MPC5200B External Bus Options

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1   Introduction

The MPC5200B external buses can be defined as:

- An independent SDRAM bus capable of supporting SDR and DDR SDRAM devices.

- A LocalPlus bus capable of supporting three different bus protocols depending on how the MPC5200B address map (4 GByte) is defined:

    — Normal (multiplexed and/or non-multiplexed) memory cycles

    — PCI, V2.2, initiator, and target operations

    — ATA-4 Ultra-33 operation

This paper describes at a high level how data may be moved internally and externally through LocalPlus bus. The LocalPlus bus has a single set of address/data signals and separate normal, PCI, and ATA control lines. The LocalPlus bus interface is a multiplexed interface because it can be a normal, a PCI, or an ATA bus depending on which area of memory the current read/write transaction references.

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2 Chip Selects

Identifying start/stop addresses for chip selects 0 – 7 and setting up base addresses in PCI base address registers 0 – 1, target base address translation registers 0 – 1, and the initiator window base/translation address register creates memory areas and controller assignments. Chip selects can support multiplexed or non-multiplexed modes and support different combinations of wait states, byte swapping, etc.

Section 3.3.2.2., "LocalPlus Bus," in the MPC5200B User's Manual explains the start/stop address registers. Two chip select start/stop address register pairs are associated with the LP_CS0 pin. One chip select start/stop register pair configures the LP_CS0 pin as the BOOT chip select in program space, and the other register pair configures the LP_CS0 pin to run normal memory access cycles in data space only. Only one of the LP_CS0 chip select start/stop address register pairs should be active at any given time. Only LP_CS0 can address program space and code execution. At BOOT time, the address space for LP_CS0 starts at 0x0000_0000 or 0xFFF0_0000 (depending on the reset configuration) and extends for 512 Kbytes by default. Chip select lines 1 – 7 can only select data space memory (Run-time program execution generally occurs from programs stored in the memory located on the SDRAM bus.). Chip select 4 and 5 can run normal memory cycles or are used during ATA cycles. Chip select 1 – 3 and 6 – 7 can only run normal memory cycles.

3 Normal Mode

Normal mode on the LocalPlus bus can consist of a multiplexed address/data external bus arrangement or non-multiplexed address/data external bus.

Multiplexed address mode has the ability to address larger ranges than the non-multiplexed mode because it incorporates two additional bank select lines. Through this mechanism, it supports addressing of 128 Mbytes total spread across four banks. Data size is limited to 32 bits max. The multiplexed address mode is the only mode that supports code execution. Additional logic is required to latch addresses and to decode bank selects. This mode is inherently slower than the non-multiplexed mode, but various address and data sizes are available on a chip select basis. Dynamic bus sizing is available in this mode.

Non-multiplexed mode consists of three sub-modes:

- Legacy mode
  - Address/data lines limited to 32
  - Supports small and medium group addresses
  - Data sizes can be 8 or 16 bits
- Most graphics mode
  - Address/data lines limited to 56
  - Supports MOST group addresses
  - Data sizes are 32 bits
- Large flash mode
  - Address/data lines limited to 40 or 48 bits
  - Supports large group addresses
  - Data sizes can be 8 or 16 bits

Address ranges are also divided into three groups: small (8 and 16), medium/MOST (24 bit), and large (26 bit). Various data sizes are available within each address group. The non-multiplexed mode supports burst access.

The LocalPlus bus normal mode interface has a single half-duplex 512 Byte FIFO (32 words by 128 bits) to support DMA transfers between the LocalPlus Bus and memory using the DMA engine in the BestComm. Memory devices connected to LP_CS0 supports code execution and can function during BOOT operation. Refer to Table 9-2, Non-Muxed Options, in the MPC5200B User's Manual for specific BOOT options the reset configuration word can select.

4   PCI Mode

Section 10.6.2.1., "Address Translation," in the MPC5200B User's Manual explains the PCI base address registers (BAR) 0 – 1 and target base address translation registers (TBATR) 0-1. BAR0/TBATR0 is a 256 KByte range and BAR1/TBATR1 is a 1 GByte range. The initiator window base/translation address registers (IMWBAR) can be mapped to two 16 MByte or larger address spaces. The LocalPlus most graphics and large flash interfaces are not compatible with any PCI operation. When these interfaces are needed, the PCI internal controller must be disabled. However, even when the PCI internal controller is disabled, the PCI clock continues to be sourced by the MPC5200B. Two FIFOs (one for RX and one for TX) support the BestComm DMA engine that supports PCI interface, therefore, enabling full-duplex transfers.

5   ATA Mode

Ten registers that provide host configuration, status, and timing control ATA mode. The ATA interface has a half-duplex FIFO for DMA transfers controlled by the BestComm DMA engine. The BestComm DMA engine writes ATA commands into the ATA FIFO which initiates ATA read and write transactions. The BestComm DMA engine fills or empties the ATA FIFO data as needed. Any BestComm DMA transfers where the source and destination are resident on the LocalPlus bus require internal BestComm SRAM buffering.

What personality the LocalPlus Bus takes on for a given transaction depends on what particular defined MPC5200B memory space the transaction references. For example, for three different read and/or write transactions, the LocalPlus bus could be in normal bus mode for the first transaction, ATA bus mode for the second transaction, and PCI bus mode for the third transaction. What mode is active is entirely dependent on how the memory map, the start/stop, and PCI base registers are set up.

The MPC5200B can support SDRAM, local-normal, local-PCI, and local-ATA protocols in a given system simultaneously with some restrictions on local-normal modes. Realize the local, PCI, and ATA functions are multiplexed amongst themselves. Each peripheral has its own FIFO and associated FIFO controller, allowing all three modes (normal, PCI, and ATA) to function at the same time.

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