

Product Specifications

PART NO.:

VL53B5269E-K9S/F8S/E7S

REV: 1.0

General Information

4GB 512M x 72 DDR3 SDRAM VLP ECC Mini-RDIMM 244-PIN

Description

The VL53B5269E is a 512M x 72 DDR3 SDRAM high density Mini-RDIMM. This memory module consists of nine stacked CMOS 512M x 8 bits with 8 banks DDR3 Synchronous DRAMs in BGA packages, a 28-bit registered buffer/PLL clock in BGA package, and a 2K EEPROM with thermal sensor in an 8-pin MLF package. This module is a 244-pin registered 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 DDR3 SDRAM.

Features

- 244-pin, mini registered dual in-line memory module (Mini-RDIMM)
- Supports ECC error detection and correction
- Fast data transfer rates: PC3-10600, PC3-8500, PC3-6400
- VDD = VDDQ = 1.5V +/-0.075V
- JEDEC standard 1.5V +/-0.075V I/O (SSTL_15)
- VDDSPD = 3.0V to 3.6V
- Eight internal component banks for concurrent operation
- 8-bit pre-fetch architecture
- Bi-directional differential data-strobe
- Nominal and dynamic on-die termination (ODT)
- ZQ calibration support
- Programmable CAS# latency: 9 (DDR3-1333), 7 (DDR3-1066), 6 (DDR3-800)
- Programmable burst; length (8)
- Average refresh period 7.8 us
- Asynchronous reset
- Fly-by topology
- On board terminated command, address, and control bus
- Serial presence detect (SPD) with thermal sensor, referenced to JEDEC SPD4_01_04 (www.JEDEC.org/download/search/4_01_04r18.pdf)
- Thermal sensor range: -20°C to +125°C (+/- 1°C accuracy)
- Gold edge contacts
- Lead-free, RoHS compliant
- PCB: Height 18.29mm (0.720"), double sided components

Pin Description

Pin Name	Function
A0~A14	Address Inputs
A10/AP	Address Input/ Autoprecharge
A12/BC#	Address Input/ Burst Chop
BA0~BA2	Bank Address Inputs
DQ0~DQ63	Data Input/Output
DQS0~DQS8	Data Strobes
DQS0#~DQS8#	Data Strobes Complement
ODT0, ODT1	On-die Termination Control
PAR_IN	Parity Input
ERR_OUT#	Parity Error Output
CK0, CK0#	Clock Input
CKE0, CKE1	Clock Enables
CS0#, CS1#	Chip Selects
RAS#	Row Address Strobes
CAS#	Column Address Strobes
WE#	Write Enable
VDD	Voltage Supply 1.5V +/- 0.075V
VSS	Ground
SA0~SA2	SPD Address
SDA	SPD Data Input/Output
SCL	SPD Clock Input
DM0~DM8	Data Masks/ Data Strobes (Read)
CB0~CB7	Data Check Bits I/O
VREFCA	Reference Voltage for CA
VREFDQ	Reference Voltage for DQ
VDDSPD	SPD Voltage Supply 3.0V to 3.6V
VTT	Termination Voltage
RESET#	Register and SDRAM Control
EVENT#	Reserved for Temp Sensing
NC	No Connect

Order Information:

VL53B5269E-K9 S X

DRAM DIE (Option)

