



8M X 64 SDRAM SODIMM based on 4M X 16, 4 Banks, 4K Refresh, 3.3V Synchronous DRAMS with SPD

DESCRIPTION

AVED Memory Products AVED8P664LS48-C75 is a 8M bit x 64 Synchronous Dynamic RAM high density memory module. The AVED Memory Products AVED8P664LS48-C75 consists of eight CMOS 4M X 16 bit with 4 banks Synchronous DRAMS in TSOP-II 400mil package and a 2K EEPROM in 8-pin TSSOP package on a 144-pin glass-epoxy substrate. Three 0.1uF decoupling capacitors are mounted on the printed circuit board in parallel for each SDRAM. The AVED Memory Products AVED8P664LS48-C75 is a Small Outline Dual In-Line Memory Module and is intended for mounting into 144-pin edge connector sockets.

Synchronous design allows precise cycle control with the use of system clock. I/O transactions are possible on every clock cycle. Range of operating frequencies and programmable latencies allow the same device to be useful for a variety of high bandwidth, high performance memory system applications.

APPLICATION

Main Memory unit for computer, Microcomputer memory, Refresh memory for CRT.

FEATURES

- Performance Ranges
- Part Identification
 - AVED8P664LS48-C75
 - 4k cycles/64ms Ref, TSOP, Gold Contact Plating
- PC 133

Part #	Maximum Frequency
AVED8P664LS48-C75	133MHz (7.5ns@CL=3)

- Burst Mode Operation
- Auto & Self-Refresh capability
- MRS cycle with address key programs
 - Latency (Access from column address)
 - Burst Length (1, 2, 4, 8 and Full Page)
 - Data Scramble (Sequential & Interleave)
- LVTTTL compatible inputs and outputs
- Single 3.3V ± 0.3V power supply
- All inputs are sampled at the positive going edge of the system clock
- Serial Presence Detect with EEPROM

PIN NAMES

Pin Name	Function
A0 - A11	Address Input (multiplexed)
BA0 - BA1	Select Bank
DQ0 - DQ63	Data Input/Output
CLK0 - CLK1	Clock Input
CKE0 - CKE1	Clock Enable Input
CS0 - CS1	Chip Select Input
RAS	Row Address Strobe
CAS	Column Address Strobe
WE	Write Enable
DQM0 - 7	DQM
Vdd	Power supply(3.3V)
Vss	Ground
SDA	Serial Address/Data/I/O
SCL	Serial Clock
DU	Don't Use
NC	No Connection



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PIN CONFIGURATIONS (FRONT SIDE/BACK SIDE)

Pin	Front	Pin	Back	Pin	Front	Pin	Back	Pin	Front	Pin	Back
1	Vss	2	Vss	51	DQ14	52	DQ46	95	DQ21	96	DQ53
3	DQ0	4	DQ32	53	DQ15	54	DQ47	97	DQ22	98	DQ54
5	DQ1	6	DQ33	55	Vss	56	Vss	99	DQ23	100	DQ55
7	DQ2	8	DQ34	57	NC	58	NC	101	Vdd	102	Vdd
9	DQ3	10	DQ35	59	NC	60	NC	103	A6	104	A7
11	Vdd	12	Vdd	Voltage Key				105	A8	106	BA0
13	DQ4	14	DQ36					107	Vss	108	Vss
15	DQ5	16	DQ37	61	CLK0	62	CKE0	109	A9	110	BA1
17	DQ6	18	DQ38	63	Vdd	64	Vdd	111	A10/AP	112	A11
19	DQ7	20	DQ39	65	$\overline{\text{RAS}}$	66	$\overline{\text{CAS}}$	113	Vdd	114	Vdd
21	Vss	22	Vss	67	$\overline{\text{WE}}$	68	CKE1	115	DQM2	116	DQM6
23	DQM0	24	DQM4	69	$\overline{\text{CS0}}$	70	*A12	117	DQM3	118	DQM7
25	DQM1	26	DQM5	71	$\overline{\text{CS1}}$	72	*A13	119	Vss	120	Vss
27	Vdd	28	Vdd	73	DU	74	CLK1	121	DQ24	122	DQ56
29	A0	30	A3	75	Vss	76	Vss	123	DQ25	124	DQ57
31	A1	32	A4	77	NC	78	NC	125	DQ26	126	DQ58
33	A2	34	A5	79	NC	80	NC	127	DQ27	128	DQ59
35	Vss	36	Vss	81	Vdd	82	Vdd	129	Vdd	130	Vdd
37	DQ8	38	DQ40	83	DQ16	84	DQ48	131	DQ28	132	DQ60
39	DQ9	40	DQ41	85	DQ17	86	DQ49	133	DQ29	134	DQ61
41	DQ10	42	DQ42	87	DQ18	88	DQ50	135	DQ30	136	DQ62
43	DQ11	44	DQ43	89	DQ19	90	DQ51	137	DQ31	138	DQ63
45	Vdd	46	Vdd	91	Vss	92	Vss	139	Vss	140	Vss
47	DQ12	48	DQ44	93	DQ20	94	DQ52	141	**SDA	142	**SCL
49	DQ13	50	DQ45					143	Vdd	144	Vdd

Pins marked * are not used in this module.

