memory location specified on the address pins will appear on the input/output pins.

The input/output pins remains in a high-impedance state unless the module is selected, outputs are enabled, and write enable is HIGH.

FEATURES

- Access times : 12, 15 and 20ns
- High-density 768Kbit design
- High-reliability, high-speed design
- Single + 5V ±0.5V power supply
- 56-pin, low-active power design
- All inputs and outputs are TTL-compatible
- Industry-standard pinout
- FR4-PCB design
- Part identification

  HMS3224M3 : 56Pin SIMM Design

  HMS3224Z3 : 56Pin ZIP Design

  →Pin-compatible with the HMS3224M3

OPTIONS MARKING

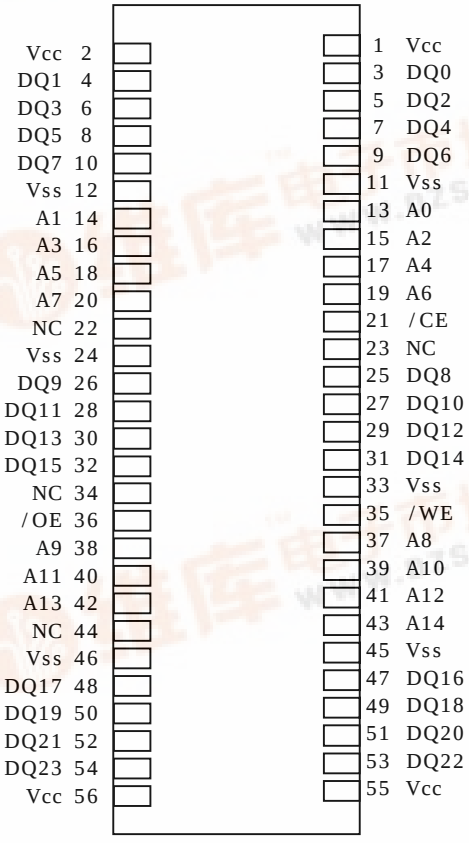
- Timing

12ns access	-12
15ns access	-15
20ns access	-20

- Packages

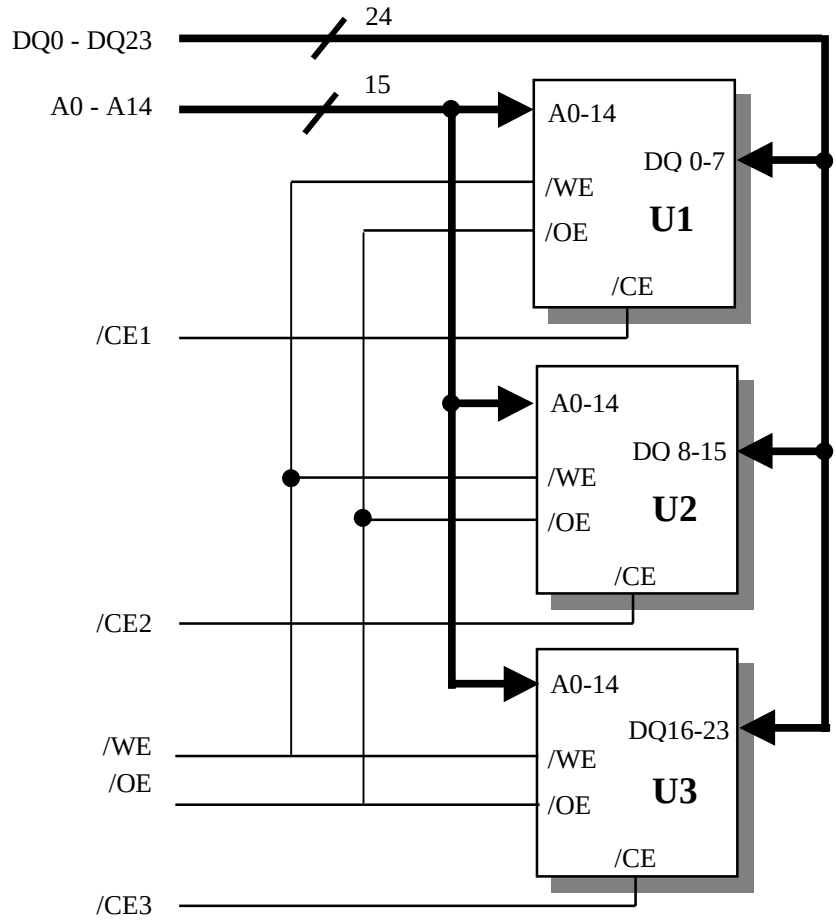
56-pin SIMM	M
56-pin ZIP	Z

PIN ASSIGNMENT



ZIP
TOP VIEW

FUNCTIONAL BLOCK DIAGRAM



TRUTH TABLE

MODE	/OE	/CE	/WE	OUTPUT	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 Vss	$V_{IN,OUT}$	-0.5V to +7.0V
Voltage on Vcc Supply Relative to Vss	V_{CC}	-0.5V to +7.0V
Power Dissipation	P_D	3W
Storage Temperature	T_{STG}	-65°C to +150°C
Operating Temperature	T_A	0°C to +70°C

- 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_A=0 to 70 °C)

PARAMETER	SYMBOL	MIN	TYP.	MAX
Supply Voltage	V_{CC}	4.5V	5.0V	5.5V
Ground	V_{SS}	0	0	0
Input High Voltage	V_{IH}	2.2	-	Vcc+0.5V**
Input Low Voltage	V_{IL}	-0.5*	-	0.8V

* V_{IL}(Min.) = -2.0V (Pulse Width ≤ 10ns) for I ≤ 20 mA