DRAM MANUFACTURER
S - SAMSUNG

MODULE SPEED
K9: PC3-10600 @ CL9
F8: PC3-8500 @ CL7
E7: PC3-6400 @ CL6

VL: Lead-free/RoHS

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Pin Configuration

244-PIN DDR3 Mini-RDIMM FRONT SIDE

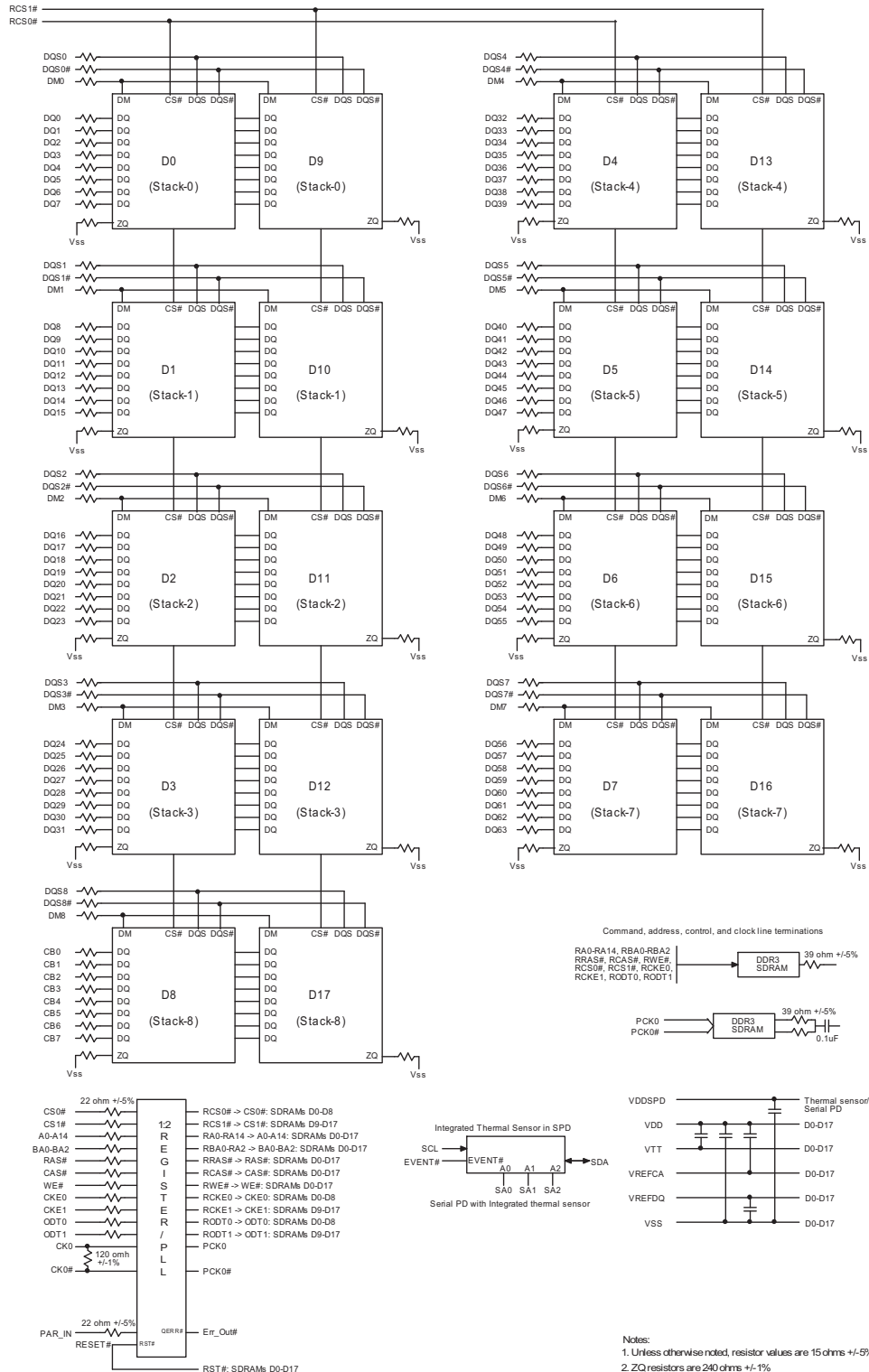
Pin	Name	Pin	Name	Pin	Name	Pin	Name
1	VTT	31	DQ24	62	A2	92	DQ40
2	VREFDQ	32	DQ25	63	VDD	93	DQ41
3	VSS	33	VSS	64	CK1 *	94	VSS
4	DQ0	34	DQS3#	65	CK1# *	95	DQS5#
5	DQ1	35	DQS3	KEY		96	DQS5
6	VSS	36	VSS	66	VDD	97	VSS
7	DQS0#	37	DQ26	67	VREFCA	98	DQ42
8	DQS0	38	DQ27	68	VDD	99	DQ43
9	VSS	39	VSS	69	PAR_IN	100	VSS
10	DQ2	40	CB0	70	VDD	101	DQ48
11	DQ3	41	CB1	71	A10/ AP	102	DQ49
12	VSS	42	VSS	72	BA0	103	VSS
13	DQ8	43	DQS8#	73	VDD	104	DQS6#
14	DQ9	44	DQS8	74	WE#	105	DQS6
15	VSS	45	VSS	75	CAS#	106	VSS
16	DQS1#	46	CB2	76	VDD	107	DQ50
17	DQS1	47	CB3	77	CS1#	108	DQ51
18	VSS	48	VSS	78	ODT1	109	VSS
19	DQ10	49	NC	79	VDD	110	DQ56
20	DQ11	50	RESET#	80	CS2# *	111	DQ57
21	VSS	51	CKE0	81	NC	112	VSS
22	DQ16	52	VDD	82	VSS	113	DQS7#
23	DQ17	53	BA2	83	DQ32	114	DQS7
24	VSS	54	Err_Out#	84	DQ33	115	VSS
25	DQS2#	55	VDD	85	VSS	116	DQ58
26	DQS2	56	A11	86	DQS4#	117	DQ59
27	VSS	57	A7	87	DQS4	118	VSS
28	DQ18	58	VDD	88	VSS	119	SA0
29	DQ19	59	A5	89	DQ34	120	SCL
30	VSS	60	A4	90	DQ35	121	SA2
		61	VDD	91	VSS	122	VTT

