1GB – 2x64Mx72 DDR2 SDRAM UDIMM, SO-DIMM w/PLL

FEATURES

- Unbuffered 200-pin (SO-DIMM) small-outline dual in-line memory module
- Support ECC detection and correction
- Fast data transfer rates: PC2-6400*, PC2-5300*, PC2-4200 and PC2-3200
- $V_{CC} = V_{CCQ} = 1.8V \pm 0.1V$
- $V_{CCSPD} = 1.7V$ to $3.6V$
- JEDEC standard 1.8V I/O (SSTL_18-compatible)
- Differential data strobe (DQS, DQS#) option
- Differential clock input (CK,CK#)
- Four-bit prefetch architecture
- Multiple internal device banks for concurrent operation
- Programmable CAS# latency (CL): 3 4, 5*, and 6*
- Adjustable data-output drive strength
- 7.8µs average periodic refresh interval
- On-die termination (ODT)
- Posted CAS# latency: 0, 1, 2, 3 and 4
- Serial Presence Detect (SPD) with EEPROM
- Auto & self refresh (64ms: 8,192 cycle refresh)
- Gold edge contacts
- Dual Rank
- RoHS compliant
- JEDEC proposed pin-out
- Package option
  - 200 Pin SO-DIMM: 30.00mm (1.181") TYP

DESCRIPTION

The WV3HG264M72EEU is a 2x64Mx72 Double Data Rate DDR2 SDRAM high density module. This memory module consists of eighteen 64Mx8 bit DDR2 Synchronous DRAMs in FBGA packages, mounted on a 200-pin SO-DIMM FR4 substrate.

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

NOTE: Consult factory for availability of:
- Vendor source control options
- Industrial temperature option

OPERATING FREQUENCIES

	PC2-3200	PC2-4200	PC2-5300*	PC2-6400*
Clock Speed	200MHz	266MHz	333MHz	400MHz
CL-t_{RCD}-t_{RP}	3-3-3	4-4-4	5-5-5	6-6-6

