

128M X 72 Bits (1GB) SDRAM Registered 168-Pin DIMM ECC (PC100)

FEATURES

- PC100 Compliant (see *Ordering Information*)
- Burst Mode Operation
- Auto and self refresh capability (8192 cycles/64ms refresh)
- LVTTTL compatible inputs and outputs
- +3.3V ± 0.3V power supply
- MRS cycle with address key programs
  - CAS Latency (CL=2 or 3)
  - Burst Length (1, 2, 4, 8)
  - Data scramble (sequential and interleave)
- All inputs are sampled at the positive going edge of the system clock
- Serial Presence Detect with 256 Byte EEPROM
- Optimized for ECC

GENERAL DESCRIPTION

The SimpleTech SL72R8S128M8H-A10xV is a 128M x 72 bits Synchronous Dynamic RAM (SDRAM) Dual In-line Memory Module (DIMM). This module consists of nine 32M x 8 bits x 4 banks IC Towers mounted on a 168-pin glass epoxy substrate. Each IC Tower consists of two CMOS 16M x 8 bits x 4 banks SDRAMs in 54-pin 400-mil TSOP-II packages. The IC Tower stacking technology is patented by SimpleTech under patent number RE.36,916.

A serial EEPROM using the two pin I<sup>2</sup>C protocol is also mounted to provide for the Serial Presence Detects (SPD). PLL circuits supply clocks to the SDRAMs. Decoupling capacitors are also mounted. Damping resistors are added to the data signals. Control and address signals are registered.

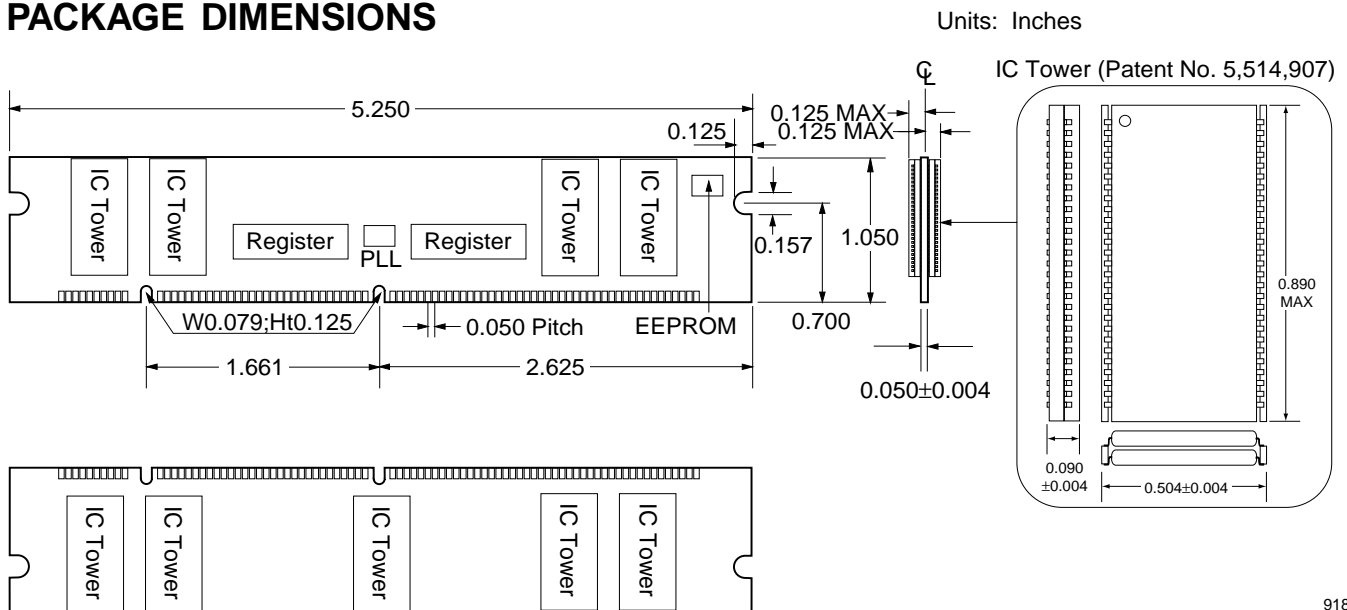
The module has gold edge connections and is intended for mounting into 168-pin DIMM edge connector sockets keyed for 3.3V power supply.

The module is PC100 compliant (see *Ordering Information* for options).

