

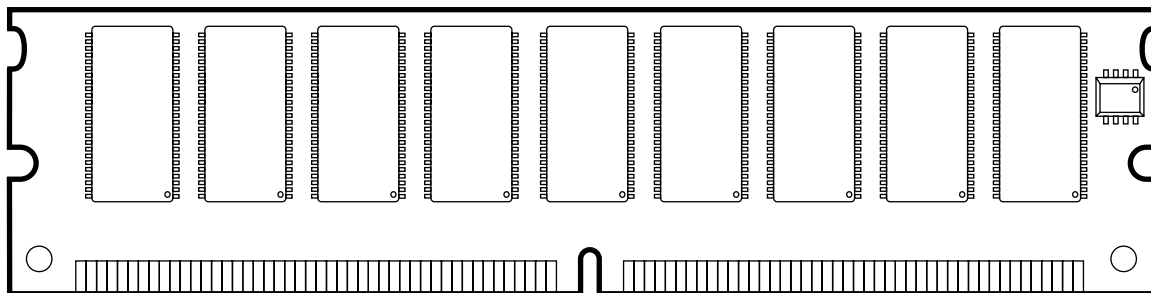
64M x 72 HIGH PERFORMANCE
UNBUFFERED ECC DDR SDRAM MODULE
Features

- 184 Pin Unbuffered 67,108,864 x 72 bit Organization DDR SDRAM Modules
- Utilizes High Performance 32M x 8 DDR SDRAM in TSOPII-66 Packages
- Single +2.5V ($\pm 0.2V$) Power Supply
- Single +2.6V ($\pm 0.1V$) Power Supply for DDR400
- Programmable CAS Latency, Burst Length, and Wrap Sequence (Sequential & Interleave)
- Auto Refresh (CBR) and Self Refresh
- All Inputs, Outputs are SSTL-2 Compatible
- 8196 Refresh Cycles every 64 ms
- Serial Presence Detect (SPD)
- DDR SDRAM Performance

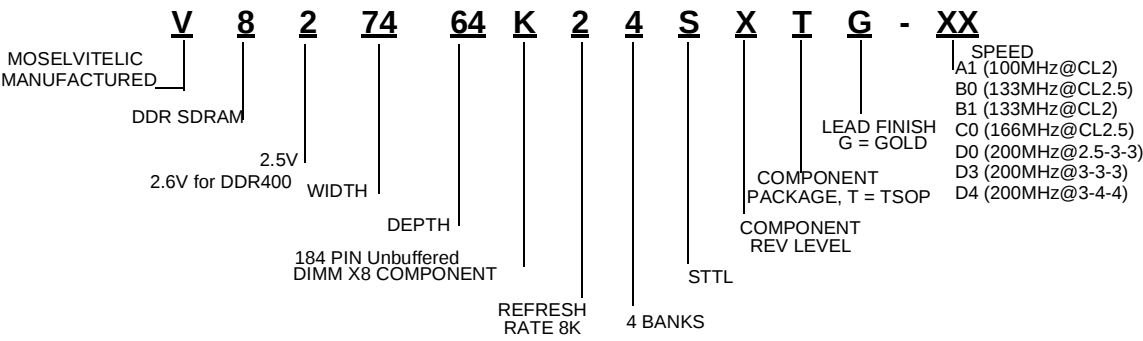
Description

The V827464K24S memory module is organized 67,108,864 x 72 bits in a 184 pin memory module. The 64M x 72 memory module uses 18 Mosel-Vitellic 32M x 8 DDR SDRAM. The x72 modules are ideal for use in high performance computer systems where increased memory density and fast access times are required.

