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# ATP A4G08QA8BNPBSE

## 8GB DDR4-2133 UNBUFFERED NON-ECC SODIMM

### DESCRIPTION

The ATP A4G08QA8BNPBSE is a high performance 8GB DDR4-2133 Unbuffered NON-ECC SDRAM memory module. It is organized as 1024M x 64 in a 260-pin Small Outline Dual-In-Line Memory Module (SODIMM) package. The module utilizes eight 1024Mx8 DDR4 SDRAMs in FBGA package. The module consists of a 512-byte serial EEPROM, which contains the module configuration information.

### KEY FEATURES

- High Density: 8GB (1024M x 64)
- DIMM Rank: 1 Rank
- Cycle Time: 0.93ns (1067MHz)
- CAS Latency: 15
- Power supply:  $V_{DD}=1.2V \pm 0.06V$   
 $V_{PP}=2.5V \pm 0.125V$   
 $V_{DDSPD}=2.2V \sim 3.6V$
- Nominal and dynamic on-die termination(ODT) for data, strobe, and mask signals
- Low-power auto self refresh (LPASR)
- Data bus inversion(DBI) for data bus
- 16 internal banks(x8); 4 groups of 4 banks each
- Internal self calibration through ZQ
- Temperature controlled refresh (TCR)
- Asynchronous Reset
- 7.8  $\mu s$  refresh interval at lower than  $T_{CASE}85^{\circ}C$ , 3.9 $\mu s$  refresh interval at  $85^{\circ}C < T_{CASE} < 95^{\circ}C$
- Support address and command signals parity function
- Selectable BC4 or BL8 on-the fly(OTF)
- Dynamic On Die Termination
- Fly-by topology
- Full module heat spreader
- PCB Height: 1.18 inches(30mm)
- Minimum Thickness of Golden Finger: 30 Micro-inch
- RoHS compliant

| Part No.       | Max Freq                  | Interface |
|----------------|---------------------------|-----------|
| A4G08QA8BNPBSE | 1067MHz (0.93ns@CL=15) x2 | POD12     |

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## ATP A4G08QA8BNPBSE

### PIN DESCRIPTION

| Pin Name      | Description   |
|---------------|---|
| A0~A16        | Address Inputs  |
| A10/AP        | Address Input/Auto precharge                              |
| A12/BC_n      | Address Input/Burst chop                                  |
| BA0,BA1       | SDRAM Bank Address  |
| BG0,BG1       | Bank group address inputs                                 |
| RAS_n         | Row address strobe input                                  |
| CAS_n         | Column address strobe input                               |
| WE_n          | Write enable input  |
| CS0_n         | Chip Selects  |
| CK0_t         | Clock Inputs, positive line                               |
| CK0_c         | Clock Inputs, negative line                               |
| CKE0          | Clock Enables   |
| C0~C2         | Chip ID   |
| ODT0          | On-die termination control lines input                    |
| ACT_n         | Command input: ACT_n indicates an ACTIVATE command.       |
| DQ0~DQ63      | Data Input /Output  |
| DQS0_t~DQS7_t | Data strobes  |
| DQS0_c~DQS7_c | Data strobes, negative line                               |
| DQM0 ~DQM7    | Data Mask   |
| SCL           | Serial clock for temperature sensor/SPD EEPROM            |
| SDA           | SPD Data Input /Output                                    |
| SA0~SA2       | Serial address inputs                                     |
| PARITY        | Parity for command and address                            |
| VDD           | Power supply  |
| VPP           | DRAM activating power supply                              |
| VREFCA        | Reference voltage for control, command, and address pins. |
| VSS           | Ground  |
| VDDSPD        | SPD Power   |
| ALERT_n       | Alert output  |
| RESET_n       | Active LOW asynchronous reset                             |
| EVENT_n       | Temperature sensor Event Output                           |
| VTT           | SDRAM I/O termination supply                              |
| VDDQ          | DRAM DQ power supply                                      |
| ZQ            | Reference ball for ZQ calibration                         |
| NC            | No Connect  |
| NF            | No function   |
| RFU           | Reserved for future use                                   |