****** V_{IH}(Min.) = Vcc+2.0V (Pulse Width ≤ 10ns) for I ≤ 20 mA

DC AND OPERATING CHARACTERISTICS (1)(0°C ≤ T_A ≤ 70 °C ; Vcc = 5V ± 0.5V)

PARAMETER	TEST CONDITIONS	SYMBOL	MIN	MAX	UNITS
Input Leakage Current	V_{IN} = Vss to Vcc	IL_I	-6	6	μA
Output Leakage Current	$\overline{CE}$=V_{IH} or $\overline{OE}$ =V_{IH} or $\overline{WE}$=V_{IL} V_{OUT}=Vss to V_{CC}	IL_0	-6	6	μA
Output High Voltage	I_{OH} = -4.0mA	V_{OH}	2.4		V
Output Low Voltage	I_{OL} = 8.0mA	V_{OL}		0.4	V

* Vcc=5.0V, Temp=25 °C

DC AND OPERATING CHARACTERISTICS (2)

DESCRIPTION	TEST CONDITIONS	SYMBOL	MAX -12	MAX -15	MAX -20	UNIT
Power Supply Current: Operating	Min. Cycle, 100% Duty /CE=V_{IL}, V_{IN}=V_{IH} or V_{IL}, I_{OUT}=0mA	l_{CC}	495	450	420	mA
Power Supply Current :Standby	Min. Cycle, /CE=V_{IH}	l_{SB}	120	120	120	mA
	f=0MHZ, /CE≥V_{CC}-0.2V, V_{IN}≥ V_{CC}-0.2V or V_{IN}≤0.2V	l_{SB1}	6	6	6	mA

CAPACITANCE

DESCRIPTION	TEST CONDITIONS	SYMBOL	MAX	UNIT
Input /Output Capacitance	$V_{I/O}$=0V	$C_{I/O}$	24	pF
Input Capacitance	V_{IN}=0V	C_{IN}	21	pF

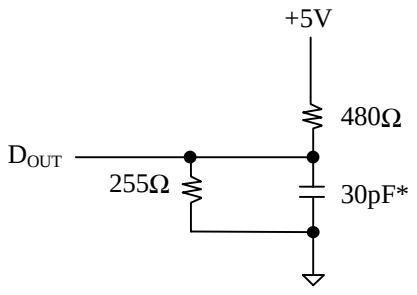
* NOTE : Capacitance is sampled and not 100% tested

AC CHARACTERISTICS ($0^oC \le T_A \le 70\ ^oC$; Vcc = 5V ± 0.5V, unless otherwise specified)

TEST CONDITIONS

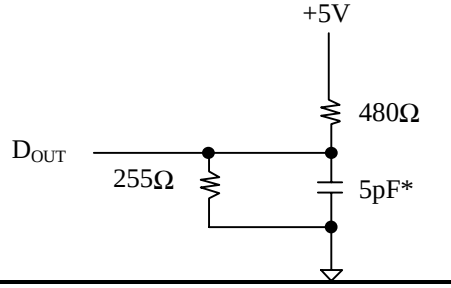
PARAMETER	VALUE
Input Pulse Level	0 to 3V
Input Rise and Fall Time	3ns
Input and Output Timing Reference Levels	1.5V
Output Load	See below