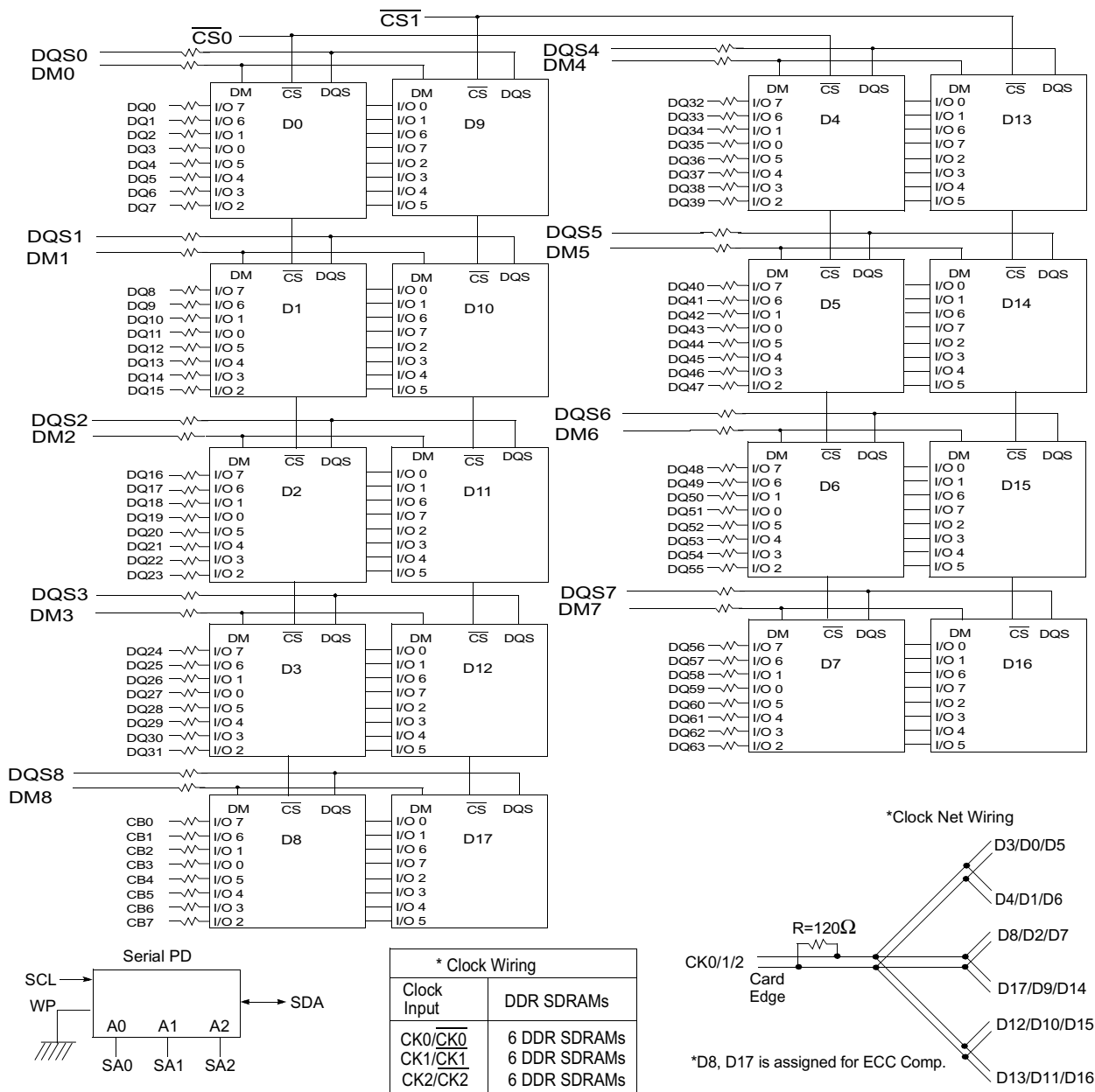
	Module Speed	D4	D3	D0	C0	B1	B0	A1	Units
t_{CK}	Clock Frequency (max.)	200 (PC400C)	200 (PC400B)	200 (PC400A)	166 (PC333)	143 (PC266A)	133 (PC266B)	125 (PC200)	MHz
t_{AC}	Clock Cycle Time CAS Latency = 2	7.5	7.5	7.5	7.5	7.5	10	10	ns
t_{AC}	Clock Cycle Time CAS Latency = 2.5	6	6	5	6	7	7.5	8	ns
t_{AC}	Clock Cycle Time CAS Latency = 3	5	5	5	-	-	-	-	ns
t_{RCD}	tRP parameter	4	3	3	3	2	3	2	CLK
t_{RP}	tRCD parameter	4	3	3	3	2	3	2	CLK



Part Number Information



Block Diagram



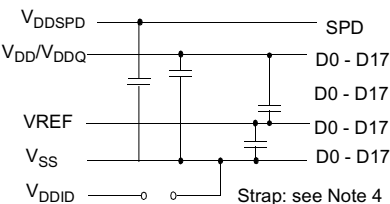
BA0 - BA1 → BA0-BA1: DDR SDRAMs D0 - D17

A0 - A12 → A0-A12: DDR SDRAMs D0 - D17

 $\overline{\text{RAS}}$ → $\overline{\text{RAS}}$: DDR SDRAMs D0 - D17 $\overline{\text{CAS}}$ → $\overline{\text{CAS}}$: DDR SDRAMs D0 - D17

CKE1 → CKE: DDR SDRAMs D9 - D17

CKE0 → CKE: DDR SDRAMs D0 - D8

 $\overline{\text{WE}}$ → $\overline{\text{WE}}$: DDR SDRAMs D0 - D17

Notes:

1. DQ-to-I/O wiring is shown as recommended but may be changed.
2. DQ/DQS/DM/CKE/CS relationships must be maintained as shown.
3. DQ, DQS, DM/DQS resistors: 22 Ohms $\pm$ 5%.
4. VDDID strap connections (for memory device VDD, VDDQ):
STRAP OUT (OPEN): VDD = VDDQ
STRAP IN (VSS): VDD $\neq$ VDDQ.
5. BAX, Ax, RAS, CAS, WE resistors: 3 Ohms $\pm$ 5%

Pin Configurations (Front Side/Back Side)