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### PIN ASSIGNMENT

| No. | Designation       | No. | Designation       | No. | Designation             | No. | Designation             |
|-----|-------------------|-----|-------------------|-----|-------------------------|-----|-------------------------|
| 1   | VSS               | 2   | VSS               | 133 | A1                      | 134 | EVENT <sub>n</sub>      |
| 3   | DQ5               | 4   | DQ4               | 135 | VDD                     | 136 | VDD                     |
| 5   | VSS               | 6   | VSS               | 137 | CK0 <sub>t</sub>        | 138 | CK1 <sub>t</sub>        |
| 7   | DQ1               | 8   | DQ0               | 139 | CK0 <sub>c</sub>        | 140 | CK1 <sub>c</sub>        |
| 9   | VSS               | 10  | VSS               | 141 | VDD                     | 142 | VDD                     |
| 11  | DQS0 <sub>c</sub> | 12  | DQM0              | 143 | PARITY                  | 144 | A0                      |
| 13  | DQS0 <sub>t</sub> | 14  | VSS               | KEY |                         |     |                         |
| 15  | VSS               | 16  | DQ6               | 145 | BA1                     | 146 | A10/AP                  |
| 17  | DQ7               | 18  | VSS               | 147 | VDD                     | 148 | VDD                     |
| 19  | VSS               | 20  | DQ2               | 149 | CS0 <sub>n</sub>        | 150 | BA0                     |
| 21  | DQ3               | 22  | VSS               | 151 | WE <sub>n</sub> /A14    | 152 | RAS <sub>n</sub> /A16   |
| 23  | VSS               | 24  | DQ12              | 153 | VDD                     | 154 | VDD                     |
| 25  | DQ13              | 26  | VSS               | 155 | ODT0                    | 156 | CAS <sub>n</sub> /A15   |
| 27  | VSS               | 28  | DQ8               | 157 | CS1 <sub>n</sub>        | 158 | A13                     |
| 29  | DQ9               | 30  | VSS               | 159 | VDD                     | 160 | VDD                     |
| 31  | VSS               | 32  | DQS1 <sub>c</sub> | 161 | ODT1                    | 162 | C0,CS2 <sub>n</sub> ,NC |
| 33  | DQM1              | 34  | DQS1 <sub>t</sub> | 163 | VDD                     | 164 | VREFCA                  |
| 35  | VSS               | 36  | VSS               | 165 | NC,CS3 <sub>c</sub> ,C1 | 166 | SA2                     |
| 37  | DQ15              | 38  | DQ14              | 167 | VSS                     | 168 | VSS                     |
| 39  | VSS               | 40  | VSS               | 169 | DQ37                    | 170 | DQ36                    |
| 41  | DQ10              | 42  | DQ11              | 171 | VSS                     | 172 | VSS                     |
| 43  | VSS               | 44  | VSS               | 173 | DQ33                    | 174 | DQ32                    |
| 45  | DQ21              | 46  | DQ20              | 175 | VSS                     | 176 | VSS                     |
| 47  | VSS               | 48  | VSS               | 177 | DQS4 <sub>c</sub>       | 178 | DQM4                    |
| 49  | DQ17              | 50  | DQ16              | 179 | DQS4 <sub>t</sub>       | 180 | VSS                     |
| 51  | VSS               | 52  | VSS               | 181 | VSS                     | 182 | DQ39                    |
| 53  | DQS2 <sub>c</sub> | 54  | DQM2              | 183 | DQ38                    | 184 | VSS                     |
| 55  | DQS2 <sub>t</sub> | 56  | VSS               | 185 | VSS                     | 186 | DQ35                    |
| 57  | VSS               | 58  | DQ22              | 187 | DQ34                    | 188 | VSS                     |
| 59  | DQ23              | 60  | VSS               | 189 | VSS                     | 190 | DQ45                    |
| 61  | VSS               | 62  | DQ18              | 191 | DQ44                    | 192 | VSS                     |
| 63  | DQ19              | 64  | VSS               | 193 | VSS                     | 194 | DQ41                    |
| 65  | VSS               | 66  | DQ28              | 195 | DQ40                    | 196 | VSS                     |
| 67  | DQ29              | 68  | VSS               | 197 | VSS                     | 198 | DQS5 <sub>c</sub>       |
| 69  | VSS               | 70  | DQ24              | 199 | DQM5                    | 200 | DQS5 <sub>t</sub>       |
| 71  | DQ25              | 72  | VSS               | 201 | VSS                     | 202 | VSS                     |
| 73  | VSS               | 74  | DQS3 <sub>c</sub> | 203 | DQ46                    | 204 | DQ47                    |
| 75  | DQM3              | 76  | DQS3 <sub>t</sub> | 205 | VSS                     | 206 | VSS                     |
| 77  | VSS               | 78  | VSS               | 207 | DQ42                    | 208 | DQ43                    |

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| No. | Designation | No. | Designation | No. | Designation | No. | Designation |
|-----|-------------|-----|-------------|-----|-------------|-----|-------------|
| 79  | DQ30        | 80  | DQ31        | 209 | VSS         | 210 | VSS         |
| 81  | VSS         | 82  | VSS         | 211 | DQ52        | 212 | DQ53        |
| 83  | DQ26        | 84  | DQ27        | 213 | VSS         | 214 | VSS         |
| 85  | VSS         | 86  | VSS         | 215 | DQ49        | 216 | DQ48        |
| 87  | NC          | 88  | NC          | 217 | VSS         | 218 | VSS         |
| 89  | VSS         | 90  | VSS         | 219 | DQS6 c      | 220 | DQM6        |
| 91  | NC          | 92  | NC          | 221 | DQS6 t      | 222 | VSS         |
| 93  | VSS         | 94  | VSS         | 223 | VSS         | 224 | DQ54        |
| 95  | NC          | 96  | NC          | 225 | DQ55        | 226 | VSS         |
| 97  | NC          | 98  | VSS         | 227 | VSS         | 228 | DQ50        |
| 99  | VSS         | 100 | NC          | 229 | DQ51        | 230 | VSS         |
| 101 | NC          | 102 | VSS         | 231 | VSS         | 232 | DQ60        |
| 103 | VSS         | 104 | NC          | 233 | DQ61        | 234 | VSS         |
| 105 | NC          | 106 | VSS         | 235 | VSS         | 236 | DQ57        |
| 107 | VSS         | 108 | RESET n     | 237 | DQ56        | 238 | VSS         |
| 109 | CKE0        | 110 | CKE1        | 239 | VSS         | 240 | DQS7 c      |
| 111 | VDD         | 112 | VDD         | 241 | DQM7        | 242 | DQS7 t      |
| 113 | BG1         | 114 | ACT n       | 243 | VSS         | 244 | VSS         |
| 115 | BG0         | 116 | ALERT n     | 245 | DQ62        | 246 | DQ63        |
| 117 | VDD         | 118 | VDD         | 247 | VSS         | 248 | VSS         |
| 119 | A12/BC n    | 120 | A11         | 249 | DQ58        | 250 | DQ59        |
| 121 | A9          | 122 | A7          | 251 | VSS         | 252 | VSS         |
| 123 | VDD         | 124 | VDD         | 253 | SCL         | 254 | SDA         |
| 125 | A8          | 126 | A5          | 255 | VDDSPD      | 256 | SA0         |
| 127 | A6          | 128 | A4          | 257 | VPP         | 258 | VTT         |
| 129 | VDD         | 130 | VDD         | 259 | VPP         | 260 | SA1         |
| 131 | A3          | 132 | A2          |     |             |     |             |

