



240pin Unbuffered DDR2 SDRAM MODULE

Based on 64Mx8 & 32Mx16 DDR2 SDRAM B Die

Features

• Performance:

Speed Sort	PC2-4200	PC2-5300	PC2-6400	PC2-6400	Unit
	-37B	-3C	-25C	-25D	
DIMM $\overline{\text{CAS}}$ Latency	4	5	5	6	
f CK Clock Frequency	266	333	400	400	MHz
t CK Clock Cycle	3.75	3	2.5	2.5	ns
f DQ DQ Burst Frequency	533	667	800	800	MHz

- JEDEC Standard 240-pin Dual In-Line Memory Module
- 32Mx64 DDR2 Unbuffered DIMM based on 32Mx16 DDR2 SDRAM B die
- 64Mx64 and 128Mx64 DDR2 Unbuffered DIMM based on 64Mx8 DDR2 SDRAM B die
- Intended for 266MHz, 333MHz, and 400MHz applications
- Inputs and outputs are SSTL-18 compatible
- $V_{DD} = V_{DDQ} = 1.8\text{Volt} \pm 0.1$
- SDRAMs have 4 internal banks for concurrent operation
- Differential clock inputs
- Data is read or written on both clock edges
- Bi-directional data strobe with one clock cycle preamble and one-half clock post-amble
- Address and control signals are fully synchronous to positive clock edge
- Programmable Operation:
 - Device $\overline{\text{CAS}}$ Latency: 3, 4, 5
 - Burst Type: Sequential or Interleave
 - Burst Length: 4, 8
 - Operation: Burst Read and Write
- Auto Refresh (CBR) and Self Refresh Modes
- Automatic and controlled precharge commands
- 13/10/1 Addressing (row/column/rank) – 256MB
- 14/10/1 Addressing (row/column/rank) – 512MB
- 14/10/2 Addressing (row/column/rank) – 1GB
- 7.8 μs Max. Average Periodic Refresh Interval
- Serial Presence Detect
- Gold contacts
- SDRAMs in 60 and 84 ball BGA Package
- RoHS compliance

Description

M2Y25664TUH4B0F, M2Y51264TU88B0B, and M2Y1G64TU8HB0B are 240-Pin Double Data Rate 2 (DDR2) Synchronous DRAM Unbuffered Dual In-Line Memory Module (UDIMM), organized as one-rank 32Mx64 and 64Mx64 and two ranks 128Mx64 high-speed memory array. NT256T64UH4B0FY use four 32Mx16 DDR2 SDRAMs. NT512T64U88B0BY use eight 64Mx8 DDR2 SDRAMs. NT1GT64U8HB0BY use sixteen 64Mx8 DDR2 SDRAMs. These DIMMs are manufactured using raw cards developed for broad industry use as reference designs. The use of these common design files minimizes electrical variation between suppliers. All Elixir DDR2 SDRAM DIMMs provide a high-performance, flexible 8-byte interface in a 5.25" long space-saving footprint.

The DIMM is intended for use in applications operating up to 233 MHz (333MHz and 400MHz) clock speeds and achieves high-speed data transfer rates of up to 533MHz (667MHz and 800MHz). Prior to any access operation, the device $\overline{\text{CAS}}$ latency and burst / length / operation type must be programmed into the DIMM by address inputs A0-A14 and I/O inputs BA0 and BA1 using the mode register set cycle.

The DIMM uses serial presence-detect implemented via a serial 2,048-bit EEPROM using a standard IIC protocol. The first 128 bytes of serial PD data are programmed and locked during module assembly. The remaining 128 bytes are available for use by the customer.



Ordering Information

Part Number	Speed			Organization	Leads	Power	Note
M2Y25664TUH4B0F -37B	266MHz (3.75ns@ CL = 4)	DDR2-533	PC2-4200	32Mx64	Gold	1.8V	
M2Y25664TUH4B0F -3C	333MHz (3.00ns@ CL = 5)	DDR2-667	PC2-5300				
M2Y25664TUH4B0F -25C	400MHz (2.50ns@ CL = 5)	DDR2-800	PC2-6400				
M2Y25664TUH4B0F -25D	400MHz (2.50ns@ CL = 6)	DDR2-800	PC2-6400				
M2Y51264TU88B0B -37B	266MHz (3.75ns@ CL = 4)	DDR2-533	PC2-4200	64Mx64			
M2Y51264TU88B0B -3C	333MHz (3.00ns@ CL = 5)	DDR2-667	PC2-5300				
M2Y51264TU88B0B -25C	400MHz (2.50ns@ CL = 5)	DDR2-800	PC2-6400				
M2Y51264TU88B0B -25D	400MHz (2.50ns@ CL = 6)	DDR2-800	PC2-6400				
M2Y1G64TU8HB0B -37B	266MHz (3.75ns@ CL = 4)	DDR2-533	PC2-4200	128Mx64			
M2Y1G64TU8HB0B -3C	333MHz (3.00ns@ CL = 5)	DDR2-667	PC2-5300				
M2Y1G64TU8HB0B -25C	400MHz (2.50ns@ CL = 5)	DDR2-800	PC2-6400				
M2Y1G64TU8HB0B -25D	400MHz (2.50ns@ CL = 6)	DDR2-800	PC2-6400				

Pin Description

CK0-CK2, CK0-CK2	Differential Clock Inputs	DQ0-DQ63	Data input/output
CKE0, CKE1	Clock Enable	DQS0-DQS8	Bidirectional data strobes
RAS	Row Address Strobe	DM0-DM8	Input Data Mask/High Data Strobes
CAS	Column Address Strobe	DQS0-DQS8	Differential data strobes
WE	Write Enable	V _{DD}	Power (1.8V)
CS0, CS1	Chip Selects	V _{REF}	Ref. Voltage for SSTL_18 inputs
A0-A9, A11-A13	Address Inputs	V _{DDSPD}	Serial EEPROM positive power supply
A10/AP	Column Address Input/Auto-precharge	V _{SS}	Ground
BA0, BA1	SDRAM Bank Address Inputs	SCL	Serial Presence Detect Clock Input
RESET	Reset pin	SDA	Serial Presence Detect Data input/output
ODT0, ODT1	Active termination control lines	SA0-2	Serial Presence Detect Address Inputs
NC	No Connect		

M2Y25664TUH4B0F / M2Y51264TU88B0B / M2Y1G64TU8HB0B

256MB: 32M x 64 / 512MB: 64M x 64 / 1GB: 128M x 64

Unbuffered DDR2 SDRAM DIMM



Pinout

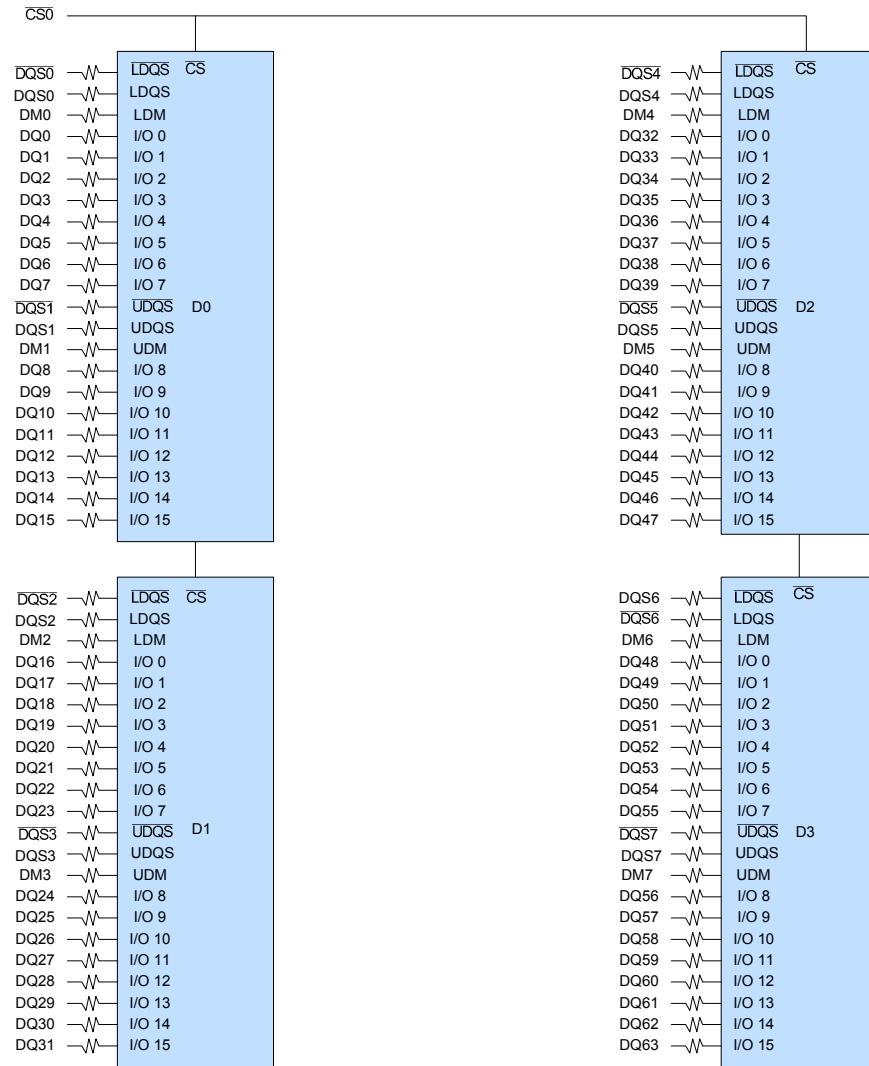
Pin	Front	Pin	Front	Pin	Front	Pin	Back	Pin	Back	Pin	Back
1	V _{REF}	42	NC	82	V _{SS}	121	V _{SS}	162	NC	202	DM4
2	V _{SS}	43	NC	83	$\overline{\text{DQS4}}$	122	DQ4	163	V _{SS}	203	NC
3	DQ0	44	V _{SS}	84	DQS4	123	DQ5	164	NC	204	V _{SS}
4	DQ1	45	NC	85	V _{SS}	124	V _{SS}	165	NC	205	DQ38
5	V _{SS}	46	NC	86	DQ34	125	DM0	166	V _{SS}	206	DQ39
6	$\overline{\text{DQS0}}$	47	V _{SS}	87	DQ35	126	NC	167	NC	207	V _{SS}
7	DQS0	48	NC	88	V _{SS}	127	V _{SS}	168	NC	208	DQ44
8	V _{SS}	49	NC	89	DQ40	128	DQ6	169	V _{SS}	209	DQ45
9	DQ2	50	V _{SS}	90	DQ41	129	DQ7	170	V _{DDQ}	210	V _{SS}
10	DQ3	51	V _{DDQ}	91	V _{SS}	130	V _{SS}	171	CKE1	211	DM5
11	V _{SS}	52	CKE0	92	$\overline{\text{DQS5}}$	131	DQ12	172	V _{DD}	212	NC
12	DQ8	53	V _{DD}	93	DQS5	132	DQ13	173	NC	213	V _{SS}
13	DQ9	54	NC	94	V _{SS}	133	V _{SS}	174	NC	214	DQ46
14	V _{SS}	55	NC	95	DQ42	134	DM1	175	V _{DDQ}	215	DQ47
15	$\overline{\text{DQS1}}$	56	V _{DDQ}	96	DQ43	135	NC	176	A12	216	V _{SS}
16	DQS1	57	A11	97	V _{SS}	136	V _{SS}	177	A9	217	DQ52
17	V _{SS}	58	A7	98	DQ48	137	CK1	178	V _{DD}	218	DQ53
18	NC	59	V _{DD}	99	DQ49	138	$\overline{\text{CK1}}$	179	A8	219	V _{SS}
19	NC	60	A5	100	V _{SS}	139	V _{SS}	180	A6	220	CK2
20	V _{SS}	61	A4	101	SA2	140	DQ14	181	V _{DDQ}	221	$\overline{\text{CK2}}$
21	DQ10	62	V _{DDQ}	102	NC	141	DQ15	182	A3	222	V _{SS}
22	DQ11	63	A2	103	V _{SS}	142	V _{SS}	183	A1	223	DM6
23	V _{SS}	64	V _{DD}	104	$\overline{\text{DQS6}}$	143	DQ20	184	V _{DD}	224	NC
24	DQ16		KEY	105	DQS6	144	DQ21		KEY	225	V _{SS}
25	DQ17	65	V _{SS}	106	V _{SS}	145	V _{SS}	185	CK0	226	DQ54
26	V _{SS}	66	V _{SS}	107	DQ50	146	DM2	186	$\overline{\text{CK0}}$	227	DQ55
27	$\overline{\text{DQS2}}$	67	V _{DD}	108	DQ51	147	NC	187	V _{DD}	228	V _{SS}
28	DQS2	68	NC	109	V _{SS}	148	V _{SS}	188	A0	229	DQ60
29	V _{SS}	69	V _{DD}	110	DQ56	149	DQ22	189	V _{DD}	230	DQ61
30	DQ18	70	A10/AP	111	DQ57	150	DQ23	190	BA1	231	V _{SS}
31	DQ19	71	BA0	112	V _{SS}	151	V _{SS}	191	V _{DDQ}	232	DM7
32	V _{SS}	72	V _{DDQ}	113	$\overline{\text{DQS7}}$	152	DQ28	192	$\overline{\text{RAS}}$	233	NC
33	DQ24	73	$\overline{\text{WE}}$	114	DQS7	153	DQ29	193	$\overline{\text{CS0}}$	234	V _{SS}
34	DQ25	74	$\overline{\text{CAS}}$	115	V _{SS}	154	V _{SS}	194	V _{DDQ}	235	DQ62
35	V _{SS}	75	V _{DDQ}	116	DQ58	155	DM3	195	ODT0	236	DQ63
36	$\overline{\text{DQS3}}$	76	$\overline{\text{CS1}}$	117	DQ59	156	NC	196	A13	237	V _{SS}
37	DQS3	77	ODT1	118	V _{SS}	157	V _{SS}	197	V _{DD}	238	V _{DDSPD}
38	V _{SS}	78	V _{DDQ}	119	SDA	158	DQ30	198	V _{SS}	239	SA0
39	DQ26	79	V _{SS}	120	SCL	159	DQ31	199	DQ36	240	SA1
40	DQ27	80	DQ32			160	V _{SS}	200	DQ37		
41	V _{SS}	81	DQ33			161	NC	201	V _{SS}		

