



# Product Specifications

PART NO:

**VL470L1624-B3S-S1**

REV: 1.0

## General Information

### 128MB 16MX64 DDR SDRAM UNBUFFERED SODIMM 200 PIN

**Description** The VL470L1624 is a 16M X 64 Double Data Rate SDRAM high density SODIMM. This memory module consists of four CMOS 16Mx16 bit with 4 banks DDR Synchronous DRAMs in TSOP packages and a 2K EEPROM in an 8-pin TSSOP package. This module is a 200-pin small out-line dual in-line memory module and is intended for mounting into a connector socket. Decoupling capacitors are mounted on the printed circuit board for each DDR SDRAM.

### Features

- Power supply: Vdd: 2.5V +/- 0.2V, Vddq: 2.5V +/- 0.2V
- Two data transfers per clock cycle
- Bidirectional data strobe (DQS)
- Differential clock inputs (CK and CK#)
- DLL aligns DQ and DQS transition with CK transition
- Programmable Read latency 2.5 (clock)
- Programmable burst; length (2, 4, 8)
- Programmable burst (sequential & interleave)
- Auto & Self refresh, (8K/64ms refresh)
- Serial presence detect (SPD) with EEPROM
- PCB: Height 30mm (1.181")
- Lead Free/ RoHS compliant
- Operating temperature (TA): -40°C to + 85°C (module screening using commercial DRAM)

Pin Name	Function
A0-A12	Address Inputs
BA0,BA1	Bank Select Address
DQ0-DQ63	Data Input/Output
DQS0-DQS7	Data Strobe Input/Output
CK0,CK0#,CK1,CK1#	Clock Input
CKE0	Clock Enable Input
CS0#	Chip Select Input
RAS#	Row Address Strobe
CAS#	Column Address Input
WE#	Write Enable
DM0-DM7	Data Mask
VDD	Power Supply
VDDQ	Power Supply for DQS
VSS	Ground
VREF	Power Supply for Reference
VDDSPD	SPD Power Supply (2.3V-3.6V)
SDA	Serial Data Input/Output
SCL	SPD Clock Input
SA0-SA2	SPD Address
NC	No Connect

### Order Information

**VL470L1624-B3 S - S1**

Screening temperature (DRAM)

DRAM MANUFACTURER  
S - SAMSUNG

MODULE SPEED  
B3: PC2700 @ CL2.5

VL: Lead-free/RoHS



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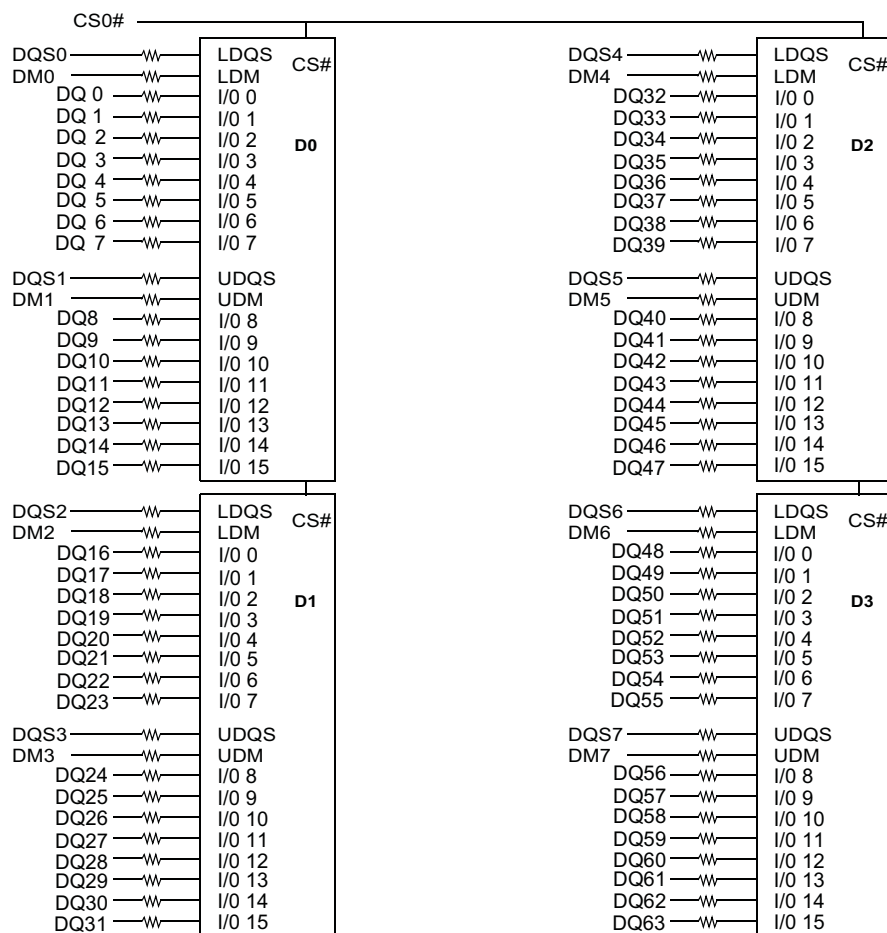
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## Pin Configuration