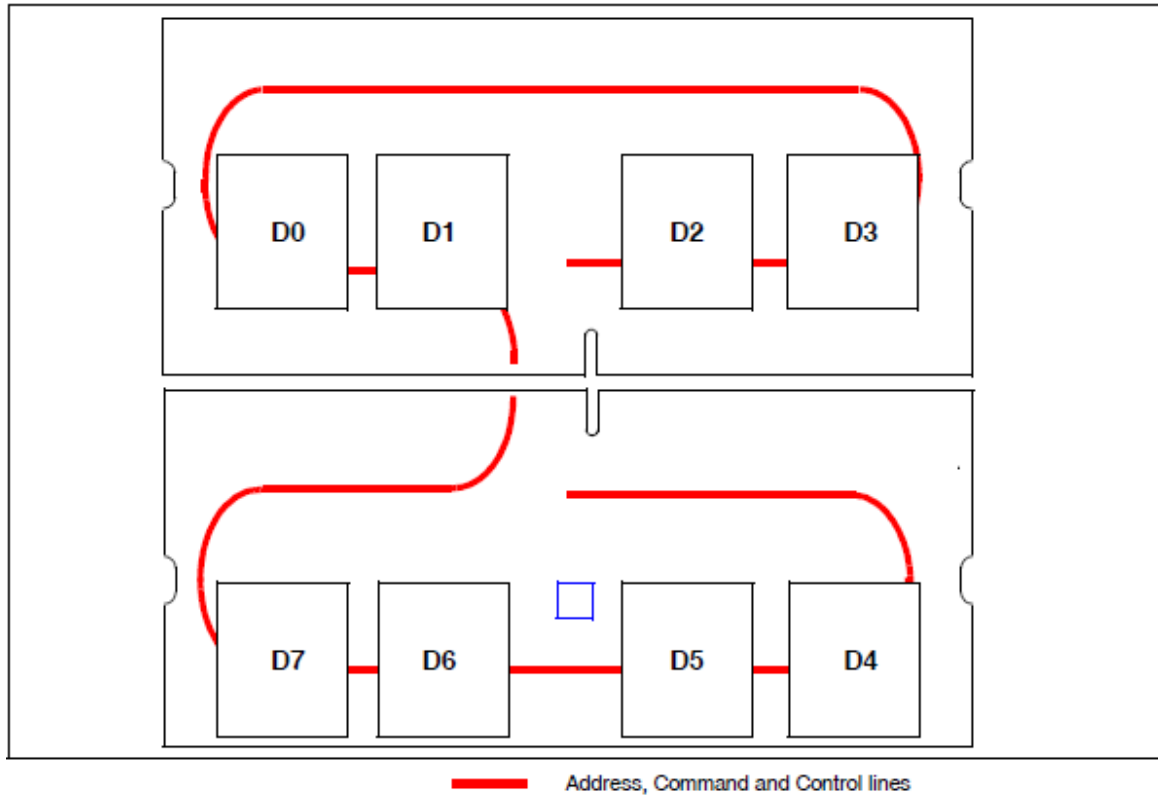
Note:  
1. VPP is 2.5V DC

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FUNCTIONAL BLOCK DIAGRAM (PART1 OF 2)



