



# 512MB- 64Mx64 DDR SDRAM UNBUFFERED

## FEATURES

- Double-data-rate architecture
- Bi-directional data strobes (DQS)
- Differential clock inputs (CK & CK#)
- Programmable Read Latency 2,2,5 (clock)
- Programmable Burst Length (2,4,8)
- Programmable Burst type (sequential & interleave)
- Edge aligned data output, center aligned data input
- Auto and self refresh
- Serial presence detect
- Power Supply: 2.5V ± 0.20V
- JEDEC standard 200 pin SO-DIMM package

## DESCRIPTION

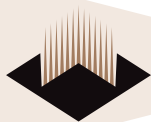
The W3EG6465S is a 64Mx64 Double Data Rate SDRAM memory module based on 512Mb DDR SDRAM component. The module consists of eight 64Mx8 DDR SDRAMs in 66 pin TSOP package mounted on a 200 Pin FR4 substrate.

Synchronous design allows precise cycle control with the use of system clock. Data I/O transactions are possible on both edges and Burst Lengths allow the same device to be useful for a variety of high bandwidth, high performance memory system applications.

\* This product is under development, is not qualified or characterized and is subject to change without notice.

## OPERATING FREQUENCIES

	DDR266 @CL=2	DDR266 @CL=2.5	DDR266 @CL=2	DDR200 @CL=2
Clock Speed	133MHz	133MHz	133MHz	100MHz
CL-trCD-trP	2-2-2	2.5-3-3	2-3-3	2-2-2



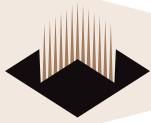
### PIN CONFIGURATIONS

Pin	Symbol	Pin	Symbol	Pin	Symbol	Pin	Symbol
1	V <sub>REF</sub>	51	V <sub>SS</sub>	101	A9	151	DQ42
2	V <sub>REF</sub>	52	V <sub>SS</sub>	102	A8	152	DQ46
3	V <sub>SS</sub>	53	DQ19	103	V <sub>SS</sub>	153	DQ43
4	V <sub>SS</sub>	54	DQ23	104	V <sub>SS</sub>	154	DQ47
5	DQ0	55	DQ24	105	A7	155	V <sub>CC</sub>
6	DQ4	56	DQ28	106	A6	156	V <sub>CC</sub>
7	DQ1	57	V <sub>CC</sub>	107	A5	157	V <sub>CC</sub>
8	DQ5	58	V <sub>CC</sub>	108	A4	158	CK1#
9	V <sub>CC</sub>	59	DQ25	109	A3	159	V <sub>SS</sub>
10	V <sub>CC</sub>	60	DQ29	110	A2	160	CK1
11	DQS0	61	DQS3	111	A1	161	V <sub>SS</sub>