Input/Output Functional Description

Symbol	Type	Polarity	Function
CK0, CK1, CK2	(SSTL)	Positive Edge	The positive line of the differential pair of system clock inputs which drives the input to the on-DIMM PLL. All the DDR2 SDRAM address and control inputs are sampled on the rising edge of their associated clocks.
$\overline{CK0}$, $\overline{CK1}$, $\overline{CK2}$	(SSTL)	Negative Edge	The negative line of the differential pair of system clock inputs which drives the input to the on-DIMM PLL.
CKE0, CKE1	(SSTL)	Active High	Activates the SDRAM CK signal when high and deactivates the CK signal when low. By deactivating the clocks, CKE low initiates the Power Down mode, or the Self Refresh mode.
$\overline{CS0}$, $\overline{CS1}$	(SSTL)	Active Low	Enables the associated SDRAM command decoder when low and disables the command decoder when high. When the command decoder is disabled, new commands are ignored but previous operations continue.
\overline{RAS} , \overline{CAS} , \overline{WE}	(SSTL)	Active Low	When sampled at the positive rising edge of the clock, \overline{RAS} , \overline{CAS} , \overline{WE} define the operation to be executed by the SDRAM.
V _{REF}	Supply		Reference voltage for SSTL-18 inputs
V _{DDQ}	Supply		Isolated power supply for the DDR SDRAM output buffers to provide improved noise immunity
ODT0, ODT1	Input	Active High	On-Die Termination control signals
BA0, BA1	(SSTL)	-	Selects which SDRAM bank is to be active.
A0 – A9 A10/AP A11 – A13	(SSTL)	-	During a Bank Activate command cycle, A0-A14 defines the row address (RA0-RA13) when sampled at the rising clock edge. During a Read or Write command cycle, A0-A9 defines the column address (CA0-CA9) when sampled at the rising clock edge. In addition to the column address, AP is used to invoke Autoprecharge operation at the end of the Burst Read or Write cycle. If AP is high, autoprecharge is selected and BA0/BA1 define the bank to be precharged. If AP is low, autoprecharge is disabled. During a Precharge command cycle, AP is used in conjunction with BA0/BA1 to control which bank(s) to precharge. If AP is high all 4 banks will be precharged regardless of the state of BA0/BA1. If AP is low, then BA0/BA1 are used to define which bank to pre-charge.
DQ0 – DQ63	(SSTL)	Active High	Data and Check Bit Input/Output pins.
V _{DD} , V _{SS}	Supply		Power and ground for the DDR SDRAM input buffers and core logic
DQS0 – DQS8 $\overline{DQS0}$ – $\overline{DQS8}$	(SSTL)	Negative and Positive Edge	Data strobe for input and output data
DM0 – DM8	Input	Active High	The data write masks, associated with one data byte. In Write mode, DM operates as a byte mask by allowing input data to be written if it is low but blocks the write operation if it is high. In Read mode, DM lines have no effect.
SA0 – SA2		-	Address inputs. Connected to either V _{DD} or V _{SS} on the system board to configure the Serial Presence Detect EEPROM address.
SDA		-	This bi-directional pin is used to transfer data into or out of the SPD EEPROM. A resistor must be connected from the SDA bus line to V _{DD} to act as a pull-up.
SCL		-	This signal is used to clock data into and out of the SPD EEPROM. A resistor may be connected from the SCL bus line to V _{DD} to act as a pull-up.
V _{DDSPD}	Supply		Serial EEPROM positive power supply.

Functional Block Diagram

(256MB, 1 Rank, 32Mx16 DDR2 SDRAMs)



BA0-BA1 BA0-BA1 : SDRAMs D0-D3

A0-A12 A0-A12 : SDRAMs D0-D3

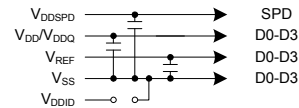
\overline{RAS} \overline{RAS} : SDRAMs D0-D3

\overline{CAS} \overline{CAS} : SDRAMs D0-D3

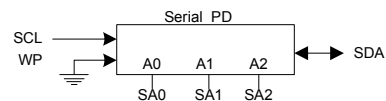
\overline{WE} \overline{WE} : SDRAMs D0-D3

CKE0 CKE : SDRAMs D0-D3

ODT0 ODT : SDRAMs D0-D3

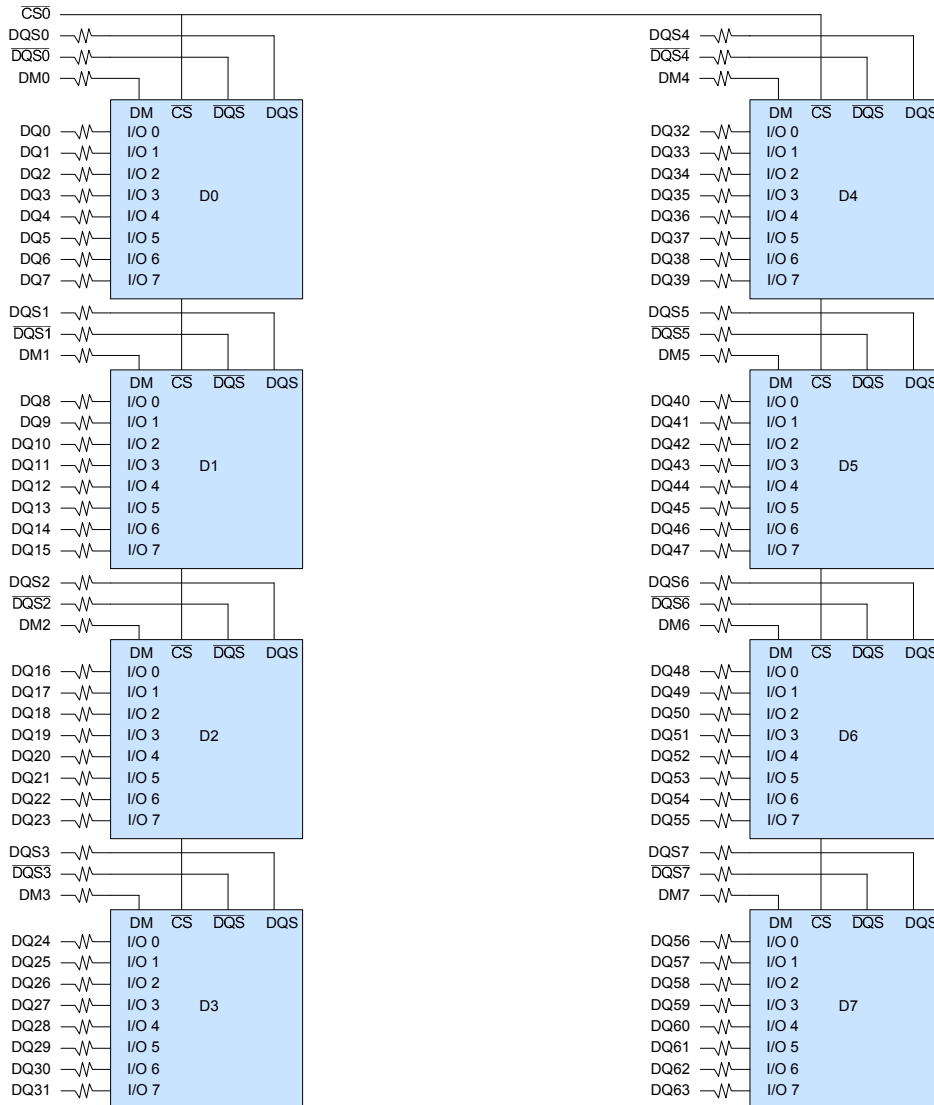


- Notes :
1. DQ-to-I/O wiring may be changed within a byte.
 2. DQ/DQS/DM/CKE/CS relationships are maintained as shown.
 3. DQ/DQS/DQS resistors are 22 Ohms +/- 5%
 4. BAx, Ax, \overline{RAS} , \overline{CAS} , \overline{WE} resistors are 5.1 Ohms +/- 5%
 5. Address and control resistors are 22 Ohms +/- 5%