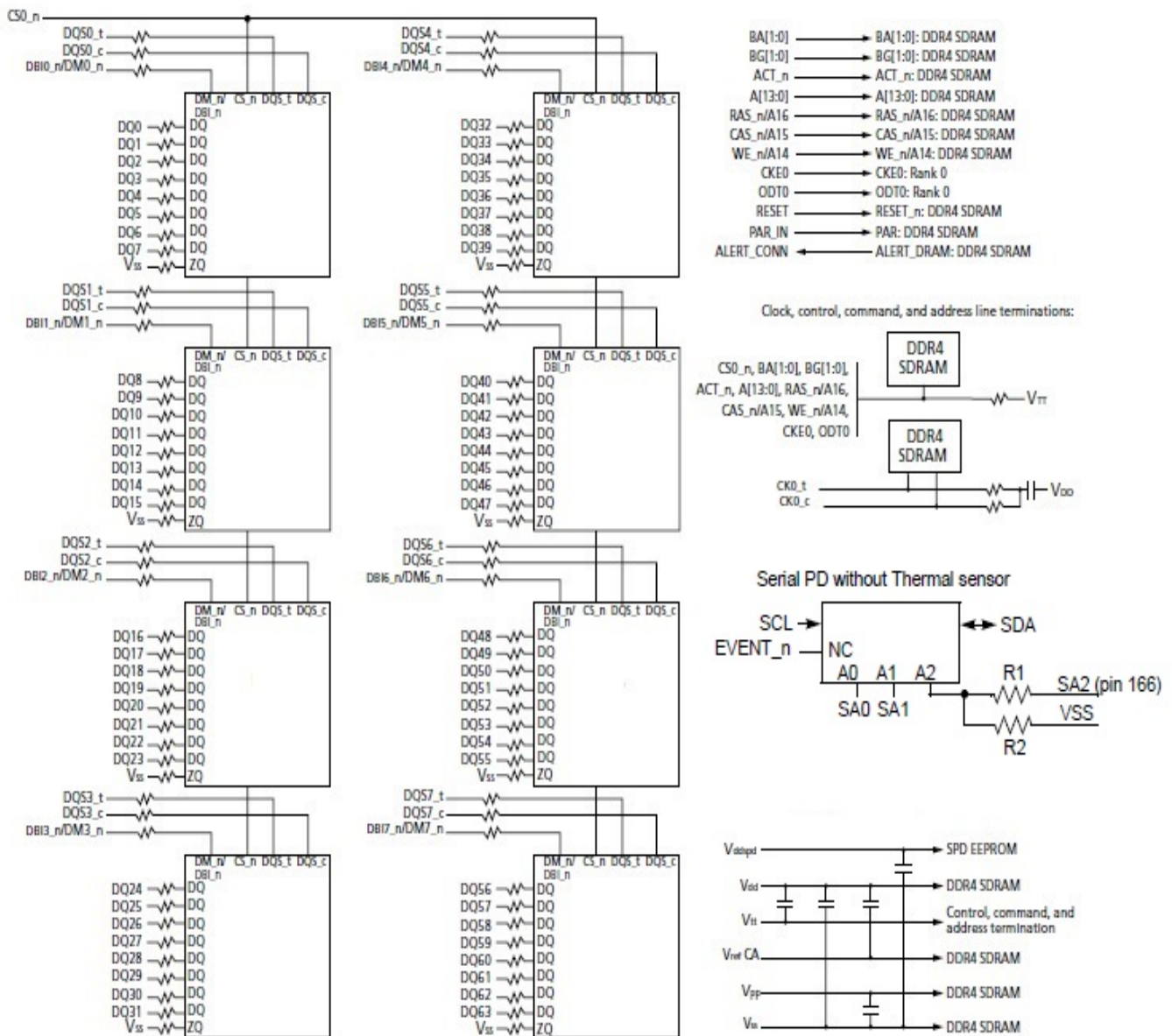
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## FUNCTIONAL BLOCK DIAGRAM (PART 2 OF 2)



Note: The ZQ ball on each DDR4 component is connected to an external 240Ω ±1% resistor that is tied to ground. It is used for the calibration of the component's ODT and output driver.

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# ATP A4G08QA8BNPBSE

## ABSOLUTE MAXIMUM DC RATINGS

| Item  | Symbol            | Rating         | Units | Notes |
|---|-------------------|----------------|-------|-------|
| Voltage on $V_{DD}$ pin relative to $V_{SS}$  | $V_{DD}$          | -0.4V ~ 1.5V   | V     | 1,3   |
| Voltage on $V_{DDQ}$ pin relative to $V_{SS}$ | $V_{DDQ}$         | -0.4V ~ 1.5V   | V     | 1,3   |
| Voltage on $V_{PP}$ pin relative to $V_{SS}$  | $V_{PP}$          | -0.4V ~ 3.0V   | V     | 4     |
| Voltage on any pin relative to $V_{SS}$       | $V_{IN}, V_{OUT}$ | -0.4V ~ 1.975V | V     | 1     |
| Storage Temperature                           | $T_{STG}$         | -55 to +100    | °C    | 1,2   |
| Operating Temperature                         | $T_{CASE}$        | 0 to +95       | °C    | 1,2   |

Note:

- Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a 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.
- Storage Temperature is the case surface temperature on the center/top side of the DRAM. For the measurement conditions, please refer to JESD51-2 standard.
- VDD and VDDQ must be within 300 mV of each other at all times; and VREFCA must be not greater than 0.6 x VDDQ, When VDD and VDDQ are less than 500 mV; VREFCA may be equal to or less than 300 mV.
- VPP must be equal or greater than VDD/VDDQ at all times.