Pins marked ** should be NC in the system which does not support SPD.



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PIN FUNCTION DESCRIPTION

Pin	Name	Input Function
CLK	System Clock	Active on the positive going edge to sample all inputs.
$\overline{\text{CS}}$	Chip Select	Disables or enables device operation by masking or enabling all inputs except CLK, CKE, and DQM.
CKE	Clock Enable	Masks system clock to freeze operation from the next clock cycle. CKE should be enabled at least one cycle prior to new command. Disables input buffers for power down in standby. CKE should be enabled 1CLK+tss prior to valid command.
A0 - A11	Address	Row/Column addresses are multiplexed on the same pins. Row Address: RA0 - RA11, Column address: CA0 - CA7.
BA0 - BA1	Bank Select Address	Selects bank to be activated during row address latch time. Selects bank for read/write during column address latch time.
$\overline{\text{RAS}}$	Row Address Strobe	Latches row addresses on the positive going edge of the CLK with $\overline{\text{RAS}}$ low. Enables row access & precharge.
$\overline{\text{CAS}}$	Column Address Strobe	Latches column address on the positive going edge of the CLK with $\overline{\text{CAS}}$ low. Enables column access.
$\overline{\text{WE}}$	Write Enable	Enables write operation and row precharge. Latches data in starting from $\overline{\text{CAS}}$, $\overline{\text{WE}}$ active.
DQM0 - DQM7	Data Input/Output Mask	Masks data output Hi-Z, tSHZ after the clock and masks the output. Blocks data input when DQM active. (Byte Masking)
DQ0 - DQ63	Data Input/Output	Data inputs/outputs are multiplexed on the same pins.
Vdd/Vss	Power Supply/Ground	Power and ground for the input buffers and the core logic.



AVED MEMORY PRODUCTS

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AVED8P664LS48-C75

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ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Rating	Unit
Voltage on any pin relative to Vss	VIN, VOUT	-1.0 ~ 4.6	V
Voltage on Vdd supply relative to Vss	Vdd, Vddq	-1.0 ~ 4.6	V
Storage Temperature	Tstg	-55 to +150	°C
Power Dissipation	Pd	8	W
Short Circuit Current	IOS	50	mA

Note: Permanent device damage may occur if ABSOLUTE MAXIMUM RATINGS are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

DC OPERATING CONDITIONS AND CHARACTERISTICS Recommended operating conditions (Voltage referenced to Vss = 0V, Ta = 0 to 70°C)

Item	Symbol	Min	Typ	Max	Unit	Notes
Supply Voltage	Vdd	3.0	3.3	3.6	V	
Input High Voltage	VIH	2.0	3.0	Vddq+0.3	V	Note 1
Input Low Voltage	VIL	-0.3	0	0.8	V	Note 2
Output high voltage	VOH	2.4	-	-	V	IOH=-2mA
Output low voltage	VOL	-	-	0.4	V	IOL=2mA
Input leakage current (Inputs)	IIL	-8	-	8	µA	Note 3
Input leakage current (I/O pins)	IIL	-3	-	3	µA	Note 3,4

- Note:** 1. VIH (max) = 5.6V AC (pulse width ≤ 3ns)
 2. VIL(min) = -2.0V AC (pulse width ≤ 3ns)
 3. Any input 0V ≤ VIN ≤ Vddq. Input leakage currents include Hi-Z output leakage for all bi-directional buffers with Tri-State outputs.
 4. DOUT is disabled, 0V ≤ VOUT ≤ Vddq

CAPACITANCE (Vdd = 3.3V, Ta = 23 °C, f=1MHz, VREF = 1.4V ± 200mV)