Output Load



Output Load (B)

for t_{HZ}, t_{LZ}, t_{WHZ}, t_{OW}, t_{OLZ} & t_{OHZ}



READ CYCLE

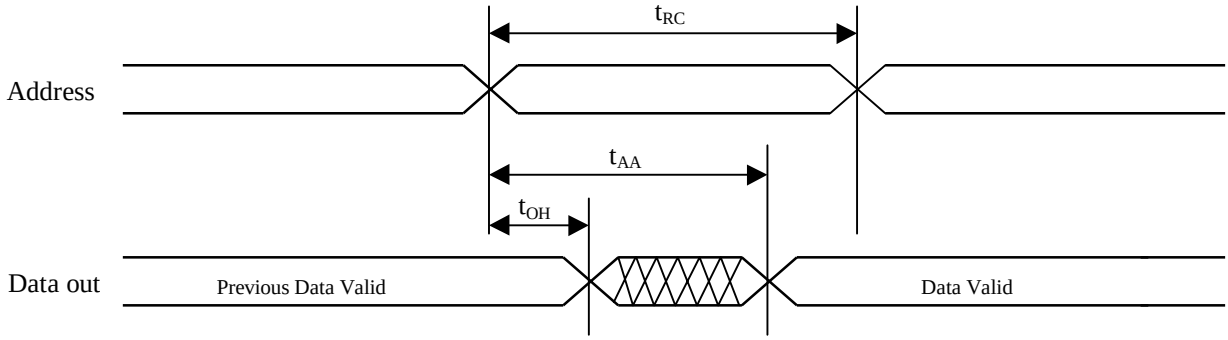
PARAMETER	SYMBOL	-12		-15		-20		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
Read Cycle Time	t_{RC}	12		15		**20**		ns
Address Access Time	t_{AA}		12		15		20	ns
Chip Select to Output	t_{CO}		12		15		20	ns
Output Enable to Output	t_{OE}		6		7		9	ns
Output Enable to Low-Z Output	t_{OLZ}	0		0		0		ns
Chip Enable to Low-Z Output	t_{LZ}	3		3		3		ns
Output Disable to High-Z Output	t_{OHZ}	0	6	0	7	0	10	ns
Chip Disable to High-Z Output	t_{HZ}	0	6	0	7	0	10	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}		12		15		20	ns

WRITE CYCLE

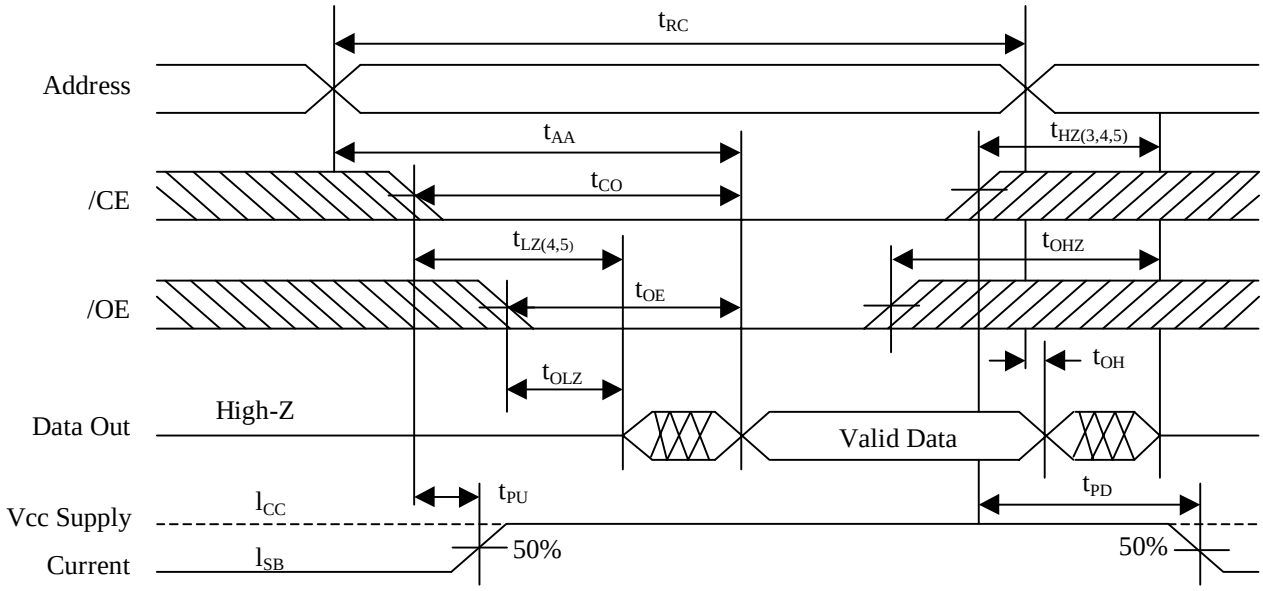
PARAMETER	SYMBOL	-12		-15		-20		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
Write Cycle Time	t_{WC}	12		15		20		ns
Chip Select to End of Write	t_{CW}	9		11		13		ns
Address Set-up Time	t_{AS}	0		0		0		ns
Address Valid to End of Write	t_{AW}	9		12		13		ns
Write Pulse Width	t_{WP}	9		12		13		ns
Write Recovery Time	t_{WR}	12		0		0		ns
Write to Output High-Z	t_{WHZ}	0	6	0	8	0	8	ns
Data to Write Time Overlap	t_{DW}	7		8		10		ns
Data Hold from Write Time	t_{DH}	0		0		0		ns
End of Write to Output Low-Z	t_{OW}	0		0		0		ns