## AC & DC OPERATING CONDITIONS

Recommended operating conditions

| Item   | Symbol        | Min.                   | Typical         | Max.                   | Units |
|--|---------------|------------------------|-----------------|------------------------|-------|
| Supply Voltage <sup>1,2,3</sup>  | $V_{DD}$      | 1.14                   | 1.2             | 1.26                   | V     |
| Supply Voltage for Output <sup>1,2,3</sup>                               | $V_{DDQ}$     | 1.14                   | 1.2             | 1.26                   | V     |
| DRAM Activating Power Supply <sup>3</sup>                                | $V_{PP}$      | 2.375                  | 2.5             | 2.75                   | V     |
| Input reference voltage command/<br>address bus                          | VREFCA(DC)    | $0.49 * V_{DD}$        | $0.50 * V_{DD}$ | $0.51 * V_{DD}$        | V     |
| Termination reference voltage (DC) -<br>command/address bus <sup>4</sup> | $V_{TT}$      | $0.49 * V_{DD} - 20mA$ | $0.50 * V_{DD}$ | $0.51 * V_{DD} + 20mA$ | V     |
| Input High Voltage (DC)  | $V_{IH} (DC)$ | $V_{REF} + 0.075$      | -               | $V_{DD}$               | V     |
| Input High Voltage (AC)  | $V_{IH} (AC)$ | $V_{REF} + 0.1$        | -               | -                      | V     |
| Input Low Voltage (DC)   | $V_{IL} (DC)$ | $V_{SS}$               | -               | $V_{REF} - 0.075$      | V     |
| Input Low Voltage (AC)   | $V_{IL} (AC)$ | -                      | -               | $V_{REF} - 0.1$        | V     |

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.
- DC bandwidth is limited to 20MHz.
- VTT termination voltages in excess of specification limit will adversely affect command and address signals' voltage margins, and reduce timing margins.

## RELIABILITY

| MTBF @25 °C (Hours) <sup>1</sup> | FIT @ 25 °C <sup>2</sup> | MTBF @40 °C (Hours) <sup>1</sup> | FIT @ 40 °C <sup>2</sup> |
|----------------------------------|--------------------------|----------------------------------|--------------------------|
| 9,236,047                        | 108                      | 4,624,904                        | 216                      |

Note:

- The Mean Time between Failures (MTBF) is calculated using a prediction methodology, Bellcore Prediction, which based on reliability data of the individual components in the module. It assumes nominal voltage, with all other parameters within specified range.
- Failures per Billion Device-Hours

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## ATP A4G08QA8BNPBSE

### IDD SPECIFICATION PARAMETER & POWER CONSUMPTION (PART1 OF 2)

Values are for the DDR4 SDRAM only and are computed from values specified in the vendor's component data sheet)

| Symbol | Proposed Conditions  | Value | Units |
|--------|--|-------|-------|
| IDD0   | <b>Operating One Bank Active-Precharge Current (AL=0)</b><br>CKE: High; External clock: On; tCK, nRC, nRAS, CL: Refer to Component Datasheet for detail pattern; BL: 81; AL: 0; CS_n: High between ACT and PRE; Command, Address, Bank Group Address, Bank Address Inputs: partially toggling; Data IO: VDDQ; DM_n: stable at 1; Bank Activity: Cycling with one bank active at a time: 0,0,1,1,2,2,... ; Output Buffer and RTT: Enabled in Mode Registers2; ODT Signal: stable at 0; Pattern Details: Refer to Component Datasheet for detail pattern   | 400   | mA    |
| IPP0   | <b>Operating One Bank Active-Precharge IPP Current</b><br>Same condition with IDD0   | 56    | mA    |