200-PIN DDR SODIMM FRONT								200-PIN DDR SODIMM BACK							
Pin	Name	Pin	Name	Pin	Name	Pin	Name	Pin	Name	Pin	Name	Pin	Name		
1	VREF	51	VSS	101	A9	151	DQ42	2	VREF	52	VSS	102	A8	152	DQ46
3	VSS	53	DQ19	103	VSS	153	DQ43	4	VSS	54	DQ23	104	VSS	154	DQ47
5	DQ0	55	DQ24	105	A7	155	VDD	6	DQ4	56	DQ28	106	A6	156	VDD
7	DQ1	57	VDD	107	A5	157	VDD	8	DQ5	58	VDD	108	A4	158	CK1#
9	VDD	59	DQ25	109	A3	159	VSS	10	VDD	60	DQ29	110	A2	160	CK1
11	DQS0	61	DQS3	111	A1	161	VSS	12	DM0	62	DM3	112	A0	162	VSS
13	DQ2	63	VSS	113	VDD	163	DQ48	14	DQ6	64	VSS	114	VDD	164	DQ52
15	VSS	65	DQ26	115	A10	165	DQ49	16	VSS	66	DQ30	116	BA1	166	DQ53
17	DQ3	67	DQ27	117	BA0	167	VDD	18	DQ7	68	DQ31	118	RAS#	168	VDD
19	DQ8	69	VDD	119	WE#	169	DQS6	20	DQ12	70	VDD	120	CAS#	170	DM6
21	VDD	71	CB0*	121	CS0#	171	DQ50	22	VDD	72	CB4*	122	CS1#*	172	DQ54
23	DQ9	73	CB1*	123	NC	173	VSS	24	DQ13	74	CB5*	124	NC	174	VSS
25	DQS1	75	VSS	125	VSS	175	DQ51	26	DM1	76	VSS	126	VSS	176	DQ55
27	VSS	77	DQS8*	127	DQ32	177	DQ56	28	VSS	78	DM8*	128	DQ36	178	DQ60
29	DQ10	79	CB2*	129	DQ33	179	VDD	30	DQ14	80	CB6*	130	DQ37	180	VDD
31	DQ11	81	VDD	131	VDD	181	DQ57	32	DQ15	82	VDD	132	VDD	182	DQ61
33	VDD	83	CB3*	133	DQS4	183	DQS7	34	VDD	84	CB7*	134	DM4	184	DM7
35	CK0	85	NC	135	DQ34	185	VSS	36	VDD	86	NC	136	DQ38	186	VSS
37	CK0#	87	VSS	137	VSS	187	DQ58	38	VSS	88	VSS	138	VSS	188	DQ62
39	VSS	89	CK2*	139	DQ35	189	DQ59	40	VSS	90	VSS	140	DQ39	190	DQ63
41	DQ16	91	CK2#*	141	DQ40	191	VDD	42	DQ20	92	VDD	142	DQ44	192	VDD
43	DQ17	93	VDD	143	VDD	193	SDA	44	DQ21	94	VDD	144	VDD	194	SA0
45	VDD	95	CKE1*	145	DQ41	195	SCL	46	VDD	96	CKE0	146	DQ45	196	SA1
47	DQS2	97	NC	147	DQS5	197	VDDSPD	48	DM2	98	NC	148	DM5	198	SA2
49	DQ18	99	A12	149	VSS	199	NC	50	DQ22	100	A11	150	VSS	200	NC