244-PIN DDR3 Mini-RDIMM BACK SIDE

Pin	Name	Pin	Name	Pin	Name	Pin	Name
123	VTT	153	DQ29	184	A1	214	DQ45
124	VSS	154	VSS	185	VDD	215	VSS
125	DQ4	155	DM3	186	CK0	216	DM5
126	DQ5	156	NC	187	CK0#	217	NC
127	VSS	157	VSS	KEY		218	VSS
128	DM0	158	DQ30	188	VDD	219	DQ46
129	NC	159	DQ31	189	VDD	220	DQ47
130	VSS	160	VSS	190	EVENT#	221	VSS
131	DQ6	161	CB4	191	A0	222	DQ52
132	DQ7	162	CB5	192	VDD	223	DQ53
133	VSS	163	VSS	193	BA1	224	VSS
134	DQ12	164	DM8	194	VDD	225	DM6
135	DQ13	165	NC	195	RAS#	226	NC
136	VSS	166	VSS	196	CS0#	227	VSS
137	DM1	167	CB6	197	VDD	228	DQ54
138	NC	168	CB7	198	ODT0	229	DQ55
139	VSS	169	VSS	199	A13	230	VSS
140	DQ14	170	NC	200	VDD	231	DQ60
141	DQ15	171	TEST *	201	CS3# *	232	DQ61
142	VSS	172	CKE1	202	NC	233	VSS
143	DQ20	173	VDD	203	VSS	234	DM7
144	DQ21	174	A15 *	204	DQ36	235	NC
145	VSS	175	A14	205	DQ37	236	VSS
146	DM2	176	VDD	206	VSS	237	DQ62
147	NC	177	A12/ BC#	207	DM4	238	DQ63
148	VSS	178	A9	208	NC	239	VSS
149	DQ22	179	VDD	209	VSS	240	VDDSPD
150	DQ23	180	A8	210	DQ38	241	SA1
151	VSS	181	A6	211	DQ39	242	SDA
152	DQ28	182	VDD	212	VSS	243	VSS
		183	A3	213	DQ44	244	VTT

*: These pins are not used in this module.

Function Block Diagram



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Absolute Maximum Ratings

Absolute Maximum Ratings					
Symbol	Parameter		MIN	MAX	Unit
VDD	Voltage on VDD pin relative to VSS		-0.4	1.975	V
VDDQ	Voltage on VDDQ pin relative to VSS		-0.4	1.975	V
VIN, VOUT	Voltage on any pin relative to VSS		-0.4	1.975	V
TSTG	Storage temperature		-55	100	°C
IL	Input leakage current; Any input 0V<VIN<VDD; VREF input 0V<VIN<0.95V; Other pins not under test = 0V	Address, BA, RAS#, CAS#,WE#, CS#, CKE, ODT	-5	5	uA
		CK, CK#	-5	150	uA
		DM	-4	4	uA
IOZ	Output leakage current; 0V<VOUT<VDDQ; DQs and ODT are disabled	DQ, DQS, DQS#	-10	10	uA
IVREF	VREF supply leakage current; VREF = Valid VREF level		-18	18	uA

DC Operating Conditions

Symbol	Parameter	Min	Typical	Max	Unit	Notes
VDD	Supply Voltage	1.425	1.5	1.575	V	1,2
VDDQ	I/O Supply Voltage	1.425	1.5	1.575	V	1,2
VREFDQ (DC)	I/O reference voltage DQ bus	0.49 x VDD	0.5 x VDD	0.51 x VDD	V	3,4
VREFCA (DC)	Input reference voltage CMD/ADD bus	0.49 x VDD	0.5 x VDD	0.51 x VDD	V	3,4
VTT	Termination Reference Voltage	-0.483 x VDDQ	0.5 x VDDQ	+0.517 x VDDQ	V	5

Note:

- Under all conditions VDDQ must be less than or equal to VDD.
- VDDQ tracks with VDD. AC parameters are measured with VDD and VDDQ tied together.
- The AC peak noise on VREF may not allow VREF to deviate from VREF(DC) by more than +/-1% VDD
- For reference: approximate VDD/2 +/-15mV.
- VTT termination voltage in excess of stated limit will adversely affect the command and address signals' voltage margin and will reduce timing margins.

Operating Temperature Condition

Symbol	Parameter	Rating	Units	Notes
TOPER	Operating temperature	0 - 95	°C	1,2

Notes:

- Operating temperature is the case surface temperature on the center/top side of the DRAM. For the measurement conditions, please refer to JEDEC JESD51-2.
- At 0 – 85°C, operation temperature range, all DRAM specifications will be supported. The refresh rate is required to double when 85°C < TOPER <= 95°C.