| IDD1   | <b>Operating One Bank Active-Read-Precharge Current (AL=0)</b><br>CKE: High; External clock: On; tCK, nRC, nRAS, nRCD, CL: Refer to Component Datasheet for detail pattern; BL: 81; AL: 0; CS_n: High between ACT, RD and PRE; Command, Address, Bank Group Address, Bank Address Inputs, Data IO: partially toggling; DM_n: stable at 1; Bank Activity: Cycling with one bank active at a time: 0,0,1,1,2,2,... ; Output Buffer and RTT: Enabled in Mode Registers2; ODT Signal: stable at 0; Pattern Details: Refer to Component Datasheet for detail pattern  | 480   | mA    |
| IDD2N  | <b>Precharge Standby Current (AL=0)</b><br>CKE: High; External clock: On; tCK, CL: Refer to Component Datasheet for detail pattern; BL: 81; AL: 0; CS_n: stable at 1; Command, Address, Bank Group Address, Bank Address Inputs: partially toggling ; Data IO: VDDQ; DM_n: stable at 1; Bank Activity: all banks closed; Output Buffer and RTT: Enabled in Mode Registers2; ODT Signal: stable at 0; Pattern Details: Refer to Component Datasheet for detail pattern  | 260   | mA    |
| IDD2NT | <b>Precharge Standby ODT Current</b><br>CKE: High; External clock: On; tCK, CL: Refer to Component Datasheet for detail pattern; BL: 81; AL: 0; CS_n: stable at 1; Command, Address, Bank Group Address, Bank Address Inputs: partially toggling ; Data IO: VSSQ; DM_n: stable at 1; Bank Activity: all banks closed; Output Buffer and RTT: Enabled in Mode Registers2; ODT Signal: toggling according ; Pattern Details: Refer to Component Datasheet for detail pattern   | 280   | mA    |
| IDD2P  | <b>Precharge Power-Down Current</b><br>CKE: Low; External clock: On; tCK, CL: Refer to Component Datasheet for detail pattern; BL: 81; AL: 0; CS_n: stable at 1; Command, Address, Bank Group Address, Bank Address Inputs: stable at 0; Data IO: VDDQ; DM_n: stable at 1; Bank Activity: all banks closed; Output Buffer and RTT: Enabled in Mode Registers2; ODT Signal: stable at 0   | 180   | mA    |
| IDD2Q  | <b>Precharge Quiet Standby Current</b><br>CKE: High; External clock: On; tCK, CL: Refer to Component Datasheet for detail pattern; BL: 81; AL: 0; CS_n: stable at 1; Command, Address, Bank Group Address, Bank Address Inputs: stable at 0; Data IO: VDDQ; DM_n: stable at 1; Bank Activity: all banks closed; Output Buffer and RTT: Enabled in Mode Registers2; ODT Signal: stable at 0   | 250   | mA    |
| IDD3N  | <b>Active Standby Current</b><br>CKE: High; External clock: On; tCK, CL: Refer to Component Datasheet for detail pattern; BL: 81; AL: 0; CS_n: stable at 1; Command, Address, Bank Group Address, Bank Address Inputs: partially toggling ; Data IO: VDDQ; DM_n: stable at 1; Bank Activity: all banks open; Output Buffer and RTT: Enabled in Mode Registers2; ODT Signal: stable at 0; Pattern Details: Refer to Component Datasheet for detail pattern  | 370   | mA    |
| IPP3N  | <b>Active Standby IPP Current</b><br>Same condition with IDD3N   | 48    | mA    |
| IDD3P  | <b>Active Power-Down Current</b><br>CKE: Low; External clock: On; tCK, CL: Refer to Component Datasheet for detail pattern; BL: 81; AL: 0; CS_n: stable at 1; Command, Address, Bank Group Address, Bank Address Inputs: stable at 0; Data IO: VDDQ; DM_n: stable at 1; Bank Activity: all banks open; Output Buffer and RTT: Enabled in Mode Registers2; ODT Signal: stable at 0  | 240   | mA    |
| IDD4R  | <b>Operating Burst Read Current</b><br>CKE: High; External clock: On; tCK, CL: Refer to Component Datasheet for detail pattern; BL: 82; AL: 0; CS_n: High between RD; Command, Address, Bank Group Address, Bank Address Inputs: partially toggling ; Data IO: seamless read data burst with different data between one burst and the next one according ; DM_n: stable at 1; Bank Activity: all banks open, RD commands cycling through banks: 0,0,1,1,2,2,... ; Output Buffer and RTT: Enabled in Mode Registers2; ODT Signal: stable at 0; Pattern Details: Refer to Component Datasheet for detail pattern | 890   | mA    |