TIMING DIAGRAMS

TIMING WAVEFORM OF READ CYCLE(Address Controlled) (/CE =/OE = V_{IL} , /WE = V_{IH})



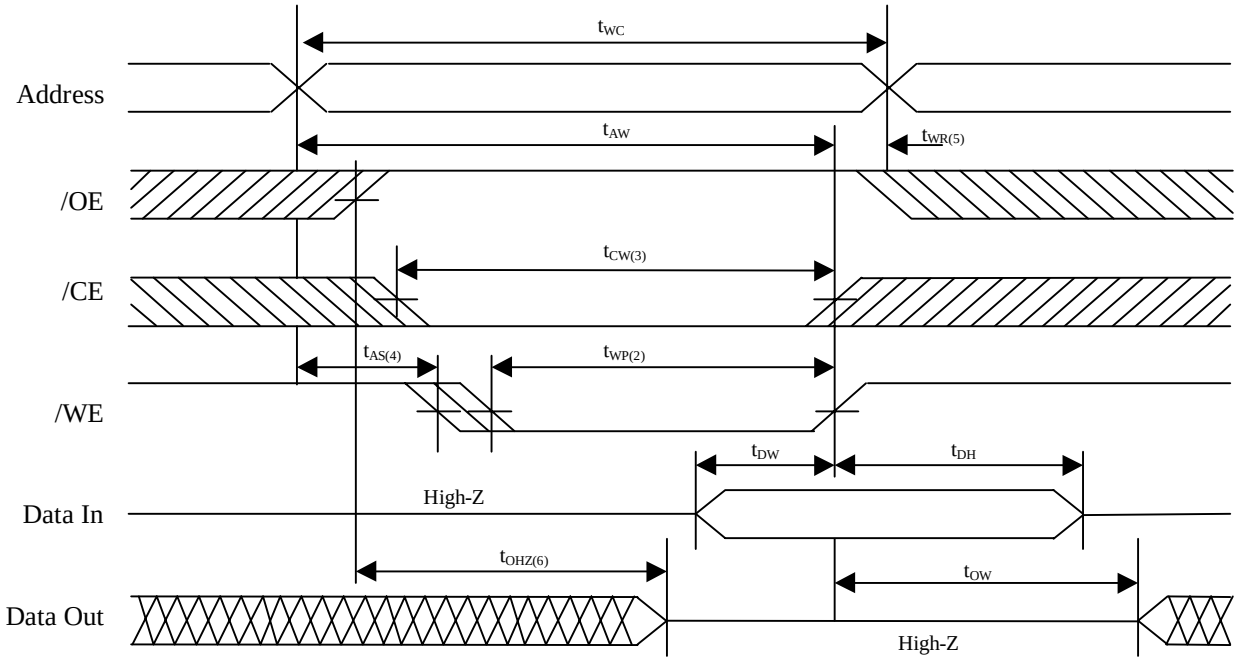
TIMING WAVEFORM OF READ CYCLE (/WE=V_{IH})