Item	Symbol	Min	Max	Unit
Input capacitance [A0 - A11, BA0 - BA1]	CIN1	30	50	pF
Input capacitance [RAS, CAS, WE]	CIN2	30	50	pF
Input capacitance (CKE0 - CKE1)	CIN3	20	30	pF
Input capacitance [CLK0 - CLK1]	CIN4	20	26	pF
Input capacitance [CS0 - CS1]	CIN5	20	30	pF
Input capacitance [DQM0 - DQM7]	CIN6	15	20	pF
Data input/output capacitance[DQ0 - DQ63]	COU	18	23	pF



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DC AND OPERATING CHARACTERISTICS (Recommended operating conditions unless otherwise noted) TA = 0 to 70°C

Symbol	Test Condition	CAS Latency	Version	Unit
			-C75	
ICC1	Burst Length = 1 tRC ≥ tRC (min) IoL = 0 mA		380	mA
ICC2P	CKE ≤ VIL (max), tCC = 15ns		8	mA
ICC2PS	CKE & CLK ≤ VIL (max), tCC = ∞		8	
ICC2N	CKE ≥ VIH (min), $\overline{CS} \geq VIH$ (min), tCC = 15ns Input signals are changed one time during 30ns		96	mA
ICC2NS	CKE ≥ VIH (min), CLK ≤ VIL (max), tCC = ∞ Input signals are stable		48	
ICC3P	CKE ≤ VIL (max), tCC = 15 ns		16	mA
ICC3PS	CKE & CLK ≤ VIL (max), tCC = ∞		16	
ICC3N	CKE ≥ VIH (min), $\overline{CS} \geq VIH$ (min), tCC = 15ns Input signals are changed one time during 30ns		160	mA
ICC3NS	CKE ≥ VIH (min), CLK ≤ VIL (max), tCC = ∞ Input signals are stable		80	
ICC4	10mA Page Burst, 2 Banks Activated tCCD = 2CLKs	3	600	mA
ICC5	tRC ≥ tRC (min)		1000	mA
ICC6	CKE ≤ 0.2V		3.6	mA

- ICC1: Operating Current (*Measured with outputs open [One Bank Active]).
- ICC2P: Precharge Standby Current in Power-down mode
- ICC2PS: Precharge Standby Current in Power-down mode.
- ICC2N: Precharge Standby Current in Non Power-down mode.
- ICC2NS: Precharge Standby Current in Non Power-down mode.
- ICC3P: Active Standby Current in Power-down mode.
- ICC3PS: Active Standby Current in Power-down mode.
- ICC3N: Active Standby Current in Non Power-down mode (One Bank Active).
- ICC3NS: Active Standby Current in Non Power-down mode (One Bank Active).
- ICC4: Operating Current (*Measured with outputs open [Two Banks Active]).
- ICC5: Refresh Current (** Refresh period is 64ms).
- ICC6: Self-Refresh Current



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AC OPERATING TEST CONDITIONS (V_{dd} = 3.3V±0.3V, T_A = 0 to 70°C)

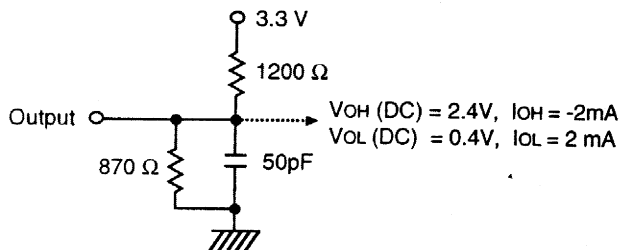
Parameter	Value
AC input levels	V _{IH} /V _{IL} = 2.4V / 0.4V
Input timing measurement reference level	1.4V
Input rise and fall time	t _r / t _f = 1ns / 1ns
Output measurement reference level	1.4V
Output load condition	See Fig. 2

OPERATING AC PARAMETER (AC operating conditions unless otherwise noted)

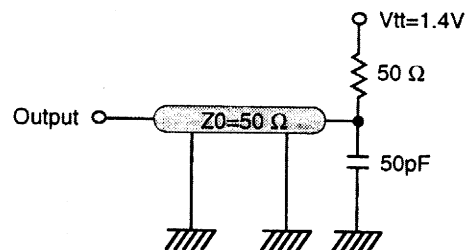
Refer to the individual component not the whole module.