12	DQM0	62	DQM3	112	A0	162	V <sub>SS</sub>
13	DQ2	63	V <sub>SS</sub>	113	V <sub>CC</sub>	163	DQ48
14	DQ6	64	V <sub>SS</sub>	114	V <sub>CC</sub>	164	DQ52
15	V <sub>SS</sub>	65	DQ26	115	A10/AP	165	DQ49
16	V <sub>SS</sub>	66	DQ30	116	BA1	166	DQ53
17	DQ3	67	DQ27	117	BA0	167	V <sub>CC</sub>
18	DQ7	68	DQ31	118	RAS#	168	V <sub>CC</sub>
19	DQ8	69	V <sub>CC</sub>	119	WE#	169	DQS6
20	DQ12	70	V <sub>CC</sub>	120	CAS#	170	DQM6
21	V <sub>CC</sub>	71	NC	121	CS0	171	DQ50
22	V <sub>CC</sub>	72	NC	122	CS1*	172	DQ54
23	DQ9	73	NC	123	NC	173	V <sub>SS</sub>
24	DQ13	74	NC	124	NC	174	V <sub>SS</sub>
25	DQS1	75	V <sub>SS</sub>	125	V <sub>SS</sub>	175	DQ51
26	DQM1	76	V <sub>SS</sub>	126	V <sub>SS</sub>	176	DQ55
27	V <sub>SS</sub>	77	DQS8	127	DQ32	177	DQ56
28	V <sub>SS</sub>	78	NC	128	DQ36	178	DQ60
29	DQ10	79	NC	129	DQ33	179	V <sub>CC</sub>
30	DQ14	80	NC	130	DQ37	180	V <sub>CC</sub>
31	DQ11	81	V <sub>CC</sub>	131	V <sub>CC</sub>	181	DQ57
32	DQ15	82	V <sub>CC</sub>	132	V <sub>CC</sub>	182	DQ61
33	V <sub>CC</sub>	83	NC	133	DQS4	183	DQS7
34	V <sub>CC</sub>	84	NC	134	DQM4	184	DQM7
35	CK0	85	NC	135	DQ34	185	V <sub>SS</sub>
36	V <sub>CC</sub>	86	NC	136	DQ38	186	V <sub>SS</sub>
37	CK0#	87	V <sub>SS</sub>	137	V <sub>SS</sub>	187	DQ58
38	V <sub>SS</sub>	88	V <sub>SS</sub>	138	V <sub>SS</sub>	188	DQ62
39	V <sub>SS</sub>	89	CK2*	139	DQ35	189	DQ59
40	V <sub>SS</sub>	90	V <sub>SS</sub>	140	DQ39	190	DQ63
41	DQ16	91	CK2*#	141	DQ40	191	V <sub>CC</sub>
42	DQ20	92	V <sub>CC</sub>	142	DQ44	192	V <sub>CC</sub>
43	DQ17	93	V <sub>CC</sub>	143	V <sub>CC</sub>	193	SDA
44	DQ21	94	V <sub>CC</sub>	144	V <sub>CC</sub>	194	SA0
45	V <sub>CC</sub>	95	CKE1*	145	DQ41	195	SCL
46	V <sub>CC</sub>	96	CKE0	146	DQ45	196	SA1
47	DQS2	97	NC	147	DQS5	197	V <sub>CCSPD</sub>
48	DQM2	98	NC	148	DQM5	198	SA2
49	DQ18	99	A12	149	V <sub>SS</sub>	199	V <sub>CCID</sub>
50	DQ22	100	A11	150	V <sub>SS</sub>	200	NC