* Consult factory for availability

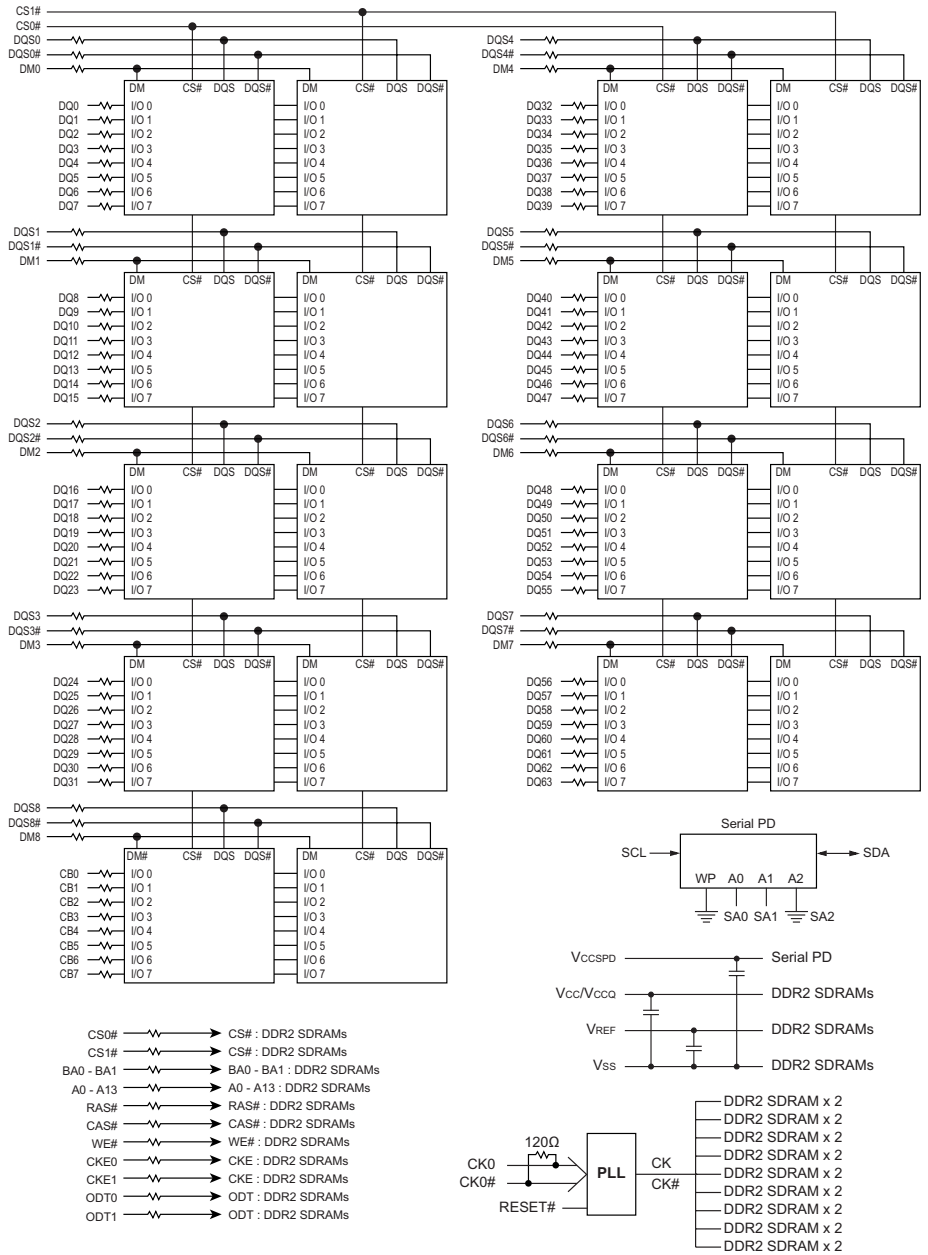
PIN CONFIGURATION

Pin No.	Symbol	Pin No.	Symbol	Pin No.	Symbol	Pin No.	Symbol
1	V_{REF}	51	DQ18	101	V_{CC}	151	V_{SS}
2	V_{SS}	52	V_{SS}	102	A6	152	V_{SS}
3	DQ0	53	DQ19	103	A5	153	DQS5#
4	DQ4	54	DQ28	104	A4	154	DM5
5	V_{SS}	55	V_{SS}	105	A3	155	DQS5
6	DQ5	56	DQ29	106	V_{CC}	156	V_{SS}
7	DQ1	57	DQ24	107	A2	157	V_{SS}
8	V_{SS}	58	V_{SS}	108	A1	158	DQ46
9	DQS0#	59	DQ25	109	V_{CC}	159	DQ42
10	DM0	60	DM3	110	A0	160	DQ47
11	DQS0	61	V_{SS}	111	A10/AP	161	DQ43
12	V_{SS}	62	V_{SS}	112	BA1	162	V_{SS}
13	V_{SS}	63	DQS3#	113	BA0	163	V_{SS}
14	DQ6	64	DQ30	114	V_{CC}	164	DQ52
15	DQ2	65	DQS3	115	RAS#	165	DQ48
16	DQ7	66	DQ31	116	WE#	166	DQ53
17	DQ3	67	V_{SS}	117	V_{CC}	167	DQ49
18	V_{SS}	68	V_{SS}	118	CS0#	168	V_{SS}
19	V_{SS}	69	DQ26	119	CAS#	169	V_{SS}
20	DQ12	70	CB4	120	ODT0	170	DM6
21	DQ8	71	DQ27	121	CS1#	171	DQS6#
22	DQ13	72	CB5	122	A13	172	V_{SS}
23	DQ9	73	V_{SS}	123	V_{CC}	173	DQS6
24	V_{SS}	74	V_{SS}	124	V_{CC}	174	DQ54
25	V_{SS}	75	CB0	125	ODT1	175	V_{SS}
26	DM1	76	DM8	126	CK	176	DQ55
27	DQS1#	77	CB1	127	NC	177	DQ50
28	V_{SS}	78	V_{SS}	128	CK#	178	V_{SS}
29	DQS1	79	V_{SS}	129	DQ32	179	DQ51
30	DQ14	80	CB6	130	V_{SS}	180	DQ60
31	V_{SS}	81	DQS8#	131	V_{SS}	181	V_{SS}
32	DQ15	82	CB7	132	DQ36	182	DQ61
33	DQ10	83	DQS8	133	DQ33	183	DQ56
34	V_{SS}	84	V_{SS}	134	DQ37	184	V_{SS}
35	DQ11	85	V_{SS}	135	DQS4#	185	DQ57
36	DQ20	86	CB2	136	V_{SS}	186	DM7
37	V_{SS}	87	CKE0	137	DQS4	187	V_{SS}
38	DQ21	88	CB3	138	DM4	188	DQ62
39	DQ16	89	NC	139	V_{SS}	189	DQS7#
40	V_{SS}	90	V_{SS}	140	V_{SS}	190	V_{SS}
41	DQ17	91	NC	141	DQ34	191	DQS7
42	RESET#	92	NC	142	DQ38	192	DQ63
43	V_{SS}	93	V_{CC}	143	DQ35	193	DQ58
44	DM2	94	NC	144	DQ39	194	SDA
45	DQS2#	95	A12	145	V_{SS}	195	V_{SS}
46	V_{SS}	96	A11	146	V_{SS}	196	SCL
47	DQS2	97	A9	147	DQ40	197	DQ59
48	DQ22	98	V_{CC}	148	DQ44	198	SA1
49	V_{SS}	99	A7	149	DQ41	199	VCCSPD
50	DQ23	100	A8	150	DQ45	200	SA0