Parameter	Symbol	Version	Unit	Note
		-C75		
Row Active to Row Active delay	t _{RRD} (min)	15	ns	1
$\overline{\text{RAS}}$ to $\overline{\text{CAS}}$ delay	t _{RCD} (min)	20	ns	1
Row precharge time	t _{RP} (min)	20	ns	1
Row active time	t _{RAS} (min)	45	ns	1
	t _{RAS} (max)	100	us	
Row cycle time	t _{RC} (min)	65	ns	1
Last data in to Row precharge	t _{RDL} (min)	2	ns	2
Last data in to new col.add. delay	t _{CDL} (min)	1	CLK	2
Last data in to burst stop	t _{BDL} (min)	1	CLK	2
Col. address to col. address delay	t _{CCD} (min)	1	CLK	3
Number of valid output data	CAS latency = 3	2	ea	4

- Note :
1. The minimum number of clock cycles is determined by dividing the minimum time required with clock cycle time, and then rounding off to the next higher integer.
 2. Minimum delay is required to complete write.
 3. All parts allow every cycle column address change.
 4. In case of row precharge interrupt, auto precharge and read burst stop.



(Fig. 1) DC Output Load Circuit



(Fig. 2) AC Output Load Circuit



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AC CHARACTERISTICS (AC Operating conditions unless otherwise noted)

Refer to the individual component, not the who

Parameter		Symbol	-C75		Unit	Note
			Min	Max		
CLK cycle Time	CAS Latency=3	tCC	7.5	1000	ns	1
CLK to valid output delay	CAS Latency=3	tSAC	-	5.4	ns	1,2
Output data hold time	CAS Latency=3	tOH	2.7		ns	2
CLK high pulse width		tCH	2.5	-	ns	3
CLK low pulse width		tCL	2.5	-	ns	3
Input setup time		tSS	1.5	-	ns	3
Input hold time		tSH	0.8	-	ns	3
CLK to output in Low-Z		tSLZ	1	-	ns	2
CLK to output in Hi-Z	CAS Latency=3	tSHZ	-	5.4	ns	

- Note:
- Parameters depend on programmed CAS latency.
 - If clock rising time is longer than 1ns, $(tr/2-0.5)ns$ should be added to the parameter.
 - Assumed input rise and fall time $(tr \& \&tf) = 1ns$.
If $tr \& \&tf$ is longer than 1ns, transient time compensation should be considered, i.e., $[(tr + \&tf)/2 - 1] ns$ should be added to the parameter.



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SIMPLIFIED TRUTH TABLE

COMMAND		CKEn-1	CKEn	\overline{CS}	\overline{RAS}	\overline{CAS}	\overline{WE}	DQM	BA0,1	A10/AP	A11,A9-0	Note	
Register	Mode Register Set	H	X	L	L	L	L	X	OP CODE			1, 2	
Refresh	Auto Refresh	H	H	L	L	L	H	X	X			3	
	Self Refresh		Entry									L	3
	Refresh	Exit	L	H	L	H	H	H	X	X			3
				H	X	X	X	3					
Bank Active & Row Address		H	X	L	L	H	H	X	V	Row Address			
Read & Column Address	Auto Precharge Disable	H	X	L	H	L	H	X	V	L	Column Address (A0 -A7)	4	
	Auto Precharge Enable									H		4, 5	
Write & Column Address	Auto Precharge Disable	H	X	L	H	L	L	X	V	L	Column Address (A0 -A7)	4	
	Auto Precharge Enable									H		4, 5	
Burst Stop		H	X	L	H	H	L	X	X			6	
Precharge	Bank Selection	H	X	L	L	H	L	X	V	L	X		
	All Banks								X	H			
Clock Suspend or Active Power Down	Entry	H	L	H	X	X	X	X	X				
				L	V	V	V						
	Exit	L	H	X	X	X	X	X					
Precharge Power Down Mode	Entry	H	L	H	X	X	X	X	X				
				L	H	H	H						
	Exit	L	H	H	X	X	X	X					
				L	V	V	V						
DQM		H			X			V	X			7	
No Operation Command		H	X	H	X	X	X	X	X				
				L	H	H	H						