Pin	Front	Pin	Front	Pin	Front	Pin	Back	Pin	Back	Pin	Back
1	VREF	32	A5	62	VDDQ	93	VSS	124	VSS	154	RAS
2	DQ0	33	DQ24	63	WE	94	DQ4	125	A6	155	DQ45
3	VSS	34	VSS	64	DQ41	95	DQ5	126	DQ28	156	VDDQ
4	DQ1	35	DQ25	65	CAS	96	VDDQ	127	DQ29	157	CS0
5	DQS0	36	DQS3	66	VSS	97	DM0	128	VDDQ	158	CS1
6	DQ2	37	A4	67	DQS5	98	DQ6	129	DM3	159	DM5
7	VDD	38	VDD	68	DQ42	99	DQ7	130	A3	160	VSS
8	DQ3	39	DQ26	69	DQ43	100	VSS	131	DQ30	161	DQ46
9	NC	40	DQ27	70	VDD	101	NC	132	VSS	162	DQ47
10	NC	41	A2	71	NC	102	NC	133	DQ31	163	NC
11	VSS	42	Vss	72	DQ48	103	A13*	134	CB4*	164	VDDQ
12	DQ8	43	A1	73	DQ49	104	VDDQ	135	CB5*	165	DQ52
13	DQ9	44	CB0*	74	VSS	105	DQ12	136	VDDQ	166	DQ53
14	DQS1	45	CB1*	75	CK2	106	DQ13	137	CK0*	167	NC
15	VDDQ	46	VDD	76	CK2	107	DM1	138	CK0*	168	VDD
16	CK1	47	DQS8*	77	VDDQ	108	VDD	139	VSS	169	DM6
17	CK1	48	A0	78	DQS6	109	DQ14	140	DM8*	170	DQ54
18	VSS	49	CB2*	79	DQ50	110	DQ15	141	A10	171	DQ55
19	DQ10	50	VSS	80	DQ51	111	CKE1	142	CB6*	172	VDDQ
20	DQ11	51	CB3*	81	VSS	112	VDDQ	143	VDDQ	173	NC
21	CKE0	52	BA1	82	VDDID	113	BA2*	144	CB7*	174	DQ60
22	VDDQ	Key		83	DQ56	114	DQ20	Key		175	DQ61
23	DQ16	53	DQ32	84	DQ57	115	A12	145	VSS	176	VSS
24	DQ17	54	VDDQ	85	VDD	116	VSS	146	DQ36	177	DM7
25	DQS2	55	DQ33	86	DQS7	117	DQ21	147	DQ37	178	DQ62
26	VSS	56	DQS4	87	DQ58	118	A11	148	VDD	179	DQ63
27	A9	57	DQ34	88	DQ59	119	DM2	149	DM4	180	VDDQ
28	DQ18	58	VSS	89	VSS	120	VDD	150	DQ38	181	SA0
29	A7	59	BA0	90	NC	121	DQ22	151	DQ39	182	SA1
30	VDDQ	60	DQ35	91	SDA	122	A8	152	VSS	183	SA2
31	DQ19	61	DQ40	92	SCL	123	DQ23	153	DQ44	184	VDDSPD

Notes:

* These pins are not used in this module.

Pin Names

Pin	Pin Description
CK1, CK1, CK2, CK2	Differential Clock Inputs
CS0, CS1	Chip Select Input
CKE0, CKE1	Clock Enable Input
RAS, CAS, WE	Command Sets Inputs
A0 ~ A12	Address
BA0, BA1	Bank Address
DQ0~DQ63	Data Inputs/Outputs
DQS0~DQS7	Data Strobe Inputs/Outputs
DM0~DM7	Data-in Mask
VDD	Power Supply

Pin	Pin Description
VDDQ	DQs Power Supply
VSS	Ground
VREF	Reference Power Supply
VDDSPD	Power Supply for SPD
SA0~SA2	E ² PROM Address Inputs
SCL	E ² PROM Clock
SDA	E ² PROM Data I/O
VDDID	VDD Identification Flag
DU	Do not Use
NC	No Connection

Serial Presence Detect Information

Bin Sort:

A1 (PC1600 @ CL2)

B0 (PC2100B @ CL2.5)

B1 (PC2100A @ CL2)

C0 (PC2700 @ CL2.5)

D0 (PC3200 @ 2.5-3-3)

D3 (PC3200 @ 3-3-3)

D4 (PC3200 @ 3-4-4)

Byte #	Function described	Function Supported							Hex value						
		A1	B0	B1	C0	D0	D3	D4	A1	B0	B1	C0	D0	D3	D4
0	Defines # of Bytes written into serial memory at module manufacturer	128bytes							80h						
1	Total # of Bytes of SPD memory device	256bytes							08h						
2	Fundamental memory type	SDRAM DDR							07h						
3	# of row address on this assembly	13							0Dh						
4	# of column address on this assembly	10							0Ah						
5	# of module Rows on this assembly	2 Bank							02h						
6	Data width of this assembly	72 bits							48h						
7	Data width of this assembly	-							00h						
8	VDDQ and interface standard of this assembly	SSTL							04h						
9	DDR SDRAM cycle time at highest CL	8ns	7.5ns	7ns	6ns	5ns	5ns	5ns	80h	75h	70h	60h	50h	50h	50h
10	DDR SDRAM Access time from clock at highest CL	±0.8 ns	±0.75 ns	±0.75 ns	±0.70 ns	±0.65 ns	±0.65 ns	±0.65 ns	80h	75h	75h	70h	65h	65h	65h
11	DIMM configuration type(Non-parity, Parity, ECC)	Non-parity, ECC							02h						
12	Refresh rate & type	7.8us & Self refresh							82h						
13	Primary DDR SDRAM width	x8							08h						
14	Error checking DDR SDRAM data width	x8							08h						
15	Minimum clock delay for back-to-back random column address	t _{CCD} =1CLK							01h						
16	DDR SDRAM device attributes : Burst lengths supported	2,4,8							0Eh						
17	DDR SDRAM device attributes : # of banks on each DDR SDRAM	4 banks							04h						
18	DDR SDRAM device attributes : CAS Latency supported	2,2.5,3							0Ch	0Ch	0Ch	0Ch	1Ch	1Ch	1Ch
19	DDR SDRAM device attributes : CS Latency	0CLK							01h						
20	DDR SDRAM device attributes : WE Latency	1CLK							02h						
21	DDR SDRAM module attributes	Differential clock / non Registered							20h						
22	DDR SDRAM device attributes : General	+/-0.2V voltage tolerance							00h						

Serial Presence Detect Information (cont.)