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# ATP A4G08QA8BNPBSE

## IDD SPECIFICATION PARAMETER & POWER CONSUMPTION (PART2 OF 2)

Values are for the DDR4 SDRAM only and are computed from values specified in the vendor's component data sheet)

| Symbol | Proposed Conditions  | Value | Units |
|--------|--|-------|-------|
| IDD4W  | <b>Operating Burst Write Current</b><br>CKE: High; External clock: On; tCK, CL: Refer to Component Datasheet for detail pattern; BL: 81; AL: 0; CS_n: High between WR; Command, Address, Bank Group Address, Bank Address Inputs: partially toggling ; Data IO: seamless write data burst with different data between one burst and the next one ; DM_n: stable at 1; Bank Activity: all banks open, WR commands cycling through banks: 0,0,1,1,2,2,... ; Output Buffer and RTT: Enabled in Mode Registers2; ODT Signal: stable at HIGH; Pattern Details: Refer to Component Datasheet for detail pattern  | 750   | mA    |
| IDD5B  | <b>Burst Refresh Current (1X REF)</b><br>CKE: High; External clock: On; tCK, CL, nRFC: Refer to Component Datasheet for detail pattern; BL: 81; AL: 0; CS_n: High between REF; Command, Address, Bank Group Address, Bank Address Inputs: partially toggling ; Data IO: VDDQ; DM_n: stable at 1; Bank Activity: REF command every nRFC ; Output Buffer and RTT: Enabled in Mode Registers2; ODT Signal: stable at 0; Pattern Details: Refer to Component Datasheet for detail pattern  | 1,360 | mA    |
| IPP5B  | <b>Burst Refresh Write IPP Current (1X REF)</b><br>Same condition with IDD5B   | 168   | mA    |
| IDD6N  | <b>Self Refresh Current: Normal Temperature Range</b><br>TCASE: 0 - 85°C; Low Power Array Self Refresh (LP ASR) : Normal4; CKE: Low; External clock: Off; CK_t and CK_c#: LOW; CL: Refer to Component Datasheet for detail pattern; BL: 81; AL: 0; CS_n#: Command, Address, Bank Group Address, Bank Address, Data IO: High; DM_n: stable at 1; Bank Activity: Self-Refresh operation; Output Buffer and RTT: Enabled in Mode Registers2; ODT Signal: MID-LEVEL  | 200   | mA    |
| IDD6E  | <b>Self-Refresh Current: Extended Temperature Range)</b><br>TCASE: 0 - 95°C; Low Power Array Self Refresh (LP ASR) : Extended4; CKE: Low; External clock: Off; CK_t and CK_c: LOW; CL: Refer to Component Datasheet for detail pattern; BL: 81; AL: 0; CS_n, Command, Address, Bank Group Address, Bank Address, Data IO: High; DM_n: stable at 1; Bank Activity: Extended Temperature Self-Refresh operation; Output Buffer and RTT: Enabled in Mode Registers2; ODT Signal: MID-LEVEL  | 260   | mA    |
| IDD6R  | <b>Self-Refresh Current: Reduced Temperature Range</b><br>TCASE: 0 - TBD (~35-45)°C; Low Power Array Self Refresh (LP ASR) : Reduced4; CKE: Low; External clock: Off; CK_t and CK_c#: LOW; CL: Refer to Component Datasheet for detail pattern; BL: 81; AL: 0; CS_n#, Command, Address, Bank Group Address, Bank Address, Data IO: High; DM_n: stable at 1; Bank Activity: Extended Temperature Self-Refresh operation; Output Buffer and RTT: Enabled in Mode Registers2; ODT Signal: MID-LEVEL   | 150   | mA    |
| IDD6A  | <b>Auto Self-Refresh Current</b><br>TCASE: 0 - 95°C; Low Power Array Self Refresh (LP ASR) : Auto4; Partial Array Self-Refresh (PASR): Full Array; CKE: Low; External clock: Off; CK_t and CK_c#: LOW; CL: Refer to Component Datasheet for detail pattern; BL: 81; AL: 0; CS_n#, Command, Address, Bank Group Address, Bank Address, Data IO: High; DM_n: stable at 1; Bank Activity: Auto Self-Refresh operation; Output Buffer and RTT: Enabled in Mode Registers2; ODT Signal: MID-LEVEL   | 200   | mA    |
| IDD7   | <b>Operating Bank Interleave Read Current</b><br>CKE: High; External clock: On; tCK, nRC, nRAS, nRCD, nRRD, nFAW, CL: Refer to Component Datasheet for detail pattern; BL: 81; AL: CL-1; CS_n: High between ACT and RDA; Command, Address, Bank Group Address, Bank Address Inputs: partially toggling ; Data IO: read data bursts with different data between one burst and the next one ; DM_n: stable at 1; Bank Activity: two times interleaved cycling through banks (0, 1, ...7) with different addressing; Output Buffer and RTT: Enabled in Mode Registers2; ODT Signal: stable at 0; Pattern Details: Refer to Component Datasheet for detail pattern | 1,310 | mA    |
| IPP7   | <b>Operating Bank Interleave Read IPP Current</b><br>Same condition with IDD7  | 84    | mA    |
| IDD8   | <b>Maximum Power Down Current</b>  | 120   | mA    |
| PDIMM  | <b>Power Consumption per DIMM</b><br>System is operating at 1067MHz clock with VDD = 1.2V. This parameter is calculated at a common loading.   | 1,640 | mW    |