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Input DC Logic Level

All voltages referenced to VSS

Symbol	Parameter	Min	Max	Unit
Command and Address				
VIHCA(DC)	Input High (Logic 1) Voltage DDR3-800/1066/1333	VREF + 0.100	VDD	V
VILCA(DC)	Input Low (Logic 0) Voltage DDR3-800/1066/1333	VSS	VREF - 0.100	V
DQ and DM				
VIHDQ(DC)	Input High (Logic 1) Voltage DDR3-800/1066/1333	VREF + 0.100	VDD	V
VILDQ(DC)	Input Low (Logic 0) Voltage DDR3-800/1066/1333	VSS	VREF - 0.100	V

Input AC Logic Level

All voltages referenced to VSS

Symbol	Parameter	Min	Max	Unit
Command and Address				
VIHCA(AC)	Input High (Logic 1) Voltage DDR3-800/1066/1333	VREF + 0.175	-	V
VILCA(AC)	Input Low (Logic 0) Voltage DDR3-800/1066/1333	-	VREF - 0.175	V
DQ and DM				
VIHDQ(AC)	Input High (Logic 1) Voltage DDR3-800/1066	VREF + 0.175	-	V
VILDQ(AC)	Input Low (Logic 0) Voltage DDR3-800/1066	-	VREF - 0.175	V
VIHDQ(AC)	Input High (Logic 1) Voltage DDR3-1333	VREF + 0.150	-	V
VILDQ(AC)	Input Low (Logic 0) Voltage DDR3-1333	-	VREF - 0.150	V

Input/Output Capacitance

TA=25°C, f=100MHz

Parameter	Symbol	DDR3-1333		DDR3-1066		DDR3-800		Unit
		Min	Max	Min	Max	Min	Max	
Input capacitance (A0~A14, BA0~BA2, RAS#, CAS#, WE#)	CIN1	5.5	6.5	5.5	6.5	5.5	6.5	pF
Input capacitance (CKE0, CKE1), (ODT0, ODT1), (CS0#, CS1#)	CIN2	5.5	6.5	5.5	6.5	5.5	6.5	pF
Input capacitance (CK0, CK0#)	CIN3	5.5	6.5	5.5	6.5	5.5	6.5	pF
Input/Output capacitance (DQ, DQS, DQS#, DM, CB)	CIO	7	9	7	9.4	7	10	pF

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IDD Specification

Condition	Symbol	DDR3-1333	DDR3-1066	DDR3-800	Unit
		K9	F8	E7	
Operating one bank active-precharge current; tCK= tCK(IDD); tRC= tRC(IDD); tRAS= tRAS MIN(IDD); CKE is HIGH, CS# is HIGH between valid commands; Address bus inputs are SWITCHING; Data bus inputs are SWITCHING	IDD0*	883	838	793	mA
Operating one bank active-read-precharge current; IOUT = 0mA; BL = 8; CL = CL(IDD); AL = 0; tCK= tCK(IDD); tRC= tRC(IDD); tRAS= tRAS MIN(IDD); tRCD= tRCD(IDD); CKE is HIGH, CS# is HIGH between valid commands; Address bus inputs are SWITCHING; Data pattern is same as IDD4W.	IDD1*	1018	973	928	mA
Precharge power-down current; All device banks idle; tCK= tCK(IDD); CKE is LOW; Other control and address bus inputs are STABLE; Data bus inputs are FLOATING	IDD2P-F**	730	640	550	mA
	IDD2P-S**	316	316	316	mA
Precharge standby current; All device banks idle; tCK= tCK(IDD); CKE is HIGH; CS# is HIGH; Other control and address bus inputs are SWITCHING; Data bus inputs are SWITCHING.	IDD2N**	820	820	730	mA
Precharge quiet standby current; All device banks idle; tCK= tCK(IDD); CKE is HIGH; CS# is HIGH; Other control and address bus inputs are STABLE; Data bus inputs are FLOATING	IDD2Q**	820	730	676	mA
Active power-down current; All device banks open; tCK= tCK(IDD); CKE is LOW; Other control and address bus inputs are STABLE; Data bus inputs are FLOATING.	IDD3P**	730	730	640	mA
Active standby current; All device banks open; tCK= tCK(IDD); tRP= tRP(IDD); tRAS= tRAS MAX(IDD); CKE is HIGH, CS# is HIGH between valid commands; Other control and address bus inputs are SWITCHING; Data bus inputs are SWITCHING.	IDD3N**	1180	1090	1000	mA
Operating burst read current; All device banks open; Continuous burst reads; IOUT = 0mA; BL = 8; CL = CL(IDD); AL = 0; tCK= tCK(IDD); tRAS= tRAS MAX(IDD); tRP= tRP(IDD); CKE is HIGH, CS# is HIGH between valid commands; Address bus inputs are SWITCHING; Data pattern is same as IDD4W.	IDD4R*	1513	1333	1153	mA
Operating burst write current; All device banks open; Continuous burst writes; BL = 8; CL = CL(IDD); AL = 0; tCK= tCK(IDD); tRAS= tRAS MAX(IDD); tRP= tRP(IDD); CKE is HIGH, CS# is HIGH between valid commands; Address bus inputs are SWITCHING; Data bus inputs are SWITCHING.	IDD4W*	1558	1378	1198	mA
Burst refresh current; tCK=tCK(IDD); Refresh command at every tRFC(IDD) interval; CKE is HIGH; CS# is HIGH between valid commands; Other control and address bus inputs are SWITCHING; Data bus inputs are SWITCHING.	IDD5**	3430	3430	3430	mA
Self refresh current; CK and CK# at 0V; CKE < 0.2V; Other control and address bus inputs are FLOATING; Data bus inputs are FLOATING.	IDD6**	216	216	216	mA
Operating bank interleave read current; All bank interleaving reads; IOUT = 0mA; BL = 8; CL = CL(IDD); AL = tRCD(IDD) - 1*tCK(IDD); tCK= tCK(IDD); tRC= tRC(IDD); tRRD = tRRD(IDD); tRCD = 1*tCK(IDD); CKE is HIGH; CS# is HIGH between valid commands; Address bus inputs are STABLE during DESELECTs; Data pattern is same as IDD4R.	IDD7*	2728	2278	2098	mA