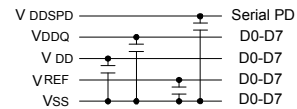


Functional Block Diagram

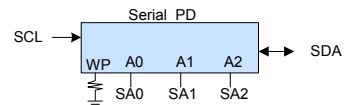
(512MB, 1 Rank, 64Mx8 DDR2 SDRAMs)



BA0-BA1 — BA0-BA2: SDRAMs D0-D7
 A0-A13 — A0-A13: SDRAMs D0-D7
 RAS — RAS: SDRAMs D0-D7
 CAS — CAS: SDRAMs D0-D7
 WE — WE: SDRAMs D0-D7
 CKE0 — CKE: SDRAMs D0-D7
 ODT0 — ODT: SDRAMs D0-D7

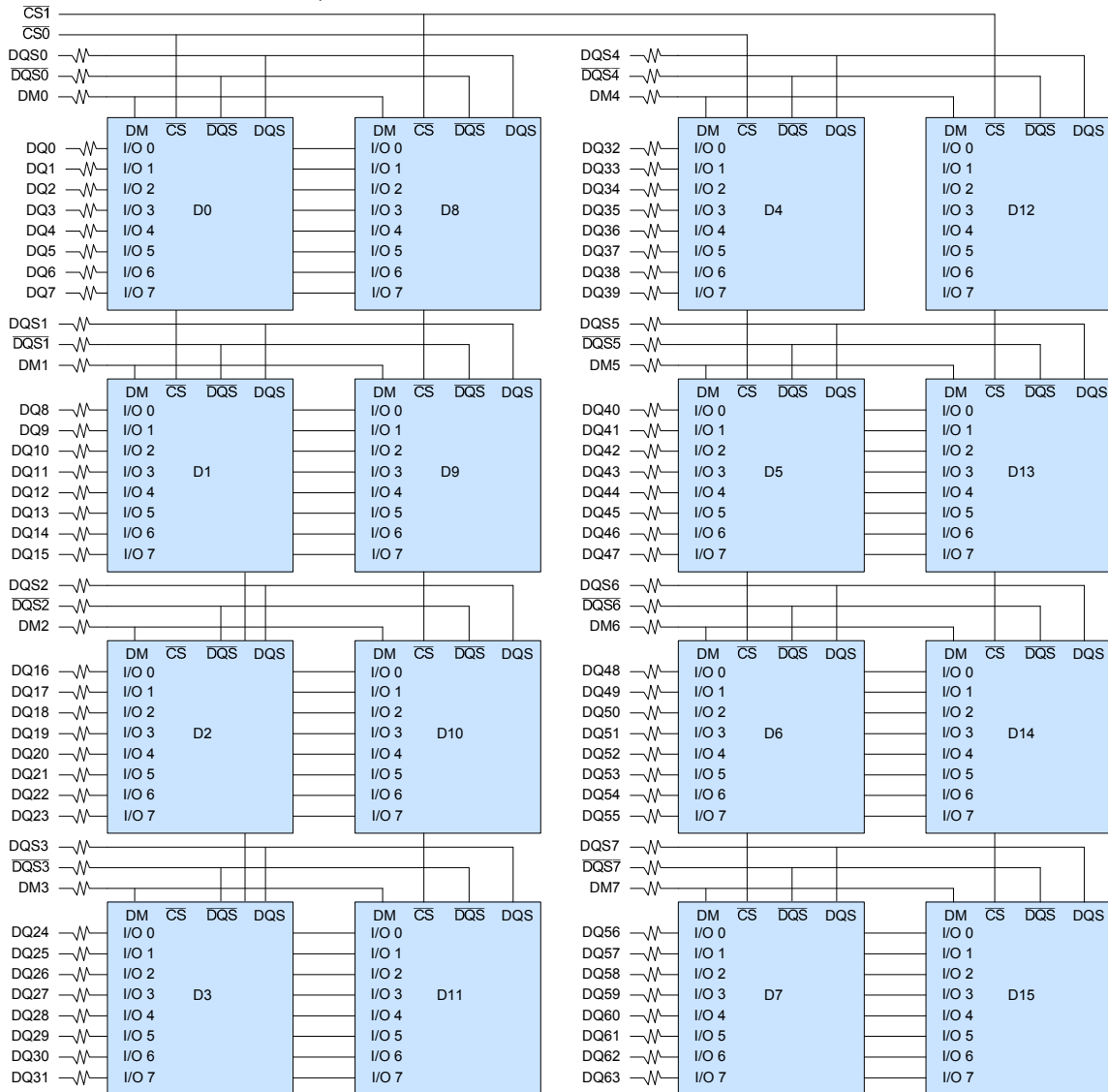


- Notes :
1. DQ-to-I/O wiring may be changed within a byte.
 2. DQ/DQS/DM/CKE/CS relationships are maintained as shown.
 3. DQ/DQS/DQS resistors are 22 Ohms +/- 5%
 4. BAx, Ax, RAS, CAS, WE resistors are 5.1 Ohms +/- 5%
 5. Address and control resistors are 22 Ohms +/- 5%



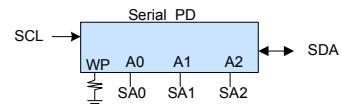
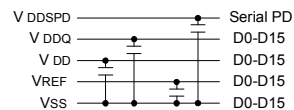
Functional Block Diagram

(1GB, 2 Rank, 64Mx8 DDR2 SDRAMs)



- BA0-BA1 — BA0-BA1 : SDRAMs D0-D15
- A0-A13 — A0-A13 : SDRAMs D0-D15
- RAS — RAS : SDRAMs D0-D15
- CAS — CAS : SDRAMs D0-D15
- WE — WE : SDRAMs D0-D15
- CKE0 — CKE : SDRAMs D0-D7
- CKE1 — CKE : SDRAMs D8-D15
- ODT0 — ODT : SDRAMs D0-D7
- ODT1 — ODT : SDRAMs D8-D15

- Notes :
1. DQ-to-I/O wiring may be changed within a byte.
 2. DQ/DQS/DM/CKE/CS relationships are maintained as shown.
 3. DQ/DQS/DQS resistors are 22 Ohms +/- 5%
 4. BAx, Ax, RAS, CAS, WE resistors are 5.1 Ohms +/- 5%
 5. Address and control resistors are 22 Ohms +/- 5%



Serial Presence Detect -- Part 1 of 2 (256MB)

32Mx64 1 RANK UNBUFFERED DDR2 SDRAM DIMM based on 32Mx16, 4Banks, 8K Refresh, 1.8V DDR2 SDRAMs with SPD

Byte	Description	SPD Entry Value			Serial PD Data Entry (Hexadecimal)			Note
		-37B	-3C	-25C	-37B	-3C	-25C	
0	Number of Serial PD Bytes Written during Production	128			80			
1	Total Number of Bytes in Serial PD device	256			08			
2	Fundamental Memory Type	DDR2			08			
3	Number of Row Addresses on Assembly	13			0D			
4	Number of Column Addresses on Assembly	10			0A			
5	Number of DIMM Bank, Package, and Height	1 rank, Height=30mm			60			
6	Data Width of this Assembly	64			40			
7	Reserved	Undefined			00			
8	Voltage Interface Level of this Assembly	SSTL_1.8V			05			
9	DDR2 SDRAM Device Cycle Time at CL=5	3.75ns	3ns	2.5ns	3D	30	25	
10	DDR2 SDRAM Device Access Time from Clock at CL=5	±0.5ns	±0.45ns	±0.4ns	50	45	40	
11	DIMM Configuration Type	Non parity/ECC			00			
12	Refresh Rate/Type	7.8µs/self			82			
13	Primary DDR2 SDRAM Width	x16			10			
14	Error Checking DDR2 SDRAM Device Width	N/A			00			
15	Reserved	Undefined			00			
16	DDR2 SDRAM Device Attributes: Burst Length Supported	4,8			0C			
17	DDR2 SDRAM Device Attributes: Number of Device Banks	4			04			
18	DDR2 SDRAM Device Attributes: $\overline{\text{CAS}}$ Latencies Supported	3,4,5			38			
19	Reserved	<4.1mm			01			
20	DDR2 SDRAM DIMM Type Information	Regular UDIMM (133.35mm)			02			
21	DDR2 SDRAM Module Attributes:	Normal DIMM			00			
22	DDR2 SDRAM Device Attributes: General	Support weak Driver, 50Ω ODT, and PASR			07			
23	Minimum Clock Cycle at CL=4	3.75ns			3D			
24	Maximum Data Access Time (t_{ac}) from Clock at CL=4	±0.5ns			50			
25	Minimum Clock Cycle Time at CL=3	5.0ns			50			
26	Maximum Data Access Time (t_{ac}) from Clock at CL=3	0.6ns			60			
27	Minimum Row Precharge Time (t_{RP})	15.0ns		12.0ns	3C		32	
28	Minimum Row Active to Row Active delay (t_{RRD})	10ns			28			
29	Minimum RAS to CAS delay (t_{RCD})	15.0ns		12.0ns	3C		32	
30	Minimum RAS Pulse Width (t_{RAS})	45.0			2D			
31	Module Bank Density	256MB			40			
32	Address and Command Setup Time Before Clock (t_{IS})	0.25ns	0.20ns	0.175ns	25	20	17	
33	Address and Command Hold Time After Clock (t_{IH})	0.375ns	0.275ns	0.25ns	37	27	25	
34	Data Input Setup Time Before Clock (t_{DS})	0.10ns	0.10ns	0.05ns	10	10	05	
35	Data Input Hold Time After Clock (t_{DH})	0.225ns	0.175ns	0.125ns	22	17	12	
36	Write Recovery Time (t_{WR})	15.0ns			3C			
37	Internal Write to Read Command delay (t_{WTR})	7.5ns			1E			
38	Internal Read to Precharge delay (t_{RTP})	7.5ns			1E			
39	Memory Analysis Probe Characteristics	Undefined			00			



