

## Block Diagram of DMA Controller and DMA Operations

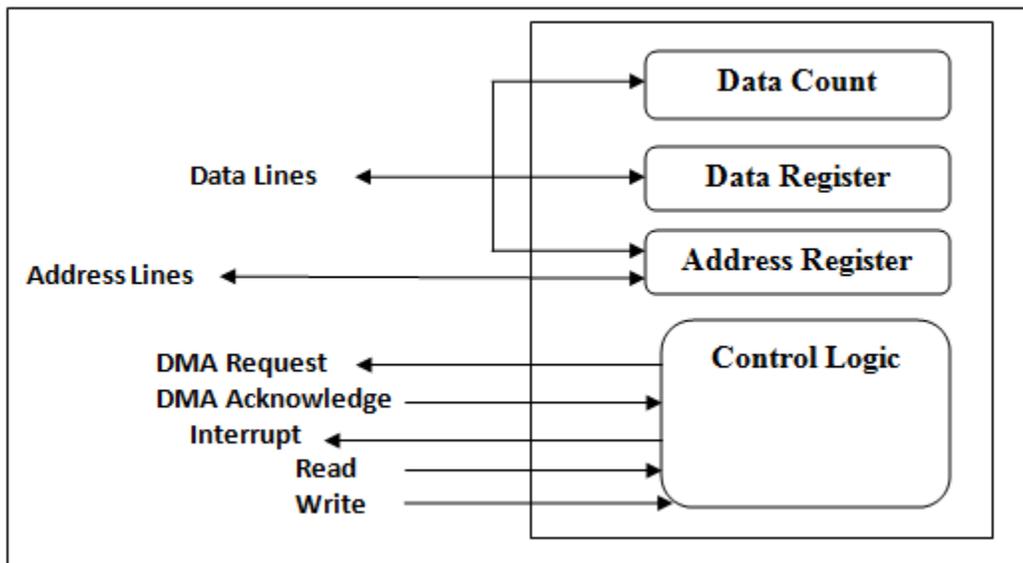


Fig 1.7: Block diagram of DMA Controller

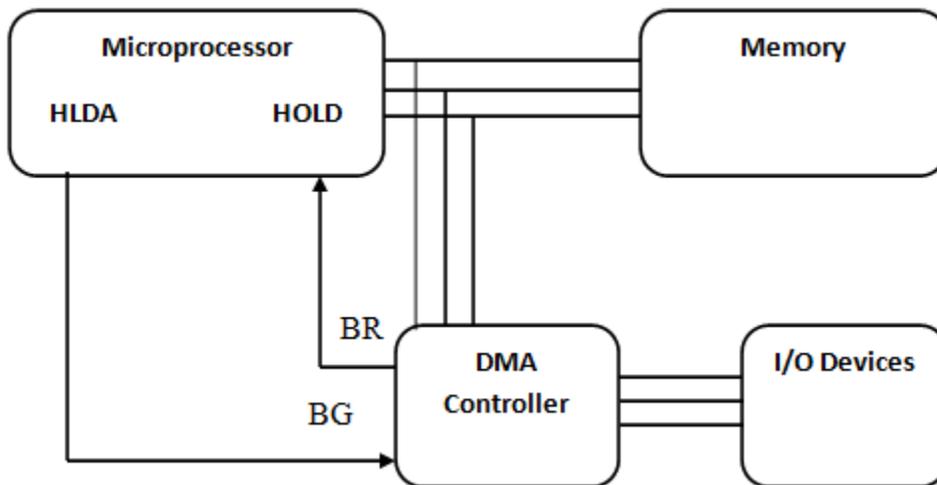


Fig 1.8: DMA Control Operation

**DMA Operation:** Direct Memory Access involves transfer of data between I/O devices and memory by an external circuitry system called DMA controller without involving the microprocessor. However, microprocessor itself initiates the DMA control process by providing starting address, size of data block and direction of data flow. DMA contains a control unit to deal with the control functions during DMA operations such as read, write and interrupt. The address

register of DMA controller is used to generate address and select I/O device to transfer the data block. The Count register counts and hold no. of data block transferred. It also specifies direction of data transfer.

### **Steps of DMA Operation:**

- a) For DMA operation to occur, the DMA controller first make a bus request (BR) by sending a control signal HOLD to the control line.
- b) On receiving the BR through HOLD pin high, the microprocessor completes the current instruction execution and afterward it generates HLDA control signal and sends it to the DMA-Controller. This event switches over the control from microprocessor to DMA Controller. The microprocessor gets idle.
- c) As soon as DMA controller receives HLDA (Hold Acknowledged) through Bus Grant (BG) line, it takes the control of system bus and start transferring the data blocks between memory and Input / Output devices, without involving the microprocessor.
- d) On completion of data transfer, the DMA controller sends a low signal to the HOLD pin and hence microprocessor makes the HLDA pin low and takes the control over system bus.

### **DMA Operation Modes:**

The DMA Controller operates under three modes:

- A. **Burst Mode:** Here DMA controller switch over the control to the microprocessor only on completion of entire data transfer, irrespective of microprocessor requiring the bus. Microprocessor has to be idle during the data transfer.
- B. **Cycle-Stealing Mode:** DMA controller relinquish the control to microprocessor on transfer of every byte, thereby microprocessor gets the control and become able to process highly prioritized instruction. DMA need to make the BG request for each byte.

**Transparent Mode:** In this mode, DMA controller can transfer data blocks only when microprocessor are executing such instruction that does not requires system bus utilization.