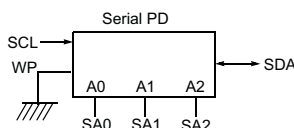
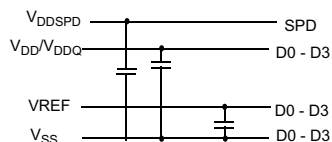
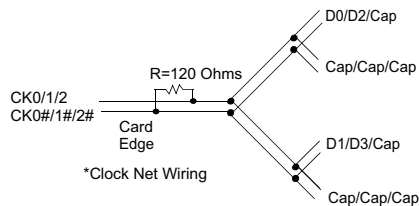
Note: \*: These pins are not used in this modules.

## Functional Block Diagram



BA0 - BA1 → BA0-BA1: DDR SDRAMs D0 - D3  
 A0 - A12 → A0-A12: DDR SDRAMs D0 - D3  
 RAS# → RAS#: SDRAMs D0 - D3  
 CAS# → CAS#: SDRAMs D0 - D3  
 CKE0 → CKE: SDRAMs D0 - D3  
 WE# → WE#: SDRAMs D0 - D3

Clock Wiring	
Clock Input	SDRAMs
CK0/CK0#	2 SDRAMs
CK1/CK1#	2 SDRAMs
CK2/CK2#	NC



- 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.



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## Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Voltage on any pin relative to Vss	V <sub>IN</sub> , V <sub>OUT</sub>	-0.5 ~ 3.6	V
Voltage on V <sub>DD</sub> & V <sub>DDQ</sub> supply relative to Vss	V <sub>DD</sub> , V <sub>DDQ</sub>	-0.5 ~ 3.6	V
Storage temperature	T <sub>STG</sub>	-55 ~ +150	°C
Operating temperature	T <sub>A</sub>	-40 ~ +85	°C
Power Dissipation	P <sub>D</sub>	4	W
Short circuit output 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.  
Exposing to higher than recommended voltage for extended periods of time could affect device reliability.

## DC Operating Conditions

T<sub>A</sub> = -40°C to +85°C

Parameter	Symbol	Min	Max	Unit	Note	
Supply voltage DDR266/DDR333 ( nominal VDD 2.5V)	V <sub>DD</sub>	2.3	2.7	V		
I/O Supply voltage DDR266/DDR333 ( nominal VDD 2.5V)	V <sub>DDQ</sub>	2.3	2.7	V		
I/O Reference voltage	V <sub>REF</sub>	0.49 * V <sub>DDQ</sub>	0.51 * V <sub>DDQ</sub>	V	1	
I/O Termination voltage	V <sub>TT</sub>	V <sub>REF</sub> -0.04	V <sub>REF</sub> +0.04	V	2	
Input logic high voltage	V <sub>IH</sub> (DC)	V <sub>REF</sub> +0.15	V <sub>DDQ</sub> +0.30	V		
Input logic low voltage	V <sub>IL</sub> (DC)	-0.3	V <sub>REF</sub> -0.15	V		
Input voltage level, CK and CK#	V <sub>IN</sub> (DC)	-0.3	V <sub>DDQ</sub> +0.30	V		
Input differential voltage, CK and CK#	V <sub>ID</sub> (DC)	0.36	V <sub>DDQ</sub> +0.60	V	3	
Input crossing point voltage, CK and CK#	V <sub>IX</sub> (DC)	0.3	V <sub>DDQ</sub> +0.60	V		
Input leakage current	Addr, CAS#,RAS#,WE#	I <sub>I</sub>	-8	8	uA	
	CS#, CKE		-8	8	uA	
	CK, CK#		-8	8	uA	
	DM		-2	2	uA	
Output leakage current	I <sub>OZ</sub>	-5	5	uA		
Output high current(normal strength) V <sub>OUT</sub> = v + 0.84V	I <sub>OH</sub>	-16.8	-	mA		
Output high current(normal strength) V <sub>OUT</sub> = V <sub>TT</sub> - 0.84V	I <sub>OL</sub>	16.8	-	mA		
Output high current(half strength) V <sub>OUT</sub> = V <sub>TT</sub> + 0.45V	I <sub>OH</sub>	-9	-	mA		
Output high current(half strength) V <sub>OUT</sub> = V <sub>TT</sub> - 0.45V	I <sub>OL</sub>	9	-	mA		

Notes:

- V<sub>REF</sub> is expected to be equal to 0.5\*V<sub>DDQ</sub> of the transmitting device, and to track variations in the DC level of the same.  
Peak to peak noise on V<sub>REF</sub> may not exceed +/- 2% of the DC value.
- V<sub>TT</sub> is not applied directly to the device. V<sub>TT</sub> is a system supply for signal termination resistors, is expected to be set equal to V<sub>REF</sub>, and must track variations in the DC level of V<sub>REF</sub>.
- V<sub>ID</sub> is the magnitude of the difference between the input level on CK and the input level of CK#.