PIN NAMES

Pin Name	Function
A0-A13	Address Inputs
BA0, BA1	SDRAM Bank Address
DQ0-DQ63	Data Input/Output
CB0-CB7	Check Bits
DQS0-DQS8	Data strobes
DQS0#-DQS8#	Data strobes complement
ODT0, ODT1	On-die termination controls
CK,CK#	Clock inputs
CKE0, CKE1	Clock enable inputs
CS0#, CS1#	Chip select inputs
RAS#	Row Address Strobe
CAS#	Column Address Strobe
WE#	Write Enable
RESET#	Register reset input
V_{CC}	Core Power
V_{SS}	Ground
SA0-SA1	SPD address
SDA	Serial Data Input/Output
V_{REF}	Input/Output Reference Voltage
DM0-DM8	Data-in mask
V_{CCSPD}	Serial EEPROM power supply
SCL	SPD Clock Input
NC	No connect

FUNCTIONAL BLOCK DIAGRAM



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

DC OPERATING CONDITIONS

All voltages referenced to V_{SS}

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Supply Voltage	V_{CC}	1.7	1.8	1.9	V	3
I/O Reference Voltage	V_{REF}	0.49 x V_{CC}	0.50 x V_{CC}	0.51 x V_{CC}	V	1
I/O Termination Voltage	V_{TT}	V_{REF}-0.04	V_{REF}	V_{REF}+0.04	V	2
SPD Supply Voltage	V_{CCSPD}	1.7	-	3.6	V	

Notes:

1 V_{REF} is expected to equal $V_{CC/2}$ of the transmitting device and to track variations in the DC level of the same. Peak-to-peak noise on V_{REF} may not exceed +/-1 percent of the DC value. Peak-to-peak AC noise on V_{REF} may not exceed +/-2 percent of V_{REF}. This measurement is to be taken at the nearest V_{REF} bypass capacitor.

2. V_{TT} is not applied directly to the device. V_{TT} is a system supply for signal termination resistors, is expected to be set equal to V_{REF} and must track variations in the DC level of V_{REF}.

3. V_{CCQ} of all IC's are tied to V_{CC}.

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter		Min	Max	Units
V_{CC}	Voltage on V_{CC} pin relative to V_{SS}		-0.5	2.3	V
V_{IN}, V_{OUT}	Voltage on any pin relative to V_{SS}		-0.5	2.3	V
I_L	Input leakage current; Any input 0V<V_{IN}<V_{CC}; V_{REF} input 0V,V_{IN},0.95V; Other pins not under test = 0V	Command/Address, RAS#, CAS#, WE#,	-90	90	µA
		CS#, CKE	-45	45	µA
		CK, CK#	-10	10	µA
		DM	-10	10	µA
I_{OZ}	Output leakage current; 0V<V_{IN}<V_{CC}; DQs and ODT are disable	DQ, DQS, DQS#	-10	10	µA
I_{VREF}	V_{REF} leakage current; V_{REF} = Valid V_{REF} level		-36	36	µA

INPUT/OUTPUT CAPACITANCE

TA=25°C, f=100MHz

Parameter	Symbol	Min	Max	Unit
Input capacitance (0A~A13, BA0~BA1, RAS#, CAS#, WE#)	$C_{IN}1$	22	40	pF
Input capacitance (CKE0, CKE1), (ODT0, ODT1)	$C_{IN}2$	13	22	pF
Input capacitance (CS0# - CS1#)	$C_{IN}3$	13	22	pF
Input capacitance (CK, CK#)	$C_{IN}4$	6	7	pF
Input capacitance (DM0~DM8), (DQS0~DQS8)	$C_{IN}5$ (665)	9	11	pF
	$C_{IN}5$ (534, 403)	9	12	pF
Input capacitance (DQ0~DQ63), (CB0~CB7)	$C_{OUT}1$ (665)	9	11	pF
	$C_{OUT}1$ (534, 403)	9	12	pF

OPERATING TEMPERATURE CONDITION

Parameter	Symbol	Rating	Units	Notes
Operating temperature (Commercial)	TOPER	0° to 85°	°C	1, 2

Notes:
1. Operating temperature is the case surface temperature on the center/top side of the DRAM. For the measurement conditions, please refer to JEDED JESD51.2
2. At 0°C - 85°C, operation temperature range, all DRAM specification will be supported.