ORDERING INFORMATION

SimpleTech P/N	PC100 100MHz Parameters					
	CL	trcd	trp	trc	Units	Comment
N/A	3	3	3	8	clks	slowest supported (option "A")
N/A	3	2	3	8	clks	2nd choice (option "B")
SL72R8S128M8H-A10CV	3	2	2	7	clks	target (option "C")
SL72R8S128M8H-A10DV	2	2	2	7	clks	goal (option "D")

PACKAGE DIMENSIONS



TOLERANCES: ±0.005 UNLESS OTHERWISE SPECIFIED

## PIN CONFIGURATION

## Pin Symbols

Pin	Symbol	Pin	Symbol	Pin	Symbol	Pin	Symbol	Pin	Symbol	Pin	Symbol	Pin	Symbol
1	VSS	25	NC	49	VDD	73	VDD	97	DQ41	121	A9	145	NC
2	DQ0	26	VDD	50	NC	74	DQ28	98	DQ42	122	BA0	146	VREF*
3	DQ1	27	$\overline{WE}$	51	NC	75	DQ29	99	DQ43	123	A11	147	REGE
4	DQ2	28	DQM0	52	CB2	76	DQ30	100	DQ44	124	VDD	148	VSS
5	DQ3	29	DQM1	53	CB3	77	DQ31	101	DQ45	125	CLK1*	149	DQ53
6	VDD	30	$\overline{S0}$	54	VSS	78	VSS	102	VDD	126	A12*	150	DQ54
7	DQ4	31	DU	55	DQ16	79	CLK2*	103	DQ46	127	VSS	151	DQ55
8	DQ5	32	VSS	56	DQ17	80	NC	104	DQ47	128	CKE0	152	VSS
9	DQ6	33	A0	57	DQ18	81	NC	105	CB4	129	$\overline{S3}$	153	DQ56
10	DQ7	34	A2	58	DQ19	82	SDA	106	CB5	130	DQM6	154	DQ57
11	DQ8	35	A4	59	VDD	83	SCL	107	VSS	131	DQM7	155	DQ58
12	VSS	36	A6	60	DQ20	84	VDD	108	NC	132	A13*	156	DQ59
13	DQ9	37	A8	61	NC	85	VSS	109	NC	133	VDD	157	VDD
14	DQ10	38	A10/AP	62	VREF*	86	DQ32	110	VDD	134	NC	158	DQ60
15	DQ11	39	BA1	63	CKE1†	87	DQ33	111	$\overline{CAS}$	135	NC	159	DQ61
16	DQ12	40	VDD	64	VSS	88	DQ34	112	DQM4	136	CB6	160	DQ62
17	DQ13	41	VDD	65	DQ21	89	DQ35	113	DQM5	137	CB7	161	DQ63
18	VDD	42	CLK0	66	DQ22	90	VDD	114	$\overline{S1}$	138	VSS	162	VSS
19	DQ14	43	VSS	67	DQ23	91	DQ36	115	$\overline{RAS}$	139	DQ48	163	CLK3*
20	DQ15	44	DU	68	VSS	92	DQ37	116	VSS	140	DQ49	164	NC
21	CB0	45	$\overline{S2}$	69	DQ24	93	DQ38	117	A1	141	DQ50	165	SA0
22	CB1	46	DQM2	70	DQ25	94	DQ39	118	A3	142	DQ51	166	SA1
23	VSS	47	DQM3	71	DQ26	95	DQ40	119	A5	143	VDD	167	SA2
24	NC	48	DU	72	DQ27	96	VSS	120	A7	144	DQ52	168	VDD

\*These pins are not used in this module.

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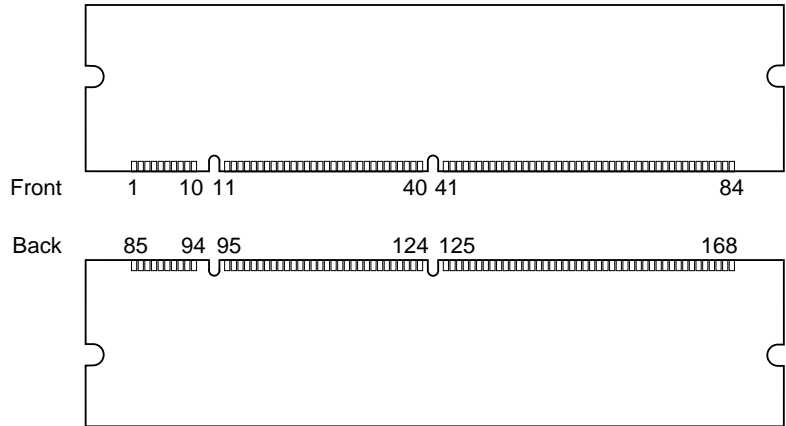
†Use of one CKE is optional via a jumper (0 $\Omega$  resistor)

