**Chapter 3 Electrical Specification**

**3.1 Absoluter Maximum Ratings**

Table 3-1 Absolute Maximum DC Ratings

|  |  |  |  |
| --- | --- | --- | --- |
| Symbol | Description | Rating | Units |
| DDR\_VDD\_AMAX | Voltage on VDD pin relative to VSS | -0.5 to 1.05 | V |
| DDR\_VDDQ\_AMAX | Voltage on VDDQ pin relative to VSS | -0.5 to 1.98 | V |
| DDR\_PLL\_AMAX | Voltage on VAA\_PLL pin relative to VSS | -0.5 to 1.98 | V |

**3.2 Recommended Operating Condition**

Table 3-2 Recommend Operating Condition

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Symbol | Parameter | Min | Typ | Max | Units |
| DDR\_VDD\_PLL | PLL and SSTL receiver supply voltage | 1.62 | 1.8 | 1.98 | V |
| DDR\_VDDQ\_4 | SSTL output supply voltage (DDR4) | 1.14 | 1.2 | 1.26 | V |
| DDR\_VDDQ\_3 | SSTL output supply voltage (DDR3) | 1.425 | 1.5 | 1.575 | V |
| DDR\_VDDQ\_3L | SSTL output supply voltage (DDR3L) | 1.283 | 1.35 | 1.45 | V |
| DDR\_VDDQ\_3U | SSTL output supply voltage (DDR3U) | 1.19 | 1.25 | 1.31 | V |
| DDR\_VDDQ\_L3 | SSTL output supply voltage (LPDDR3) | 1.14 | 1.2 | 1.3 | V |
| DDR\_VDDQ\_LP | SSTL output supply voltage (LVCMOS) | 1.65 | 1.8 | 1.95 | V |
| DDR\_VREF | SSTL reference supply voltage | 0.49\*VDDQ | 0.5\*VDDQ | 0.51\*VDDQ | V |
| DDR\_VTT | External termination voltage | VREF-40mV | VREF | VREF+40mV | V |
| DDR\_T | Junction temperature | -40 | 25 | 125 | ℃ |

**3.3 DC Characteristics**

Table 3-3 DC Specifications

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Symbol | Parameter | Min | Typ | Max | Units |
| DDR4\_Mode | DDR\_VIH(DC) | DC input voltage High | VREF+0.1 |  | VDDQ | V |
| DDR\_VIL(DC) | DC input voltage Low | VSSQ |  | VREF-0.1 | V |
| DDR\_VOH | DC output logic High | 0.9\*VDDQ |  |  | V |
| DDR\_VOL | DC output logic Low |  |  | 0.1\*VDDQ | V |
| DDR\_RTT | Input termination resistance (ODT) to VDDQ | 200 | 240 | 280 | ohm |
| 100 | 120 | 140 |
| 67 | 80 | 93 |
| 50 | 60 | 70 |
| 42 | 48 | 56 |
| 34 | 40 | 46 |
| 28 | 34 | 40 |
| DDR3\_Mode | DDR\_VIH(DC) | DC input voltage High | VREF+0.1 |  | VDDQ | V |
| DDR\_VIL(DC) | DC input voltage Low | VSSQ-0.3 |  | VREF-0.1 | V |
| DDR\_VOH | DC output logic High | 0.8\*VDDQ |  |  | V |
| DDR\_VOL | DC output logic Low |  |  | 0.2\*VDDQ | V |
| DDR\_RTT | Input termination resistance (ODT) to VDDQ/2 | 100 | 120 | 140 | ohm |
| 54 | 60 | 66 |
| 36 | 40 | 44 |
| DDR3L\_Mode | DDR\_VIH(DC) | DC input voltage High | VREF+0.09 |  | VDDQ | V |
| DDR\_VIL(DC) | DC input voltage Low | VSSQ-0.3 |  | VREF-0.09 | V |
| DDR\_VOH | DC output logic High | 0.8\*VDDQ |  |  | V |
| DDR\_VOL | DC output logic Low |  |  | 0.2\*VDDQ | V |
| DDR\_RTT | Input termination resistance (ODT) to VDDQ/2 | 100 | 120 | 140 | ohm |
| 54 | 60 | 66 |
| 36 | 40 | 44 |
| LPDDR3\_Mode | DDR\_VIH(DC) | DC input voltage High | VREF+0.1 |  | VDDQ | V |
| DDR\_VIL(DC) | DC input voltage Low | VSSQ |  | VREF-0.1 | V |
| DDR\_VOH | DC output logic High | 0.9\*VDDQ |  |  | V |
| DDR\_VOL | DC output logic Low |  |  | 0.1\*VDDQ | V |
| DDR\_RTT | Input termination resistance (ODT) to VDDQ | 100 | 120 | 140 | ohm |
| 200 | 240 | 280 |