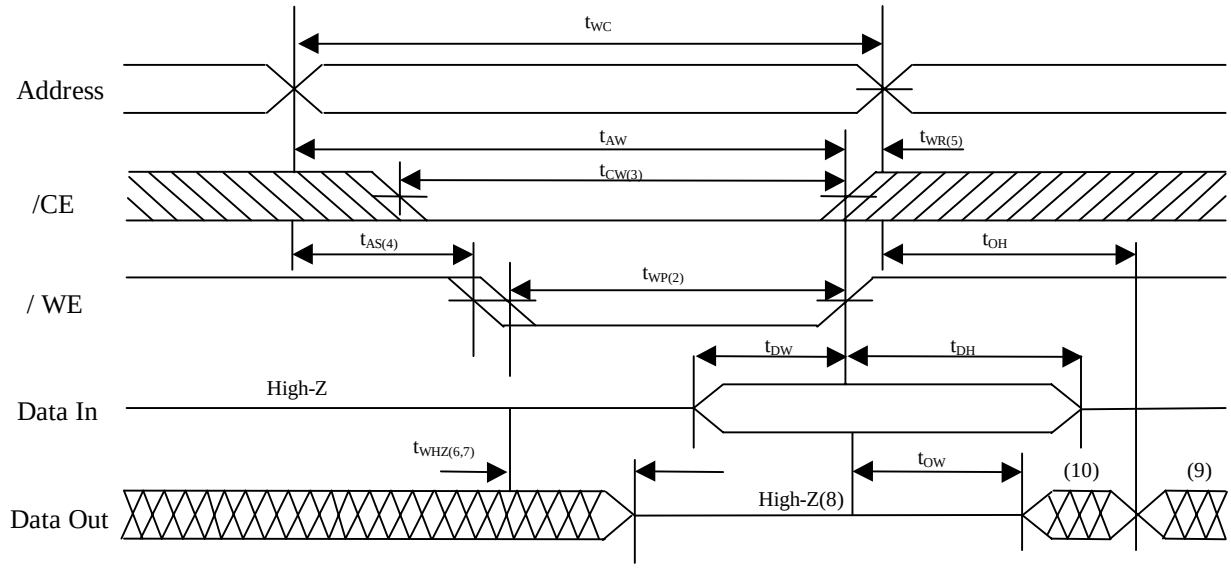
Notes (Read Cycle)

1. /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_{HZ} and t_{OHZ} are defined as the time at which the outputs achieve the open circuit condition are not referenced to V_{OH} or V_{OL} levels.
4. At any given temperature and voltage condition, t_{HZ} (max.) is less than t_{LZ} (min.) both for a given device and from device to device.
5. Transition is measured ± 200mV from steady state voltage with Load (B). This parameter is sampled and not 100% tested.
6. Device is continuously selected with /CE = V_{IL}.
7. Address valid prior to coincident with /CE transition low.

TIMING WAVEFORM OF WRITE CYCLE (/OE = Clock)



TIMING WAVEFORM OF WRITE CYCLE (/OE Low Fixed)



Notes(Write Cycle)

1. All write cycle timing is referenced from the last valid address to the first transition address.
2. A write occurs during the overlap of a low /CE and a low /WE. A write begins at the latest transition among /CE going low and /WE going low: A write ends at the earliest transition among /CE going high and /WE going high. t_{WP} is measured from the beginning of write to the end of write.

3. t_{CW} is measured from the later of /CE going low to the end of write.
4. t_{AS} is measured from the address valid to the beginning of write.
5. t_{WR} is measured from the end of write to the address change. t_{WR} applied in case a write ends as /CE, or /WE going high.
6. If /OE,/CE and /WE are in the read mode during this period, the I/O pins are in the output low-Z state. Inputs of opposite
   phase of the output must not be applied because bus contention can occur.
7. For common I/O applications, minimization or elimination of bus contention conditions is necessary during read and write
   cycle.
8. If /CE goes low simultaneously with /WE going low or after /WE going low, the outputs remain high impedance state.
9. D_{OUT} is the read data of the new address.
10. When /CE is low: I/O pins are in the output state. The input signals in the opposite phase leading to the output should not be applied.