**PIN CONFIGURATION** *(continued)*

**Pin Functions**

Pin Symbol	Pin Function
A0-A9,A11,A12	Address Inputs
A10/AP	Address Input/Autoprecharge
BA0, BA1	Bank Select Address Inputs
DQ0-DQ63	Data Inputs/Outputs
CB0-CB7	Check Bit Data Inputs/Outputs
$\overline{WE}$	Write Enable
CLK0	Clock Inputs
CKE0, CKE1*	Clock Enable Input
$\overline{RAS}$	Row Address Strobe
$\overline{CAS}$	Column Address Strobe
DQM0-DQM7	Data Input/Output Mask
$\overline{S_0}, \overline{S_2}$	Chip Select Inputs
REGE	Register Enable
SDA	Serial Data Input/Output
SCL	Serial Clock
SA0-SA2	Serial Address Inputs
VDD	Power (+3.3V)
VSS	Ground
NC	No Connection
DU	Don't Use

**Pin Arrangement**



\*Use of one CKE is optional via a jumper (0 $\Omega$  resistor)

## SERIAL PRESENCE DETECT INFORMATION

Serial PD Interface Protocol: I<sup>2</sup>C; Current sink capability of SDA driver ≤3mA; Maximum clock frequency: 100 KHz

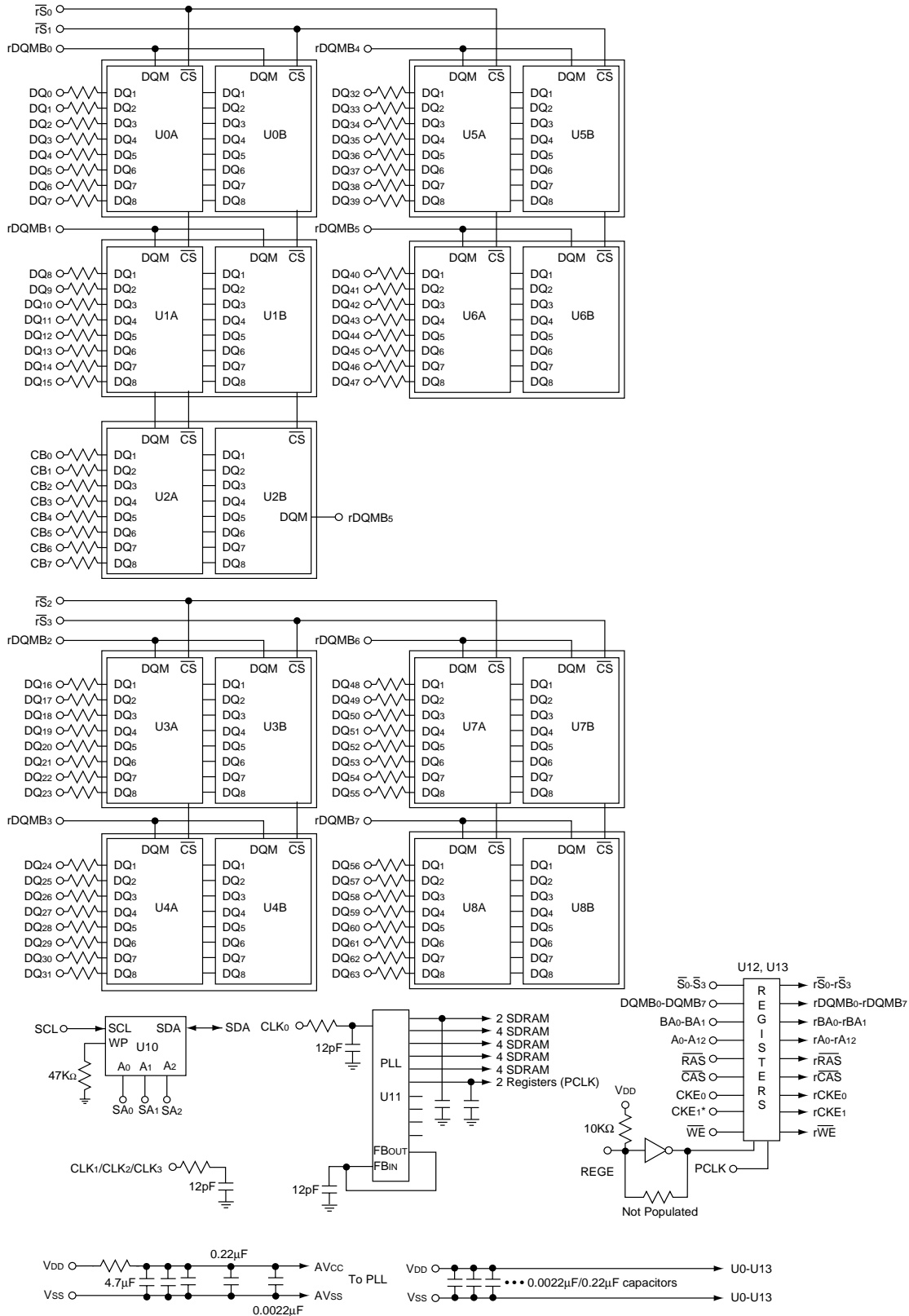
Byte #	Function Described	Function Supported				Hex Value			
		A	B	C	D	A	B	C	D
0	# of bytes written into serial memory at module manufacturer	128 bytes				80h			
1	Total # of bytes of SPD memory device	256Bytes (2K-bit)				08h			
2	Fundamental memory type	SDRAM				04h			
3	# of row addresses on this assembly	13				0Dh			
4	# of column addresses on this assembly	11				0Bh			
5	# of module banks on this assembly	2 banks				02h			
6	Data width of this assembly	72 bits				48h			
7	...Data width of this assembly (continued)	—				00h			
8	Voltage interface standard of this assembly	LVTTL				01h			
9	SDRAM cycle time at CL=3 (tCYC)	—	—	10ns	10ns	—	—	A0h	A0h
10	SDRAM access time from clock at CL=3 (tAC)	—	—	6ns	6ns	—	—	60h	60h
11	DIMM configuration type	ECC				02h			
12	Refresh rate/type	7.8μs, Self-refresh				82h			
13	SDRAM width	8 bits				08h			
14	Error Checking DRAM data width	8 bits				08h			
15	Min. CLK delay for back-to-back rand. col. addr.	tCCD=1 CLK				01h			
16	SDRAM device attributes: burst lengths supported	1,2,4,8				0Fh			
17	SDRAM device attributes: # of banks on SDRAM device	4 banks				04h			
18	SDRAM device attributes: CAS latency	CAS latency = 2,3				06h			
19	SDRAM device attributes: CS latency	CS latency = 0				01h			
20	SDRAM device attributes: Write latency	Write Latency = 0				01h			
21	SDRAM module attributes	Registered/Buffered/PLL				1Fh			
22	SDRAM device attributes: general	VCC10%, B/R, S/W, P/A, A/P				0Eh			
23	Minimum clock cycle time at CL=2 (tCYC)	—	—	15ns	10ns	—	—	F0h	A0h
24	Max. data access time form clock at CL=2 (tAC)	—	—	8ns	6ns	—	—	80h	60h
25	Minimum clock cycle time at CL=1 (tCYC)	—	—	—	—	—	—	00h	00h
26	Max. data access time from clock at CL=1 (tAC)	—	—	—	—	—	—	00h	00h
27	Minimum row precharge time (tRP)	—	—	20ns	20ns	—	—	14h	14h
28	Minimum row active to row active delay (tRRD)	—	—	20ns	20ns	—	—	14h	14h
29	Mininum RAS to CAS (tRCD)	—	—	20ns	20ns	—	—	14h	14h
30	Mininum RAS pulse width (tRAS)	—	—	50ns	50ns	—	—	32h	32h
31	Module bank density	512MB				80h			
32	Min. command and address signal setup time (tAS)	2ns				20h			
33	Min. command and address signal hold time (tAH)	1ns				10h			
34	Min. data signal input setup time (tDS)	2ns				20h			
35	Min. data signal input hold time (tDH)	1ns				10h			

