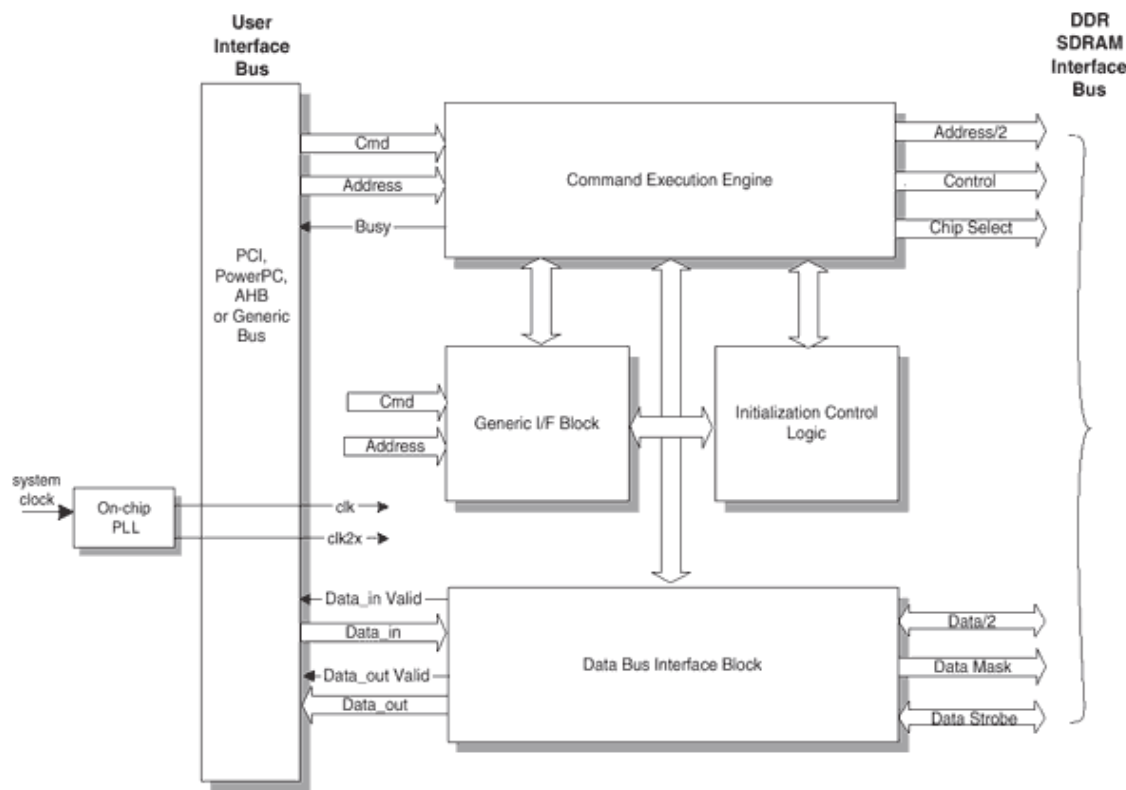


DDR SDRAM Controller - Pipelined for ispXPGA and ORCA4

Overview

DDR (Double Data Rate) SDRAM was introduced as a replacement for SDRAM memory running at bus speeds over 75MHz. DDR SDRAM is similar in function to the regular SDRAM but doubles the bandwidth of the memory by transferring data twice per cycle on both edges of the clock signal, implementing burst mode data transfer.

The DDR SDRAM Controller is a parameterized core giving user the flexibility for modifying the data widths, burst transfer rates, and CAS latency settings of the design. In addition, the DDR core supports intelligent bank management, which is done by maintaining a database of "all banks activated" and the "rows activated" in each bank. With this information, the DDR SDRAM Controller decides if an active or pre-charge command is needed. This effectively reduces the latency of read/write commands issued to the DDR SDRAM.