Byte #	Function described	Function Supported							Hex value						
		A1	B0	B1	C0	D0	D3	D4	A1	B0	B1	C0	D0	D3	D4
23	DDR SDRAM cycle time at 2nd highest CL	10ns	10ns	7.5ns	7.5ns	5.0ns	6.0ns	6.0ns	A0h	A0h	75h	75h	50h	60h	60h
24	DDR SDRAM Access time from clock at 2nd highest CL	±0.8 ns	±0.75 ns	±0.75 ns	±0.70 ns	±0.65 ns	±0.70 ns	±0.70 ns	80h	75h	75h	70h	65h	70h	70h
25	DDR SDRAM cycle time at 3rd highest CL	-	-	-	-	7.5ns	7.5ns	7.5ns	00h			75h	75h	75h	
26	DDR SDRAM Access time from clock at 3rd highest CL	-	-	-	-	±0.75 ns	±0.75 ns	±0.75 ns	00h			75h	75h	75h	
27	Minimum row precharge time (=t _{RP})	20ns	20ns	15ns	18ns	15ns	15ns	20ns	50h	50h	3Ch	48h	3Ch	3Ch	50h
28	Minimum row activate to row active delay(=t _{RRD})	15ns	15ns	15ns	12ns	10ns	10ns	10ns	3Ch	3Ch	3Ch	30h	28h	28h	28h
29	Minimum RAS to CAS delay(=t _{RCD})	20ns	20ns	15ns	18ns	15ns	15ns	20ns	50h	50h	3Ch	48h	3Ch	3Ch	50h
30	Minimum active to precharge time(=t _{RAS})	50ns	45ns	45ns	42ns	40ns	40ns	40ns	32h	2Dh	2Dh	2Ah	28h	28h	28h
31	Module ROW density	256MB							40h						
32	Command and address signal input setup time	1.1ns	0.9ns	0.9ns	0.75 ns	0.6ns	0.6ns	0.6ns	B0h	90h	90h	75h	60h	60h	60h
33	Command and address signal input hold time	1.1ns	0.9ns	0.9ns	0.75 ns	0.6ns	0.6ns	0.6ns	B0h	90h	90h	75h	60h	60h	60h
34	Data signal input setup time	0.6ns	0.5ns	0.5ns	0.45 ns	0.4ns	0.4ns	0.4ns	60h	50h	50h	45h	40h	40h	40h
35	Data signal input hold time	0.6ns	0.5ns	0.5ns	0.45 ns	0.4ns	0.4ns	0.4ns	60h	50h	50h	45h	40h	40h	40h
36-40	Superset information (may be used in future)								00h						
41	SDRAM device minimum active to active/auto-refresh time (=t _{RC})	70ns	65ns	65ns	60ns	60ns	60ns	60ns	46h	41h	41h	3Ch	3Ch	3Ch	3Ch
42	SDRAM device minimum active to autorefresh to active/auto-refresh time (=t _{RFC})	80ns	75ns	75ns	72ns	70ns	70ns	70ns	50h	4Bh	4Bh	48h	46h	46h	46h
43	SDRAM device maximum device cycle time (=t _{CK MAX})	12ns	12ns	12ns	12ns	12ns	12ns	12ns	30h	30h	30h	30h	30h	30h	30h
44	SDRAM device maximum skew between DQS and DQ signals (=t _{DQSQ})	0.6ns	0.5ns	0.5ns	0.45ns	0.4ns	0.4ns	0.4ns	3Ch	32h	32h	2Dh	28h	28h	28h
45	SDRAM device maximum read datahold skew factor (=t _{QHS})	1ns	0.75ns	0.75ns	0.60ns	0.55 ns	0.55 ns	0.55 ns	A0h	75h	75h	60h	55h	55h	55h
46-61	Superset information (may be used in future)	-							00h						
62	SPD data revision code	Initial release							00h	00h	00h	00h	11h	11h	11h
63	Checksum for Bytes 0 ~ 62	-							FAh	35h	DDh	5Eh	B6h	D1h	F9h
64	Manufacturer JEDEC ID code	Mosel Vitelic							40h						

Byte #	Function described	Function Supported							Hex value						
		A1	B0	B1	C0	D0	D3	D4	A1	B0	B1	C0	D0	D3	D4
65 -71	 Manufacturer JEDEC ID code								00h						
72	Manufacturing location	02=Taiwan 05=China 0A=S-CH													
73-90	Module part number (ASCII)	V827464K24S													
91	Manufacturer revision code (For PCB)	0							00						
92	Manufacturer revision code (For component)	0							00						
93	Manufacturing date (Week)	-							-						
94	Manufacturing date (Year)	-							-						
95~98	Assembly serial #	-							-						
99~127	Manufacturer specific data (may be used in future)	Undefined							00h						
128~255	Open for customer use	Undefined							00h						

DC Operating Conditions

(T_A = 0 to 70°C, Voltage referenced to V_{SS} = 0V)

Parameter	Symbol	Min	Typ.	Max	Unit	Note
Power Supply Voltage	V _{DD}	2.3	2.5	2.7	V	
Power Supply Voltage for DDR400	V _{DD}	2.5	2.6	2.7	V	
Power Supply Voltage	V _{DDQ}	2.3	2.5	2.7	V	1
Power Supply Voltage for DDR400	V _{DDQ}	2.5	2.6	2.7	V	1
Input High Voltage	V _{IH}	V _{REF} + 0.15	-	V _{DDQ} + 0.3	V	
Input Low Voltage	V _{IL}	-0.3	-	V _{REF} - 0.15	V	2
I/O Termination Voltage	V _{TT}	V _{REF} - 0.04	V _{REF}	V _{REF} + 0.04	V	
Reference Voltage	V _{REF}	V _{DDQ/2} - 0.05	-	V _{DDQ/2} + 0.05	V	
Input Leakage Current	I _I	-2	-	2	μA	
Output Leakage Current	I _{OZ}	-5	-	5	μA	
Output High Current (V _{OUT} = 1.95V)	I _{OH}	-16.8	-	-	mA	
Output Low Current (V _{OUT} = 0.35V)	I _{OL}	16.8	-	-	mA	

Notes: 1. V_{DDQ} must not exceed the level of V_{DD}.
2. V_{IL} (min) is acceptable -1.5V AC pulse width with <= 5ns of duration.

