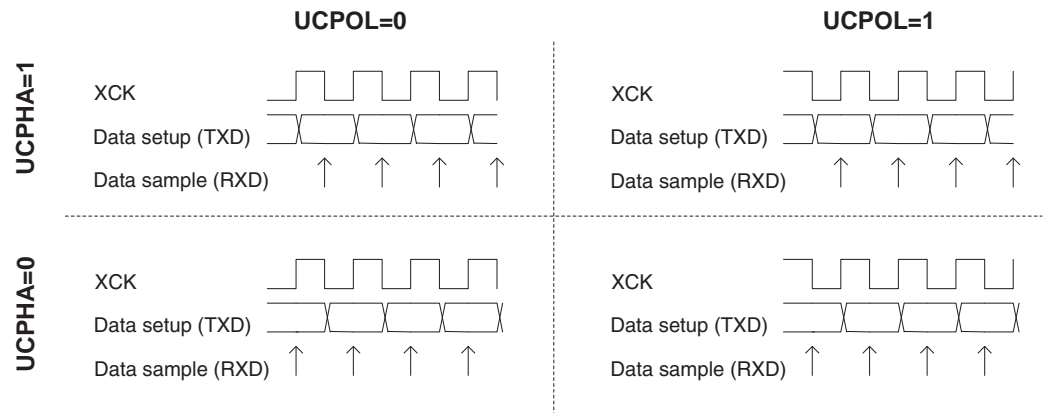


**Figure 18-1.** UCPHAn and UCPOLn data transfer timing diagrams.



## 18.5 Frame Formats

A serial frame for the MSPIM is defined to be one character of 8 data bits. The USART in MSPIM mode has two valid frame formats:

- 8-bit data with MSB first
- 8-bit data with LSB first

A frame starts with the least or most significant data bit. Then the next data bits, up to a total of eight, are succeeding, ending with the most or least significant bit accordingly. When a complete frame is transmitted, a new frame can directly follow it, or the communication line can be set to an idle (high) state.

The UDORDn bit in UCSRnC sets the frame format used by the USART in MSPIM mode. The Receiver and Transmitter use the same setting. Note that changing the setting of any of these bits will corrupt all ongoing communication for both the Receiver and Transmitter.

16-bit data transfer can be achieved by writing two data bytes to UDRn. A UART transmit complete interrupt will then signal that the 16-bit value has been shifted out.

### 18.5.1 USART MSPIM Initialization

The USART in MSPIM mode has to be initialized before any communication can take place. The initialization process normally consists of setting the baud rate, setting master mode of operation (by setting DDR\_XCKn to one), setting frame format and enabling the Transmitter and the Receiver. Only the transmitter can operate independently. For interrupt driven USART operation, the Global Interrupt Flag should be cleared (and thus interrupts globally disabled) when doing the initialization.

**Note:** To ensure immediate initialization of the XCKn output the baud-rate register (UBRRn) must be zero at the time the transmitter is enabled. Contrary to the normal mode USART operation the UBRRn must then be written to the desired value after the transmitter is enabled, but before the first transmission is started. Setting UBRRn to zero before enabling the transmitter is not necessary if the initialization is done immediately after a reset since UBRRn is reset to zero.

Before doing a re-initialization with changed baud rate, data mode, or frame format, be sure that there is no ongoing transmissions during the period the registers are changed. The TXCn Flag can be used to check that the Transmitter has completed all transfers, and the RXCn Flag can