Features

- Performance of Greater than 100MHz (200 DDR)
- Interfaces to JEDEC Standard DDR SDRAMs
- Supports DDR SDRAM Data Widths of 16, 32 and 64 Bits
- Supports up to 8 External Memory Banks
- Programmable Burst Lengths of 2, 4, or 8
- Programmable CAS Latency of 1.5, 2.0, 2.5 or 3.0
- Byte-level Writing Supported
- Increased Throughput Using Command Pipelining and Bank Management
- Supports Power-down and Self Refresh Modes
- Automatic Initialization
- Automatic Refresh During Nomal and Power-down Modes

Timing and Settings Parameters Implemented as Programmable Registers

Bus Interfaces to PCI Target, PowerPC and AMBA (AHB) Buses Available

Complete Synchronous Implementation

Evaluation Configurations

Performance and Resource Utilization for ORCA 4¹

Parameter File	ddrct_gen_o4_1_008.lpc	ddrct_ahb_o4_1_008.lpc
Core Configuration	Generic I/F	AHB I/F
ORCA 4 PFUs ²	344	560
LUTs	1359	2322
Registers	1559	2451
Dist. RAM ³	N/A	18
fMAX (MHz)	100 (200 DDR)	100 (200 DDR)
External Pins	239	242
SysMEM™ EBRs	N/A	N/A
Parameter File	ddrct_pci_o4_1_008.lpc	ddrct_ppc_o4_1_008.lpc
Core Configuration	PCI I/F	PPC I/F
ORCA 4 PFUs ²	510	492
LUTs	2024	1922
Registers	2070	2170
Dist. RAM ³	16	18
fMAX (MHz)	66 ⁴	100 (200 DDR)
External Pins	246	181
SysMEM™ EBRs	N/A	N/A

¹ Performance and utilization characteristics are generated using an OR4E022BA352 in ispLEVER™ v.3.0 software except for the AHB configuration 008 which is generated using OR4E042BM416. Synthesized using Synplicity Synplify, v.7.0.3. When using this IP core in a different density, package, speed, or grade within the ORCA Series 4 family, performance may vary slightly.

² PFU is a standard logic block of some Lattice devices. For more information, check the data sheet of the device.

³ Dist. RAM = distributed memory.

⁴ Performance for the PCI configuration of this DDR core is limited by the maximum throughput of the PCI 2.2 interface (66MHz).

⁵ All parameters are set to their default values as shown in the Data Sheet.

Performance and Resource Utilization for XPGA¹

Parameter File	ddrct_gen_xp_1_002.lpc	ddrct_ahb_xp_1_002.lpc
Device	LFX125B-4FH516CES/2X	LFX500B-4FH516CES/2X
Core Configuration	Generic I/F	AHB I/F

ispXPGA PFUs²	393	751
LUTs	1116	1928
Registers	910	1599
f_{MAX}	100	100
External Pins	142	145
SysMEM™ EBRs	N/A	N/A
Parameter File	ddrct_pci_xp_1_002.lpc	ddrct_ppc_xp_1_002.lpc
Device	LFX500C-4FH516CES/2X	LFX500B-4FH516CES/2X
Core Configuration	PCI I/F	PPC I/F
ispXPGA PFUs²	688	647
LUTs	1867	1670
Registers	1333	1392
f_{MAX}	66 ³	100
External Pins	170	154
SysMEM™ EBRs	N/A	N/A

¹ Performance and utilization characteristics are generated using the ispXPGA device shown above in ispLEVER v.3.1 software. The evaluation version of this IP core only works on this specific device density, package and speed grade. ² PFU is a standard logic block of some Lattice devices. For more information, check the data sheet of the device.

³ Performance for the PCI configuration of this DDR core is limited by the maximum throughput of the PCI 2.2 interface (66MHz).

Ordering Information

Part Numbers:

For ORCA 4:

DDRCT-GEN-O4-N1

DDRCT-PPC-O4-N1

DDRCT-PCI-O4-N1

DDRCT-AHB-O4-N1

For ispXPGA:

DDRCT-GEN-XP-N1

DDRCT-PCI-XP-N1

DDRCT-AHB-XP-N1

DDRCT-PPC-XP-N1

To find out how to purchase the DDR SDRAM Controller - Pipelined IP Core, please contact your **local Lattice Sales Office**.