AC Operating Conditions(T_A = 0 to 70 °C, Voltage referenced to V_{SS} = 0V)

Parameter	Symbol	Min	Max	Unit	Note
Input High (Logic 1) Voltage, DQ, DQS and DM signals	V _{IH(AC)}	V _{REF} + 0.31		V	
Input Low (Logic 0) Voltage, DQ, DQS and DM signals	V _{IL(AC)}		V _{REF} - 0.31	V	
Input Differential Voltage, CK and $\overline{\text{CK}}$ inputs	V _{ID(AC)}	0.7	V _{DDQ} + 0.6	V	1
Input Crossing Point Voltage, CK and $\overline{\text{CK}}$ inputs	V _{IX(AC)}	0.5*V _{DDQ-0.2}	0.5*V _{DDQ+0.2}	V	2

Notes: 1. VID is the magnitude of the difference between the input level on CK and the input on $\overline{\text{CK}}$.
 2. The value of VIX is expected to equal 0.5*V_{DDQ} of the transmitting device and must track variations in the DC level of the same.

AC Operating Test Conditions (T_A = 0 to 70°C, Voltage referenced to V_{SS} = 0V)

Parameter	Value	Unit
Reference Voltage	V _{DDQ} × 0.5	V
Termination Voltage	V _{DDQ} × 0.5	V
AC Input High Level Voltage (V _{IH} , min)	V _{REF} + 0.31	V
AC Input Low Level Voltage (V _{IL} , max)	V _{REF} - 0.31	V
Input Timing Measurement Reference Level Voltage	V _{REF}	V
Output Timing Measurement Reference Level Voltage	V _{TT}	V
Input Signal maximum peak swing	1.5	V
Input minimum Signal Slew Rate	1	V/ns
Termination Resistor (R _T)	50	ohm
Series Resistor (R _S)	25	ohm
Output Load Capacitance for Access Time Measurement (C _L)	30	pF

DDR SDRAM I_{DD} SPEC TABLE

Symbol		A1 PC1600@CL=2	B0 PC2100B@CL=2.5	B1 PC2100A@CL=2	C0 PC2100A@CL=2.5	D0/D3/D4 PC3200A@CL=3	Unit
IDD0		680	870	870	1060	1080	mA
IDD1		850	1100	1100	1280	1440	mA
IDD2P		120	120	120	120	120	mA
IDD2F		440	500	500	560	620	mA
IDD2Q		280	340	340	380	420	mA
IDD3P		210	290	290	370	450	mA
IDD3N		360	460	460	550	810	mA
IDD4R		1150	1400	1400	1700	2430	mA
IDD4W		1180	1350	1350	1600	2250	mA
IDD5		1600	1700	1700	1800	1890	mA
IDD6	Normal	54	54	54	54	54	mA
	Low power	33	33	33	33	33	mA
IDD7		1980	2580	2580	3180	3600	mA

* Module I_{DD} was calculated on the basis of component I_{DD} and can be differently measured according to DQ loading cap.

Detailed test conditions for DDR SDRAM IDD1 & IDD**IDD1 : Operating current: One bank operation**

1. Typical Case : Vdd = 2.5V, T=25' C

2. Worst Case : Vdd = 2.7V, T= 10' C

3. Only one bank is accessed with tRC(min), Burst Mode, Address and Control inputs on NOP edge are changing once per clock cycle. Iout = 0mA

4. Timing patterns

- DDR200(100Mhz, CL=2) : tCK = 10ns, CL2, BL=4, tRCD = 2*tCK, tRAS = 5*tCK

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

- DDR266B(133Mhz, CL=2.5) : tCK = 7.5ns, CL=2.5, BL=4, tRCD = 3*tCK, tRC = 9*tCK, tRAS = 5*tCK

Read : A0 N R0 N P0 N N N A0 N - repeat the same timing with random address changing

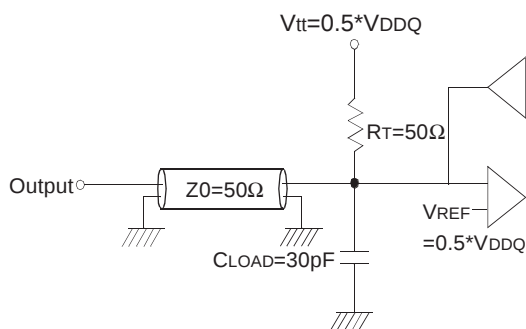
*50% of data changing at every burst

- DDR266A (133Mhz, CL=2) : tCK = 7.5ns, CL=2, BL=4, tRCD = 3*tCK, tRC = 9*tCK, tRAS = 5*tCK

Read : A0 N R0 N P0 N N N A0 N - repeat the same timing with random address changing

*50% of data changing at every burst

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



Output Load Circuit (SSTL_2)

Input/Output Capacitance(V_{DD} = 2.5V, V_{DDQ} = 2.5V, T_A = 25°C, f = 1MHz)

Parameter	Symbol	Min	Max	Unit
Input capacitance (A ₀ ~ A ₁₁ , BA ₀ ~ BA ₁ , $\overline{\text{RAS}}$, $\overline{\text{CAS}}$, $\overline{\text{WE}}$)	CIN ₁	50	62	pF
Input capacitance (CKE ₀)	CIN ₂	42	55	pF
Input capacitance ($\overline{\text{CS}}$ ₀)	CIN ₃	42	55	pF
Input capacitance (CLK ₁ , CLK ₂)	CIN ₄	20	28	pF
Data & DQS input/output capacitance (DQ ₀ ~DQ ₆₃)	C _{OUT}	6	10	pF
Input capacitance (DM0~DM8)	CIN ₅	6	10	pF