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## AC Operating Conditions

TA = -40°C to +85°C

Parameter	Symbol	Min	Max	Unit	Notes
Input High (Logic1) Voltage	VIH(AC)	VREF+0.31		V	1
Input Low (Logic0) Voltage	VIL(AC)		VREF-0.31	V	1
Input Differential Voltage, CK and CK# inputs	VID(AC)	0.7	VDDQ+0.6	V	
Input Crossing Point Voltage, CK and CK# input	VIX(AC)	0.5*VDDQ-0.2	0.5*VDDQ+0.2	V	

Notes: 1. VIH overshoot:  $VIH = VDDQ + 1.5V$  for a pulse width  $\leq 3ns$  and the pulse can not be greater than 1/3 of the cycle rate.  
 VIL undershoot:  $VIL = -1.5V$  for a pulse width  $\leq 3ns$  and the pulse can not be greater than 1/3 of the cycle rate.

## Input/Output Capacitance

TA=25°C, f=100MHz

Parameter	Symbol	Min	Max	Unit
Input capacitance (A0~A12, BA0~BA1,RAS#,CAS#,WE#)	CIN1	12	16	pF
Input capacitance (CKE0)	CIN2	12	16	pF
Input capacitance (CS0#)	CIN3	12	16	pF
Input capacitance (CK0,CK0#,CK1,CK1#)	CIN4	12	16	pF
Input capacitance (DM0 ~ DM7), (DQS0 ~ DQS7)	CIN5	8	9	pF
Input capacitance (DQ0 ~ DQ63)	COUT1	8	9	pF



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## IDD Specification

TA = -40°C to +85°C

Condition	Symbol	-B3	Unit
OPERATING CURRENT: One device bank active; Active-Precharge; $t_{RC}=t_{RC(MIN)}$ ; $t_{CK}=t_{CK(MIN)}$ ; DQ,DM and DQS inputs change once per clock cycle; Address and control inputs change once every two clock cycles	IDD0	360	mA
OPERATING CURRENT: One device bank; Active-Read-Precharge; BL=4; $t_{RC}=t_{RC(MIN)}$ ; $t_{CK}=t_{CK(MIN)}$ ; $I_{OUT}=0mA$ ; Address and control inputs change once per clock cycle	IDD1	500	mA
PRECHARGE POWER-DOWN STANDBY CURRENT: All device banks are idle; Power-down mode; $t_{CK}=t_{CK(MIN)}$ ; CKE=LOW	IDD2P	12	mA
IDLE STANDBY CURRENT: CS#=HIGH; All device banks are idle; $t_{CK}=t_{CK(MIN)}$ ; CKE=HIGH; Address and other control inputs changing once per clock cycle. $V_{IN}=V_{REF}$ for DQ,DQS and DM	IDD2F	120	mA
ACTIVE POWER-DOWN STANDBY CURRENT: One device bank active; Power-down mode; $t_{CK}=t_{CK(MIN)}$ ; CKE=LOW	IDD3P	140	mA
ACTIVE STANDBY CURRENT: CS#=HIGH; CKE=HIGH; One device bank active; $t_{RAS}=t_{RAS(MAX)}$ ; $t_{CK}=t_{CK(MIN)}$ ; DQ,DM and DQS inputs change twice per clock cycle; Address and other control inputs changing once per clock cycle	IDD3N	220	mA
OPERATING CURRENT: Burst = 2; Reads; Continuous burst; One device bank active; Address and other control inputs changing once per clock cycle; $t_{CK}=t_{CK(MIN)}$ ; $I_{OUT}=0mA$	IDD4R	800	mA
OPERATING CURRENT: Burst = 2; Writes; Continuous burst; One device bank active; Address and other control inputs changing once per clock cycle; $t_{CK}=t_{CK(MIN)}$ ; DQ,DM and DQS inputs change twice per clock cycle	IDD4W	760	mA
AUTO REFRESH CURRENT: $T_{RC}=T_{RFC(MIN)}$	IDD5	720	mA
SELF-REFRESH CURRENT: CKE< 0.2V	IDD6	12	mA
OPERATING CURRENT: Four device bank interleaving Reads Burst=4 with auto precharge; $t_{RC}=t_{RC(MIN)}$ ; $t_{CK}=t_{CK(MIN)}$ ; Address and control inputs change only during Active READ, or WRITE commands	IDD7	1400	mA