INPUT DC LOGIC LEVEL

All voltages referenced to V_{SS}

Parameter	Symbol	Min	Max	Units
Input High (Logic 1) Voltage	V_{IH}(DC)	V_{REF} + 0.125	V_{CC} + 0.300	V
Input Low (Logic 0) Voltage	V_{IL}(DC)	-0.300	V_{REF} - 0.125	V

INPUT AC LOGIC LEVEL

All voltages referenced to V_{SS}

Parameter	Symbol	Min	Max	Unit
AC Input High (Logic 1) Voltage DDR2-400 & DDR2-533	V_{IH}(AC)	V_{REF} + 0.250	-	V
AC Input High (Logic 1) Voltage DDR2-667	V_{IH}(AC)	V_{REF} + 0.200	-	V
AC Input High (Logic 0) Voltage DDR2-400 & DDR2-533	V_{IL}(AC)	-	V_{REF} - 0.250	V
AC Input High (Logic 0) Voltage DDR2-667	V_{IL}(AC)	-	V_{REF} - 0.200	V

DDR2 I_{CC} SPECIFICATIONS AND CONDITIONS

Includes DDR2 SDRAM components only

V_{CC} = +1.8V ± 0.1V

Symbol	Proposed Conditions		806	665	534	403	Units
I_{CC0}*	Operating one bank active-precharge current; $t_{CK} = t_{CK}(I_{CC})$, $t_{RC} = t_{RC}(I_{CC})$, $t_{RAS} = t_{RAS}min(I_{CC})$; CKE is HIGH, CS# is HIGH between valid commands; Address bus inputs are SWITCHING; Data bus inputs are SWITCHING		TBD	1,137	1,092	1,092	mA
I_{CC1}*	Operating one bank active-read-precharge current; I_{OUT} = 0mA; BL = 4, CL = CL(I_{CC}), AL = 0; $t_{CK} = t_{CK}(I_{CC})$, $t_{RC} = t_{RC}(I_{CC})$, $t_{RAS} = t_{RAS}min(I_{CC})$, $t_{RCD} = t_{RCD}(I_{CC})$; CKE is HIGH, CS# is HIGH between valid commands; Address bus inputs are SWITCHING; Data pattern is same as I_{CC}4W		TBD	1,272	1,227	1,227	mA
I_{CC2P}*	Precharge power-down current; All banks idle; $t_{CK} = t_{CK}(I_{CC})$; CKE is LOW; Other control and address bus inputs are STABLE; Data bus inputs are FLOATING		TBD	444	444	444	mA
I_{CC2Q}**	Precharge quiet standby current; All banks idle; $t_{CK} = t_{CK}(I_{CC})$; CKE is HIGH, CS# is HIGH; Other control and address bus inputs are STABLE; Data bus inputs are FLOATING		TBD	930	840	840	mA
I_{CC2N}**	Precharge standby current; All banks idle; $t_{CK} = t_{CK}(I_{CC})$; CKE is HIGH, CS# is HIGH; Other control and address bus inputs are SWITCHING; Data bus inputs are SWITCHING		TBD	1,020	930	930	mA
I_{CC3P}**	Active power-down current; All banks open; $t_{CK} = t_{CK}(I_{CC})$; CKE is LOW; Other control and address bus inputs are STABLE; Data bus inputs are FLOATING	Fast PDN Exit MRS(12) = 0	TBD	840	840	840	mA
		Slow PDN Exit MRS(12) = 1	TBD	516	516	516	mA
I_{CC3N}**	Active standby current; All banks open; $t_{CK} = t_{CK}(I_{CC})$, $t_{RAS} = t_{RAS}max(I_{CC})$, $t_{RP} = t_{RP}(I_{CC})$; CKE is HIGH, CS# is HIGH between valid commands; Other control and address bus inputs are SWITCHING; Data bus inputs are SWITCHING		TBD	1,290	1,200	1,200	mA
I_{CC4W}*	Operating burst write current; All banks open, Continuous burst writes; BL = 4, CL = CL(I_{CC}), AL = 0; $t_{CK} = t_{CK}(I_{CC})$, $t_{RAS} = t_{RAS}max(I_{CC})$, $t_{RP} = t_{RP}(I_{CC})$; CKE is HIGH, CS# is HIGH between valid commands; Address bus inputs are SWITCHING; Data bus inputs are SWITCHING		TBD	1,632	1,452	1,362	mA
I_{CC4R}*	Operating burst read current; All banks open, Continuous burst reads, I_{OUT} = 0mA; BL = 4, CL = CL(I_{CC}), AL = 0; $t_{CK} = t_{CK}(I_{CC})$, $t_{RAS} = t_{RAS}max(I_{CC})$, $t_{RP} = t_{RP}(I_{CC})$; CKE is HIGH, CS# is HIGH between valid commands; Address bus inputs are SWITCHING; Data pattern is same as I_{CC}4W		TBD	1,677	1,497	1,362	mA
I_{CC5B}**	Burst auto refresh current; $t_{CK} = t_{CK}(I_{CC})$; Refresh command at every $t_{RFC}(I_{CC})$ interval; CKE is HIGH, CS# is HIGH between valid commands; Other control and address bus inputs are SWITCHING; Data bus inputs are SWITCHING		TBD	3,000	2,820	2,820	mA
I_{CC6}**	Self refresh current; CK and CK\ at 0V; CKE 0.2V; Other control and address bus inputs are FLOATING; Data bus inputs are FLOATING	Normal	TBD	144	144	144	mA
I_{CC7}*	Operating bank interleave read current; All bank interleaving reads, I_{OUT} = 0mA; BL = 4, CL = CL(I_{CC}), AL = $t_{RC}D(I_{CC})$-1*$t_{CK}(I_{CC})$; $t_{CK} = t_{CK}(I_{CC})$, $t_{RC} = t_{RC}(I_{CC})$, $t_{RRD} = t_{RRD}(I_{CC})$, t_{RCD} = 1*$t_{CK}(I_{CC})$; CKE is HIGH, CS# is HIGH between valid commands; Address bus inputs are STABLE during DESELECTs; Data bus inputs are SWITCHING.		TBD	2,352	2,352	2,352	mA