Serial Presence Detect -- Part 2 of 2 (256MB)

32Mx64 1 RANK UNBUFFERED DDR2 SDRAM DIMM based on 32Mx16, 4Banks, 8K Refresh, 1.8V DDR2 SDRAMs with SPD

Byte	Description	SPD Entry Value			Serial PD Data Entry (Hexadecimal)			Note
		-37B	-3C	-25C	-37B	-3C	-25C	
40	Extension of Byte 41 t_{RC} and Byte 42 t_{RFC}	00: The number below a decimal point of t_{RC} and t_{RFC} are 0, t_{RFC} is less than 256ns. 30: The number below a decimal point of t_{RC} is 5, t_{RFC} is less than 256ns			00		30	
41	Minimum Core Cycle Time (t_{RC})	60.0ns		57.5ns	3C		39	
42	Min. Auto Refresh Command Cycle Time (t_{RFC})	105ns			69			
43	Maximum Clock Cycle Time (t_{CK})	8.0ns			80			
44	Max. DQS-DQ Skew Factor (t_{DQS})	0.30ns	0.24ns	0.20ns	1E	18	14	
45	Read Data Hold Skew Factor (t_{QHS})	0.40ns	0.34ns	0.30ns	28	22	1E	
46	PLL Relock Time	N/A			00			
47	Tcasemax DT4R4W Delta	95°C 0°C	95°C 1.2°C	95°C 0°C	50	53	50	
48	Thermal Resistance of DRAM Package from Top (Case) to Ambient (Psi-T-A DRAM)	59°C/W			76			
49	DRAM Case Temperature Rise from Ambient due to Activate-Precharge/Mode Bits (DT0/Mode Bits)	7.85°C	8.41°C	9.42°C	47	4F	5F	
50	DRAM Case Temperature Rise from Ambient due to Precharge/Quiet Standby (DT2N/DT2Q)	4.48°C	5.61°C	5.72°C	2D	39	3A	
51	DRAM Case Temperature Rise from Ambient due to Precharge Power-Down (DT2P)	0.78°C			35			
52	DRAM Case Temperature Rise from Ambient due to Active Standby (DT3N)	4.82°C	5.61°C	6.73°C	21	26	2D	
53	DRAM Case Temperature Rise from Ambient due to Active Power-Down with Fast PDN Exit (DT3Pfast)	3.14°C	3.7°C	4.37°C	3F	4A	58	
54	DRAM Case Temperature Rise from Ambient due to Active Power-Down with Slow PDN Exit (DT3Pslow)	1.01°C			29			
55	DRAM Case Temperature Rise from Ambient due to Page Open Burst Read/DT4R4W Mode Bit (DT4R/DT4R4W Mode Bit)	12.33°C	14.57°C	17.38°C	3E	4A	58	
56	DRAM Case Temperature Rise from Ambient due to Burst Refresh (ST5B)	16.82°C	17.94°C	19.62°C	22	24	28	
57	DRAM Case Temperature Rise from Ambient due to Bank Interleave Reads with Auto-Precharge (DT7)	17.94°C	19.06°C	19.06°C	24	27	27	
58	Thermal Resistance of PLL Package from Top (Case) to Ambient (Psi T-A PLL)	00			00			
59	Thermal Resistance of Register Package from Top (Case) to Ambient (Psi T-A Register)	00			00			
60	PLL Case Temperature Rise from Ambient due to PLL Active (DT PLL Active)	00			00			
61	Register Case Temperature Rise from Ambient due to Register Active/Mode Bit (DT Register Active/Mode Bit)	00			00			
62	SPD Reversion	1.2			12			
63	Checksum for byte 0-62	Checksum data			06	FA	15	
64-71	Manufacturer's JEDEC ID Code	NANYA			7F7F7F0B00000000			
72	Module Manufacturing Location	Manufacturing Code			--			
73-91	Module Part number	Module Part Number in ASCII			--			
92-255	Reserved	Undefined			--			

Serial Presence Detect – Part 1 of 2 (512MB)

64Mx64 1 RANK UNBUFFERED DDR2 SDRAM DIMM based on 64Mx8, 4Banks, 8K Refresh, 1.8V DDR2 SDRAMs with SPD

Byte	Description	SPD Entry Value			Serial PD Data Entry (Hexadecimal)			Note
		-37B	-3C	-25C	-37B	-3C	-25C	
0	Number of Serial PD Bytes Written during Production	128			80			
1	Total Number of Bytes in Serial PD device	256			08			
2	Fundamental Memory Type	DDR2			08			
3	Number of Row Addresses on Assembly	14			0E			
4	Number of Column Addresses on Assembly	10			0A			
5	Number of DIMM Bank, Package, and Height	1 rank, Height=30mm			60			
6	Data Width of this Assembly	64			40			
7	Reserved	Undefined			00			
8	Voltage Interface Level of this Assembly	SSTL_1.8V			05			
9	DDR2 SDRAM Cycle Time at CL=5 (ns)	3.75	3	2.5	3D	30	25	
10	DDR2 SDRAM Access Time from Clock at CL=5 (ns)	±0.50	±0.45	±0.40	50	45	40	
11	DIMM Configuration Type	Non parity/ECC			00			
12	Refresh Rate/Type	7.8µs/self			82			
13	Primary DDR2 SDRAM Width	X8			08			
14	Error Checking DDR2 SDRAM Device Width	N/A			00			
15	Reserved	Undefined			00			
16	DDR2 SDRAM Device Attributes: Burst Length Supported	4,8			0C			
17	DDR2 SDRAM Device Attributes: Number of Device Banks	4			04			
18	DDR2 SDRAM Device Attributes: $\overline{\text{CAS}}$ Latencies Supported	3,4,5			38			
19	Reserved	<4.1mm			01			
20	DDR2 SDRAM DIMM Type Information	Regular UDIMM (133.35mm)			02			
21	DDR2 SDRAM Module Attributes:	Normal DIMM			00			
22	DDR2 SDRAM Device Attributes: General	Support weak Driver, 50Ω ODT, and PASR			07			
23	Minimum Clock Cycle at CL=4	3.75ns			3D			
24	Maximum Data Access Time (t_{ac}) from Clock at CL=4 (ns)	±0.5			50			
25	Minimum Clock Cycle Time at CL=3 (ns)	5.0			50			
26	Maximum Data Access Time (t_{ac}) from Clock at CL=3 (ns)	±0.6			60			
27	Minimum Row Precharge Time (t_{RP}) (ns)	15.0		12.5	3C		32	
28	Minimum Row Active to Row Active delay (t_{RRD})	7.5ns			1E			
29	Minimum RAS to CAS delay (t_{RCD}) (ns)	15.0		12.5	3C		32	
30	Minimum RAS Pulse Width (t_{RAS})	45.0			2D			
31	Module Bank Density	512MB			80			
32	Address and Command Setup Time Before Clock (t_{IS}) (ns)	0.25	0.20	0.175	25	20	17	
33	Address and Command Hold Time After Clock (t_{IH}) (ns)	0.375	0.275	0.25	37	27	25	
34	Data Input Setup Time Before Clock (t_{DS})	0.10ns		0.05ns	10		05	
35	Data Input Hold Time After Clock (t_{DH}) (ns)	0.225	0.175	0.125	22	17	12	
36	Write Recovery Time (t_{WR})	15.0ns			3C			
37	Internal Write to Read Command delay (t_{WTR})	7.5ns			1E			
38	Internal Read to Precharge delay (t_{RTP})	7.5ns			1E			
39	Memory Analysis Probe Characteristics	Undefined			00			



Serial Presence Detect -- Part 2 of 2 (512MB)

64Mx64 1RANK UNBUFFERED DDR2 SDRAM DIMM based on 64Mx8, 4Banks, 8K Refresh, 1.8V DDR2 SDRAMs with SPD

Byte	Description	SPD Entry Value			Serial PD Data Entry (Hexadecimal)			Note
		-37B	-3C	-25C	-37B	-3C	-25C	
40	Extension of Byte 41 t _{RC} and Byte 42 t _{RFC}	00: The number below a decimal point of t _{RC} and t _{RFC} are 0, t _{RFC} is less than 256ns. 30: The number below a decimal point of t _{RC} is 5, t _{RFC} is less than 256ns			00		30	
41	Minimum Core Cycle Time (t _{RC}) (ns)	60.0		57.5	3C		39	
42	Min. Auto Refresh Command Cycle Time (t _{RFC})	105ns			69			
43	Maximum Clock Cycle Time (t _{CK})	8.0ns			80			
44	Max. DQS-DQ Skew Factor (t _{DQS}) (ns)	0.3	0.24	0.2	1E	18	14	
45	Read Data Hold Skew Factor (t _{QHS}) (ns)	0.40	0.34	0.30ns	28	22	1E	
46	PLL Relock Time	N/A			00			
47	Tcasemax DT4R4W Delta	95°C 0°C	95°C 1.2°C	95°C 0°C	50	53	50	
48	Thermal Resistance of DRAM Package from Top (Case) to Ambient (Psi-T-A DRAM)	61°C/W			7A			
49	DRAM Case Temperature Rise from Ambient due to Activate-Precharge/Mode Bits (DT0/Mode Bits)	8.11°C	8.69°C	9.74°C	4B	53	63	
50	DRAM Case Temperature Rise from Ambient due to Precharge/Quiet Standby (DT2N/DT2Q)	4.64°C	5.8°C	5.91°C	2F	3A	3C	
51	DRAM Case Temperature Rise from Ambient due to Precharge Power-Down (DT2P)	0.81°C			37			
52	DRAM Case Temperature Rise from Ambient due to Active Standby (DT3N)	4.98°C	5.8°C	6.95°C	22	27	2F	
53	DRAM Case Temperature Rise from Ambient due to Active Power-Down with Fast PDN Exit (DT3Pfast)	3.25°C	3.82°C	4.52°C	41	4D	5B	
54	DRAM Case Temperature Rise from Ambient due to Active Power-Down with Slow PDN Exit (DT3Pslow)	1.04°C			2A			
55	DRAM Case Temperature Rise from Ambient due to Page Open Burst Read/DT4R4W Mode Bit (DT4R/DT4R4W Mode Bit)	12.75°C	15.07°C	17.96°C	40	4C	5C	
56	DRAM Case Temperature Rise from Ambient due to Burst Refresh (ST5B)	17.39°C	18.54°C	20.28°C	23	26	29	
57	DRAM Case Temperature Rise from Ambient due to Bank Interleave Reads with Auto-Precharge (DT7)	18.54°C	19.7°C		26	28		
58	Thermal Resistance of PLL Package from Top (Case) to Ambient (Psi T-A PLL)	00			00			
59	Thermal Resistance of Register Package from Top (Case) to Ambient (Psi T-A Register)	00			00			
60	PLL Case Temperature Rise from Ambient due to PLL Active (DT PLL Active)	00			00			
61	Register Case Temperature Rise from Ambient due to Register Active/Mode Bit (DT Register Active/Mode Bit)	00			00			
62	SPD Reversion	1.2			12			
63	Checksum for byte 0-62	Checksum data			4A	3E	5C	
64-71	Manufacturer's JEDEC ID Code	NANYA			7F7F7F0B00000000			
72	Module Manufacturing Location	Manufacturing Code			--			
73-91	Module Part number	Module Part Number in ASCII			--			
92-255	Reserved	Undefined			--			