AC Characteristics (AC operating conditions unless otherwise noted)

Parameter	Sym- bol	(DDR400A) D0		(DDR400B) D3		(DDR400C) D4		(DDR333) C0		(DDR266A) B1		(DDR266B) B0		(DDR200) A1		Unit	Note
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Row Cycle Time	t _{RC}	60	-	60	-	60	-	60	-	65	-	65	-	70	-	ns	
Auto Refresh Row Cycle Time	t _{RFC}	70	-	70	-	70	-	72	-	75	-	75	-	80	-	ns	
Row Active Time	t _{RAS}	40	120K	40	120K	40	120K	42	120K	45	120K	45	120K	50	120K	ns	
Row Address to Column Address Delay	t _{RCD}	15	-	15	-	20	-	18	-	15	-	20	-	20	-	ns	
Row Active to Row Active Delay	t _{RRD}	10	-	10	-	10	-	12	-	15	-	15	-	15	-	ns	
Column Address to Column Address Delay	t _{CCD}	1	-	1	-	1	-	1	-	1	-	1	-	1	-	CLK	
Row Precharge Time	t _{RP}	15	-	15	-	20	-	18	-	15	-	20	-	20	-	ns	
Write Recovery Time	t _{WR}	15	-	15	-	15	-	12	-	15	-	15	-	15	-	ns	
Last Data-In to Read Command	t _{DRL}	1	-	1	-	1	-	1	-	1	-	1	-	1	-	CLK	

AC Characteristics (cont.)

Parameter	Sym- bol	(DDR400A) D0		(DDR400B) D3		(DDR400C) D4		(DDR333) C0		(DDR266A) B1		(DDR266B) B0		(DDR200) A1		Unit	Note
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Auto Precharge Write Recovery + Precharge Time	t _{DAL}	35	-	35	-	35	-	35	-	35	-	35	-	35	-	ns	
System Clock Cycle Time	CAS Latency = 3	t _{CK}	5	12	5	12	5	12	-	12	-	12	-	12	-	12	ns
	CAS Latency = 2.5		5	12	6	12	6	12	6	12	7	12	7.5	12	8	12	ns
	CAS Latency = 2		7.5	12	7.5	12	7.5	12	7.5	12	7.5	12	10	12	10	12	ns
Clock High Level Width	t _{CH}	0.45	0.55	0.45	0.55	0.45	0.55	0.45	0.55	0.45	0.55	0.45	0.55	0.45	0.55	CLK	
Clock Low Level Width	t _{CL}	0.45	0.55	0.45	0.55	0.45	0.55	0.45	0.55	0.45	0.55	0.45	0.55	0.45	0.55	CLK	
Data-Out edge to Clock edge Skew	t _{AC}	-0.65	0.65	-0.65	0.65	-0.65	0.65	-0.75	0.75	-0.75	0.75	-0.75	0.75	-0.8	0.8	ns	
DQS-Out edge to Clock edge Skew	t _{DQSK}	-0.60	0.60	-0.60	0.60	-0.60	0.60	-0.75	0.75	-0.75	0.75	-0.75	0.75	-0.8	0.8	ns	
DQS-Out edge to Data-Out edge Skew	t _{DQSQ}	-	0.40	-	0.40	-	0.40	-	0.45	-	0.5	-	0.5	-	0.6	ns	
Data-Out hold time from DQS	t _{QH}	t _{HPmin} - 0.75ns	-	t _{HPmin} - 0.75ns	-	t _{HPmin} - 0.75ns	-	t _{HPmin} - 0.75ns	-	t _{HPmin} - 0.75ns	-	t _{HPmin} - 0.75ns	-	t _{HPmin} - 0.75ns	-	ns	1
Clock Half Period	t _{HP}	t _{CH/L} min	-	t _{CH/L} min	-	t _{CH/L} min	-	t _{CH/L} min	-	t _{CH/L} min	-	t _{CH/L} min	-	t _{CH/L} min	-	ns	1
Input Setup Time (fast slew rate)	t _{IS}	0.6	-	0.6	-	0.6	-	0.75	-	0.9	-	0.9	-	1.1	-	ns	2,3,5,6
Input Hold Time (fast slew rate)	t _{IH}	0.6	-	0.6	-	0.6	-	0.75	-	0.9	-	0.9	-	1.1	-	ns	2,3,5,6
Input Setup Time (slow slew rate)	t _{IS}	0.75	-	0.75	-	0.75	-	0.8	-	1.0	-	1.0	-	1.1	-	ns	2,4,5,6
Input Hold Time (slow slew rate)	t _{IH}	0.75	-	0.75	-	0.75	-	0.8	-	1.0	-	1.0	-	1.1	-	ns	2,4,5,6
Input Pulse Width	t _{IPW}	0.4	0.6	0.4	0.6	0.4	0.6	0.4	0.6	2.2	-	2.2	-	-	-	ns	6
Write DQS High Level Width	t _{DQSH}	0.35		0.35		0.35		0.35		0.35		0.35		0.35		CLK	
Write DQS Low Level Width	t _{DQSL}	0.35		0.35		0.35		0.35		0.35		0.35		0.35		CLK	
CLK to First Rising edge of DQS-In	t _{DQSS}	0.72	1.25	0.72	1.25	0.72	1.25	0.75	1.25	0.75	1.25	0.75	1.25	0.75	1.25	CLK	
Data-In Setup Time to DQS-In (DQ & DM)	t _{DS}	0.40	-	0.40	-	0.40	-	0.45	-	0.5	-	0.5	-	0.6	-	ns	7
Data-in Hold Time to DQS-In (DQ & DM)	t _{DH}	0.40	-	0.40	-	0.40	-	0.45	-	0.5	-	0.5	-	0.6	-	ns	7
DQ & DM Input Pulse Width	t _{DIPW}	1.75	-	1.75	-	1.75	-	1.75	-	1.75	-	1.75	-	2	-	ns	