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**SERIAL PRESENCE DETECT INFORMATION** *(continued)*

Byte #	Function Described	Function Supported				Hex Value			
		A	B	C	D	A	B	C	D
36-61	Superset information (may be used in future)	—				00h			
62	SPD revision	—	—	1.2	1.2	—	—	12h	12h
63	Checksum for bytes 0-62	JEDEC calculation				xxh			
64	Manufacturer's JEDEC ID code per JEP-106E	Continuation code				7Fh			
65	Man. JEDEC ID code (continued)	SimpleTech's ID				A8h			
66-71	—	—				00h			
72	Manufacturing location	SimpleTech USA				01h			
73-90	Manufacturer's part number					xxh			
91	Revision code of PCB	Rev A				01h			
92	—					00h			
93	Manufacturing date	Year (BCD)				yy			
94		Calender Week (BCD)				ww			
95	Assembly serial number	Tester number				ss			
96		Serial number (bits 7-0)				ss			
97		Serial number (bits 15-8)				ss			
98		Serial number (bits 23-16)				ss			
99-125	Manufacturer's specific data					xxh			
126	Intel specification frequency	100MHz				64h			
127	Intel specification details	1000-1111				—	—	8Fh	8Fh
128-255	Unused storage locations	—				FFh			

FUNCTIONAL BLOCK DIAGRAM



All resistors are 10Ω unless otherwise specified.  
 DQ wiring may differ from that described in this drawing;  
 however, DQ/DQMB relationships is maintained as shown.

\*Use of one CKE is optional via a jumper.