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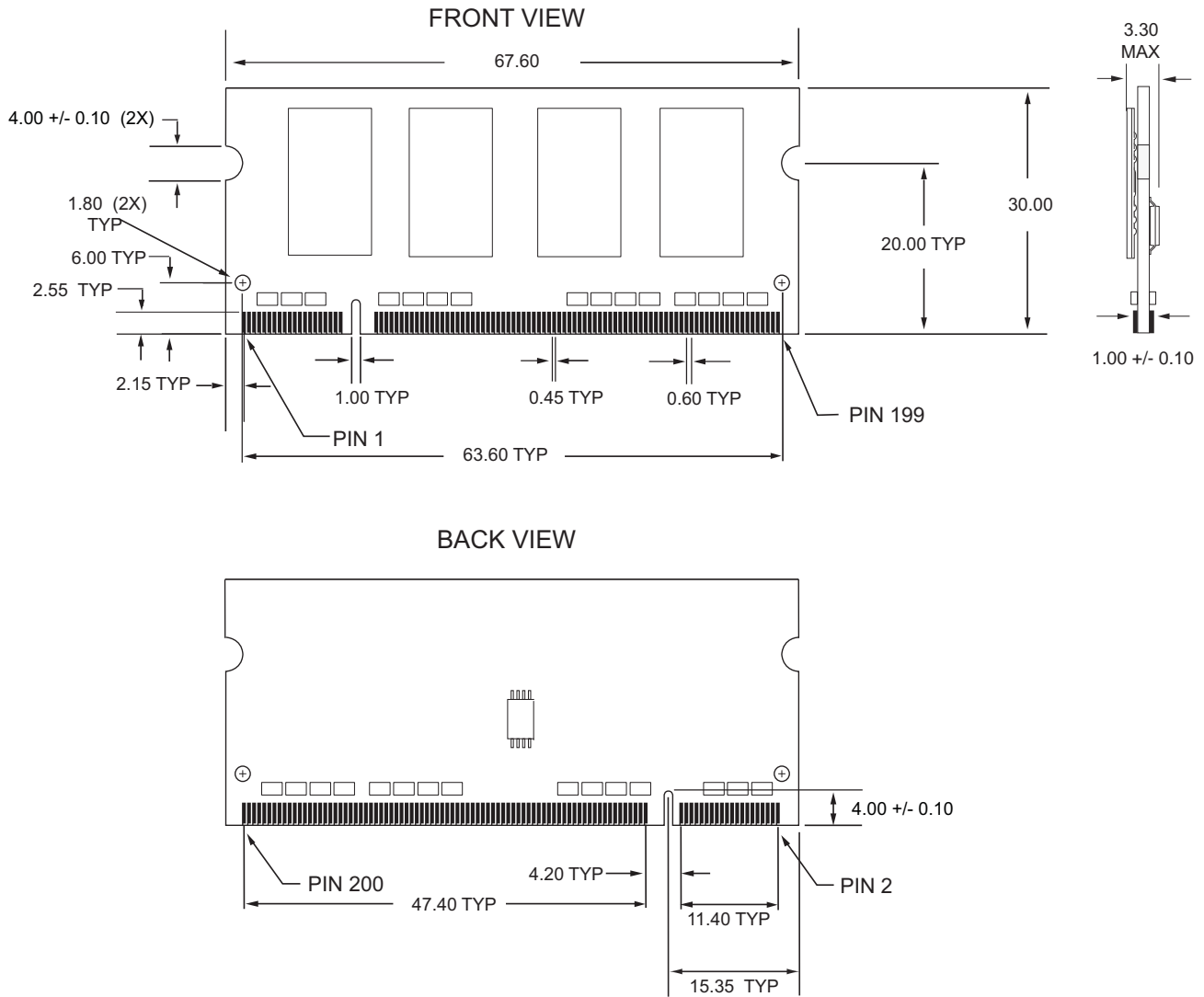
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## AC Timing Parameters & Specifications