Note: IDD specification is based on Samsung B-die components.

*: Value calculated as one module rank in this operating condition, and all other module ranks in IDD2P (CKE LOW) mode.

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

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REV: 1.0

AC TIMING PARAMETERS & SPECIFICATIONS

Parameter	Symbol	DDR3-1333 (-K9)		DDR3-1066 (-F8)		DDR3-800 (-E7)		Unit
		MIN	MAX	MIN	MAX	MIN	MAX	
Clock Timing								
Minimum Clock Cycle Time (DLL off mode)	tCK(DLL_OFF)	8	-	8	-	8	-	ns
Average Clock Period	tCK(avg)	1.5	<1.875	1.875	<2.5	2.5	3.3	ns
Clock Period	tCK(abs)	tCK(avg)min + tJIT(per)min	tCK(avg)max + tJIT(per)max	tCK(avg)min + tJIT(per)min	tCK(avg)max + tJIT(per)max	tCK(avg)min + tJIT(per)min	tCK(avg)max + tJIT(per)max	ns
Average high pulse width	tCH(avg)	0.47	0.53	0.47	0.53	0.47	0.53	tCK(avg)
Average low pulse width	tCL(avg)	0.47	0.53	0.47	0.53	0.47	0.53	tCK(avg)
Clock Period Jitter	tJIT(per)	-80	80	-90	90	-100	100	ps
Clock Period Jitter during DLL locking period	tJIT(per, lck)	-70	70	-80	80	-90	90	ps
Cycle to Cycle Period Jitter	tJIT(cc)	160		180		200		ps
Cycle to Cycle Period Jitter during DLL locking period	tJIT(cc, lck)	140		160		180		ps
Cumulative error across 2 cycles	tERR(2per)	-118	118	-132	132	-147	147	ps
Cumulative error across 3 cycles	tERR(3per)	-140	140	-157	157	-175	175	ps
Cumulative error across 4 cycles	tERR(4per)	-155	155	-175	175	-194	194	ps
Cumulative error across 5 cycles	tERR(5per)	-168	168	-188	188	-209	209	ps
Cumulative error across 6 cycles	tERR(6per)	-177	177	-200	200	-222	222	ps
Cumulative error across 7 cycles	tERR(7per)	-186	186	-209	209	-232	232	ps
Cumulative error across 8 cycles	tERR(8per)	-193	193	-217	217	-241	241	ps
Cumulative error across 9 cycles	tERR(9per)	-200	200	-224	224	-249	249	ps
Cumulative error across 10 cycles	tERR(10per)	-205	205	-231	231	-257	257	ps
Cumulative error across 11 cycles	tERR(11per)	-210	210	-237	237	-263	263	ps
Cumulative error across 12 cycles	tERR(12per)	-215	215	-242	242	-269	269	ps
Cumulative error across n = 13, 14 ... 49, 50 cycles	tERR(nper)	tERR(nper)min =(1+ 0.68ln(n))*tJIT(per)min tERR(nper)max=(1+ 0.68ln(n))*tJIT(per)max						ps
Absolute clock HIGH pulse width	tCH(abs)	0.43	-	0.43	-	0.43	-	tCK(avg)
Absolute clock Low pulse width	tCL(abs)	0.43	-	0.43	-	0.43	-	tCK(avg)
Data Timing								
DQS,DQS# to DQ skew, per group, per access	tDQSQ	-	125	-	150	-	200	ps
DQ output hold time from DQS, DQS#	tQH	0.38	-	0.38	-	0.38	-	tCK(avg)
DQ low-impedance time from CK, CK#	tLZ(DQ)	-500	250	-600	300	-800	400	ps
DQ high-impedance time from CK, CK#	tHZ(DQ)	-	250	-	300	-	400	ps
Data setup time to DQS, DQS# referenced to Vih(ac)Vil(ac) levels	tDS(base)	30	-	25	-	75	-	ps
Data hold time to DQS, DQS# referenced to Vih(ac)Vil(ac) levels	tDH(base)	65	-	100	-	150	-	ps
DQ and DM Input pulse width for each input	tDIPW	400	-	490	-	600	-	ps