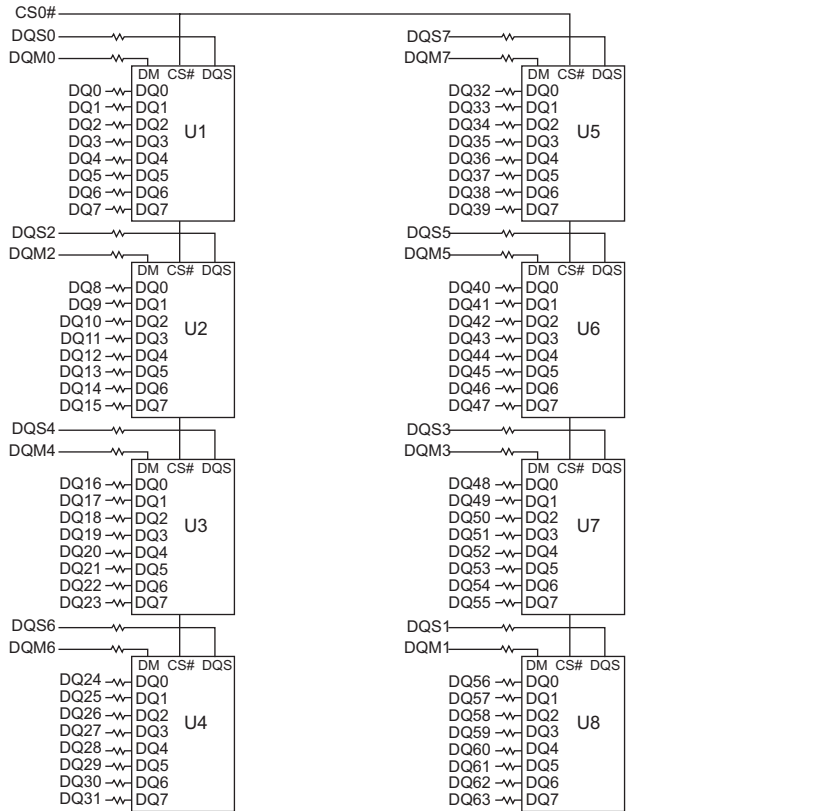
### PIN NAMES

A0 – A12	Address input (Multiplexed)
BA0-BA1	Bank Select Address
DQ0-DQ63	Data Input/Output
DQS0-DQS8	Data Strobe Input/Output
CK0, CK1	Clock Input
CK0#, CK1#	Clock Input
CKE0	Clock Enable Input
CS0#	Chip select Input
RAS#	Row Address Strobe
CAS#	Column Address Strobe
WE#	Write Enable
DQM0-DQM7	Data-In Mask
V <sub>CC</sub>	Power Supply (2.5V)
V <sub>CCQ</sub>	Power Supply for DQS (2.5V)
V <sub>SS</sub>	Ground
V <sub>REF</sub>	Power Supply for Reference
V <sub>CCSPD</sub>	Serial EEPROM Power Supply (2.3V to 3.6V)
SDA	Serial data I/O
SCL	Serial clock
SA0-SA2	Address in EEPROM
V <sub>CCID</sub>	V <sub>CC</sub> Identification Flag
NC	No Connect

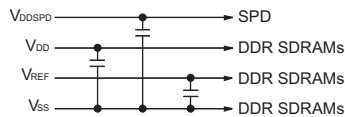
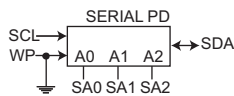
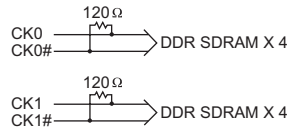
\*Not Used



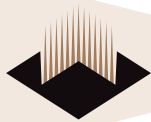
FUNCTIONAL BLOCK DIAGRAM



- BA0, BA1 → BA0, BA1: DDR SDRAMs
- A0-A12 → A0-A12: DDR SDRAMs
- RAS# → RAS#: DDR SDRAMs
- CAS# → CAS#: DDR SDRAMs
- CKE0 → CKE0: DDR SDRAMs
- WE# → WE#: DDR SDRAMs



NOTE: All resistor values are 22 ohms unless otherwise specified.



**ABSOLUTE MAXIMUM RATINGS**

Parameter	Symbol	Value	Units
Voltage on any pin relative to V <sub>ss</sub>	V <sub>IN</sub> , V <sub>OUT</sub>	-0.5 to 3.6	V
Voltage on V <sub>cc</sub> supply relative to V <sub>ss</sub>	V <sub>CC</sub> , V <sub>CCQ</sub>	-1.0 to 3.6	V
Storage Temperature	T <sub>STG</sub>	-55 to +150	°C
Power Dissipation	P <sub>D</sub>	8	W
Short Circuit Current	I <sub>OS</sub>	50	mA

Note:  
 Permanent device damage may occur if "ABSOLUTE MAXIMUM RATINGS" are exceeded.  
 Functional operation should be restricted to recommended operating condition.  
 Exposure to higher than recommended voltage for extended periods of time could affect device reliability.

**DC CHARACTERISTICS**

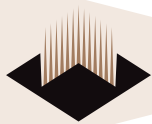
0°C ≤ T<sub>A</sub> ≤ 70°C, V<sub>CC</sub> = 2.5V ± 0.2V

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V <sub>CC</sub>	2.3	2.7	V
Supply Voltage	V <sub>CCQ</sub>	2.3	2.7	V
Reference Voltage	V <sub>REF</sub>	V <sub>CCQ</sub> /2 - 50mV	V <sub>CCQ</sub> /2 + 50mV	V
Termination Voltage	V <sub>TT</sub>	V <sub>REF</sub> - 0.04	V <sub>REF</sub> + 0.04	V
Input High Voltage	V <sub>IH</sub>	V <sub>REF</sub> + 0.15	V <sub>CCQ</sub> + 0.3	V
Input Low Voltage	V <sub>IL</sub>	-0.3	V <sub>REF</sub> - 0.15	V
Output High Voltage	V <sub>OH</sub>	V <sub>TT</sub> + 0.76	—	V
Output Low Voltage	V <sub>OL</sub>	—	V <sub>TT</sub> - 0.76	V