I_{CC} specification is based on **SAMSUNG** components. Other DRAM manufactures specification may be different.

Note:

* Value calculated as one module rank in this operating condition, and all other module ranks in I_{CC2P} (CKE LOW) mode.

** Value calculated reflects all module ranks in this operating condition.

AC TIMING PARAMETERS & SPECIFICATIONS

V_{CC} = +1.8V ± 0.1V

AC CHARACTERISTICS				806		665		534		403		
PARAMETER			SYMBOL	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	UNIT
Clock	Clock cycle time	CL = 6	$t_{CK\ (6)}$	TBD	TBD							ps
		CL = 5	$t_{CK\ (5)}$	TBD	TBD	3,000	8,000					ps
		CL = 4	$t_{CK\ (4)}$	TBD	TBD	3,750	8,000	3,750	8,000	5,000	8,000	ps
		CL = 3	$t_{CK\ (3)}$	TBD	TBD	5,000	8,000	5,000	8,000	5,000	8,000	ps
	CK high-level width		t_{CH}	TBD	TBD	0.45	0.55	0.45	0.55	0.45	0.55	t_{CK}
	CK low-level width		t_{CL}	TBD	TBD	0.45	0.55	0.45	0.55	0.45	0.55	t_{CK}
	Half clock period		t_{HP}	TBD	TBD	$_{MIN}(t_{CH},t_{CL})$		$_{MIN}(t_{CH},t_{CL})$		$_{MIN}(t_{CH},t_{CL})$		ps
	Clock jitter		t_{JIT}	TBD	TBD	-125	125	-125	125	-125	125	ps
Data	DQ output access time from CK/CK#		t_{AC}	TBD	TBD	-450	+450	-500	+500	-600	+600	ps
	Data-out high-impedance window from CK/CK#		t_{HZ}	TBD	TBD		$t_{AC(MAX)}$		$t_{AC(MAX)}$		$t_{AC(MAX)}$	ps
	Data-out low-impedance window from CK/CK#		t_{LZ}	TBD	TBD	$t_{AC(MIN)}$	$t_{AC(MAX)}$	$t_{AC(MIN)}$	$t_{AC(MAX)}$	$t_{AC(MIN)}$	$t_{AC(MAX)}$	ps
	DQ and DM input setup time relative to DQS		t_{DS}	TBD	TBD	100		100		150		
	DQ and DM input hold time relative to DQS		t_{DH}	TBD	TBD	225		225		275		
	DQ and DM input pulse width (for each input)		t_{DIPW}	TBD	TBD	0.35		0.35		0.35		t_{CK}
	Data hold skew factor		t_{QHS}	TBD	TBD		340		400		450	ps
	DQ…DQS hold, DQS to first DQ to go nonvalid, per access		t_{QH}	TBD	TBD	t_{HP} - t_{QHS}		t_{HP} - t_{QHS}		t_{HP} - t_{QHS}		ps
	Data valid output window (DVW)		t_{DVW}	TBD	TBD	t_{QH} - t_{DQSQ}		t_{QH} - t_{DQSQ}		t_{QH} - t_{DQSQ}		ns
Data Strobe	DQS input high pulse width		t_{DQSH}	TBD	TBD	0.35		0.35		0.35		t_{CK}
	DQS input low pulse width		t_{DQSL}	TBD	TBD	0.35		0.35		0.35		t_{CK}
	DQS output access time from CK/CK#		t_{DQSCK}	TBD	TBD	-400	+400	-450	+450	-500	+500	ps
	DQS falling edge to CK rising … setup time		t_{DSS}	TBD	TBD	0.2		0.2		0.2		t_{CK}
	DQS falling edge from CK rising … hold time		t_{DSH}	TBD	TBD	0.2		0.2		0.2		t_{CK}
	DQS…DQ skew, DQS to last DQ valid, per group, per access		t_{DQSQ}	TBD	TBD		240		300		350	ps
	DQS read preamble		t_{RPRE}	TBD	TBD	0.9	1.1	0.9	1.1	0.9	1.1	t_{CK}
	DQS read postamble		t_{RPST}	TBD	TBD	0.4	0.6	0.4	0.6	0.4	0.6	t_{CK}
	DQS write preamble setup time		t_{WPRES}	TBD	TBD	0		0		0		p s
	DQS write preamble		t_{WPRE}	TBD	TBD	0.35		0.35		0.35		t_{CK}
	DQS write postamble		t_{WPST}	TBD	TBD	0.4	0.6	0.4	0.6	0.4	0.6	t_{CK}
	Write command to first DQS latching transition		t_{DQSS}	TBD	TBD	WL-0.25	WL+0.25	WL-0.25	WL+0.25	WL-0.25	WL+0.25	t_{CK}
	Address and control input pulse width for each input		t_{IPW}	TBD	TBD	0.6		0.6		0.6		t_{CK}
	Address and control input setup time		t_{IS}	TBD	TBD	200		250		250		ps
	Address and control input hold time		t_{IH}	TBD	TBD	275		375		475		ps
	Address and control input hold time		t_{CCD}	TBD	TBD	2		2		2		t_{CK}