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REV: 1.0

AC TIMING PARAMETERS & SPECIFICATIONS

Parameter	Symbol	DDR3-1333 (-K9)		DDR3-1066 (-F8)		DDR3-800 (-E7)		Unit
		MIN	MAX	MIN	MAX	MIN	MAX	
Data Strobe Timing								
DQS, DQS# READ Preamble	tRPRE	0.9	-	0.9	-	0.9	-	tCK
DQS, DQS# differential READ Postamble	tRPST	0.3	-	0.3	-	0.3	-	tCK
DQS, DQS# output high time	tQSH	0.4	-	0.38	-	0.38	-	tCK(avg)
DQS, DQS# output low time	tQSL	0.4	-	0.38	-	0.38	-	tCK(avg)
DQS, DQS# WRITE Preamble	tWPRE	0.9	-	0.9	-	0.9	-	tCK
DQS, DQS# WRITE Postamble	tWPST	0.3	-	0.3	-	0.3	-	tCK
DQS, DQS# rising edge output access time from rising CK, CK#	tDQCK	-255	255	-300	300	-400	400	ps
DQS, DQS# low-impedance time (Referenced from RL-1)	tLZ(DQS)	-500	250	-600	300	-800	400	ps
DQS, DQS# high-impedance time (Referenced from RL+BL/ 2)	tHZ(DQS)	-	250	-	300	-	400	ps
DQS, DQS# differential input low pulse width	tDQSL	0.45	0.55	0.45	0.55	0.45	0.55	tCK
DQS, DQS# differential input high pulse width	tDQSH	0.45	0.55	0.45	0.55	0.45	0.55	tCK
DQS, DQS# rising edge to CK, CK# rising edge	tDQSS	-0.25	0.25	-0.25	0.25	-0.25	0.25	tCK(avg)
DQS,DQS# failing edge setup time to CK, CK# rising edge	tDSS	0.2	-	0.2	-	0.2	-	tCK(avg)
DQS,DQS# failing edge hold time to CK, CK# rising edge	tDSH	0.2	-	0.2	-	0.2	-	tCK(avg)
Command and Address Timing								
DLL locking time	tDLLK	512	-	512	-	512	-	nCK
Internal READ Command to PRECHARGE Command delay	tRTP	max (4tCK,7.5ns)	-	max (4tCK,7.5ns)	-	max (4tCK,7.5ns)	-	
Delay from start of internal write transaction to internal read command	tWTR	max (4tCK,7.5ns)	-	max (4tCK,7.5ns)	-	max (4tCK,7.5ns)	-	
WRITE recovery time	tWR	15	-	15	-	15	-	ns
Mode Register Set command cycle time	tMRD	4	-	4	-	4	-	nCK
Mode Register Set command update delay	tMOD	max (12tCK,15ns)	-	max (12tCK,15ns)	-	max (12tCK,15ns)	-	
CAS# to CAS# command delay	tCCD	4	-	4	-	4	-	nCK
Auto precharge write recovery + precharge time	tDAL(min)	WR + roundup (tRP / tCK(AVG))						nCK
Multi-Purpose Register Recovery Time	tMPRR	1	-	1	-	1	-	nCK
ACTIVE to PRECHARGE command period	tRAS	36	9*tREFI	37.5	9*tREFI	37.5	9*tREFI	ns
ACTIVE to ACTIVE command period for 1KB page size	tRRD	max (4tCK,6ns)	-	max (4tCK,7.5ns)	-	max (4tCK,10ns)	-	
ACTIVE to ACTIVE command period for 2KB page size	tRRD	max (4tCK,7.5ns)	-	max (4tCK,10ns)	-	max (4tCK,10ns)	-	
Four activate window for 1KB page size	tFAW	30	-	37.5	-	40	-	ns
Four activate window for 2KB page size	tFAW	45	-	50	-	50	-	ns
Command and Address setup time to CK, CK# referenced to Vih(ac) / Vil(ac) levels	tIS(base)	65	-	125	-	200	-	ps
Command and Address hold time from CK, CK# referenced to Vih(ac) / Vil(ac) levels	tIH(base)	140	-	200	-	275	-	ps
Control & Address Input pulse width for each input	tIPW	620	-	780	-	900	-	ps