**CAPACITANCE**

T<sub>A</sub> = 25°C, f = 1MHz, V<sub>CC</sub> = 3.3V, V<sub>REF</sub> = 1.4V ± 200mV

Parameter	Symbol	Max	Unit
Input Capacitance (A0-A12)	C <sub>IN1</sub>	29	pF
Input Capacitance (RAS#, CAS#, WE#)	C <sub>IN2</sub>	29	pF
Input Capacitance (CKE0)	C <sub>IN3</sub>	29	pF
Input Capacitance (CK0,CK0#)	C <sub>IN4</sub>	26	pF
Input Capacitance (CS0#)	C <sub>IN5</sub>	29	pF
Input Capacitance (DQM0-DQM8)	C <sub>IN6</sub>	8	pF
Input Capacitance (BA0-BA1)	C <sub>IN7</sub>	29	pF
Data input/output capacitance (DQ0-DQ63)(DQS)	C <sub>OUT</sub>	8	pF



**IDD SPECIFICATIONS AND TEST CONDITIONS**

Recommended operating conditions, 0°C ≤ T<sub>A</sub> ≤ 70°C, V<sub>CCQ</sub> = 2.5V ± 0.2V, V<sub>CC</sub> = 2.5V ± 0.2V

Parameter	Symbol	Conditions	DDR266@CL=2 Max 2-2-2	DDR266@CL=2.5 Max 2.5-3-3	DDR266@CL=2 Max 2-3-3	DDR200@CL=2 Max 2-2-2	Units
Operating Current	I <sub>DD0</sub>	One device bank; Active - Precharge; t <sub>RC</sub> =t <sub>RC</sub> (MIN); t <sub>CK</sub> =t <sub>CK</sub> (MIN); DQ,DM and DQS inputs changing once per clock cycle; Address and control inputs changing once every two cycles.	1320	1320	1320	1320	mA
Operating Current	I <sub>DD1</sub>	One device bank; Active-Read-Precharge; Burst = 2; t <sub>RC</sub> =t <sub>RC</sub> (MIN);t <sub>CK</sub> =t <sub>CK</sub> (MIN); I <sub>out</sub> = 0mA; Address and control inputs changing once per clock cycle.	1520	1520	1520	1520	mA
Precharge Power-Down Standby Current	I <sub>DD2P</sub>	All device banks idle; Power- down mode; t <sub>CK</sub> =t <sub>CK</sub> (MIN); CKE=(low)	48	48	48	48	mA
Idle Standby Current	I <sub>DD2F</sub>	CS# = High; All device banks idle; t <sub>CK</sub> =t <sub>CK</sub> (MIN); CKE = high; Address and other control inputs changing once per clock cycle. Vin = Vref for DQ, DQS and DM.	400	400	400	400	mA
Active Power-Down Standby Current	I <sub>DD3P</sub>	One device bank active; Power-down mode; t <sub>CK</sub> (MIN); CKE=(low)	400	400	400	400	mA
Active Standby Current	I <sub>DD3N</sub>	CS# = High; CKE = High; One device bank; Active-Precharge; t <sub>RC</sub> =t <sub>RAS</sub> (MAX); t <sub>CK</sub> =t <sub>CK</sub> (MIN); DQ, DM and DQS inputs changing twice per clock cycle; Address and other control inputs changing once per clock cycle.	760	760	760	760	mA
Operating Current	I <sub>DD4R</sub>	Burst = 2; Reads; Continous burst; One device bank active;Address and control inputs changing once per clock cycle; t <sub>CK</sub> =t <sub>CK</sub> (MIN); I <sub>out</sub> = 0mA.	1760	1760	1760	1760	mA
Operating Current	I <sub>DD4W</sub>	Burst = 2; Writes; Continous burst; One device bank active; Address and control inputs changing once per clock cycle; t <sub>CK</sub> =t <sub>CK</sub> (MIN); DQ,DM and DQS inputs changing twice per clock cycle.	2000	2000	2000	2000	mA
Auto Refresh Current	I <sub>DD5</sub>	t <sub>RC</sub> =t <sub>RC</sub> (MIN)	2480	2480	2480	2480	mA
Self Refresh Current	I <sub>DD6</sub>	CKE ≤ 0.2V	40	40	40	40	mA
Operating Current	I <sub>DD7A</sub>	Four bank interleaving Reads (BL=4) with auto precharge with t <sub>RC</sub> =t <sub>RC</sub> (MIN); t <sub>CK</sub> =t <sub>CK</sub> (MIN); Address and control inputs change only during Active Read or Write commands.	3840	3840	3840	3840	mA