Parameter	Symbol	-B3		Unit
		MIN	MAX	
Row Cycle Time	t <sub>RC</sub>	60		ns
Refresh row cycle time	t <sub>RFC</sub>	72		ns
Row active	t <sub>RAS</sub>	42	70K	ns
RAS# to CAS# delay	t <sub>RCD</sub>	18		ns
Row precharge time	t <sub>RP</sub>	18		ns
Row active to row active delay	t <sub>RRD</sub>	12		ns
Write recovery time	t <sub>WR</sub>	15		ns
Last data in to READ command	t <sub>WTR</sub>	1		tCK
Clock cycle time	CL=2	-	-	ns
	CL=2.5	6	12	ns
	CL=3	-	-	ns
Clock high level width	t <sub>CH</sub>	0.45	0.55	tCK
Clock low level width	t <sub>CL</sub>	0.45	0.55	tCK
DQS-out access time from CK/CK#	t <sub>DQSCK</sub>	-0.6	+0.6	ns
Output data access time from CK/CK#	t <sub>AC</sub>	-0.7	+0.7	ns
Data strobe edge to output data edge	t <sub>DQSQ</sub>	-	0.45	ns
Read preamble	t <sub>RPRE</sub>	0.9	1.1	tCK
Read postamble	t <sub>RPST</sub>	0.4	0.6	tCK
CK to valid DQS-in	t <sub>DQSS</sub>	0.75	1.25	tCK
DQS-in setup time	t <sub>WPRES</sub>	0		ns
DQS-in hold time	t <sub>WPRE</sub>	0.25		tCK
DQS falling edge to CK rising-setup time	t <sub>DSS</sub>	0.2		tCK
DQS falling edge to CK rising-hold time	t <sub>DSH</sub>	0.2		tCK
DQS-in high level width	t <sub>DQSH</sub>	0.35		tCK
DQS-in low level width	t <sub>DQSL</sub>	0.35		tCK
Address and control input setup time (fast)	t <sub>ISf</sub>	0.75		ns
Address and control input hold time (fast)	t <sub>IHf</sub>	0.75		ns
Address and control input setup time (slow)	t <sub>ISs</sub>	0.8		ns
Address and control input hold time (slow)	t <sub>IHs</sub>	0.8		ns
Data-out high impedance time from CK/CK#	t <sub>HZ</sub>	-0.7	+0.70	ns
Data-out low impedance time from CK/CK#	t <sub>LZ</sub>	-0.70	+0.70	ns
Mode register set cycle	t <sub>MRD</sub>	12		ns
DQ & DM setup time to DQS	t <sub>DS</sub>	0.45		ns
DQ & DM hold time to DQS	t <sub>DH</sub>	0.45		ns
Control & address input pulse width	t <sub>IPW</sub>	2.2		ns
DQ & DM input pulse width	t <sub>DIPW</sub>	1.75		ns
Exit self refresh to non-Read command	t <sub>XSNR</sub>	75		ns
Exit self refresh to Read command	t <sub>XSRD</sub>	200		tCK
Refresh interval time	t <sub>REFI</sub>		7.8	us
Output DQS valid window	t <sub>QH</sub>	t <sub>HP</sub> -t <sub>QHS</sub>	-	ns
Clock half period	t <sub>HP</sub>	t <sub>CLmin</sub> or t <sub>CHmin</sub>	-	ns
Data hold skew factor	t <sub>QHS</sub>		0.55	ns
DQS write postamble	t <sub>WPST</sub>	0.4	0.6	tCK
Active Read with auto precharge command	t <sub>RAP</sub>	18		
Auto precharge Write recovery + Precharge time	t <sub>DAL</sub>	t <sub>WR</sub> /t <sub>CK</sub> + t <sub>RP</sub> /t <sub>CK</sub>		tCK

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## Package Dimensions



**NOTE:**  
All dimensions are in millimeters with tolerance +/- 0.15mm unless otherwise specified.



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## Revision History

Date	Rev.	Page	Changes
08/25/09	1.0	All	Spec release