* AC specification is based on **SAMSUNG** components. Other DRAM manufactures specification may be different.

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AC TIMING PARAMETERS & SPECIFICATIONS (cont'd)

V_{CC} = +1.8V ± 0.1V

AC CHARACTERISTICS			806		665		534		403		
	PARAMETER	SYMBOL	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	UNIT
Command and Address	ACTIVE to ACTIVE (same bank) command	t_{RC}	TBD	TBD	55		55		55		ns
	ACTIVE bank a to ACTIVE bank b command	t_{RRD}	TBD	TBD	7.5		7.5		7.5		ns
	ACTIVE to READ or WRITE delay	t_{RCD}	TBD	TBD	15		15		15		ns
	Four Bank Activate period	t_{FAW}	TBD	TBD	37.5	37.5	37.5	37.5	37.5	37.5	ns
	ACTIVE to PRECHARGE command	t_{RAS}	TBD	TBD	45	70,000	45	70,000	45	70,000	ns
	Internal READ to precharge command delay	t_{RTP}	TBD	TBD	7.5		7.5		7.5		ns
	Write recovery time	t_{WR}	TBD	TBD	15		15		15		ns
	Auto precharge write recovery + precharge time	t_{DAL}	TBD	TBD	t_{WR} + t_{RP}		t_{WR} + t_{RP}		t_{WR} + t_{RP}		ns
	Internal WRITE to READ command delay	t_{WTR}	TBD	TBD	7.5		7.5		10		ns
	PRECHARGE command period	t_{RP}	TBD	TBD	15		15		15		ns
	PRECHARGE ALL command period	t_{RPA}	TBD	TBD	t_{RP}+t_{CK}		t_{RP}+t_{CK}		t_{RP}+t_{CK}		ns
	LOAD MODE command cycle time	t_{MRD}	TBD	TBD	2		2		2		t_{CK}
	CKE low to CK,CK# uncertainty	t_{DELAY}	TBD	TBD	t_{IS} + t_{CK} + t_{IH}		t_{IS} + t_{CK} + t_{IH}		t_{IS} + t_{CK} + t_{IH}		ns
Self Refresh	REFRESH to Active of Refresh to Refresh command interfal	t_{RFC}	TBD	TBD	105	70,000	105	70,000	105	70,000	ns
	Average periodic refresh interval	t_{REFI}	TBD	TBD		7.8		7.8		7.8	µs
	Exit self refresh to non-READ command	t_{XSNR}	TBD	TBD	t_{RFC} (MIN) + 10		t_{RFC} (MIN) + 10		t_{RFC} (MIN) + 10		ns
	Exit self refresh to READ command	t_{XSRD}	TBD	TBD	200		200		200		t_{CK}
	Exit self refresh timing reference	t_{ISXR}	TBD	TBD	t_{IS}		t_{IS}		t_{IS}		ps
ODT	ODT turn-on delay	t_{AOND}	TBD	TBD	2	2	2	2	2	2	t_{CK}
	ODT turn-on	t_{AON}	TBD	TBD	t_{AC} (MIN)	t_{AC} (MAX) + 1000	t_{AC} (MIN)	t_{AC} (MAX) + 1000	t_{AC} (MIN)	t_{AC} (MAX) + 1000	ps
	ODT turn-off delay	t_{AOFD}	TBD	TBD	2.5	2.5	2.5	2.5	2.5	2.5	t_{CK}
	ODT turn-off	t_{AOF}	TBD	TBD	t_{AC} (MIN)	t_{AC} (MAX) + 600	t_{AC} (MIN)	t_{AC} (MAX) + 600	t_{AC} (MIN)	t_{AC} (MAX) + 600	ps
	ODT turn-on (power-down mode)	t_{AONPD}	TBD	TBD	t_{AC} (MIN) + 2000	2 x t_{CK} + t_{AC} (MAX) + 1000	t_{AC} (MIN) + 2000	2 x t_{CK} + t_{AC} (MAX) + 1000	t_{AC} (MIN) + 2000	2 x t_{CK} + t_{AC} (MAX) + 1000	ps
	ODT turn-off (power-down mode)	t_{AOFPD}	TBD	TBD	t_{AC} (MIN) + 2000	2.5 x t_{CK} + t_{AC} (MAX) + 1000	t_{AC} (MIN) + 2000	2.5 x t_{CK} + t_{AC} (MAX) + 1000	t_{AC} (MIN) + 2000	2.5 x t_{CK} + t_{AC} (MAX) + 1000	ps
	ODT to power-down entry latency	t_{ANPD}	TBD	TBD	3		3		3		t_{CK}
	ODT power-down exit latency	t_{AXPD}	TBD	TBD	8		8		8		t_{CK}
Power-Down	Exit active power-down to READ command, MR[bit12=0]	t_{XARD}	TBD	TBD	2		2		2		t_{CK}
	Exit active power-down to READ command, MR[bit12=1]	t_{XARDS}	TBD	TBD	7 - AL		6 - AL		6 - AL		t_{CK}
	A Exit precharge power-down to any non-READ command.	t_{XP}	TBD	TBD	2		2		2		t_{CK}
	CKE minimum high/low time	t_{CKE}	TBD	TBD	3		3		3		t_{CK}