DETAILED TEST CONDITIONS FOR DDR SDRAM I<sub>DD1</sub> & I<sub>DD7A</sub>

I<sub>DD1</sub> : OPERATING CURRENT : ONE BANK

1. Typical Case : V<sub>CC</sub>=2.5V, T=25°C
2. Worst Case : V<sub>CC</sub>=2.7V, T=10°C
3. Only one bank is accessed with t<sub>RC</sub> (min), Burst Mode, Address and Control inputs on NOP edge are changing once per clock cycle. I<sub>OUT</sub> = 0mA
4. Timing Patterns :
  - DDR200 (100 MHz, CL=2) : t<sub>CK</sub>=10ns, CL2, BL=4, t<sub>RCD</sub>=2\*t<sub>CK</sub>, t<sub>TRAS</sub>=5\*t<sub>CK</sub>  
Read : A0 N R0 N N P0 N A0 N - repeat the same timing with random address changing; 50% of data changing at every burst
  - DDR266 (133MHz, CL=2.5) : t<sub>CK</sub>=7.5ns, CL=2.5, BL=4, t<sub>RCD</sub>=3\*t<sub>CK</sub>, t<sub>RC</sub>=9\*t<sub>CK</sub>, t<sub>TRAS</sub>=5\*t<sub>CK</sub>  
Read : A0 N N R0 N P0 N N A0 N - repeat the same timing with random address changing; 50% of data changing at every burst
  - DDR266 (133MHz, CL=2) : t<sub>CK</sub>=7.5ns, CL=2, BL=4, t<sub>RCD</sub>=3\*t<sub>CK</sub>, t<sub>RC</sub>=9\*t<sub>CK</sub>, t<sub>TRAS</sub>=5\*t<sub>CK</sub>  
Read : A0 N N R0 N P0 N N A0 N - repeat the same timing with random address changing; 50% of data changing at every burst

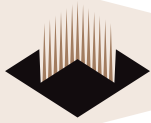
I<sub>DD7A</sub> : OPERATING CURRENT : FOUR BANKS

1. Typical Case : V<sub>CC</sub>=2.5V, T=25°C
2. Worst Case : V<sub>CC</sub>=2.7V, T=10°C
3. Four banks are being interleaved with t<sub>RC</sub> (min), Burst Mode, Address and Control inputs on NOP edge are not changing. I<sub>OUT</sub>=0mA
4. Timing Patterns :
  - DDR200 (100 MHz, CL=2) : t<sub>CK</sub>=10ns, CL2, BL=4, t<sub>RRD</sub>=2\*t<sub>CK</sub>, t<sub>RCD</sub>=3\*t<sub>CK</sub>, Read with Autoprecharge  
Read : A0 N A1 R0 A2 R1 A3 R2 A0 R3 A1 R0 - repeat the same timing with random address changing; 100% of data changing at every burst
  - DDR266 (133MHz, CL=2.5) : t<sub>CK</sub>=7.5ns, CL=2.5, BL=4, t<sub>RRD</sub>=3\*t<sub>CK</sub>, t<sub>RCD</sub>=3\*t<sub>CK</sub>  
Read with Autoprecharge  
Read : A0 N A1 R0 A2 R1 A3 R2 N R3 A0 N A1 R0 - repeat the same timing with random address changing; 100% of data changing at every burst
  - DDR266 (133MHz, CL=2) : t<sub>CK</sub>=7.5ns, CL2=2, BL=4, t<sub>RRD</sub>=2\*t<sub>CK</sub>, t<sub>RCD</sub>=2\*t<sub>CK</sub>  
Read : A0 N A1 R0 A2 R1 A3 R2 N R3 A0 N A1 R0 - repeat the same timing with random address changing; 100% of data changing at every burst