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REV: 1.0

AC TIMING PARAMETERS & SPECIFICATIONS

Parameter	Symbol	DDR3-1333 (-K9)		DDR3-1066 (-F8)		DDR3-800 (-E7)		Unit
		MIN	MAX	MIN	MAX	MIN	MAX	
Refresh Timing								
2Gb REFRESH to REFRESH OR REFRESH to ACTIVE command interval	tRFC	160	-	160	-	160	-	ns
Average periodic refresh interval (0°C<= TCASE <= 85 °C)	tREFI	7.8		7.8		7.8		us
Average periodic refresh interval (85°C<= TCASE <= 95 °C)	tREFI	3.9		3.9		3.9		us
Calibration Timing								
Power-up and RESET calibration time	tZQinitl	512	-	512	-	512	-	tCK
Normal operation Full calibration time	tZQoper	256	-	256	-	256	-	tCK
Normal operation Short calibration time	tZQCS	64	-	64	-	64	-	tCK
Reset Timing								
Exit Reset from CKE HIGH to a valid command	tXPR	max (5tCK, tRFC + 10ns)	-	max (5tCK, tRFC + 10ns)	-	max (5tCK, tRFC + 10ns)	-	
Self Refresh Timing								
Exit Self Refresh to commands not requiring a locked DLL	tXS	max(5tCK, tRFC + 10ns)	-	max(5tCK, tRFC + 10ns)	-	max(5tCK, tRFC + 10ns)	-	
Exit Self Refresh to commands requiring a locked DLL	tXSDLL	tDLLK(min)	-	tDLLK(min)	-	tDLLK(min)	-	nCK
Minimum CKE low width for Self refresh entry to exit timing	tCKESR	tCKE(min) + 1tCK	-	tCKE(min) + 1tCK	-	tCKE(min) + 1tCK	-	
Valid Clock Requirement after Self Refresh Entry (SRE)	tCKSRE	max(5tCK, 10ns)	-	max(5tCK, 10ns)	-	max(5tCK, 10ns)	-	
Valid Clock Requirement before Self Refresh Exit (SRX)	tCKSRX	max(5tCK, 10ns)	-	max(5tCK, 10ns)	-	max(5tCK, 10ns)	-	
Power Down Timing								
Exit Power Down with DLL to any valid command; Exit Precharge Power Down with DLL frozen to commands not requiring a locked DLL	tXP	max (3tCK,6ns)	-	max (3tCK,7.5ns)	-	max (3tCK,7.5ns)	-	
Exit Precharge Power Down with DLL frozen to commands requiring a locked DLL	tXPDLL	max (10tCK,24ns)	-	max (10tCK,24ns)	-	max (10tCK,24ns)	-	
CKE minimum pulse width	tCKE	max (3tCK, 5.625ns)	-	max (3tCK, 5.625ns)	-	max (3tCK, 7.5ns)	-	
Command pass disable delay	tCPDED	1	-	1	-	1	-	nCK
Power Down Entry to Exit Timing	tPD	tCKE(min)	9*tREFI	tCKE(min)	9*tREFI	tCKE(min)	9*tREFI	tCK
Timing of ACT command to Power Down entry	tACTPDEN	1	-	1	-	1	-	nCK
Timing of PRE command to Power Down entry	tPRPDEN	1	-	1	-	1	-	nCK
Timing of RD/RDA command to Power Down entry	tRDPDEN	RL + 4 + 1	-	RL + 4 + 1	-	RL + 4 + 1	-	
Timing of WR command to Power Down entry BL8 (OTF, MRS), BL4OTF	tWRPDEN	WL + 4 +(tWR/ tCK)	-	WL + 4 +(tWR/ tCK)	-	WL + 4 +(tWR/ tCK)	-	nCK
Timing of WRA command to Power Down entry BL8 (OTF, MRS), BL4OTF	tWRAPDEN	WL+4+WR+ 1	-	WL+4+WR+1	-	WL+4+WR+1	-	nCK
Timing of WR command to Power Down entry (BL4MRS)	tWRPDEN	WL + 2 +(tWR/ tCK)	-	WL + 2 +(tWR/ tCK)	-	WL + 2 +(tWR/ tCK)	-	nCK
Timing of WRA command to Power Down entry (BL4MRS)	tWRAPDEN	WL+2+WR+ 1	-	WL+2+WR+1	-	WL+2+WR+1	-	nCK
Timing of REF command to Power Down entry	tREFPDEN	1	-	1	-	1	-	
Timing of MRS command to Power Down entry	tMRSPDEN	tMOD(min)	-	tMOD(min)	-	tMOD(min)	-	

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AC TIMING PARAMETERS & SPECIFICATIONS