Serial Presence Detect – Part 1 of 2 (1GB)

128Mx64 2 RANKs UNBUFFERED DDR2 SDRAM DIMM based on 64Mx8, 4Banks, 8K Refresh, 1.8V DDR2 SDRAMs with SPD

Byte	Description	SPD Entry Value			Serial PD Data Entry (Hexadecimal)			Note
		-37B	-3C	-25C	-37B	-3C	-25C	
0	Number of Serial PD Bytes Written during Production	128			80			
1	Total Number of Bytes in Serial PD device	256			08			
2	Fundamental Memory Type	DDR2			08			
3	Number of Row Addresses on Assembly	14			0E			
4	Number of Column Addresses on Assembly	10			0A			
5	Number of DIMM Bank, Package, and Height	2 rank, Height=30mm			61			
6	Data Width of this Assembly	64			40			
7	Reserved	Undefined			00			
8	Voltage Interface Level of this Assembly	SSTL_1.8V			05			
9	DDR2 SDRAM Cycle Time at CL=5 (ns)	3.75	3	2.5	3D	30	25	
10	DDR2 SDRAM Access Time from Clock at CL=5 (ns)	±0.5	±0.45	±0.4	50	45	40	
11	DIMM Configuration Type	Non parity/ECC			00			
12	Refresh Rate/Type	7.8µs/self			82			
13	Primary DDR2 SDRAM Width	X8			08			
14	Error Checking DDR2 SDRAM Device Width	N/A			00			
15	Reserved	Undefined			00			
16	DDR2 SDRAM Device Attributes: Burst Length Supported	4,8			0C			
17	DDR2 SDRAM Device Attributes: Number of Device Banks	4			04			
18	DDR2 SDRAM Device Attributes: $\overline{\text{CAS}}$ Latencies Supported	3,4,5			38			
19	Reserved	<4.1mm			01			
20	DDR2 SDRAM DIMM Type Information	Regular UDIMM (133.35mm)			02			
21	DDR2 SDRAM Module Attributes:	Normal DIMM			00			
22	DDR2 SDRAM Device Attributes: General	Support weak Driver, 50Ω ODT, and PASR			07			
23	Minimum Clock Cycle at CL=4	3.75ns			3D			
24	Maximum Data Access Time (t_{ac}) from Clock at CL=4	±0.5ns			50			
25	Minimum Clock Cycle Time at CL=3	5.0ns			50			
26	Maximum Data Access Time (t_{ac}) from Clock at CL=3	0.6ns			60			
27	Minimum Row Precharge Time (t_{RP}) (ns)	15.0	12.5		3C	32		
28	Minimum Row Active to Row Active delay (t_{RRD})	7.5ns			1E			
29	Minimum RAS to CAS delay (t_{RCD}) (ns)	15.0	12.5		3C	32		
30	Minimum RAS Pulse Width (t_{RAS})	45.0			2D			
31	Module Bank Density	512MB			80			
32	Address and Command Setup Time Before Clock (t_{IS}) (ns)	0.25	0.20	0.175	25	20	17	
33	Address and Command Hold Time After Clock (t_{IH}) (ns)	0.375	0.275	0.25	37	27	25	
34	Data Input Setup Time Before Clock (t_{DS}) (ns)	0.10	0.10	0.05	10	10	05	
35	Data Input Hold Time After Clock (t_{DH}) (ns)	0.225	0.175	0.125	22	17	12	
36	Write Recovery Time (t_{WR})	15.0ns			3C			
37	Internal Write to Read Command delay (t_{WTR})	7.5ns			1E			
38	Internal Read to Precharge delay (t_{RTP})	7.5ns			1E			
39	Memory Analysis Probe Characteristics	Undefined			00			



Serial Presence Detect -- Part 2 of 2 (1GB)

128Mx64 2 RANKs UNBUFFERED DDR2 SDRAM DIMM based on 64Mx8, 4Banks, 8K Refresh, 1.8V DDR2 SDRAMs with SPD

Byte	Description	SPD Entry Value			Serial PD Data Entry (Hexadecimal)			Note
		-37B	-3C	-25C	-37B	-3C	-25C	
40	Extension of Byte 41 t_{RC} and Byte 42 t_{RFC}	00: The number below a decimal point of t_{RC} and t_{RFC} are 0, t_{RFC} is less than 256ns. 30: The number below a decimal point of t_{RC} is 5, t_{RFC} is less than 256ns			00		30	
41	Minimum Core Cycle Time (t_{RC}) (ns)	60.0		57.5	3C		39	
42	Min. Auto Refresh Command Cycle Time (t_{RFC})	105ns			69			
43	Maximum Clock Cycle Time (t_{CK})	8.0ns			80			
44	Max. DQS-DQ Skew Factor (t_{DQS}) (ns)	0.3	0.24	0.2	1E	18	14	
45	Read Data Hold Skew Factor (t_{QHS}) (ns)	0.40	0.34	0.30	28	22	1E	
46	PLL Relock Time	N/A			00			
47	Tcasemax DT4R4W Delta	95°C 0°C	95°C 1.2°C	95°C 0°C	50	53	50	
48	Thermal Resistance of DRAM Package from Top (Case) to Ambient (Psi-T-A DRAM)	61°C/W			7A			
49	DRAM Case Temperature Rise from Ambient due to Activate-Precharge/Mode Bits (DT0/Mode Bits)	8.11°C	8.69°C	9.74°C	4B	53	63	
50	DRAM Case Temperature Rise from Ambient due to Precharge/Quiet Standby (DT2N/DT2Q)	4.64°C	5.8°C	5.91°C	2F	3A	3C	
51	DRAM Case Temperature Rise from Ambient due to Precharge Power-Down (DT2P)	0.81°C			37			
52	DRAM Case Temperature Rise from Ambient due to Active Standby (DT3N)	4.98°C	5.8°C	6.95°C	22	27	2F	
53	DRAM Case Temperature Rise from Ambient due to Active Power-Down with Fast PDN Exit (DT3Pfast)	3.25°C	3.82°C	4.52°C	41	4D	5B	
54	DRAM Case Temperature Rise from Ambient due to Active Power-Down with Slow PDN Exit (DT3Pslow)	1.04°C			2A			
55	DRAM Case Temperature Rise from Ambient due to Page Open Burst Read/DT4R4W Mode Bit (DT4R/DT4R4W Mode Bit)	12.75°C	15.07°C	17.96°C	40	4C	5C	
56	DRAM Case Temperature Rise from Ambient due to Burst Refresh (ST5B)	17.39°C	18.54°C	20.28°C	23	26	29	
57	DRAM Case Temperature Rise from Ambient due to Bank Interleave Reads with Auto-Precharge (DT7)	18.54°C	19.7°C		26	28		
58	Thermal Resistance of PLL Package from Top (Case) to Ambient (Psi T-A PLL)	00			00			
59	Thermal Resistance of Register Package from Top (Case) to Ambient (Psi T-A Register)	00			00			
60	PLL Case Temperature Rise from Ambient due to PLL Active (DT PLL Active)	00			00			
61	Register Case Temperature Rise from Ambient due to Register Active/Mode Bit (DT Register Active/Mode Bit)	00			00			
62	SPD Reversion	1.2			12			
63	Checksum for byte 0-62	Checksum data			4B	3F	5D	
64-71	Manufacturer's JEDEC ID Code	NANYA			7F7F7F0B00000000			
72	Module Manufacturing Location	Manufacturing Code			--			
73-91	Module Part number	Module Part Number in ASCII			--			
92-255	Reserved	Undefined			--			



Absolute Maximum Ratings

Symbol	Parameter	Rating	Units
V _{IN} , V _{OUT}	Voltage on I/O pins relative to V _{SS}	-0.5 to 2.3	V
V _{DD}	Voltage on VDD supply relative to V _{SS}	-1.0 to +2.3	V
V _{DDQ}	Voltage on VDDQ supply relative to V _{SS}	-0.5 to +2.3	V

Note: Stresses greater than those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is stress rating only, and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

DC operating Conditions

Symbol	Parameter	Rating	Units	Note
T _{CASE}	Operating Temperature (Ambient)	0 to 95	°C	1,2,3
T _{STG}	Storage Temperature (Plastic)	-55 to 100	°C	
I _L	Short Circuit Output Current	-5 to 5	µA	

Note:

1. Case temperature is measured at top and center side of any DRAMs.
2. t_{CASE} > 85 °C → t_{REFI} = 3.9 µs
3. All DRAM specification only support 0 °C < t_{CASE} < 85 °C

DC Electrical Characteristics and Operating Conditions

(T_{CASE} = 0 °C ~ 85 °C; V_{DDQ} = 1.8V ± 0.1V; V_{DD} = 1.8V ± 0.1V, See AC Characteristics)

Symbol	Parameter	Min	Max	Units	Notes
V _{DD}	Supply Voltage	1.7	1.9	V	1
V _{DDQ}	I/O Supply Voltage	1.7	1.9	V	1
V _{SS} , V _{SSQ}	Supply Voltage, I/O Supply Voltage	0	0	V	
V _{REF}	I/O Reference Voltage	0.49V _{DDQ}	0.51V _{DDQ}	V	1, 2
V _{IH} (DC)	Input High (Logic1) Voltage	V _{REF} + 0.125	V _{DDQ} + 0.3	V	1
V _{IL} (DC)	Input Low (Logic0) Voltage	-0.3	V _{REF} - 0.125	V	1

Note:

1. Inputs are not recognized as valid until V_{REF} stabilizes.
2. V_{REF} is expected to be equal to 0.5 V_{DDQ} 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 2% of the DC value.