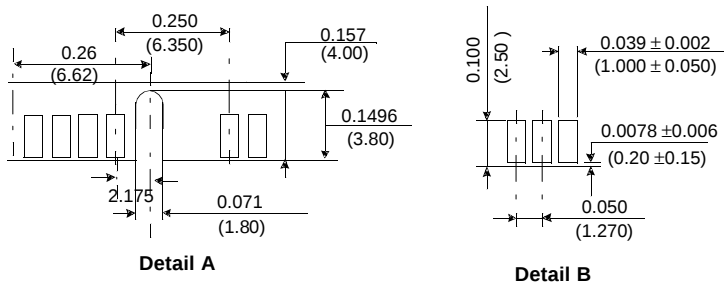
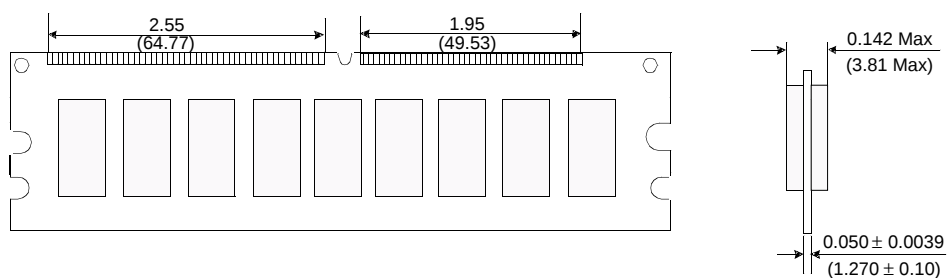
Parameter	Symbol	(DDR400A) D0		(DDR400B) D3		(DDR400C) D4		(DDR333) C0		(DDR266A) B1		(DDR266B) B0		(DDR200) A1		Unit	Note
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Read DQS Preamble Time	t_{RPRE}	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	CLK	
Read DQS Postamble Time	t_{RPST}	0.4	0.6	0.4	0.6	0.4	0.6	0.4	0.6	0.4	0.6	0.4	0.6	0.4	0.6	CLK	
Write DQS Preamble Setup Time	t_{WPRES}	0	-	0	-	0	-	0	-	0	-	0	-	0	-	CLK	
Write DQS Preamble Hold Time	t_{WPREH}	0.25	-	0.25	-	0.25	-	0.25	-	0.25	-	0.25	-	0.25	-	CLK	
Write DQS Postamble Time	t_{WPST}	0.4	0.6	0.4	0.6	0.4	0.6	0.4	0.6	0.4	0.6	0.4	0.6	0.4	0.6	CLK	
Mode Register Set Delay	t_{MRD}	2	-	2	-	2	-	2	-	2	-	2	-	2	-	CLK	
Power Down Exit Time to any command	t_{XPDN}	1	-	1	-	1	-	1	-	1	-	1	-	1	-	CLK	
Exit Self Refresh to Non-Read Command	t_{XSNR}	200	-	200	-	200	-	200	-	75	-	75	-	80	-	CLK	
Exit Self Refresh to Read Command	t_{XSRD}	200	-	200	-	200	-	200	-	200	-	200	-	200	-	CLK	8
Average Periodic Refresh Interval	t_{REFI}	-	7.8	-	7.8	-	7.8	-	7.8	-	7.8	-	7.8	-	7.8	us	

Notes: 1. This calculation accounts for $t_{DQSQ}(\max)$, the pulse width distortion of on-chip circuit and jitter.
2. Data sampled at the rising edges of the clock : A0~A11, BA0~BA1, CKE, CS, RAS, CAS, WE.
3. For command/address input slew rate $\geq 1.0V/ns$
4. For command/address input slew rate $\geq 0.5V/ns$ and $< 1.0V/ns$
5. CK, $\overline{CK}$ slew rates are $\geq 1.0V/ns$
6. These parameters guarantee device timing, but they are not necessarily tested on each device, and they may be guaranteed by design or tester correlation.
7. Data latched at both rising and falling edges of Data Strobe(DQS) : DQ, DM
8. Minimum of 200 cycles of stable input clocks after Self Refresh Exit command, where CKE is held high, is required to complete Self Refresh Exit and lock the internal DLL circuit of DDR SDRAM.