Legend : A = Activate, R = Read, W = Write, P = Precharge, N = NOP

A (0-3) = Activate Bank 0-3

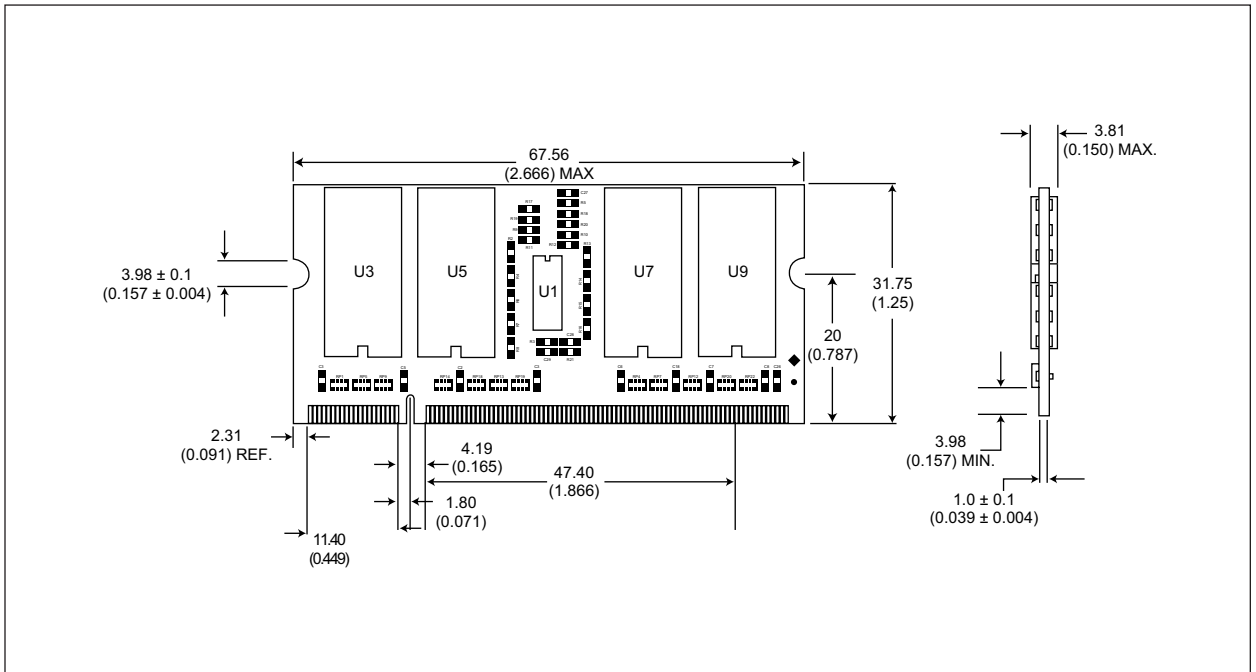
R (0-3) = Read Bank 0-3



ORDERING INFORMATION FOR D4

Part Number	Speed	CAS Latency	trCD	trP	Height*	Temperature
W3EG6465S262D4C	133MHz/266Mb/s	2	2	2	31.75 (1.25")	0°C to 70°C
W3EG6465S263D4C	133MHz/266Mb/s	2	3	3	31.75 (1.25")	0°C to 70°C
W3EG6465S265D4C	133MHz/266Mb/s	2.5	3	3	31.75 (1.25")	0°C to 70°C
W3EG6465S202D4C	100MHz/200Mb/s	2	2	2	31.75 (1.25")	0°C to 70°C

PACKAGE DIMENSIONS FOR D4



\* ALL DIMENSIONS ARE IN MILLIMETERS AND (INCHES)



**Document Title**

512MB- 64Mx64 DDR SDRAM UNBUFFERED

**Revision History**

<b>Rev #</b>	<b>History</b>	<b>Release Date</b>	<b>Status</b>
Rev 1	Created Datasheet	3-27-02	Advanced
Rev 2	Change package drawing	2-6-03	Advanced
Rev 3	3.1 Removed "ED" from part marking	5-04	Preliminary