Environmental Parameters

Symbol	Parameter	Rating	Units	Note
T _{OPR}	Module Operating Temperature Range (ambient)	0 to 55	°C	3
H _{OPR}	Operating Humidity (relative)	10 to 90	%	
T _{STG}	Storage Temperature (Plastic)	-55 to 100	°C	1
H _{STG}	Storage Humidity (without condensation)	5 to 95	%	1
P _{BAR}	Barometric Pressure (operating & storage)	105 to 69	K Pascal	1,2

Note:

1. Stresses greater than those listed may cause permanent damage to the device. This is a stress rating only, and device functional operation at or above the conditions indicated is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
2. Up to 9850 ft.
3. The component maximum case temperature shall not exceed the value specified in the component spec.

Operating, Standby, and Refresh Currents

T_{CASE} = 0 °C ~ 85 °C; V_{DDQ} = V_{DD} = 1.8V ± 0.1V (256MB, 1 Rank, 32Mx16 DDR2 SDRAMs)

Symbol	Parameter/Condition	PC2-4200 (-37B)	PC2-5300 (-3C)	PC2-6400 (-25C)	Unit
I _{DD0}	Operating Current: one bank; active/precharge; t _{RC} = t _{RC} (MIN); t _{CK} = t _{CK} (MIN); DQ, DM, and DQS inputs changing twice per clock cycle; address and control inputs changing once per clock cycle	420	440	480	mA
I _{DD1}	Operating Current: one bank; active/read/precharge; Burst = 2; t _{RC} = t _{RC} (MIN); CL=2.5; t _{CK} = t _{CK} (MIN); I _{OUT} = 0mA; address and control inputs changing once per clock cycle	420	460	500	mA
I _{DD2P}	Precharge Power-Down Standby Current: all banks idle; power-down mode; CKE ≤ V _{IL} (MAX); t _{CK} = t _{CK} (MIN)	60	60	60	mA
I _{DD2N}	Idle Standby Current: CS ≥ V _{IH} (MIN); all banks idle; CKE ≥ V _{IH} (MIN); t _{CK} = t _{CK} (MIN); address and control inputs changing once per clock cycle	160	180	200	mA
I _{DD2Q}	Precharge standby current; All banks idle; t _{CK} = t _{CK} (IDD); CKE is high; CS is high; Other control and address bus inputs are STABLE; Data bus inputs are FLOATING.	180	220	220	mA
I _{DD3PF}	Active Power-Down Standby Current: one bank active; power-down mode; CKE ≤ V _{IL} (MAX); t _{CK} = t _{CK} (MIN); Fast PDN Exit MRS(12) = 0mA	120	160	180	mA
I _{DD3PS}	Active Power-Down Standby Current: one bank active; power-down mode; CKE ≤ V _{IL} (MAX); t _{CK} = t _{CK} (MIN); Slow PDN Exit MRS(12) = 1mA	60	60	60	mA
I _{DD3N}	Active Standby Current: one bank; active/precharge; CS ≥ V _{IH} (MIN); CKE ≥ V _{IH} (MIN); t _{RC} = t _{RAS} (MAX); t _{CK} = t _{CK} (MIN); DQ, DM, and DQS inputs changing twice per clock cycle; address and control inputs changing once per clock cycle	200	240	280	mA
I _{DD4W}	Operating Current: one bank; Burst = 2; writes; continuous burst; address and control inputs changing once per clock cycle; DQ and DQS inputs changing twice per clock cycle; CL=2.5; t _{CK} = t _{CK} (MIN)	580	700	740	mA
I _{DD4R}	Operating Current: one bank; Burst = 2; reads; continuous burst; address and control inputs changing once per clock cycle; DQ and DQS outputs changing twice per clock cycle; CL = 2.5; t _{CK} = t _{CK} (MIN); I _{OUT} = 0mA	620	720	740	mA
I _{DD5}	Auto-Refresh Current: t _{RC} = t _{RFC} (MIN)	660	700	760	mA
I _{DD6}	Self-Refresh Current: CKE ≤ 0.2V	60	60	60	mA
I _{DD7}	Operating Current: four bank; four bank interleaving with BL = 4, address and control inputs randomly changing; 50% of data changing at every transfer; t _{RC} = t _{RC} (min); I _{OUT} = 0mA.	1100	1140	1140	mA
Note: Module IDD was calculated from component IDD. It may differ from the actual measurement.					

Operating, Standby, and Refresh Currents

T_{CASE} = 0 °C ~ 85 °C; V_{DDQ} = V_{DD} = 1.8V ± 0.1V (512MB, 1 Rank, 64Mx8 DDR2 SDRAMs)

Symbol	Parameter/Condition	PC2-4200 (-37B)	PC2-5300 (-3C)	PC2-6400 (-25C)	Unit
I _{DD0}	Operating Current: one bank; active/precharge; t _{RC} = t _{RC} (MIN); t _{CK} = t _{CK} (MIN); DQ, DM, and DQS inputs changing twice per clock cycle; address and control inputs changing once per clock cycle	720	760	840	mA
I _{DD1}	Operating Current: one bank; active/read/precharge; Burst = 2; t _{RC} = t _{RC} (MIN); CL=2.5; t _{CK} = t _{CK} (MIN); I _{OUT} = 0mA; address and control inputs changing once per clock cycle	720	800	880	mA
I _{DD2P}	Precharge Power-Down Standby Current: all banks idle; power-down mode; CKE ≤ V _{IL} (MAX); t _{CK} = t _{CK} (MIN)	120	120	120	mA
I _{DD2N}	Idle Standby Current: CS ≥ V _{IH} (MIN); all banks idle; CKE ≥ V _{IH} (MIN); t _{CK} = t _{CK} (MIN); address and control inputs changing once per clock cycle	320	360	400	mA
I _{DD2Q}	Precharge Quiet Standby Current: All banks idle; \overline{CS} is HIGH; CKE is HIGH; t _{CK} = t _{CK} (MIN); Other control and address inputs are stable, Data bus inputs are floating.	360	440	440	mA
I _{DD3PF}	Active Power-Down Current: All banks open; t _{CK} = t _{CK} (MIN), CKE is LOW; Other control and address inputs are STABLE, Data bus inputs are floating. MRS A12 bit is set to low (Fast Power-down Exit).	240	320	360	mA
I _{DD3PS}	Active Power-Down Current: All banks open; t _{CK} = t _{CK} (MIN), CKE is LOW; Other control and address inputs are STABLE, Data bus inputs are floating. MRS A12 bit is set to high (Slow Power-down Exit).	120	120	120	mA
I _{DD3N}	Active Standby Current: one bank; active/precharge; CS ≥ V _{IH} (MIN); CKE ≥ V _{IH} (MIN); t _{RC} = t _{RAS} (MAX); t _{CK} = t _{CK} (MIN); DQ, DM, and DQS inputs changing twice per clock cycle; address and control inputs changing once per clock cycle	400	480	560	mA
I _{DD4W}	Operating Current: one bank; Burst = 2; writes; continuous burst; address and control inputs changing once per clock cycle; DQ and DQS inputs changing twice per clock cycle; CL=2.5; t _{CK} = t _{CK} (MIN)	1000	1240	1320	mA
I _{DD4R}	Operating Current: one bank; Burst = 2; reads; continuous burst; address and control inputs changing once per clock cycle; DQ and DQS outputs changing twice per clock cycle; CL = 2.5; t _{CK} = t _{CK} (MIN); I _{OUT} = 0mA	1040	1240	1280	mA
I _{DD5}	Auto-Refresh Current: t _{RC} = t _{RFC} (MIN)	1320	1400	1520	mA
I _{DD6}	Self-Refresh Current: CKE ≤ 0.2V	120	120	120	mA
I _{DD7}	Operating Current: four bank; four bank interleaving with BL = 4, address and control inputs randomly changing; 50% of data changing at every transfer; t _{RC} = t _{RC} (min); I _{OUT} = 0mA.	1400	1480	1480	mA

Note:

Module IDD was calculated from component IDD. It may differ from the actual measurement.

Operating, Standby, and Refresh Currents

$T_{CASE} = 0\text{ }^{\circ}\text{C} \sim 85\text{ }^{\circ}\text{C}$; $V_{DDQ} = V_{DD} = 1.8\text{V} \pm 0.1\text{V}$ (1GB, 2 Ranks, 64Mx8 DDR2 SDRAMs)