Absolute Maximum Ratings

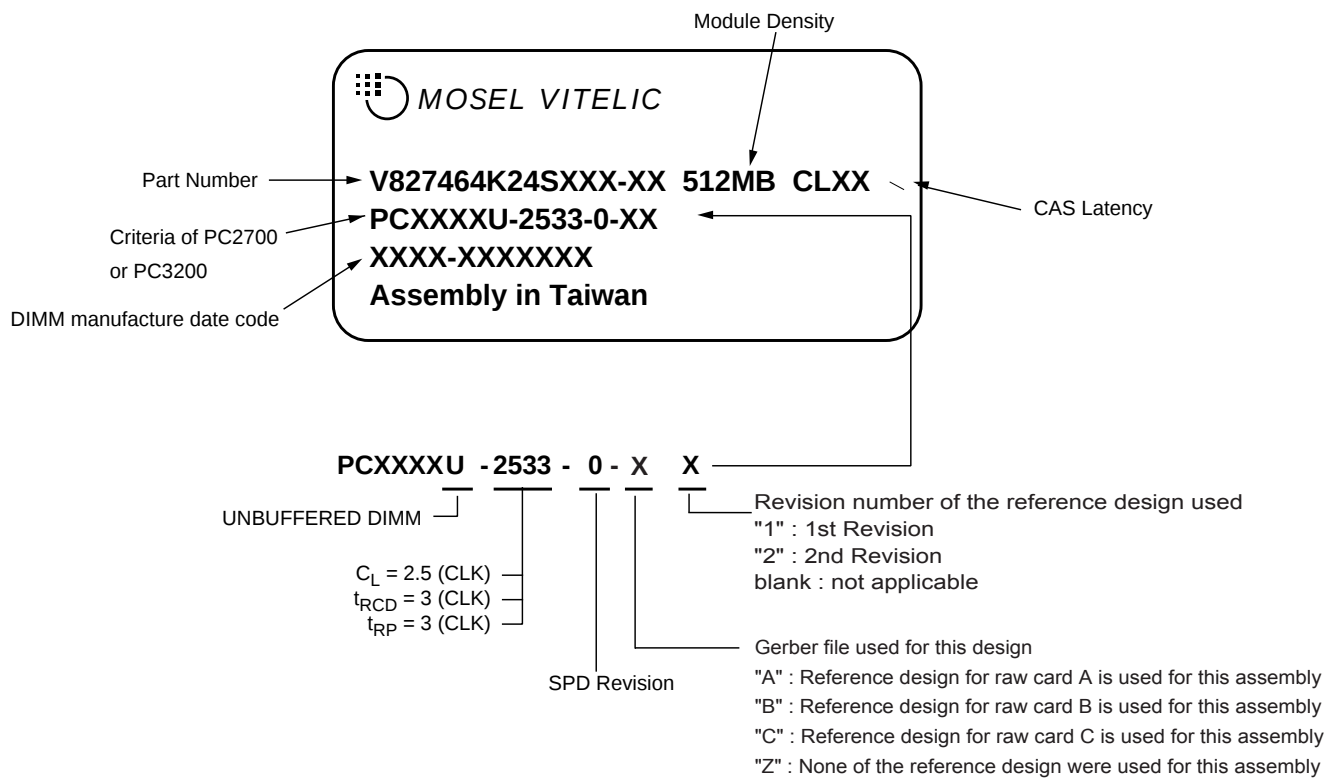
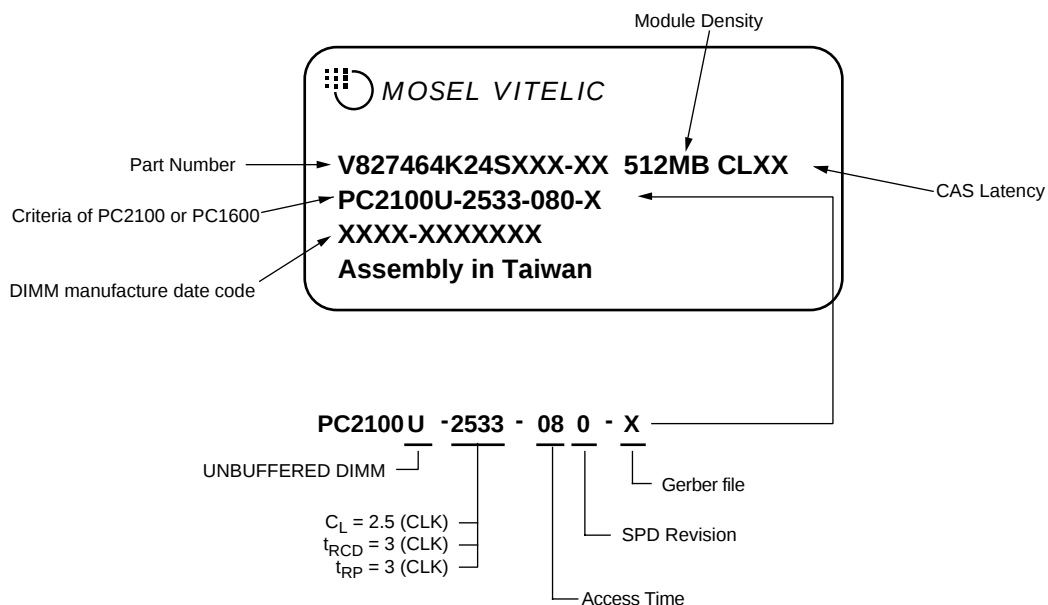
Parameter	Symbol	Rating	Unit
Ambient Temperature	T_A	0 ~ 70	°C
Storage Temperature	T_{STG}	-55 ~ 125	°C
Voltage on Any Pin relative to V_{SS}	V_{IN}, V_{OUT}	-0.5 ~ 3.6	V
Voltage on V_{DD} relative to V_{SS}	V_{DD}	-0.5 ~ 3.6	V
Voltage on V_{DDQ} relative to V_{SS}	V_{DDQ}	-0.5 ~ 3.6	V
Output Short Circuit Current	I_{OS}	50	mA
Power Dissipation	P_D	9	W
Soldering Temperature • Time	T_{SOLDER}	260 • 10	°C • Sec

Note: Operation at above absolute maximum rating can adversely affect device reliability

[illegible]

Tolerances: $\pm 0.005(.13)$ unless otherwise specified

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