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# ATP A4G08QA8BNPBSE

## TIMING PARAMETER

| Parameter  | Symbol    | DDR4-2133                   |         | Units            |
|--|-----------|-----------------------------|---------|------------------|
|  |           | Min                         | Max     |                  |
| Clock cycle time at CL=15, CWL=11  | tCK       | 0.938                       | <1.071  | ns               |
| Internal read command to first data  | tAA       | 14.06                       | 18      | ns               |
| ACT to internal read or write delay time   | tRCD      | 14.06                       |         | ns               |
| PRE command period   | tRP       | 14.06                       |         | ns               |
| ACT to ACT or REF command period   | tRC       | 47.06                       |         | ns               |
| ACTIVE to PRECHARGE command period   | tRAS      | 33                          | 9*tREFI | ns               |
| Average clock high pulse width   | tCH(avg)  | 0.48                        | 0.52    | tCK              |
| Average clock low pulse width  | tCL(avg)  | 0.48                        | 0.52    | tCK              |
| DQS, $\overline{DQS}$ to DQ skew, per group, per access  | tDQSQ     | -                           | TBD     | ps               |
| DQ output hold time from DQS, $\overline{DQS}$   | tQH       | TBD                         | -       | tCK              |
| DQ low-impedance time from CK, $\overline{CK}$   | tLZ(DQ)   | -360                        | 180     | ps               |
| DQ high-impedance time from CK, $\overline{CK}$  | tHZ(DQ)   | -                           | 180     | ps               |
| DQS, $\overline{DQS}$ READ Preamble  | tRPRE     | 0.9                         | TBD     | tCK              |
| DQS, $\overline{DQS}$ differential READ Postamble  | tRPST     | TBD                         | TBD     | tCK              |
| DQS, $\overline{DQS}$ output high time   | tQSH      | 0.4                         | -       | tCK              |
| DQS, $\overline{DQS}$ output low time  | tQSL      | 0.4                         | -       | tCK              |
| DQS, $\overline{DQS}$ WRITE Preamble   | tWPRE     | 0.9                         | -       | tCK              |
| DQS, $\overline{DQS}$ WRITE Postamble  | tWPST     | TBD                         | TBD     | tCK              |
| DQS, $\overline{DQS}$ low-impedance time (Referenced from RL-1)  | tLZ(DQS)  | -360                        | 180     | ps               |
| DQS, $\overline{DQS}$ high-impedance time (Referenced from RL+BL/2)  | tHZ(DQS)  | -                           | 180     | ps               |
| DQS, $\overline{DQS}$ differential input low pulse width   | tDQSL     | 0.46                        | 0.54    | tCK              |
| DQS, $\overline{DQS}$ differential input high pulse width  | tDQSH     | 0.46                        | 0.54    | tCK              |
| DQS, $\overline{DQS}$ rising edge to CK, $\overline{CK}$ rising edge   | tDQSS     | -0.27                       | 0.27    | tCK              |
| DQS, $\overline{DQS}$ falling edge setup time to CK, $\overline{CK}$ rising edge   | tDSS      | 0.18                        | -       | tCK              |
| DQS, $\overline{DQS}$ falling edge hold time to CK, $\overline{CK}$ rising edge  | tDSH      | 0.18                        | -       | tCK              |
| DLL locking time   | tDLLK     | 768                         | -       | nCK <sup>1</sup> |
| Internal READ Command to PRECHARGE Command delay   | tRTP      | max(4nCK,7.5ns)             | -       |                  |
| Delay from start of internal write trans-action to internal read command for different bank group                                  | tWTR_S    | max(2nCK,2.5ns)             | -       |                  |
| Delay from start of internal write trans-action to internal read command for same bank group                                       | tWTR_L    | max(4nCK,7.5ns)             | -       |                  |
| WRITE recovery time  | tWR       | 15                          | -       | ns               |
| Mode Register Set command cycle time   | tMRD      | 8                           | -       | nCK <sup>1</sup> |
| Mode Register Set command update delay   | tMOD      | max(24nCK,15ns)             | -       |                  |
| $\overline{CAS}$ to $\overline{CAS}$ command delay for same bank group   | tCCD      | 6                           | -       | nCK <sup>1</sup> |
| Auto precharge write recovery + precharge time   | tDAL      | tWR + roundup (tRP / tCK)   | -       | nCK <sup>1</sup> |
| Multi-Purpose Register Recovery Time   | tMPRR     | 1                           | -       | nCK <sup>1</sup> |
| ACTIVE to ACTIVE command delay to same bank group for 1KB page size  | tRRD      | max(4nCK,5.3ns)             | -       |                  |
| Four activate window for 1KB page size   | tFAW      | max(20nCK,21ns)             | -       |                  |
| Command and Address setup time to CK, $\overline{CK}$ referenced to Vih(ac) / Vil(ac) levels                                       | tIS(base) | 80                          | -       | ps               |
| Command and Address hold time from CK, $\overline{CK}$ referenced to Vih(ac) / Vil(ac) levels                                      | tIH(base) | 105                         | -       | ps               |
| Power-up and RESET calibration time  | tZQinit   | 1024                        | -       | nCK <sup>1</sup> |
| Normal operation Full calibration time   | tZQoper   | 512                         | -       | nCK <sup>1</sup> |
| Normal operation short calibration time  | tZQCS     | 128                         | -       | nCK <sup>1</sup> |
| Exit Reset from CKE HIGH to a valid command  | tXPR      | max (5nCK,tRFC( min))+10ns) | -       |                  |
| Exit Power Down with DLL on to any valid command; Exit Precharge Power Down with DLL frozen to commands not requiring a locked DLL | tXP       | max(4nCK,6ns)               | -       |                  |
| Asynchronous RTT turn-on delay (Power-Down with DLL frozen)  | tAONAS    | 1                           | 9       | ns               |
| Asynchronous RTT turn-off delay (Power-Down with DLL frozen)   | tAOFAS    | 1                           | 9       | ns               |
| RTT dynamic change skew  | tADC      | 0.3                         | 0.7     | tCK              |
| 8Gb REFRESH to REFRESH OR REFRESH to ACTIVE command interval   | tRFC      | 350                         | -       | ns               |
| Average periodic refresh interval (0°C ≤ TCASE ≤ 85 °C)  | tREFI     | 7.8                         | 7.8     | us               |
| Average periodic refresh interval (85°C ≤ TCASE ≤ 95 °C)   | tREFI     | 3.9                         | 3.9     | us               |
| Exit Self Refresh to commands not requiring a locked DLL   | tXS       | tRFC(min)+10ns              | -       |                  |
| Exit Self Refresh to commands requiring a locked DLL   | tXSDLL    | tDLLK(min)                  | -       | nCK <sup>1</sup> |
| Power Down Entry to Exit Timing  | tPD       | tCKE(min)                   | 9*tREFI | tCK              |
| Write leveling output delay  | tWLO      | 0                           | 9.5     | ns               |
| Write leveling output error  | tWLOE     | TBD                         | TBD     | ns               |

Note:

1. Unit 'nCK' represents one clock cycle of the input clock, counting the actual clock edges.

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# ATP A4G08QA8BNPBSE

## PHYSICAL DIMENSIONS (UNITS IN INCHES)

(Drawing not to scale)



Note: Tolerance on all dimensions  $\pm 0.006$  inch (0.15mm) unless otherwise noted

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