Symbol	Parameter/Condition	PC2-4200 (-37B)	PC2-5300 (-3C)	PC2-6400 (-25C)	Unit
I _{DD0}	Operating Current: one bank; active/precharge; $t_{RC} = t_{RC}(\text{MIN})$; $t_{CK} = t_{CK}(\text{MIN})$; DQ, DM, and DQS inputs changing twice per clock cycle; address and control inputs changing once per clock cycle	1040	1120	1240	mA
I _{DD1}	Operating Current: one bank; active/read/precharge; Burst = 2; $t_{RC} = t_{RC}(\text{MIN})$; CL=2.5; $t_{CK} = t_{CK}(\text{MIN})$; IOUT = 0mA; address and control inputs changing once per clock cycle	1040	1160	1280	mA
I _{DD2P}	Precharge Power-Down Standby Current: all banks idle; power-down mode; $CKE \leq V_{IL}(\text{MAX})$; $t_{CK} = t_{CK}(\text{MIN})$	240	240	240	mA
I _{DD2N}	Idle Standby Current: $CS \geq V_{IH}(\text{MIN})$; all banks idle; $CKE \geq V_{IH}(\text{MIN})$; $t_{CK} = t_{CK}(\text{MIN})$; address and control inputs changing once per clock cycle	640	720	800	mA
I _{DD2Q}	Precharge Quiet Standby Current: All banks idle; \overline{CS} is HIGH; CKE is HIGH; $t_{CK} = t_{CK}(\text{MIN})$; Other control and address inputs are stable, Data bus inputs are floating.	720	880	880	mA
I _{DD3PF}	Active Power-Down Current: All banks open; $t_{CK} = t_{CK}(\text{MIN})$, CKE is LOW; Other control and address inputs are STABLE, Data bus inputs are floating. MRS A12 bit is set to low (Fast Power-down Exit).	480	640	720	mA
I _{DD3PS}	Active Power-Down Current: All banks open; $t_{CK} = t_{CK}(\text{MIN})$, CKE is LOW; Other control and address inputs are STABLE, Data bus inputs are floating. MRS A12 bit is set to high (Slow Power-down Exit).	240	240	240	mA
I _{DD3N}	Active Standby Current: one bank; active/precharge; $CS \geq V_{IH}(\text{MIN})$; $CKE \geq V_{IH}(\text{MIN})$; $t_{RC} = t_{RAS}(\text{MAX})$; $t_{CK} = t_{CK}(\text{MIN})$; DQ, DM, and DQS inputs changing twice per clock cycle; address and control inputs changing once per clock cycle	720	840	960	mA
I _{DD4W}	Operating Current: one bank; Burst = 2; writes; continuous burst; address and control inputs changing once per clock cycle; DQ and DQS inputs changing twice per clock cycle; CL=2.5; $t_{CK} = t_{CK}(\text{MIN})$	1320	1600	1720	mA
I _{DD4R}	Operating Current: one bank; Burst = 2; reads; continuous burst; address and control inputs changing once per clock cycle; DQ and DQS outputs changing twice per clock cycle; CL = 2.5; $t_{CK} = t_{CK}(\text{MIN})$; IOUT = 0mA	1360	1600	1680	mA
I _{DD5}	Auto-Refresh Current: $t_{RC} = t_{RFC}(\text{MIN})$	1640	1760	1920	mA
I _{DD6}	Self-Refresh Current: $CKE \leq 0.2\text{V}$	240	240	240	mA
I _{DD7}	Operating Current: four bank; four bank interleaving with BL = 4, address and control inputs randomly changing; 50% of data changing at every transfer; $t_{RC} = t_{RC}(\text{min})$; IOUT = 0mA.	1720	1840	1880	mA

Note:

Module IDD was calculated from component IDD. It may differ from the actual measurement.

AC Timing Specifications for DDR2 SDRAM Devices Used on Module

(T_{CASE} = 0 °C ~ 85 °C; V_{DDQ} = 1.8V ± 0.1V; V_{DD} = 1.8V ± 0.1V, See AC Characteristics) (Part 1 of 2)

Symbol	Parameter	PC2-4200		PC2-5300		PC2-6400		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
t _{AC}	DQ output access time from CK/ \overline{CK}	-0.50	0.50	-0.45	+0.45	-0.40	+0.40	ns
t _{DQSCK}	DQS output access time from CK/ \overline{CK}	-0.45	0.45	-0.40	+0.40	-0.35	+0.35	ns
t _{CH}	CK high-level width	0.45	0.55	0.45	0.55	0.45	0.55	tck
t _{CL}	CK low-level width	0.45	0.55	0.45	0.55	0.45	0.55	tck
t _{HP}	Minimum half clk period for any given cycle; defined by clk high (t _{CH}) or clk low (t _{CL}) time	t _{CH} or t _{CL}	-	t _{CH} or t _{CL}	-	t _{CH} or t _{CL}	-	tck
t _{CK}	Clock Cycle Time	3.75	8	3	8	2.5	8	ns
t _{DS}	DQ and DM input setup time(differential data strobe)	0.1	-	0.1	-	0.05	-	ns
t _{DH}	DQ and DM input hold time(differential data strobe)	0.225	-	0.175	-	0.125	-	ns
t _{IPW}	Input pulse width	0.6	-	0.6	-	0.6	-	tck
t _{DIPW}	DQ and DM input pulse width (each input)	0.35	-	0.35	-	0.35	-	tck
t _{HZ}	Data-out high-impedance time from CK/ \overline{CK}	-	t _{AC} max	-	t _{AC} max	-	t _{AC} max	ns
t _{LZ(DQS)}	DQS low-impedance time from CK/ \overline{CK}	t _{AC} min	t _{AC} max	t _{AC} min	t _{AC} max	t _{AC} min	t _{AC} max	ns
t _{LZ(DQ)}	DQ low-impedance time from CK/ \overline{CK}	2t _{AC} min	t _{AC} max	2t _{AC} min	t _{AC} max	2t _{AC} min	t _{AC} max	ns
t _{DQSQ}	DQS-DQ skew (DQS & associated DQ signals)	-	0.3	-	0.24	-	0.20	ns
t _{QHS}	Data hold Skew Factor	-	0.4	-	0.34	-	0.3	ns
t _{QH}	Data output hold time from DQS	t _{HP} - t _{QHS}	-	t _{HP} - t _{QHS}	-	t _{HP} - t _{QHS}	-	ns
t _{DQSS}	Write command to 1st DQS latching transition	-0.25	0.25	-0.25	+0.25	-0.25	+0.25	tck
t _{DQSL,(H)}	DQS input low (high) pulse width (write cycle)	0.35	-	0.35	-	0.35	-	tck
t _{DSS}	DQS falling edge to CK setup time (write cycle)	0.2	-	0.2	-	0.2	-	tck
t _{DSH}	DQS falling edge hold time from CK (write cycle)	0.2	-	0.2	-	0.2	-	tck
t _{MRD}	Mode register set command cycle time	2	-	2	-	2	-	tck
t _{WPST}	Write postamble	0.4	0.6	0.40	0.60	0.40	0.60	tck
t _{WPPE}	Write preamble	0.35	-	0.35	-	0.35	-	tck
t _{IH}	Address and control input hold time	375	-	275	-	250	-	ps
t _{IS}	Address and control input setup time	250	-	200	-	175	-	ps
t _{RPRE}	Read preamble	0.9	1.1	0.90	1.10	0.90	1.10	tck
t _{RPST}	Read postamble	0.4	0.6	0.40	0.60	0.40	0.60	tck
t _{RRD}	Active bank A to Active bank B command	10	-	7.5	-	7.5	-	ns
t _{Delay}	Minimum time clocks remains ON after CKE asynchronously drops Low	t _{IS} +t _{CK} + t _{IH}		t _{IS} + t _{CK} + t _{IH}	-	t _{IS} + t _{CK} + t _{IH}	-	ns
t _{REFI}	Average Periodic Refresh Interval (85°C < T _{CASE} ≤ 95°C)	3.9		3.9		3.9		μs
	Average Periodic Refresh Interval (0°C ≤ T _{CASE} ≤ 85°C)	7.8		7.8		7.8		μs
t _{OIT}	OCD drive mode output delay	0	12	0	12	0	12	ns
t _{CCD}	\overline{CAS} to \overline{CAS}	2		2		2		tck

AC Timing Specifications for DDR2 SDRAM Devices Used on Module

(T_{CASE} = 0 °C ~ 85 °C; V_{DDQ} = 1.8V ± 0.1V; V_{DD} = 1.8V ± 0.1V, See AC Characteristics) (Part 2 of 2)

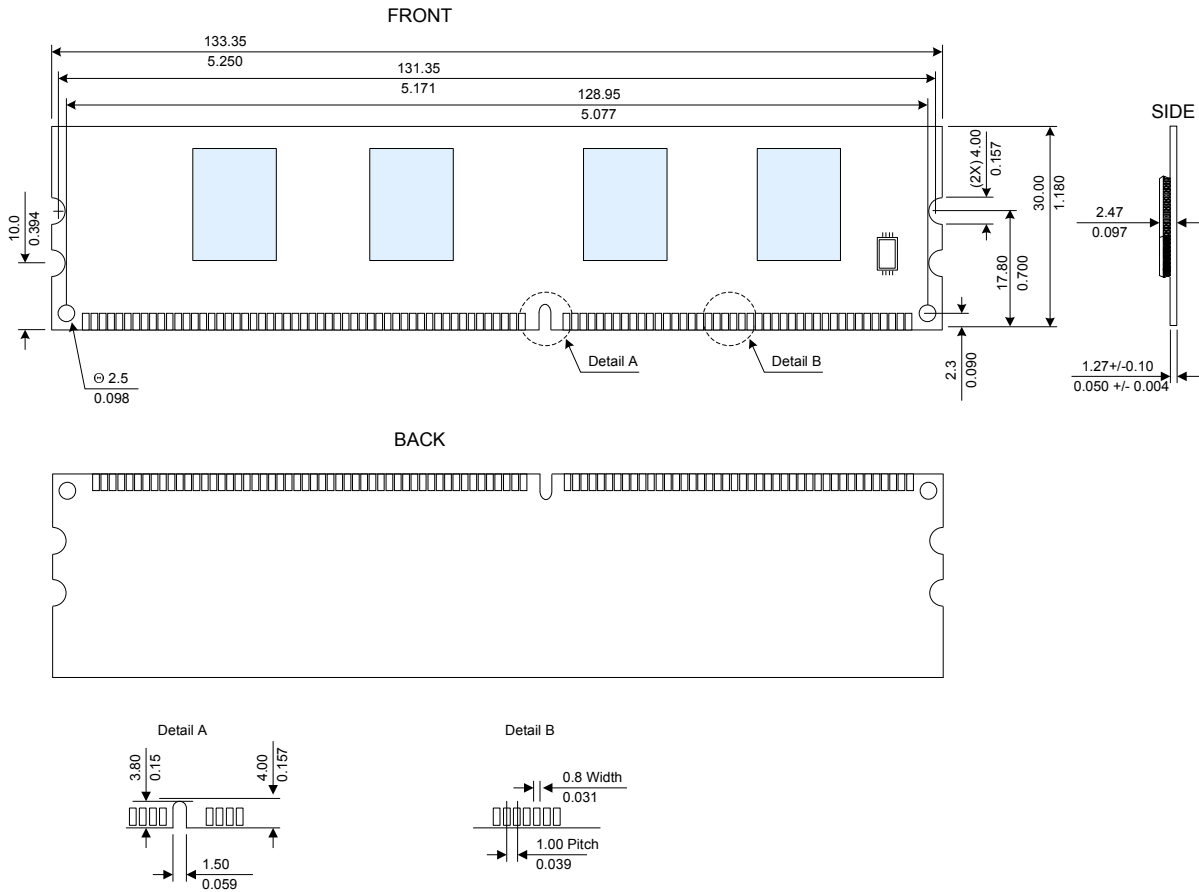
Symbol	Parameter	PC2-4200		PC2-5300		PC2-6400		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
tWR	Write recovery time without Auto-Precharge	15	-	15	-	15	-	ns
WR	Write recovery time with Auto-Precharge	tWR/tCK	-	tWR/tCK	-	tWR/tCK	-	tCK
tdAL	Auto precharge write recovery + precharge time	WR+tRP	-	WR+tRP	-	WR+tRP	-	tCK
twTR	Internal write to read command delay	7.5	-	7.5	-	7.5	-	ns
trTP	Internal read to precharge command delay	7.5	-	7.5	-	7.5	-	ns
tXSNR	Exit self refresh to a Non-read command	trFC+10	-	trFC+10	-	trFC+10	-	ns
tXSRD	Exit self refresh to a Read command	200	-	200	-	200	-	tCK
tXP	Exit precharge power down to any Non- read command	2	-	2	-	2	-	tCK
tXARD	Exit active power down to read command	2	-	2	-	2	-	tCK
tXARDS	Exit active power down to read command	6-AL	-	7-AL	-	8-AL	-	tCK
tCKE	CKE minimum pulse width	3	-	3	-	3	-	tCK
ODT								
tAOND	ODT turn-on delay	2	2	2	2	2	2	tCK
tAON	ODT turn-on	tAC (min)	tAC (max) +1	tAC (min)	tAC (max) +0.7	tAC (min)	tAC (max) +0.7	ns
tAONPD	ODT turn-on (Power down mode)	tAC (min) +2	2tCK + tAC(max) +1	tAC (min) +2	2tCK + tAC(max) +1	tAC (min) +2	2tCK + tAC(max) +1	ns
tAOFD	ODT turn-off delay	2.5	2.5	2.5	2.5	2.5	2.5	tCK
tAOF	ODT turn-off	tAC(min)	tAC(max) +0.6	tAC(min)	tAC(max) +0.6	tAC(min)	tAC(max) +0.6	ns
tAOFPD	ODT turn-off (Power down mode)	tAC (min)+2	2.5tCK + tAC(max) +1	tAC (min)+2	2.5tCK + tAC(max) +1	tAC (min)+2	2.5tCK + tAC(max) +1	ns
tANPD	ODT to power down entry latency	3	-	3	-	3	-	tCK
tAXPD	ODT power down exit latency	8	-	8	-	8	-	tCK