* AC specification is based on **SAMSUNG** components. Other DRAM manufactures specification may be different.

ORDERING INFORMATION FOR PD4

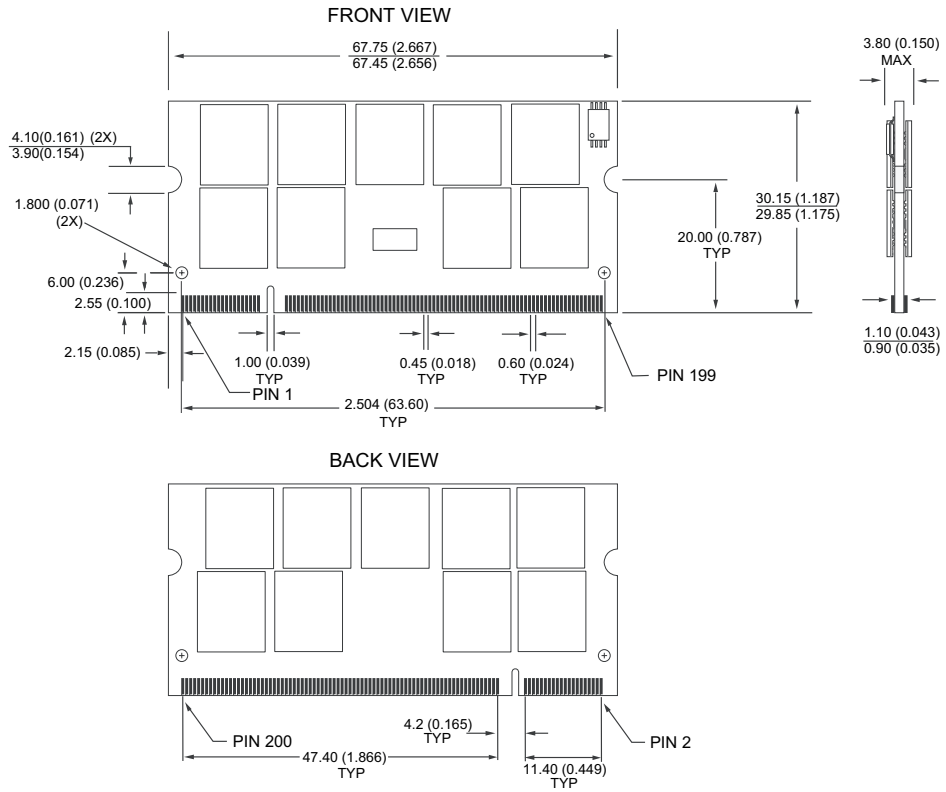
Part Number	Speed/Data Rate	CAS Latency	t_{RCD}	t_{RP}	Height*
WV3HG264M72EEU806PD4xxG**	400MHz/800Mb/s	6	6	6	30.00mm (1.81")TYP
WV3HG264M72EEU665PD4xxG**	333MHz/667Mb/s	5	5	5	30.00mm (1.81")TYP
WV3HG264M72EEU534PD4xxG	266MHz/533Mb/s	4	4	4	30.00mm (1.81")TYP
WV3HG264M72EEU403PD4xxG	200MHz/400Mb/s	3	3	3	30.00mm (1.81")TYP

** Consult factory for availability

NOTES:

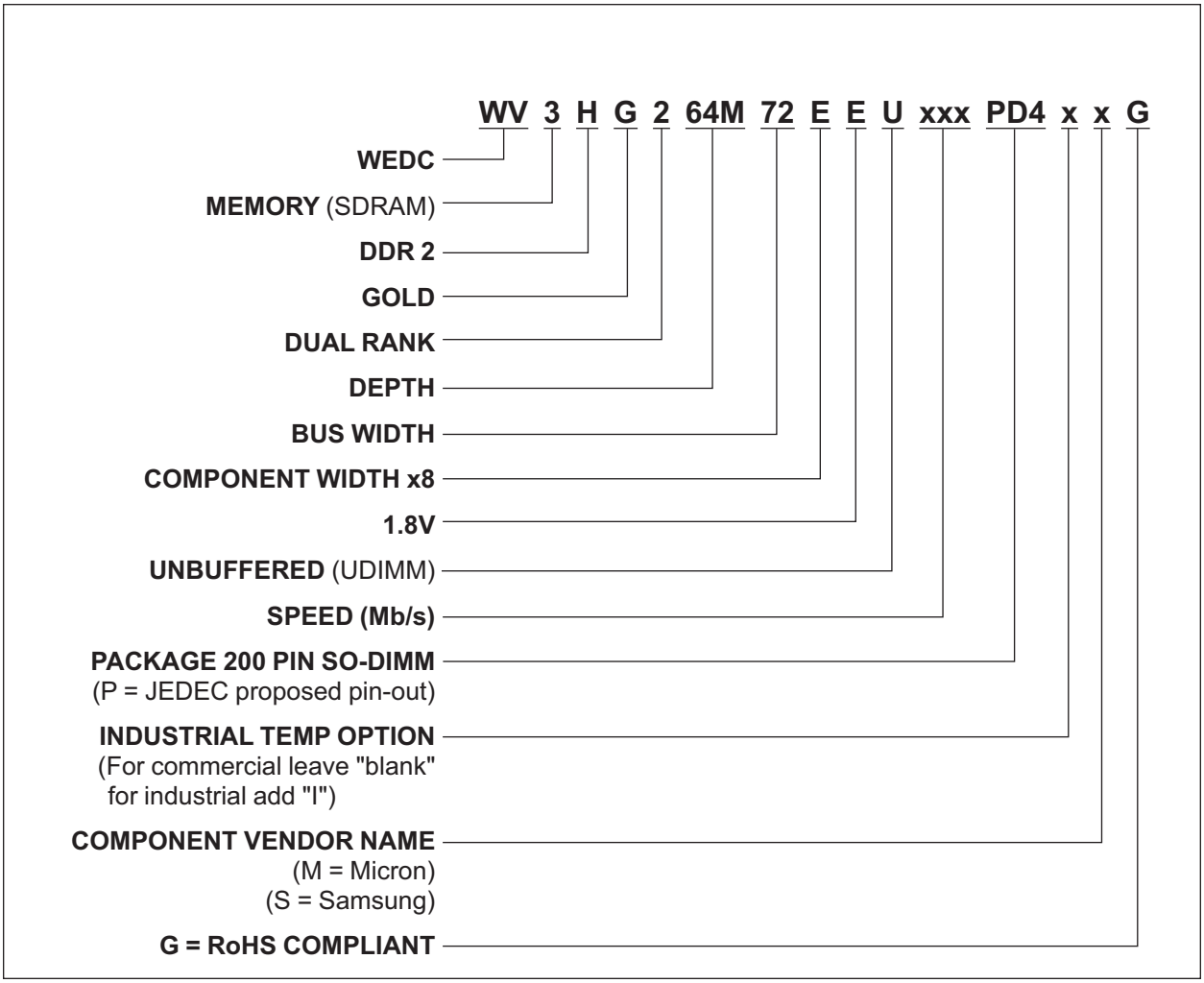
- RoHS product. ("G" = RoHS Compliant)
- Vendor specific part numbers are used to provide memory component source control. The place holder for this is shown as a lower case "x" in the part numbers above and is to be replaced with respective vendors code. Consult factory for qualified sourcing options. (M = Micron, S = Samsung & consult factory for others)

PACKAGE DIMENSIONS FOR PD4



* ALL DIMENSIONS ARE IN MILLIMETERS AND (INCHES)
Tolerances: ±0.13 (0.005) unless otherwise specified

PART NUMBERING GUIDE



Document Title

1GB – 2x64Mx72 DDR2 SDRAM UNBUFFERED, SO-DIMM w/PLL

DRAM DIE OPTIONS:

- SAMSUNG: C-Die, will move to E-Die Q2'06
- MICRON: U37Y: B-Die

Revision History

Rev #	History	Release Date	Status
Rev 0	Created	August 2005	Concept
Rev 1	1.0 Updated I_{CC}, CAP & AC specs 1.1 Added industrial temp option to part numbering guide 1.2 Changed from concept to advanced	March 2006	Advanced
Rev 2	2.0 Update I_{CC}, CAP & AC specs 2.1 Added "P" for JEDEC proposed pin-out 2.2 Added die Rev info	April 2006	Advanced