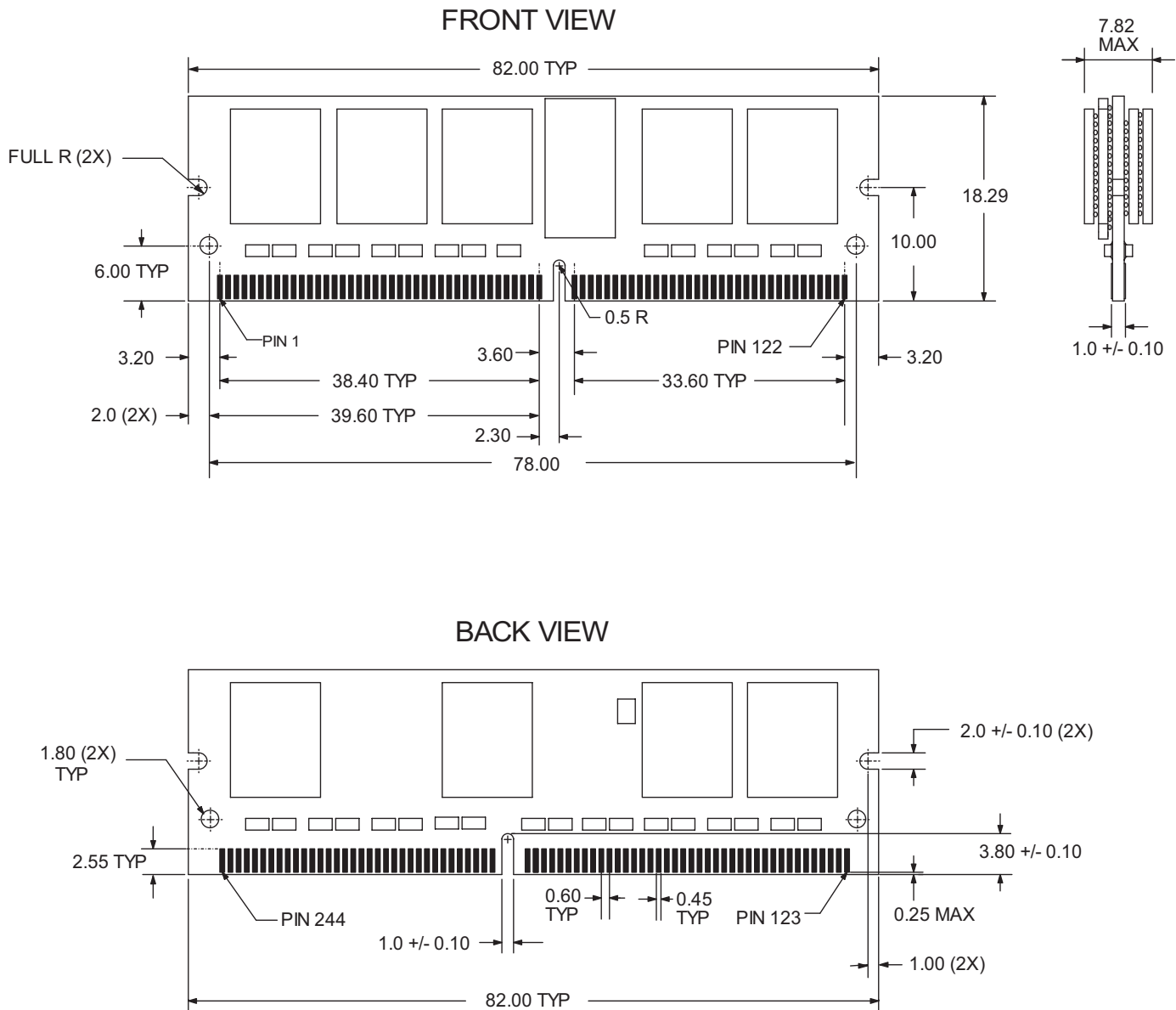
Parameter	Symbol	DDR3-1333 (-K9)		DDR3-1066 (-F8)		DDR3-800 (-E7)		Unit
		MIN	MAX	MIN	MAX	MIN	MAX	
ODT Timing								
ODT high time without write command or with write command and BC4	ODTH4	4	-	4	-	4	-	nCK
ODT high time with Write command and BL8	ODTH8	6	-	6	-	6	-	nCK
Asynchronous RTT turn-on delay (Power-Down with DLL frozen)	tAONPD	2	8.5	2	8.5	2	8.5	ns
Asynchronous RTT turn-off delay (Power-Down with DLL frozen)	tAOFPD	2	8.5	2	8.5	2	8.5	ns
ODT turn-on	tAON	-250	250	-300	300	-400	400	ps
RTT_NOM and RTT_WR turn-off time from ODTL off reference	tAOF	0.3	0.7	0.3	0.7	0.3	0.7	tCK(av g)
RTT dynamic change skew	tADC	0.3	0.7	0.3	0.7	0.3	0.7	tCK(av g)
Write Leveling Timing								
First DQS pulse rising edge after tDQSS margining mode is programmed	tWLMRD	40	-	40	-	40	-	tCK
DQS/DQS delay after tDQS margining mode is programmed	tWLDQSEN	25	-	25	-	25	-	tCK
Setup time for tDQSS latch	tWLS	195	-	245	-	325	-	ps
Hold time for tDQSS latch	tWLH	195	-	245	-	325	-	ps
Write leveling output delay	tWLO	0	9	0	9	0	9	ns
Write leveling output error	tWLOE	0	2	0	2	0	2	ns

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Package Dimensions



Note: 1. All dimension are in millimeters with tolerance +/- 0.15mm unless otherwise specified.
 2. The dimensional diagram is for reference only.

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Revision History:

Date	Rev.	Page	Changes
09/24/09	1.0	All	Spec release