Speed Grade Definition

Symbol	Parameter	-37B		-3C		-25C		Unit
		Min	Max	Min	Max	Min	Max	
tRAS	Row Active Time	45	70,000	45	70,000	45	70,000	ns
tRC	Row Cycle Time	60	-	60	-	57.5	-	ns
trCD	RAS to CAS delay	15	-	15	-	12.5	-	ns
tRP	Row Precharge Time	15	-	15	-	12.5	-	ns

Package Dimensions

(256MB, 1 Rank, 32Mx16 DDR2 SDRAMs)



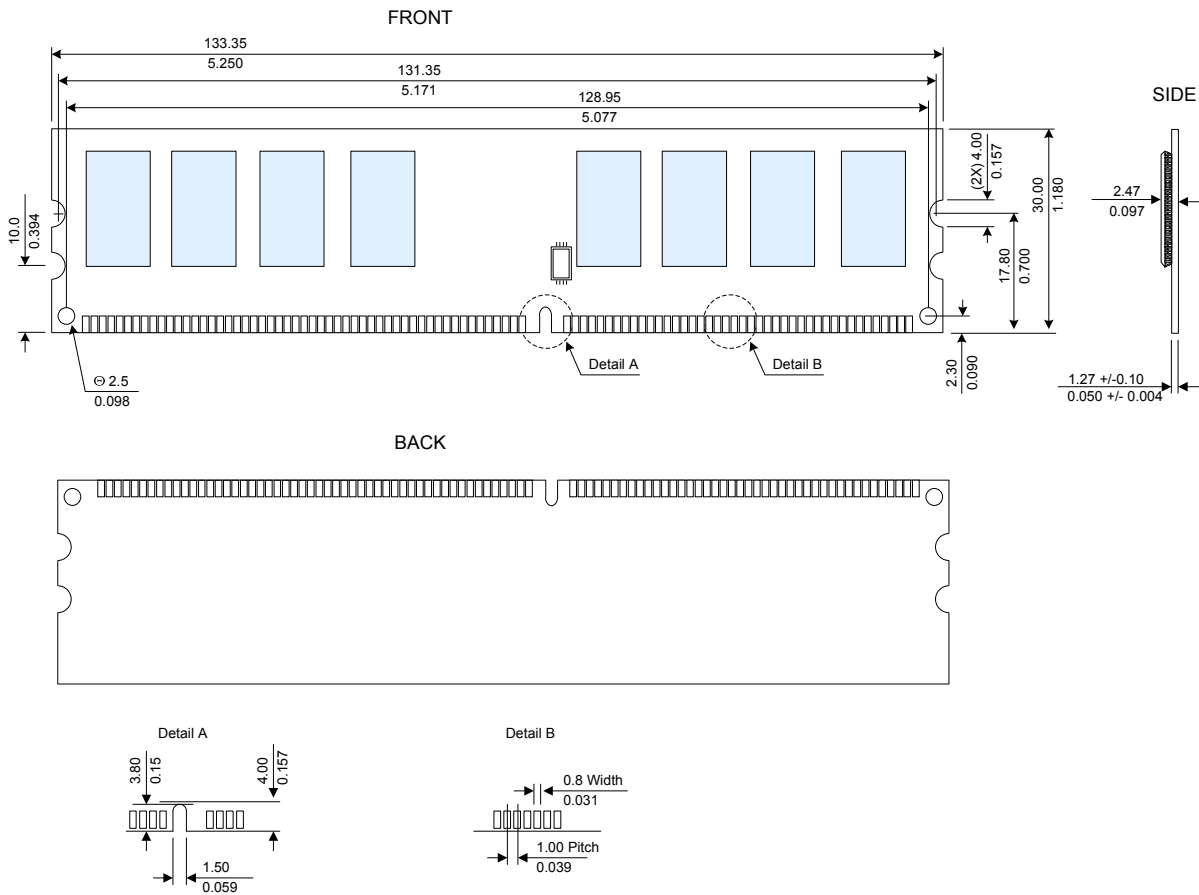
Note: All dimensions are typical with tolerances of +/- 0.15 (0.006) unless otherwise stated.

Units: Millimeters (Inches)

Note: Device position is only for reference.

Package Dimensions

(512MB, 1 Rank, 64Mx8 DDR2 SDRAMs)



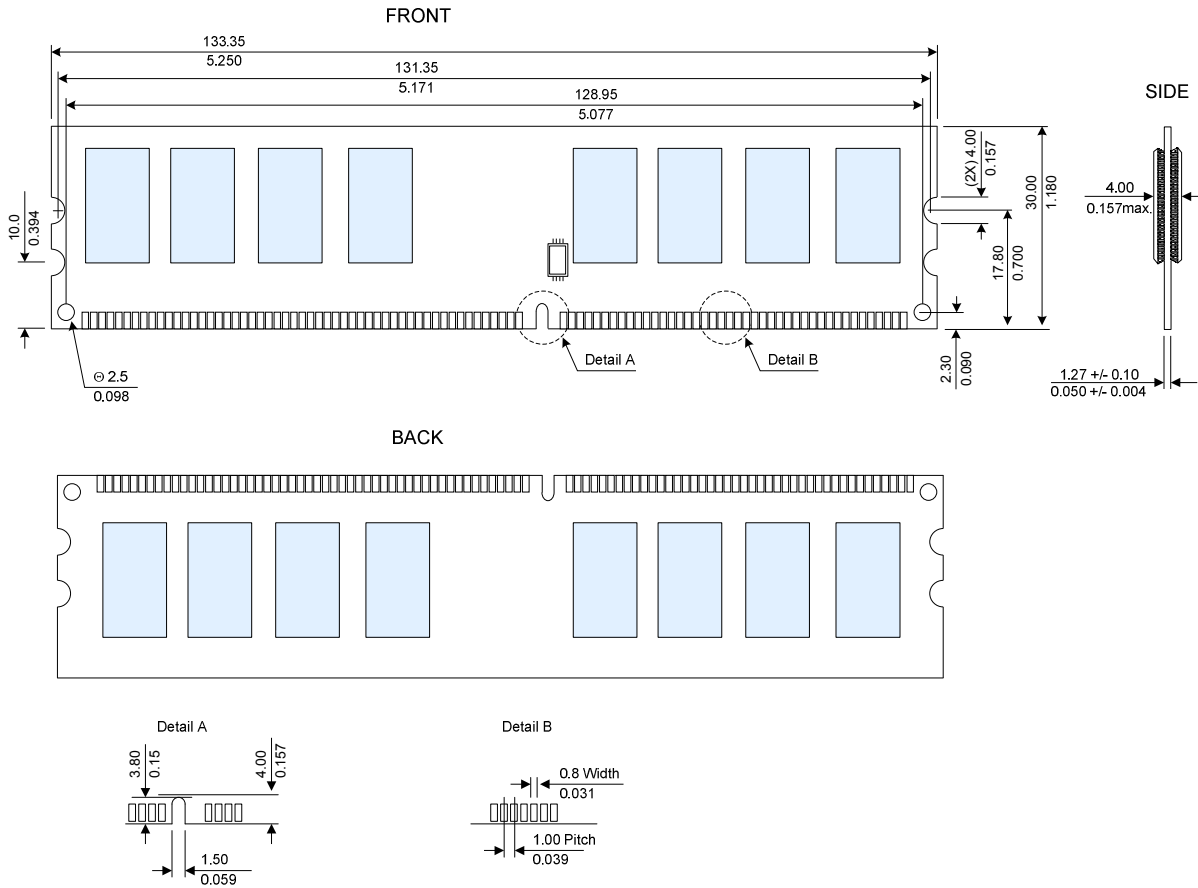
Note: All dimensions are typical with tolerances of +/- 0.15 (0.006) unless otherwise stated.

Units: Millimeters (Inches)

Note: Device position is only for reference.

Package Dimensions

(1GB, 2 Rank, 64Mx8 DDR2 SDRAMs)



Note: All dimensions are typical with tolerances of +/- 0.15 (0.006) unless otherwise stated.

Units: Millimeters (Inches)

Note: Device position is only for reference.



Revision Log

Rev	Date	Modification
0.1	07/2006	Preliminary Release
1.0	08/2006	Official Release -37B/-3C/-25C products.