**3.4 Recommended Operating Frequency**

Table 3-4 Recommended operating frequency

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Symbol | Parameter | Condition | Min | Typ | Max | Unit |
| DDR4\_Mode | ddr\_data\_rate | DDR data rate | 1.0V, 25℃ |  |  |  | Mbps |
| 1.1V, -40℃ |  |  |  |
| 0.9V, 125℃ |  |  | 2400 |
| DDR3\_Mode | ddr\_data\_rate | DDR data rate | 1.0V, 25℃ |  |  |  | Mbps |
| 1.1V, -40℃ |  |  |  |
| 0.9V, 125℃ |  |  | 2133 |
| DDR3L\_Mode | ddr\_data\_rate | DDR data rate | 1.0V, 25℃ |  |  |  | Mbps |
| 1.1V, -40℃ |  |  |  |
| 0.9V, 125℃ |  |  | 1866 |
| LPDDR3\_Mode | ddr\_data\_rate | DDR data rate | 1.0V, 25℃ |  |  |  | Mbps |
| 1.1V, -40℃ |  |  |  |
| 0.9V, 125℃ |  |  | 2133 |

**3.5 Electrical Characteristics for DDR IO**

Table 3-5 Electrical Characteristics for DDR IO

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Symbol | Parameter | Min | Typ | Max | Units |
| DDR4\_Mode | DDR\_C\_IO | I/O capacitance (equivalent at VDDQ/2) | 1.94 | 1.97 | 2.11 | pF |
| DDR\_PRCVQ\_AC | Input mode AC power (VDDQ rail) | 0.17 | 0.20 | 0.23 | uW/MHz |
| DDR\_PRCV\_AC | Input mode AC power (VDD rail) | 0.13 | 0.15 | 0.22 | uW/MHz |
| DDR\_PDRVQ\_AC | Output mode AC power (VDDQ rail) | 8.08 | 8.08 | 9.77 | uW/MHz |
| DDR\_PDRV\_AC | Output mode AC power (VDD rail) | 1.34 | 1.67 | 2.27 | uW/MHz |
| DDR3\_Mode | DDR\_C\_IO | I/O capacitance (equivalent at VDDQ/2) | 1.91 | 1.94 | 2.07 | pF |
| DDR\_PRCVQ\_AC | Input mode AC power (VDDQ rail) | 0.20 | 0.21 | 0.24 | uW/MHz |
| DDR\_PRCV\_AC | Input mode AC power (VDD rail) | 0.13 | 0.15 | 0.19 | uW/MHz |
| DDR\_PDRVQ\_AC | Output mode AC power (VDDQ rail) | 10.83 | 10.83 | 12.35 | uW/MHz |
| DDR\_PDRV\_AC | Output mode AC power (VDD rail) | 1.35 | 1.68 | 2.27 | uW/MHz |
| DDR3L\_Mode | DDR\_C\_IO | I/O capacitance (equivalent at VDDQ/2) | 1.92 | 1.96 | 2.09 | pF |
| DDR\_PRCVQ\_AC | Input mode AC power (VDDQ rail) | 0.20 | 0.22 | 0.26 | uW/MHz |
| DDR\_PRCV\_AC | Input mode AC power (VDD rail) | 0.13 | 0.15 | 0.22 | uW/MHz |
| DDR\_PDRVQ\_AC | Output mode AC power (VDDQ rail) | 8.43 | 8.43 | 10.76 | uW/MHz |
| DDR\_PDRV\_AC | Output mode AC power (VDD rail) | 1.34 | 1.67 | 2.27 | uW/MHz |
| LPDDR3\_Mode | DDR\_C\_IO | I/O capacitance (equivalent at VDDQ/2) | 1.94 | 1.97 | 2.11 | pF |
| DDR\_PRCVQ\_AC | Input mode AC power (VDDQ rail) | 0.20 | 0.23 | 0.26 | uW/MHz |
| DDR\_PRCV\_AC | Input mode AC power (VDD rail) | 0.12 | 0.15 | 0.22 | uW/MHz |
| DDR\_PDRVQ\_AC | Output mode AC power (VDDQ rail) | 7.38 | 7.38 | 9.17 | uW/MHz |
| DDR\_PDRV\_AC | Output mode AC power (VDD rail) | 1.34 | 1.67 | 2.27 | uW/MHz |