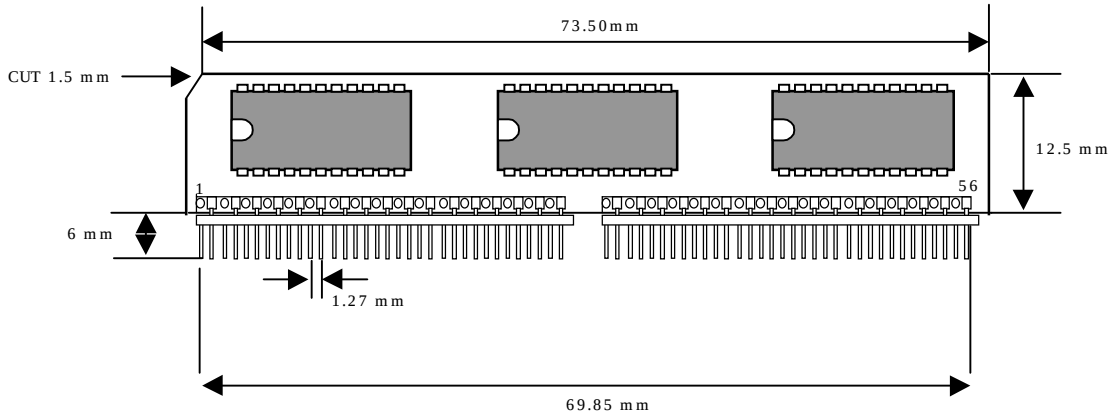
FUNCTIONAL DESCRIPTION

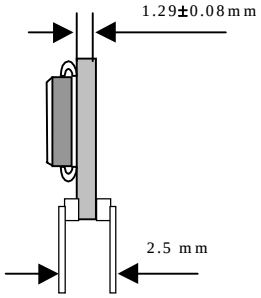
/CE	/WE	/OE	MODE	I/O PIN	SUPPLY CURRENT
H	X*	X	Not Select	High-Z	l_{SB}, l_{SB1}
L	H	H	Output Disable	High-Z	l_{CC}
L	H	L	Read	D_{OUT}	l_{CC}
L	L	X	Write	D_{IN}	l_{CC}

Note: X means Don't Care

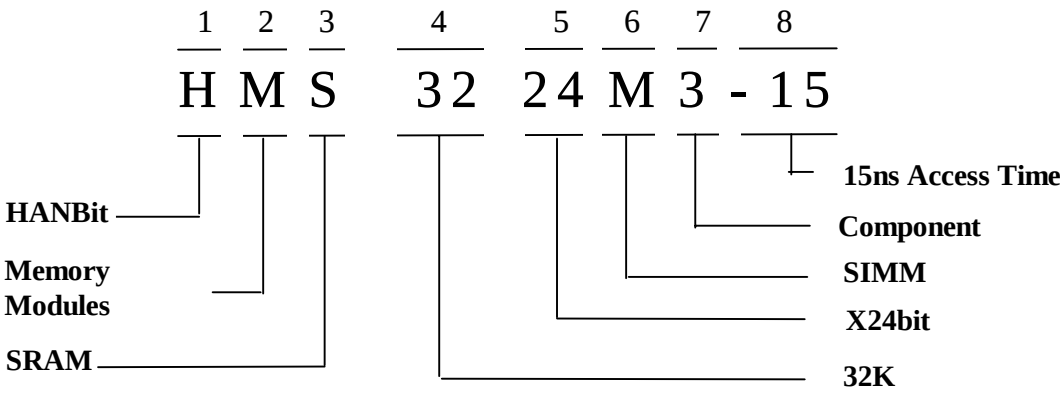
PACKAGING INFORMATION

ZIP Design





ODERING INFORMATION



1. - Product Line Identifier
HANBit Technology ---------- H
2. - Memory Modules
3. - SRAM
4. - Depth : 32K
5. - Width : x 24bit
6. - Package Code
SIMM ---------- M
ZIP ---------- Z

7. – Number of Memory Components
8. - Access time
10 ---------- 10ns
12 ---------- 12ns
15 ---------- 15ns
17 ---------- 17ns
20 ---------- 20ns