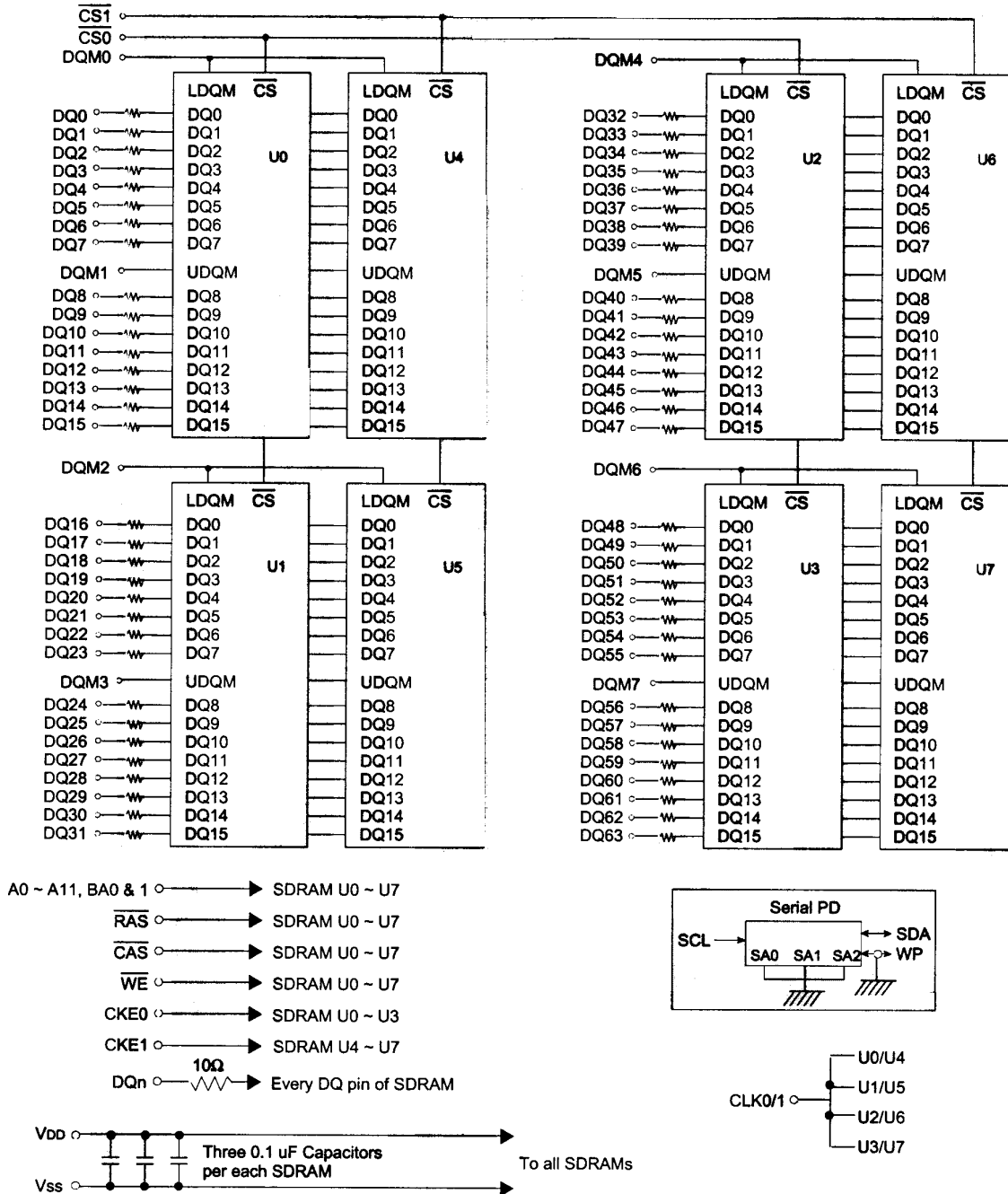
(V = Valid, X = Don't Care, H = Logic High, L = Logic Low)

- Note:**
- OP Code: Operand Code
A0 - A11, BA0 - BA1 : Program keys @ MRS.
 - MRS can be issued only at all banks precharge state.
A new command can be issued after 2 clock cycles of MRS.
 - Auto-Refresh functions are same as CBR refresh of DRAM.
The automatic precharge without row precharge command is meant by "Auto."
Auto/Self-Refresh can be issued only at all banks precharge state.
 - BA0 - BA1: Bank select address.
If both BA0 and BA1 are "Low" at read, write, row active and precharge, bank A is selected.
If both BA0 is "Low" and BA1 is "High" at read, write, row active and precharge, bank B is selected.
If both BA0 is "High" and BA1 is "Low" at read, write, row active and precharge, bank C is selected.
If both BA0 and BA1 are "High" at read, write, row active and precharge, bank D is selected.
If A10/AP is "High" at row precharge, BA0 and BA1 are ignored and all banks are selected.
 - During burst read or write with auto precharge, new read/write command cannot be issued.
Another bank read/write command can be issued after the end of burst.
New row active of the associated bank can be issued at tRP after the end of burst.
 - Burst stop command is valid at every burst length.
 - DQM sampled at positive going edge of a CLK masks the data-in at the very CLK (Write DQM latency is 0) but makes Hi-Z state the data-out of 2 CLK cycles after. (Read DQM latency is 2)



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FUNCTIONAL BLOCK DIAGRAM



Note: Use a zero ohm jumper to isolate A12 from the SDRAM pins in non-256M bit designs.

